

**Model Answers**  
**B.Sc. (First Semester) Examination, 2013**  
**Paper-LZC 101: Animal Diversity-I (Non Chordates)**

**Section A**

**Q. 1- Answer**

- |           |            |             |           |          |
|-----------|------------|-------------|-----------|----------|
| (i)- (c)  | (ii)- (a)  | (iii)- (a)  | (iv)- (b) | (v)- (b) |
| (vi)- (d) | (vii)- (c) | (viii)- (a) | (ix)- (a) | (x)- (d) |

**Section B**

**Q. 2- Answer:**

**Morphological characters for taxonomic study**

- Morphology is the basic tool of taxonomy, because identification is primarily based on the characters of the animal. The morphological characters are easily observable in all animals. They have provided the basic information for a majority of the classification systems in animal taxonomy
- Morphology is very helpful in taxonomic study of closely related species. The features that distinguish closely related species of animals are usually superficial differences such as colour, size, and proportion.
- One morphological feature useful in classifying animals and in determining their evolutionary relationships is the presence or absence of cellular differentiation—*i.e.*, animals may be either single celled or composed of many kinds of cells specialized to perform particular functions.
- Another major distinguishing morphological feature of animal phyla is the presence or absence of segmentation. The members of several phyla have bodies characterized by the presence of a row of segments, or body units, of the same fundamental structure. Segmented animals include the vertebrates, the annelids and the arthropods.
- An evolutionary tendency in many animal phyla has been the progressive differentiation of the anterior end to form a head with conspicuous sense organs and an accumulation of nervous tissues, a brain; the tendency is termed cephalization.
- Some morphological structures are found only in one phylum; for example, only the Coelenterata have stinging cells (nematocysts); the Echinodermata have a peculiar water vascular system, and only the Chordates have a dorsally located, hollow nerve cord.
- Detailed comparisons of the morphological features of different animals provide strong arguments for the evolutionary relationships among different species.
- Careful study of adaptive morphological aspects has permitted inferences about the course of the evolutionary history of various animals and of their successive adaptations to changing environments.

**Embryological characters for taxonomic study**

- Embryology strictly refers to the study of the development of the embryo and the structure of the mature embryo.

- There are several aspects which favour the use of embryological characters in taxonomy. The most significant and important feature is the high degree of correlation amongst embryological characters.
- Embryological characters are conservative.
- In animals embryonic and juvenile stages often help greatly in their identification, specially in those organism which include several distinct larval stages, each separated by a moult. The study of both the adult and their larvae helps in avoiding confusion in those organisms where adult and larvae are totally distinct morphologically.
- There are many animal groups where classification is greatly helped by the use of immature stages. The study of egg structure has been used to resolve the some *Anopheles* spp. complex into a number of sibling species.
- Embryological studies have also helped in the classification and separation of species of those animal groups whose morphological traits are less reliable, as for example sponges.

### **Q. 3- Answer:**

#### **Body Symmetry in Non-chordates:**

- The arrangement of body structures with reference to the body axis is called body symmetry.
- Animals which can be divided by at least one plane so that the resulting halves are similar to each other are described as symmetrical.
- Animals which cannot be divided into similar halves by any plane passing through its body are described as asymmetrical. There are three basic forms of symmetry:

##### **(i) Spherical Symmetry:**

- It is a type of symmetry seen in animals having spherical shape, with the body parts arranged concentrically around a central point.
- A sphere has an infinite number of planes of symmetry that can pass through the centre to divide it into similar halves.
- This type of symmetry is rare in animals and is exhibited only in some protozoans such as radiolarians. In such animals, there is no polarity as in other symmetrical animals.

