PHYLUM MOLLUSCA

Mollusca means "soft body" or "soft-bodied". It came from the latin words "molluscus" meaning "thin-walled", and "mollis" meaning "soft".

They are the second largest animal phylum after arthropods, and the largest phylum in aquatic life. consisting of more than 100,000 living or extant species, and about 80,000 extinct or fossil species.

The word mollusca (molluscus) was proposed by Aristotle for "cuttlefish". It was coined by Johnson in 1650 but was later used by Linnaeus in his classification in 1758.

The study of Molluscs is known as Malacology while the study of shells is known as Conchology. Scientist that study molluscs and shells are called Malacologist and Conchologists respectively.

General Characteristics

1. They are mostly aquatic (mostly marine and freshwater, and some are terrestrial living in damp soil.
2. They are triploblastic.
3. They are bilaterally symmetrical except gastropods.
4. They exhibit organ-system level of organisation.
5. Their body is soft, and unsegmented except Neopilina.
6. Their body is covered by calcareous shells except octopuses with internal shell, and Aplacophorans with no shell.
7. They are coelomates i.e they have coelom (internal body cavity) known as schizocoel or haemocoel.
8. The body is divided into head, (absent in pelecypods, and Scaphopods) ventral muscular foot, and dorsal visceral hump/mass.
9. Locomotion (creeping, burrowing, and swimming) takes place by ventral foot.
10. Head bears eye, tentacles (modified into arms in octopus) and sense organs, like osphradium, and statocyst except pelecypods, and scaphopods.

11. Their body is covered by mantle which secretes shell.
12. They have open circulatory system except Cephalopoda which has closed system.
13. Excretion takes place by a pair of metanephridia or organs of Bo organ (bivalve mollusks), and the waste product is ammonia
14. Digestive system is well-developed with a hard chitinous rasping organ called radula.
15. Respiration takes place through one or more gills or ctenidia, pulmonary sac or mantle (general body surface in the terrestrial forms.
16. They have separate sexes (dioecious e.g Pila globosa) but some are hermaphrodite (monoecious e.g Helix, Lim
17. Fertilization is external (in sessile forms such as oysters) or internal.
18. Cleavage is spiral and determinate.
19. Development may be direct or indirect.
20. Larva is trocophore, veliger or glochidium.
21. Nervous system consists of many paired ganglia, connectives, and nerves.
22. Blood is haemocyanin (Cu^{2+} carrying pigment) — can 3X more oxygen than haemoglobin.
- Oxygenated haemocyanin is blue in colour
Deoxygenated haemocyanin is colourless.

CLASSIFICATION

1. Domain | Superkingdom: Eukaryota | Eukarya
2. Kingdom: Animalia
3. Subkingdom: Eumetazoa | Metazoa | Bilateria
4. Infrakingdom: Protostomia
5. Superphylum: Lophotrochozoa | Lophozoa
6. Phylum: Mollusca
7. Subphylum: 1. Aculifera (Scale-bearers)
   2. Conchifera (Shell-bearers)
8. Class: 1. Aplacophora
   2. Monoplacophora
   3. Polyplacophora
   4. Bivalvia
   5. Gastropoda
   6. Cephalopoda
   7. Scaphopoda.

CLASS: APLACOPHORA

Greek: A = without; Plax = plate; phorein = to bear

Aplacophorans are a group of small worm-like molluscs devoid of any shell. They are popularly known as "Solenogasters", and "mud-moles".

It has two subclasses

1. Caudofoveats or Chaetodermomorpha (130+ species)
2. Solenogasters or Neomeniomorpha. (350+ species)

Characteristics

1. The body is cylindrical or bilaterally symmetrical
2. It contains a dorsal longitudinal keel or crest.
3. Some are burrowing (Caudofoveata), No foot. and others are creeping (Solenogasters) have a foot
4. The long, and narrow vermiform body has poorly developed head, no shell (but has calcareous scales or spicules), and well differentiated mantle, and foot.
5. A posterior cavity is present. The anus, and a pair of coelom ducts opens to it. This cavity probably represents the degenerative mantle cavity. In burrowing forms, it houses a pair of gills.

