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ANIMAL KINGDOM

BASIS OF CLASSIFICATION

In spite of differences in structure and form of different animals, there are fundamental features common to various individuals in relation to the arrangement of cells, body symmetry, nature of coelom, patterns of digestive, circulatory or reproductive systems.

Levels of Organisation

1. Levels of organisation

Accordingly given below are three basic levels of organisation.

(i) Cellular level of organisation:

The cells in the organisms are arranged as loose cells aggregates, hence it is called cellular level of organisation, e.g. sponges.

(ii) Tissue level of organisation:

The cells are organised into tissues and there is division of labour and specific tissues perform specific functions, e.g. coelenterates.

(iii) Organ level of organisation:

Various tissues are organised and grouped together to form organs. Each organ performs a specific function, for example, stomach is an organ. Organ level of organisation is higher level of organisation e.g. it occurs in groups from aschelminths, Annelida to all chordates.

Organ systems in different groups of animals exhibit various patterns of complexities. For example, the digestive system in Platyhelminthes has only a single opening to the outside of the body that serves as both mouth and anus, and is hence called incomplete

A complete digestive system has two openings, mouth and anus. Similarly, the circulatory system may be of two types:

(i) open type in which the blood is pumped out of the heart and the cells and tissues are directly bathed in it and

(ii) closed type in which the blood is circulated through a series of vessels of varying diameters (arteries, veins and capillaries).

Symmetry

Animals can be categorised based on their symmetry.

1 Asymmetrical

any plane that passes through the centre does not divide them into equal halves. Sponges are mostly asymmetrical

2 Radial symmetry

When any plane passing through the central axis of the body divides the organism into two identical halves, it is called radial symmetry. Coelenterates, ctenophores and echinoderms have this kind of body plan

3. Bilateral symmetry

where the body can be divided into identical left and right halves in only one plane, exhibit bilateral symmetry.

Exmple Animals like annelids, arthropods, etc.

Diploblastic and Triploblastic Organisation

Diploblastic animals

Animals in which the cells are arranged in two embryonic layers, an external ectoderm and an internal endoderm, are called diploblastic animals, e.g., coelenterates

Triploblastic animals

An undifferentiated layer, mesoglea, is present in between the ectoderm and the endoderm Those animals in which the developing embryo has a third germinal layer, mesoderm, in between the ectoderm and endoderm, are called triploblastic animals.

Coelom OR Body Cavity

Presence or absence of a cavity between the body wall and the gut wall is very important in classification. The body cavity, which is lined by mesoderm is called coelom.

Animals possessing coelom are called coelomates, e.g., annelids, molluscs, arthropods, echinoderms, hemichordates, and chordates.

In some animals, the body cavity is not lined by mesoderm, instead, the mesoderm is present as scattered pouches in between the ectoderm and endoderm. Such a body cavity is called pseudocoelom and the animals possessing them are called pseudocoelomates, e.g., aschelminths.

The animals in which the body cavity is absent are called acoelomates, e.g., Platyhelminthes.

Segmentation

In some animals, the body is externally and internally divided into segments with a serial repetition of at least some organs.

For example, in earthworm, the body shows this pattern called metameric segmentation and the phenomenon is known as metamerism.

The body of animals could be unsegmented, pseudo-segmented or metamerically segmented.

(i) Unsegmented: Body is not segmented at all as in roundworms.

(ii) Segmented: Body is externally and internally divided into segments called metameres. Parts of various organ