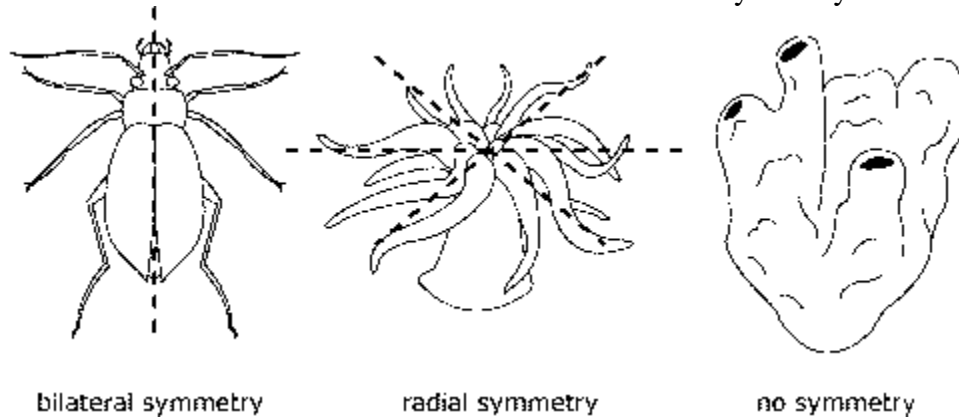
##### **(ii) Radial Symmetry:**

- This type of symmetry is seen in animals having a cylindrical body shape.
- The body parts are arranged around an imaginary axis. Such an animal can be cut into two equal halves by any plane passing through the axis. The axis in such animals is described as oral-aboral axis.
- A radially symmetrical animal usually has a mouth at or near the center of one surface, which is consequently known as the oral surface.
- The opposite surface is the aboral surface and it may, or may not, bear an anus.
- Radial symmetry allows animals to reach out in all directions from one center.
- Radial symmetry is found in several coelenterates.
- One modification of radial symmetry is the biradial symmetry where the body parts are arranged in such a way that two planes of sectioning can divide the animal into similar halves. Biradial symmetry can be seen in sea anemones and ctenophores.

##### **(iii) Bilateral Symmetry:**

- Bilateral symmetry is found in animals having an elongated body shape.

- The body parts are arranged on either side of an imaginary axis. Such an animal can be cut into two equal halves by only one plane passing through the axis. In such animals the body axis is described as median-longitudinal or antero-posterior axis.
- Structures near the plane of symmetry (i.e., the center of the animal) are said to be **median**, or medial, whereas those away from the center and near the sides are **lateral**.
- Bilaterally symmetrical animals tend to be active and to move forward at an anterior end, which eventually led to concentration of sensory organs in the anterior end, or head.
- All animals from flat worms to vertebrates exhibit bilateral symmetry.



#### Q. 4- Answer:

##### Nematode Parasites

##### i. *Ascaris lumbricoides*

- Causes Ascariasis
- Most common roundworm infection in people, especially in areas of poor sanitation.

##### Transmission and Infection:

- Swallowing of food contaminated with *Ascaris* eggs, usually contaminated through contact with soil or other objects.
- *Ascaris* eggs are hardy and can survive in the environment for years. Once swallowed, the eggs hatch and release larvae into the intestine. Each larva migrates through the Intestine- lymphatic system-blood-lungs.
- Larvae can also get lost and migrate to other parts of the body.
- Once in the lung, the larvae pass into the alveoli and moves up the respiratory tract where it is swallowed.
- The larvae then mature in the small intestine where it remains as an adult worm (6- 20 inches in length) and feeds on the intestine's liquid contents.

##### Symptoms

- Asymptomatic
- Migration can cause: coughing and fever.
- Large worm burdens can cause abdominal cramps and blockage.

##### Prevention

- Sanitation
- By avoiding undercooked foods.

##### ii. *Wucheria bancrofti*

- Causes filariasis or Elephantiasis which is an arthropod (insect)-borne infection.

- Elephantiasis is caused by the larvae of *W. bancrofti* which develop in the mosquito.
- When bitten, the larval forms pass through the lymphatics and mature to thread like adults in the lymph glands.
- After the male and females mate, eggs are released and larvae form as microfilaria in the general circulation where they are picked up by mosquitoes during feeding.
- Location of mature adults in the lymph glands causes obstruction of lymphatic drainage which then results in massive swelling of the extremities.
- This worm can also affect the pituitary gland, causing dwarfism. Usually asymptomatic, but can cause disfigurement.

