

CHAPTER 10 MOLLUSCS

10.1 A Significant Space

- A. Evolved a fluid-filled space within the mesoderm, the **coelom**
- B. Efficient hydrostatic skeleton; room for networks of blood vessels, the alimentary canal, and associated organs.

10.2 Characteristics

A. Phylum Mollusca

1. Contains nearly 75,000 living species and 35,000 fossil species.
2. They have a soft body.
3. They include chitons, tooth shells, snails, slugs, nudibranchs, sea butterflies, clams, mussels, oysters, squid octopuses and nautilus (Figure 10.1A-E).
4. Some may weigh 450 kg and some grow to 18 m long, but 80% are under 5 centimeters in size.
5. Shell collecting is a popular pastime.
6. Classes: Gastropoda (snails...), Bivalvia (clams, oysters...), Polyplacophora (chitons), Cephalopoda (squids, nautilus, octopuses), Monoplacophora, Scaphopoda, Caudofoveata, and Solenogastres.

B. Ecological Relationships

1. Molluscs are found from the tropics to the polar seas.
2. Most live in the sea as bottom feeders, burrowers, borers, grazers, carnivores, predators and filter feeders.
1. Fossil evidence indicates molluscs evolved in the sea; most have remained marine.
2. Some bivalves and gastropods moved to brackish and fresh water.
3. Only snails (gastropods) have successfully invaded the land; they are limited to moist, sheltered habitats with calcium in the soil.

C. Economic Importance

1. Culturing of pearls and pearl buttons is an important industry.
2. Burrowing shipworms destroy wooden ships and wharves.
3. Snails and slugs are garden pests; some snails are intermediate hosts for parasites.

D. Position in Animal Kingdom (see Inset, page 172)

E. Biological Contributions (see Inset, page 172)

10.3 Form and Function

A. Mollusc Body Plan: Head-Foot and Visceral Mass Portions (Figure 10.2).

1. The **head-foot** portion contains the feeding, cephalic sensory and locomotor organs.
2. The **visceral mass** portion contains digestive, circulatory, respiratory, and reproductive organs.
3. Two folds of skin form the protective **mantle** or pallium.
4. The space between mantle and body wall is the **mantle cavity**.
5. The mantle cavity houses the gills (**ctenidia**) or a lung.
6. In most molluscs, the mantle secretes a protective shell over the visceral mass.

B. Head-Foot

1. Most molluscs have a well-developed head bearing the mouth and some sensory organs.
2. Photosensory receptors range from simple to complex eyes.
3. Tentacles may be present.
4. Posterior to the mouth is the chief locomotor organ, the foot.
5. **Radula** (Figure 10.3)
 - a. The radula is unique to molluscs; it is found in all except bivalves and some solenogastres.
 - b. The radula is a protruding, rasping, tongue-like organ.
 - c. The ribbon-like membrane has rows of tiny teeth—up to 250,000—pointed backward.
 - d. The radula rasps off fine particles of food material from surfaces.
 - e. The radula serves as a conveyor belt to move particles to the digestive tract.
 - f. Complex muscles move the radula and its supporting cartilages (**odontophore**).
6. **Foot**
 - a. The foot is usually ventral.
 - b. It can function for attachment to the substratum or for locomotion.
 - c. Modifications include the attachment disc of limpets, the hatchet foot of clams and the siphon jet of squids.
 - d. Secreted mucus can aid in adhesion or help some molluscs glide on cilia.

7. Visceral Mass

- a. Mantle and Mantle Cavity
 - 1) A mantle is a sheath of skin on each side of the body; it secretes the shell when present.
 - 2) The mantle cavity houses the gills or lungs that develop from the mantle.
 - 3) The exposed surface of the mantle also serves for gaseous exchange.
 - 4) In aquatic molluscs, a continuous flow of water brings in oxygen and food, flushes out wastes.
 - 5) Products of digestive, excretory and reproductive systems empty into the mantle cavity.

- 6) Cephalopods use the head and mantle cavity to create jet propulsion.
- b. **Shell** (Figure 10.4)
 - 1) When present, the shell is secreted by the mantle and lined by it.
 - 2) The **periostracum** is the outer horny layer, composed of conchiolin, a tanned protein.
 - 3) The middle **prismatic layer** has closely packed prisms of calcium carbonate.
 - 4) The inner **nacreous layer** is next to the mantle; the nacre is laid down in thin layers.
 - 5) The thick periostracum of freshwater molluscs protects against acid from leaf decay in streams.
 - 6) The shell appears during the larval period and grows throughout life.
8. **Internal Structure and Function**
 - a. General
 - 1) The open circulatory system includes a pumping heart, blood vessels and blood sinuses.
 - 2) Most cephalopods have a closed system with a heart, vessels and capillaries.
 - 3) Most molluscs have a pair of kidneys or metanephridia.
 - 4) Kidney ducts also discharge sperm and eggs.
 - 5) The nervous system has pairs of ganglia but is generally simpler than in annelids.
 - 6) In air-breathing snails, the nervous system produces growth hormones.
 - 7) Sense organs vary and may be highly specialized.
 - b. Most are **dioecious** but some are **hermaphroditic**.
 - c. The egg hatches and produces free-swimming trochophore larvae (Figure 10.5).
 - d. In many gastropods and bivalves, an intermediate larval stage—the **veliger**—occurs next (Figure 10.6).
9. **Characteristics of phylum mollusca (see Inset, page 175)**