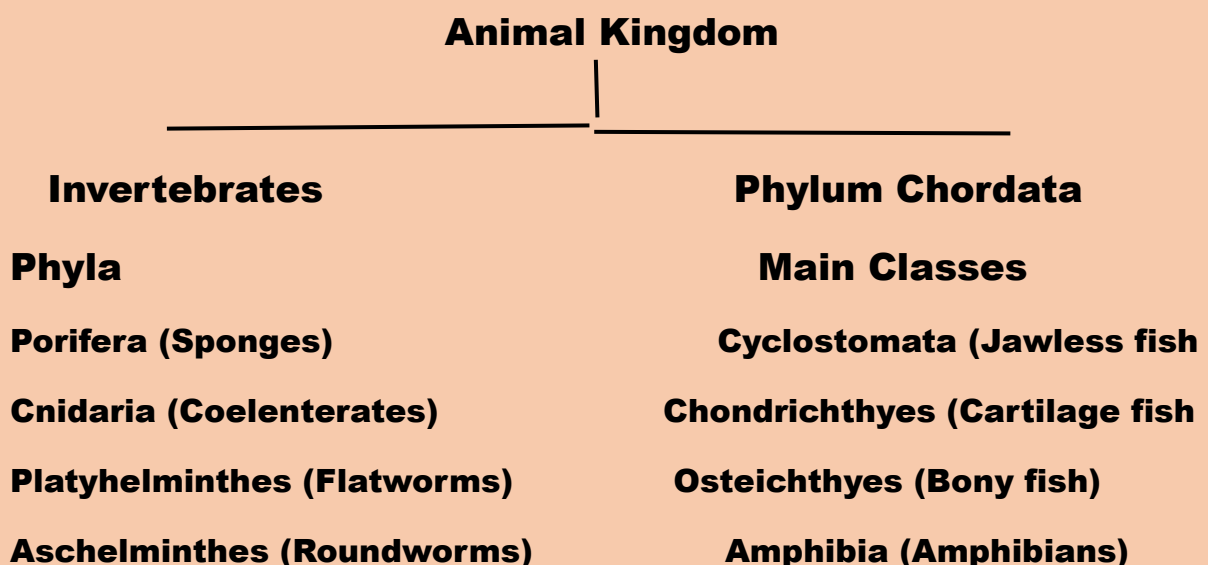
systems are present in different segments e.g. earthworm.

(iii) **Pseudosegmented:** In some animals, the body may look segmented but in true sense body is not divided, the segments are repetitive independent units and have the capability of performing all functions independent of other segments. Such segments are called pseudosegments and the body is pseudosegmented

Notochord

Notochord is a mesodermally derived rod-like structure formed on the dorsal side during embryonic development in some animals. Animals with notochord are called chordates and those animals which do not form this structure are called non-chordates, e.g., porifera to echinoderms.

CLASSIFICATION OF ANIMALS



Annelida (Segmented worms)

Reptilia (Reptiles)

Arthropoda (Arthropods)

Tetrapods

Mollusca (Molluscs)

Aves (Birds)

Echinodermata (Echinoderms)

Mammalia

Hemichordata

Phylum – Porifera

Members of this phylum are commonly known as sponges. They are generally marine and mostly asymmetrical animals.

These are primitive multicellular animals and have cellular level of organisation. Sponges have a water transport or canal system.

Water enters through minute pores (ostia) in the body wall into a central cavity, spongocoel, from where it goes out through the osculum.

This pathway of water transport is helpful in food gathering, respiratory exchange and removal of waste.

Choanocytes or collar cells line the spongocoel and the canals. Digestion is intracellular.

The body is supported by a skeleton made up of spicules or spongin fibres.

Sexes are not separate (hermaphrodite), i.e., eggs and sperms are produced by the same individual.

Sponges reproduce asexually by fragmentation and sexually by formation of gametes.

Fertilisation is internal and development is indirect having a larval stage which is morphologically distinct from the adult.

Examples: Sycon (Scypha), Spongilla (Fresh water sponge) and Euspongia (Bath sponge).

Phylum – Coelenterata (Cnidaria)

The name cnidaria is derived from the cnidoblasts or cnidocytes (which contain the stinging capsules or nematocysts) present on the tentacles and the body.

Cnidoblasts are used for anchorage, defense and for the capture of prey.

Cnidarians exhibit tissue level of organisation and are diploblastic.

They have a central gastro-vascular cavity with a single opening, mouth on hypostome.

Digestion is extracellular and intracellular. Some of the cnidarians, e.g., corals have a skeleton composed of calcium carbonate.

Cnidarians exhibit two basic body forms called polyp and medusa .

The former is a sessile and cylindrical form like Hydra, Adamsia, etc. whereas, the latter is umbrella-shaped and free-swimming like Aurelia or jelly fish.

Those cnidarians which exist in both forms exhibit alternation of generation (Metagenesis), i.e., polyps produce medusae asexually and medusae form the polyps sexually (e.g., Obelia).

Examples: Physalia , Adamsia (Sea anemone), Pennatula (Sea-pen), Gorgonia (Sea-fan) and Meandrina (Brain coral).