**Prevention:** Control of intermediate hosts (flies, mosquitoes)

### iii. *Ancylostoma duodenale*

- Causes ancylostomiasis
- Intestinal roundworms, common in moist, warm places where sanitation is poor.

#### **Transmission**

- Eggs are passed in the human stool and hatch in the soil after 2 days.
- Larvae emerge to live in the soil and when fully mature can penetrate the skin.

#### **Infection**

- Direct contact with infected soil, especially in areas where human waste is used as a fertilizer. Skin ► lymphatic ► bloodstream ►lungs ►airway to throat ►swallowed.
- Reach intestine where they develop into adults and attach themselves by their mouths to the lining of the upper small intestine (jejunum). Produce an anticoagulant in order to live off the blood of the host.

#### **Symptoms**

- Skin becomes itchy and red, rashes appears on skin
- Coughing, wheezing, fever
- Pain in upper abdomen, loss of appetite, malnutrition
- Anemia

**Prevention:** Maintenance of proper sanitation

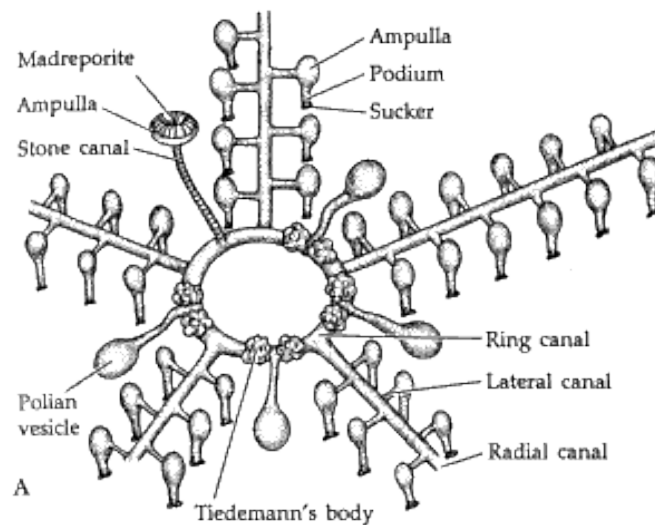
## **Q. 5- Answer**

### **Significance of Water-vascular system of echinoderm**

- The water-vascular system is a characteristic feature of echinoderms.
- It comprises an internal hydraulic system of canals and reservoirs containing a watery fluid, the system consisting of a sieve plate, or madreporite, and a ring vessel, or water-vascular ring, that are connected by a frequently calcified vessel called the stone canal.
- Five radial water canals extend outward from the ring vessel and give rise to branches that end in the tube feet, which are in contact with the sea.
- The madreporite, which is usually located externally, takes in water from outside the body; if internally located, as is the case in many holothurians, fluid is taken from the body cavity. The water or fluid passes from the madreporite to the ring vessel and along the radial canals to the tube feet. The tube feet are extended by contractions of localized muscle areas in the radial canals (ophiuroids) or by contractions of offshoots of the radial canals called ampullae (asteroids,

concentricycloids, echinoids, and holothurians); the contractions force fluid into the tube feet, which then extend.