N.B Caudofoveata are burrowing
Solenogasters are epibenthic (creeping forms)

6. Straight and well differentiated alimentary canal with large digestive caecum. is present
7. In most cases, there is a radula in the buccal cavity and a style sac in the intestine. Where radula is absent buccal cavity acts as a sucking pump.
8. Burrowing forms feed on small micro-organisms and detritus. The creeping species (solenogasters) feed on cnidarians.
9. Heart consists of a single auricle, and single ventricle. They have haemocoel which is divided by a muscular septum into dorsal haemocoel, and pedal haemocoel. It connects pericardial cavity with mantle cavity.
10. Excretory system is poorly developed without nephridia. Podocytes, and epidermal gland cells perform the excretory function.
11. Nervous system is primitive, and ladder-like having a pair of cerebral ganglia, 2 pairs of longitudinal nerve cords and their transverse commissures.
12. They are mostly hermaphroditic but some are gonochoric (modified coelom ducts). The gonoducts open into the mantle cavity.
13. Gametes are discharged directly into the pericardial cavity.
14. Development is direct (to adult) in some, and indirect in others through a trochophore larval stage.

Examples:

i Chaetodermomorpha – Chaetoderma, Falcidens, Scutopus.

ii Neomeniomorpha – Neomenia, Meiomenia, Eleutheromenia, Epimenia australis

CLASS: MONOPLACOPHORA

Greek' Mono = one ' plax = plate ' Pherein = bearing

Monoplacophora meaning "bearing one plate" is a polyphyletic superclass of molluscs with a cap-like shell inhabiting the deep sea. They can be regarded as the ancestors of all molluscs. Extant representatives were recognized in 1952 from fossil records.

Characteristics

1. They are internally segmented (metameric segmentation)
2. They are bilaterally symmetrical.
3. They bear one shell which varies from a flat shield to a short cone. they have dome shaped mantle.
4. Their length ranges from 3mm to 3cm.

5. The foot is broad, and flat with 8 pairs of pedal retractor muscles.
6. The mantle cavity has 5 or 6 pairs of monopectinate gills for respiration
7. The mouth lies in front of the foot, and the anus opens posteriorly to the mantle cavity. There is a preoral fold in front of the mouth extending laterally as a longer ciliated palp-like structure. Another fold projects behind the mouth on either sides as pectoral tentacles.
8. The buccal cavity has a radula, and a subradular organ. The stomach has a crystalline style. There is a long coiled intestine.
9. Six pairs of nephridia for excretion
10. Heart has two pairs of auricles, and a pair of ventricles, and is surrounded by paired pericardial coelom.
11. They have open circulatory system.
12. Nervous system is typical with a pair of cerebral ganglia, circumoral nerve ring, a pair of visceral nerves, and a pair of pedal nerves.
13. Sexes are separate. Two pairs of gonads are located in the middle of the body.
14. Fertilization is external
15. Development is unknown with trocophore larva.

Example: Neopilina galatheae, Living fossil

Neopilina is a connective link between annelids and molluscs.

Annelida characteristics are:-

1. Metameric segmentation
2. Nephridia
3. Trocophore larva
4. Paired muscles and gills.

Molluscs characteristics are:-

1. ~~Possession~~ Mantle
2. Radula
3. Shell.

Domain: Eukaryota
Kingdom: Animalia
phylum: Mollusca
Class: Monoplacophora
Order: Neopilinida
Family: Neopilinidae
Genus: Neopilina
Species: Neopilina galatheae

CLASS: POLYPLACOPHORA

Greek: Poly = many; Plax = Plate; Phoros = to bear

They are popularly known as Chitons. They were formerly known as Amphineura or Loricates. There are about 940 extant species, and 430 fossil species with 13 families.

Polyplacophora means "bearing many plates".

Characteristics

1. They are dorso-ventrally flattened oval-shaped animals.
2. They are bilaterally symmetrical.
3. They are marine; living on hard substrates in shallow marine water.
4. They have a dorsal calcareous shell of eight plates embedded in a tough mantle. The mantle edge is called the girdle and it is stuffened. (N.B 3 head plates, 4 tail plates, 1 anal plate).
5. They have a large muscular ventral foot which

helps with attachment to substrates. (N.B Girdle and foot can act as suction cup).