Phylum – Ctenophora

Ctenophores, commonly known as sea walnuts or comb jellies are exclusively marine, radially symmetrical, diploblastic organisms with tissue level of organisation.

The body bears eight external rows of ciliated comb plates, which help in locomotion.

Digestion is both extracellular and intracellular.

Bioluminescence (the property of a living organism to emit light) is well-marked in ctenophores.

Sexes are not separate.

Reproduction takes place only by sexual means.

Fertilisation is external with indirect development.

Examples: Pleurobrachia and Ctenoplana.

Phylum – Platyhelminthes

They have dorso-ventrally flattened body, hence are called flatworms .

These are mostly endoparasites found in animals including human beings.

Flatworms are bilaterally symmetrical, triploblastic and acoelomate animals with organ level of organisation. Hooks and suckers are present in the parasitic forms.

Some of them absorb nutrients from the host directly through their body surface.

Specialised cells called flame cells help in osmoregulation and excretion.

Sexes are not separate. Fertilisation is internal and development is through many larval stages.

Some members like Planaria possess high regeneration capacity.

Examples: Taenia (Tapeworm), Fasciola (Liver fluke).

Phylum – Aschelminthes

The body of the aschelminthes is circular in cross-section, hence, the name roundworms.

They may be free living, aquatic and terrestrial or parasitic in plants and animals.

Roundworms have organ-system level of body organisation.

They are bilaterally symmetrical, triploblastic and pseudocoelomate animals.

Alimentary canal is complete with a well-developed muscular pharynx.

An excretory tube removes body wastes from the body cavity through the excretory pore.

Sexes are separate (dioecious), i.e., males and females are distinct. Often females are longer than males.

Examples: Ascaris (Roundworm), Wuchereria (Filaria worm), Ancylostoma (Hookworm).

Phylum – Annelida

They may be aquatic (marine and fresh water) or terrestrial; free-living, and sometimes parasitic.

They exhibit organ-system level of body organisation and bilateral symmetry.

They are triploblastic, metamerically segmented and coelomate animals.

Their body surface is distinctly marked out into segments or metamerous and, hence, the phylum name Annelida.

They possess longitudinal and circular muscles which help in locomotion.

Aquatic annelids like Nereis possess lateral appendages, parapodia, which help in swimming.

A closed circulatory system is present.

Nephridia help in osmoregulation and excretion.

Neural system consists of paired ganglia (sing. ganglion) connected by lateral nerves to a double ventral nerve cord.

Nereis, an aquatic form, is dioecious, but earthworms and leeches are monoecious.

Reproduction is sexual.

Examples: Nereis, Pheretima (Earthworm) and Hirudinaria (Blood sucking leech).

Phylum – Arthropoda

This is the largest phylum of Animalia which includes insects.

They have organ-system level of organisation.

They are bilaterally symmetrical, triploblastic, segmented and coelomate animals.

The body of arthropods is covered by chitinous exoskeleton.

The body consists of head, thorax and abdomen.

They have jointed appendages (arthros-joint, poda-appendages).

Respiratory organs are gills, book gills, book lungs or tracheal system.

Circulatory system is of open type. Sensory organs like antennae, eyes (compound and simple), statocysts or balancing organs are present.

Excretion takes place through malpighian tubules.

They are mostly dioecious.

Fertilisation is usually internal.

They are mostly oviparous.

Development may be direct or indirect

Examples:

Economically important insects – Apis (Honey bee), Bombyx (Silkworm), Laccifer (Lac insect) Vectors – Anopheles, Culex and Aedes (Mosquitoes) Gregarious pest – Locusta (Locust) Living fossil – Limulus (King crab)

Phylum – Mollusca

This is the second largest animal phylum.

Molluscs are terrestrial or aquatic (marine or fresh water) having an organ-system level of organisation.

They are bilaterally symmetrical, triploblastic and coelomate animals.

Body is covered by a calcareous shell and is unsegmented with a distinct head, muscular foot and visceral hump.

A soft and spongy layer of skin forms a mantle over the visceral hump.

The space between the hump and the mantle is called the mantle cavity in which feather like gills are present.

They have respiratory and excretory functions.

The anterior head region has sensory tentacles.

The mouth contains a file-like rasping organ for feeding, called radula.

They are usually dioecious and oviparous with indirect development.