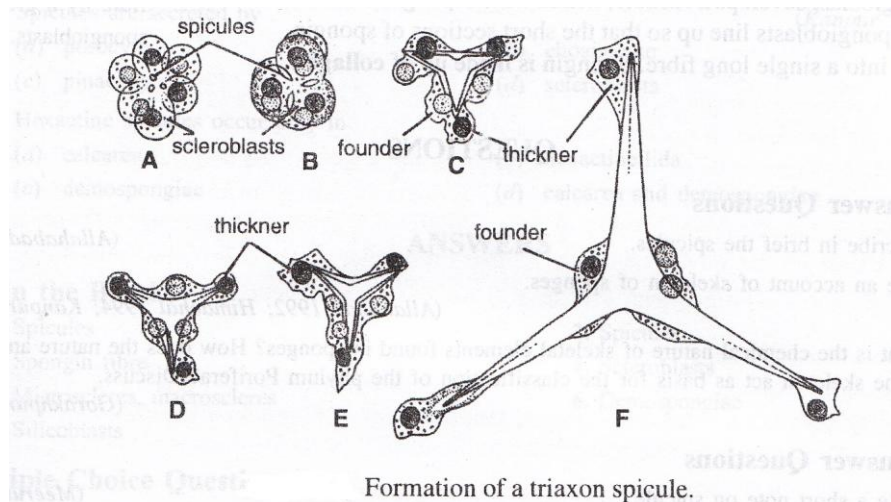
- The tube feet may have well-developed suckers with great holding power, may taper to a point, or may be adapted for respiration, feeding, burrow building, mucus production, or sensory perception.
  - Attachment of tube feet to hard substrates is achieved through a combination of suction and mucus production. The mucus contains adhesive and de-adhesive mucopolysaccharides.
  - Respiratory tube feet have high oxygen uptake; they are usually located on parts of the body where water flow is unimpeded.
  - Tube feet have been implicated in photoreception and chemoreception; the eyespots in the terminal tentacles of asteroids are the most conspicuous photoreceptors.
  - The tube feet of crinoids are arranged in clumps of three on the arms and on the pinnules. They secrete and spread a net of sticky mucus that traps small organisms. In ophiuroids the tube feet are used to gain a hold on a surface and to pass food to the mouth. The numerous tube feet of asteroids are used in locomotion; asteroids with suckered feet may use them to exert a continuous pull on the valves of shellfish (e.g., oysters, mussels) until muscles holding the valves tire and open slightly, allowing the asteroid to insert its stomach. In sea daisies the ring of tube feet is probably used for attachment to substrates. Holothurians use tube feet for the same purpose. Tentacles around the mouth of holothurians are modified tube feet used to capture food; tentacles used to capture plankton are branched and sticky, while those used to scoop mud and shovel it into the mouth have a simpler structure.
  - The tube feet of echinoids serve a variety of functions. The mouth of regular echinoids is surrounded by sensory tube feet, and tube feet farther from the mouth are used in locomotion. On the upper side of the body near the anus, the tube feet have respiratory and sensory functions. The tube feet of irregular echinoids, which burrow, are modified in various ways for feeding, burrow construction, and sensory and respiratory functions.



## Q. 6- Answer

### Spicule Formation in Porifera:

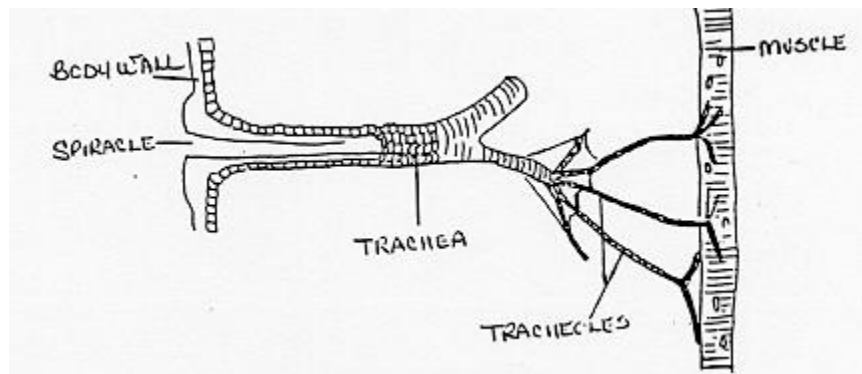
- Spicules are crystalline structures consisting of spines or rays that radiate from a point.
- They are secreted by mesenchymal amoebocytes, called scleroblasts.
- All kinds of spicules have a core of organic material around which is deposited either calcium carbonate or colloidal silica. Accordingly the spicules are of two types: calcareous and siliceous.
- Spicules are secreted by special cells called sclerocytes, derived from the mesenchymal scleroblasts.
- Scleroblast secreting a calcareous spicule is called calcoblast, while that producing a siliceous spicule is called silicoblast.
- A monoaxon spicule, or each ray of triradiate spicule is secreted by a group of two sclerocytes, one is called as thickener cells while the other is known as founder cell.
- A binucleate scleroblast give rise to two types of sclerocytes, one is called as thickener cells while the other is known as founder cell.
- A monoaxon spicule or each ray of triradiate spicule is secreted by a group of these two types of sclerocytes.
- A particle of calcium carbonate is deposited between two nuclei of these sclerocytes.
- The particle grows drawing apart first the two nuclei and then the two sclerocytes.
- Thickener cell lays down the additional layers of calcium carbonate resulting in increase in the thickness of spicule.
- After completion of the formation of spicule the two cells wander in to mesenchyme.
- A siliceous monoaxon is believed to be secreted only by a single silicoblast, whereas triaxon siliceous is secreted by a multinucleate cell which was formed by repeated nuclear division of a single silicoblast.