10.4 Classes Caudofoveata and Solenogastres

A. Members are wormlike, marine organisms .

1. Both classes are often united in the class Aplacophora
2. Characteristics include reduced heads, lack of nephridia, and calcareous spicules in the integument.
3. Caudofoveates have one pair of gills, are dioecious, and burrow.
4. Solenogasters resemble caudofoveates but have no radula or gills and are hermaphroditic.
5. They do not burrow but live freely on the bottom and feed on cnidarians.

B. Class Monoplacophora (Figure 10.7).

1. Previously considered extinct, a living specimen was discovered in 1952; now a dozen extant species are known.
2. Small molluscs with a rounded shell, they resemble limpets.
3. However, some organs are repeated: gills, metanephridia, and gonads.
4. Repetition of segments may indicate a metameric ancestor.
5. *Neopilina* shows only pseudometamerism, not indicative of a metameric ancestor.

C. Class Polyplacophora: Chitons (Figures 10.9 and 10.10)

1. Chitons are somewhat flattened mollusks, 2-5 cm in length, with **eight overlapping dorsal plates (valves)** (Figure 10.8).
2. Photosensitive structures similar to eyes pierce the plates.
3. Most prefer rocky intertidal surfaces and stray only short distances for feeding
4. The chiton radula scrapes algae from the rocks.
5. The mantle extends around the chiton margin, forming a **girdle**.
6. **Gills** are suspended from the roof of the mantle cavity and grooves form a closed chamber so water flows from anterior to posterior.
7. A pair of **osphradia** serves as a sense organ to sample water in the mantle groove.
8. Blood pumped by a three-chambered heart travels through the aorta and sinuses to the gills.
9. A pair of metanephridia carries wastes from the pericardial cavity to the exterior.
10. Sexes are separate and trochophore larvae metamorphose into juveniles without a veliger stage.

D. Class Scaphopoda

1. Tusk or tooth shells are found living on the ocean bottom from the subtidal zone to 6000 m depth (Figure 10.10).
2. The slender body is covered with a mantle; the tubular shell is open at both ends.
3. This is a unique body plan: the mantle is wrapped around the viscera and fused to form a tube.
4. The foot protrudes from the larger end to burrow into mud; the small end extends into water.
5. Foot and ciliary action move respiratory water through the mantle cavity.
6. Gills are absent and gaseous exchange occurs via the mantle.
7. Detritus and protozoa are caught on cilia on the foot or the mucous-covered knobs of the tentacles.

E. Class Gastropoda

1. This class is the most diverse and contains 40,000 living and 15,000 fossil species.
2. It includes snails, limpets, slugs, whelks, conches, periwinkles, sea slugs, sea hares and sea butterflies; slow sluggish sedentary animals.