Examples: Pila (Apple snail), Pinctada (Pearl oyster), Sepia (Cuttlefish), Loligo (Squid), Octopus (Devil fish), Aplysia (Seahare), Dentalium (Tusk shell) and Chaetopleura (Chito

Phylum – Echinodermata

These animals have an endoskeleton of calcareous ossicles and, hence, the name Echinodermata.

All are marine with organ-system level of organisation.

The adult echinoderms are radially symmetrical but larvae are bilaterally symmetrical.

They are triploblastic and coelomate animals.

Digestive system is complete with mouth on the lower (ventral) side and anus on the upper (dorsal) side.

The most distinctive feature of echinoderms is the presence of water vascular system which helps in locomotion, capture and transport of food and respiration.

An excretory system is absent.

Sexes are separate. Reproduction is sexual.

Fertilisation is usually external.

Development is indirect with free-swimming larva.

Examples: Asterias (Star fish), Echinus (Sea urchin), Antedon (Sea lily), Cucumaria (Sea cucumber) and Ophiura (Brittle star).

Phylum – Hemichordata

Hemichordata was earlier considered as a sub-phylum under phylum Chordata. But now it is placed as a separate phylum under non-chordata.

Hemichordates have a rudimentary structure in the collar region called stomochord, a structure similar to notochord.

This phylum consists of a small group of worm-like marine animals with organ-system level of organisation.

They are bilaterally symmetrical, triploblastic and coelomate animals.

The body is cylindrical and is composed of an anterior proboscis, a collar and a long trunk .

Circulatory system is of open type. Respiration takes place through gills.

Excretory organ is proboscis gland. Sexes are separate.

Fertilisation is external. Development is indirect.

Examples: Balanoglossus and Saccoglossus.

Phylum – Chordata

Animals belonging to phylum Chordata are fundamentally characterised by the presence of a notochord, a dorsal hollow nerve cord and paired pharyngeal gill slits.

These are bilaterally symmetrical, triploblastic, coelomate with organ-system level of organisation.

They possess a post anal tail and a closed circulatory system.

Phylum Chordata is divided into three subphyla: Urochordata or Tunicata, Cephalochordata and Vertebrata.

Subphyla Urochordata and Cephalochordate are often referred to as protochordates and are exclusively marine.

In Urochordata, notochord is present only in larval tail, while in Cephalochordata, it extends from head to tail region and is persistent throughout their life.

Examples: Urochordata – Ascidia, Salpa, Doliolum; Cephalochordata – Branchiostoma (Amphioxus or Lancelet).

The members of subphylum Vertebrata possess notochord during the embryonic period.

The notochord is replaced by a cartilaginous or bony vertebral column in the adult. Thus all vertebrates are chordates but all chordates are not vertebrates.

Besides the basic chordate characters, vertebrates have a ventral muscular heart with two, three or four chambers, kidneys for excretion and osmoregulation and paired appendages which may be fins or limbs.

Class – Cyclostomata

All living members of the class Cyclostomata are ectoparasites on some fishes.

They have an elongated body bearing 6-15 pairs of gill slits for respiration.

Cyclostomes have a sucking and circular mouth without jaws.

Their body is devoid of scales and paired fins. Cranium and vertebral column are cartilaginous.

Circulation is of closed type.

Cyclostomes are marine but migrate for spawning to fresh water. After spawning, within a few days, they die. Their larvae, after metamorphosis, return to the ocean.

Examples: Petromyzon (Lamprey) and Myxine (Hagfish).

Class – Chondrichthyes

They are marine animals with streamlined body and have cartilaginous endoskeleton.

Mouth is located ventrally. Notochord is persistent throughout life.

Gill slits are separate and without operculum (gill cover).

The skin is tough, containing minute placoid scales.

Teeth are modified placoid scales which are backwardly directed.

These animals are predaceous.

Due to the absence of air bladder, they have to swim constantly to avoid sinking Heart is two-chambered (one auricle and one ventricle).

Some of them have electric organs (e.g., Torpedo) and some possess poison sting (e.g., Trygon).

They are cold-blooded (poikilothermous) animals, i.e., they lack the capacity to regulate their body temperature.

Sexes are separate. In males pelvic fins bear claspers. They have internal fertilisation and many of them are viviparous.