## Q. 7: Answer

### Tracheal Respiration in Cockroach

- A system of numerous, shiny, transparent and branched **air tubes** or **tracheae** are found for gaseous exchange in cockroach.
- There are 6 longitudinal tracheal tubes -2 dorsal, 2 ventral and 2 laterals which are interconnected by transverse commissures.
- Chitinous rings prevent collapse of trachea.
- Tracheae branch into smaller tubes known as tracheoles. The tubes branch repeatedly so that extremely fine tubules, tracheoles, reach the individual cells or small groups of cells inside the body.
- Atmospheric air enters into and escapes out from this system through ten pairs of slit-like apertures called **spiracles** located on lateral sides of the body. Two pairs of these are thoracic and eight pairs are abdominal.



- Thoracic spiracles are some what larger. One pair of these in between prothorax and the other between mesothorax and metathorax upon respective pleurites.
- The first pair of abdominal spiracle are dorsolateral upon tergite of first abdominal segment, but the remaining seven pairs are upon the pleurites of second to eight segments.

### Mechanism

- Harmonious contractions and relaxations of **tergo-sternal muscles** at regular intervals cause rhythmic expansion and compression of all abdomen leading to inspiration (with relaxation) and expiration (with contraction) of air.
- At rest, the oxygen requirement is less. Tracheolar ends get filled with tissue fluid. The movement of  $O_2$  is along the pressure gradient as the tracheolar ends are losing oxygen to the cells for performing cellular respiration.
- $O_2$  requirement increases during activity. Tracheolar fluid is withdrawn out of Tracheoles. Alternate expansion and contraction of abdominal cavity occurs involving tergo-sternal muscle and abdominal muscles. High level of  $CO_2$  in abdominal cavity makes tergo-sternal muscle and abdominal muscles to contract pushing out the air from tracheal system to the outside through spiracle. With relaxation abdomen expands i.e., tracheal trunks and tracheae expand and as a result, air rushes into tracheae, tracheoles via spiracles which results in inspirations.

### Q. 8. Answer

**Types of Asexual Reproduction in Protozoa:** Asexual reproduction generally occurs in protozoans during - the favourable conditions (mainly optimum temperature, availability of nutrients).

#### Binary Fission

- It is the simplest and most common method of asexual reproduction.
- The whole parental body acts as the reproductive unit. The nucleus of the unicellular parent organism divides into two. This is followed by the division of the cytoplasm and 2 daughter cells of almost equal size are formed.
- The daughter cells grow in size and then divide again. Binary fission involves mitosis only and hence the resultant individuals are genetically identical to each other and to the parent.

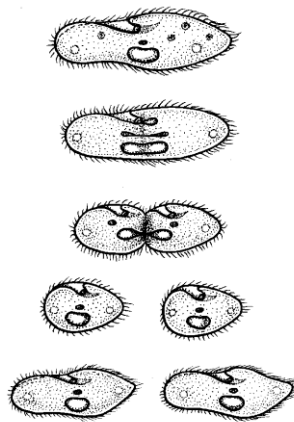
**Examples:** Seen in Euglena, Amoeba, Paramecium.