6. They have a poorly differentiated head without eyes or tentacles
7. Their mantle cavity with grooves around the foot, has 6 - 88 pairs of ctenidia or gills which are connected to the siphon aperture in the tail plate by a pair of long tubes called siphons
8. Their anus is subterminal without jaws.
9. Radula is present, their radula teeth have iron oxides (magnitite)
10. Sexes are separate (Dioecious)
11. Fertilization is external.
12. They have trocophore larva.
13. Development is direct into miniature adult without intermidiate larva called veliger larva.
14. They possess a heart (3-chambered; 2 auricles and 1 ventricle) and an open circulatory system.
15. They possess a pair of nephridia that are connected to the pericardial cavity around the heart and open to the pallial cavity (mantle cavity).
16. They have a simple nervous system with two pairs of lateral nerve cords and many special minute sensory organs called aesthetes that pass through the shell valves.
17. They feed on sponges, bryozoans diatoms and algae scraped from substrates with their radula. Some feed on crustaceans, barnacles and Lacteria

Example: Chiton tuberculatus, Chiton affinis

Domain: Eukaryots
Kingdom: Animalia
Phylum: Molluscs
Class: Polyplacophora
Order: Chitonids
Family: Chitonidae
Sub family: Chitoninae
Genus: Chiton
Species: Chiton affinis

CLASS: BIVALVIA

There are 30,000 species of this class. it is the second longest molluscan class. This class includes the clams, oysters, mussels and scallops. They are also called pelecypoda or lamellibranchs.

Characteristics

1. They live in, marine, and freshwater.
2. They have bilaterally symmetrical, and laterally flattened bodies.
3. They have sheet-like bodies.
4. Shell consists of two convex valves (hence the name bivalves). Shell covers the laterally compressed animals. Along the dorsal margin of the shell is a proteinaceous hinge, and a series of modifications of shell called teeth. The oldest part of the shell is called umbo. Adductor muscles at either end of shell close the shell. Mantle attaches to the shell around the adductor muscles, and near the shell margin.

N.B If a sand grain or a parasite lodges between the

the shell and mantle, the mantle secretes nacre around forming a pearl.

5. Head is not distinct, and eye, tentacles, and jaws are absent.
6. Radula is absent and most bivalves are sedentary and filter feeders. Therefore they are used in removing bacteria from polluted water.
7. They have paired gills (one on each side). Cilia cover gills, and the gills form folded sheets called lamellae. One end of gill is attached to the foot and the other end attached to the mantle.

Gas exchange is through the gills covered by cilia. Cilia move water into the mantle cavity through an incurrent into vertical channels in the gills called water tubes.

In moving water through water tubes, water and blood are in close proximity, and gases exchange by diffusion. Water exit through suprabranchial chamber, and then through an excurrent opening in the mantle.

8. Margin of mantle has sensory cells, and photoreceptors alongside other receptors like statocysts near pedal ganglion, and an osphradium in the mantle
9. Nervous system consists of 3 pairs of interconnected ganglia; cerebral, pedal, and visceral ganglia.
10. They burrow in mud or sand.
11. They have plough-shaped ventral foot.
12. Most bivalves are dioecious but a few are monoecious (hermaphrodites). Some species are protandric. Gonads are in the visceral mass, and their ducts open directly into the mantle cavity.
13. Fertilization is external.
14. Development is indirect with veliger larval stage.
15. They have a trochophore larva which in most

freshwater bivalves, the young are bored to a modified veliger stage called glochidium which is parasitic on fishes.

16 Bivalves have an open circulating system that bathes the organs in blood (hemolymph). The heart has 3 chambers: two auricles, receiving blood from the gills, and a single ventricle which is muscular and pumps hemolymph into the aorta, and to the rest of the body

17 The excretory organs of bivalves are a pair of nephridia (or kidneys) which open into the pericardium.

18 Metabolic wastes are voided through a nephridiopore near the front of the upper part of the mantle cavity, and are excreted.

Classification

There are four subclasses namely:

1. Heterodonts which has 5600 species.
2. Palaeoheterodonts which has 908 species
3. Protobranchia which has 700 species.
4. Pteriomorphia which has 2000 species.

Giant Clam.

Kingdom: Animalia
Phylum: Molluscs
Class: Bivalvia
Subclass: Heterodonts
Order: Cardiida
Family: Cardiidae
Genus: Tridacna
Species: Tridacna gigas.

Economic Importance

1. These molluscs are exploited for food.
2. They are used as efficient bait in fishing.
3. They are used in the treatment of various diseases preparation of medicines, and medicinal oils.
4. The pearl oysters and other molluscan shell are used for decorative, and ornamental purposes.
5. Their shells rich in calcium are mainly used for lime making, and poultry feeds making.
6. Marine borers belonging to the families Pholadidae and Teredinidae cause substantial damage to underwater wooden construction, wooden sailing craft, and floating timber especially in the tropics