Examples: Scoliodon (Dog fish), Pristis (Saw fish), Carcharodon (Great white shark), Trygon (Sting ray).

Class – Osteichthyes

Their body is streamlined.

Mouth is mostly terminal.

They have four pairs of gills which are covered by an operculum on each side.

Skin is covered with cycloid/ctenoid scales.

Air bladder is present which regulates buoyancy.

Heart is twochambered (one auricle and one ventricle).

They are cold-blooded animals.

Sexes are separate. Fertilisation is usually external.

They are mostly oviparous and development is direct.

Examples: Marine – Exocoetus (Flying fish), Hippocampus (Sea horse); Freshwater – Labeo (Rohu), Catla (Katla), Clarias (Magur); Aquarium – Betta (Fighting fish), Pterophyllum (Angel fish).

Class – Amphibia

Most of them have two pairs of limbs.

Body is divisible into head and trunk.

Tail may be present in some. The amphibian skin is moist (without scales).

The eyes have eyelids.

A tympanum represents the ear.

Alimentary canal, urinary and reproductive tracts open into a common chamber called cloaca which opens to the exterior.

Respiration is by gills, lungs and through skin.

The heart is threechambered (two auricles and one ventricle).

These are cold-blooded animals.

Sexes are separate.

Fertilisation is external.

They are oviparous and development is indirect.

Examples: Bufo (Toad), Rana (Frog), Hyla (Tree frog), Salamandra (Salamander), Ichthyophis (Limbless amphibia).

Class – Reptilia

They are mostly terrestrial animals and their body is covered by dry and cornified skin, epidermal scales.

They do not have external ear openings.

Tympanum represents ear.

Limbs, when present, are two pairs.

Heart is usually three-chambered, but four-chambered in crocodiles.

Reptiles are poikilotherms.

Snakes and lizards shed their scales as skin cast. Sexes are separate.

Fertilisation is internal.

They are oviparous and development is direct.

Examples: Chelone (Turtle), Testudo (Tortoise), Chameleon (Tree lizard), Calotes (Garden lizard), Crocodilus (Crocodile), Alligator (Alligator). Hemidactylus (Wall lizard), Poisonous snakes – Naja (Cobra), Bangarus (Krait), Vipera (Viper).

Class – Aves

The characteristic features of Aves (birds) are the presence of feathers and most of them can fly except flightless birds (e.g., Ostrich). They possess beak.

The forelimbs are modified into wings.

The hind limbs generally have scales and are modified for walking, swimming or clasping the tree branches.

Skin is dry without glands except the oil gland at the base of the tail.

Endoskeleton is fully ossified (bony) and the long bones are hollow with air cavities (pneumatic).

The digestive tract of birds has additional chambers, the crop and gizzard.

Heart is completely fourchambered.

They are warm-blooded (homoiothermous) animals, i.e., they are able to maintain a constant body temperature.

Respiration is by lungs.

Air sacs connected to lungs supplement respiration.

Sexes are separate.

Fertilisation is internal. They are oviparous and development is direct.

Examples : Corvus (Crow), Columba (Pigeon), Psittacula (Parrot), Struthio (Ostrich), Pavo (Peacock), Aptenodytes (Penguin), Neophron (Vulture).

Class – Mammalia

They are found in a variety of habitats – polar ice caps, deserts, mountains, forests, grasslands, and dark caves.

Some of them have adapted to fly or live in water.

The most unique mammalian characteristic is the presence of milk producing glands (mammary glands) by which the young ones are nourished.

They have two pairs of limbs, adapted for walking, running, climbing, burrowing, swimming or flying .

The skin mammals is unique in possessing hair.

External ears or pinnae are present. Different types of teeth are present in the jaw.

Heart is fourchambered. They are homoiothermous.

Respiration is by lungs.

Sexes are separate and fertilisation is internal.

They are viviparous with few exceptions and development is direct.

**Examples: Oviparous-Ornithorhynchus (Platypus);
Viviparous - Macropus (Kangaroo), Pteropus (Flying fox),
Camelus (Camel), Macaca (Monkey), Rattus (Rat), Canis
(Dog), Felis (Cat), Elephas (Elephant), Equus (Horse),
Delphinus (Common dolphin), Balaenoptera (Blue whale),
Panthera tigris (Tiger), Panthera leo (Lion).**

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