Based on the plane of cytoplasmic division binary fission is of 3 types, namely:

- a) Simple binary fission
- b) Transverse binary fission
- c) Longitudinal binary fission

**a) Simple binary fission:** When the cytoplasmic division passes through any plane, the fission is called simple binary fission. Example: Amoeba

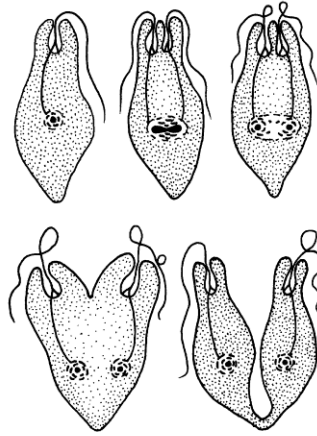
**b) Transverse binary fission:** When the plane of cytoplasmic division coincides with the transverse axis of the individual, the fission is called transverse binary fission. Example: Paramecium, Planaria



Transverse binary fission in Paramecium

**c) Longitudinal binary fission:** When the plane of cytoplasmic division coincides with the longitudinal axis of the individual, the fission is called longitudinal binary fission. Example: Euglena.



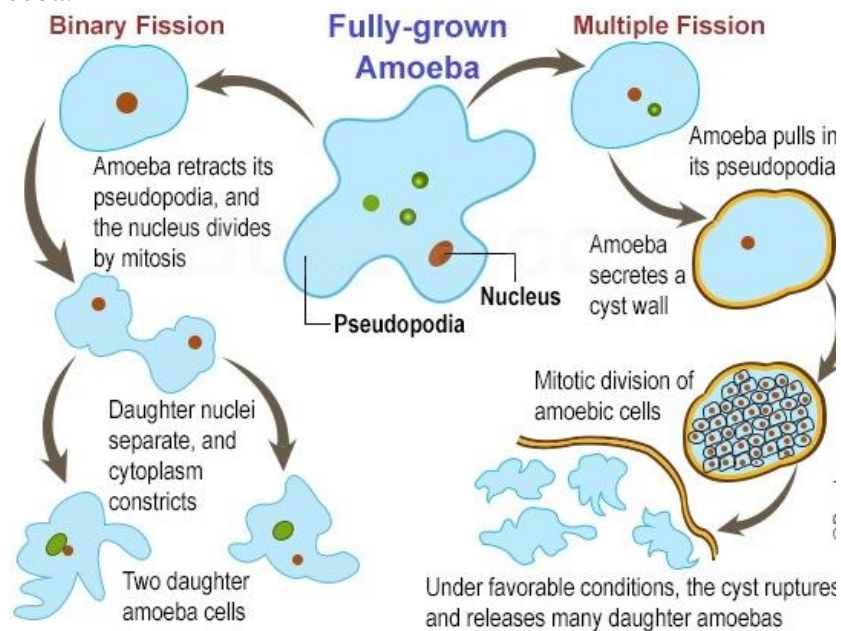


Longitudinal binary fission in Euglena

### Multiple Fission:

- In some protozoans the nucleus of the parent divides into many daughter nuclei by repeated divisions (amitosis).
- This is followed by the division of the cytoplasm into several parts with each part enclosing one nucleus.
- So a number of daughter cells are formed from a single parent at the same time. This kind of fission is known as multiple fission.

Example: Seen in Plasmodium (malarial parasite) where it is known as schizogony or sporulation, Amoeba.



During unfavourable conditions, amoeba withdraws its pseudopodia, becomes almost round and secretes a three-layered hard covering called cyst around itself. This phenomenon is called encystation and lasts till the favourable conditions set in. On the onset of favourable conditions, the encysted amoeba divides by multiple fission to produce a large number of minute pseudopodiospores. At this point, the cyst bursts open and the spores are liberated into the

surrounding medium. Each pseudopodiospore develops into an amoeba. This entire process is termed as sporulation.

### **Budding**

- Budding is common in - Suctorian protozoans eg : *Acinata*
- The bud is - a smaller individual formed after nuclear division
- If only one bud is formed at a time such budding is called - monotonic budding.
- Monotonic budding occurs in - *Vorticella*
- Multiple buds are formed in - Suctorians.
- Exogenous budding: buds formed on the outer surface of the body, e.g *Ephelota*
- Endogenous budding: buds developed inside the body, e.g *Acinata*