3. They vary from primitive marine forms to air-breathing terrestrial snails and slugs.
4. **Torsion** is a twisting process that diverts the veliger from a bilateral to asymmetrical form.
5. Gastropod shells are one-piece univalve, coiled, or uncoiled.
6. **Torsion** (Figure 10.11)
 - a. Only gastropods undergo torsion.
 - b. Torsion moves the mantle cavity from the posterior to the front of the body.
 - c. This twists the visceral organs through a 90 to 180 degree rotation while in the veliger stage.
 - d. The anus cavity and mantle cavity move from posterior to anterior, opening above the head.
 - e. Gills, kidneys and heart auricles are switched left-to-right; the nerve cords are also twisted.
 - f. This allows the possibility of wastes washing back over gills, or “**fouling.**”
 - g. After torsion, the head can be withdrawn into the shell for protection.
 - h. Sense organs would better sample water in the direction of travel.
7. Many snails have an operculum covering the shell aperture.
8. **Coiling** (Figure 10.12 A, B, C, D)
 - a. Coiling or spiral winding of the shell and visceral mass is not the same as torsion.
 - b. It occurs at the same larval stage as torsion but had a separate earlier evolutionary origin.
 - c. All living gastropods descended from coiled, torted ancestors even if they now lack this trait (all whorls lay in a single plane—Figure 10.12A)
 - d. A **planospiral** shell has all whorls in a single plane; it is the primitive state.
 - e. A **conispiral** shape provides more compactness; each whorl is to the side of the previous one.
 - f. Shifting the shell upward and back helped balance the uneven weight distribution.
 - g. However, the gill, auricle and kidney of the right side are lost in most species leading to bilateral asymmetry.
 - h. Loss of the right gill allows one solution to the problem of fouling; wastes expel to the right.
9. **Adaptations to Avoid Fouling (Figure 10.13)**
 - a. A coiled shell made possible a way to avoid fouling.
 - b. Water is brought into the left side of the mantle cavity and out the right side, carrying with it the wastes from the anus and nephridiopore, which lie near the right side (Figure 10.13).
 - c. Some gastropods vent excurrent water through a dorsal slot or hole in the shell.
 - d. Opisthobranchs exhibit detorsion as adults.
10. **Feeding Habits**
 - a. Adaptation of the radula provides much variation in gastropod feeding habits.
 - b. Many are herbivorous; some graze on plankton.
 - c. Some scavenge on decaying flesh; others are active carnivores that tear prey using their radula.
 - d. Some molluscs collect debris as a mucous ball to ingest it; sea butterflies secrete a mucous net.
 - e. Digestion is usually extracellular in the lumen of the stomach.
 - f. Abalones hold seaweed with the foot and break off pieces with their radula (Figure 10.14A).
 - g. Oyster borers and moon snails have an extensible proboscis for drilling holes in the shells of bivalves (Figure 10.14B).
 - h. After grinding in the so-called gizzard in sea hares, extracellular digestion in the lumen of the stomach takes place (Figure 10.15).
 - i. Species of *Conus* can deliver a lethal sting to secure prey; the venom is a **conotoxin** that is specific for its neuroreceptors of its preferred prey (Figure 10.16).
11. **Internal Form and Function**
 - a. Respiration in many molluscs is performed by **ctenidia (gills)** in the mantle cavity.
 - b. Pulmonates have a highly vascular area in the mantle that serves as a lung.
 - c. The lung opens to the outside by a small opening, the **pneumostome** (see Figure 10.20B).
 - d. Aquatic pulmonates surface to expel a gas bubble and inhale by curling, thus forming a siphon.
 - e. Most have a single nephridium and well-developed circulatory and nervous systems (Figure 10.17).
 - g. Sense organs include eyes, statocysts, tactile organs and chemoreceptors.
 - h. Gastropods include both monoecious and dioecious species.
 - i. Copulation in monoecious species may involve exchange spermatophores.
 - j. Eggs are emitted singly or in clusters, and may be transparent or in tough egg capsules.
 - k. Marine young emerge as veliger larvae; others develop directly into a juvenile within the egg.
12. **Major Groups of Gastropods**
 - a. **Classification**
 - 1) Traditional classification has recognized three subclasses of Gastropoda.
 - 2) **Prosobranchia, Opisthobranchia, Pulmonata**
 - 3) **Opisthobranchia** may or may not be paraphyletic.
 - 4) Opisthobranchia and **Pulmonata** together form a monophyletic grouping.

- b. **Prosobranchs** (see Figure 10.18A)
 - 1) These are periwinkles, limpets, whelks, conches, slipper shells, oyster borers, and rock shells.
 - c. **Opisthobranchs** (see Figures 10.15, 10.19)
 - 1) This group includes sea slugs, sea hares, nudibranchs, and canoe shells.
 - 2) Their shell is reduced or absent.
 - 3) The sea hare *Aplysia* has large anterior tentacles and a vestigial shell.
 - 4) Nudibranchs have no shell as adults.
 - 5) Small body projections (cerata) are used for respiration in nudibranchs.
 - d. **Pulmonates** (Figure 10.17, 10.20)
 - 1) This group includes all land and most freshwater snails and slugs.
 - 2) The ancestral ctenidia have been lost and the vascularized mantle wall is now a lung.
 - 3) Air fills this lung by contraction of the mantle floor.
 - 4) Aquatic species have one pair of tentacles; land forms have two pair of tentacles and the posterior pair has eyes (Figure 10.20A,B).
 - 5) Nonpulmonate aquatic species have an operculum.
- F. Class Bivalvia (Pelecypoda)**
- 1. Bivalves include mussels, clams, scallops, oysters, and shipworms (Figures 10.21, 10.22).
 - 2. They range in size from 1-2 mm in length to the giant South Pacific clams.
 - 3. Most are **sedentary filter feeders** or **suspension feeders** dependent on ciliary currents to bring in food.
 - 4. Bivalves lack a head, radula, and other aspects of cephalization.
 - 5. Most are marine; some live in freshwater streams, ponds and lakes.
 - 6. **Form and Function**
 - a. **Shell**
 - 1) The two shells or **valves** are held together by a **hinge ligament**.
 - 2) The valves are drawn together by strong **adductor muscles** (Figure 10.23).
 - 3) The **umbo** is the bulge, the oldest part of the shell with growth occurring outward in rings.
 - 4) Pearls are produced when an irritant is lodged between the shell and mantle; layers of nacre are secreted around the foreign material.
 - b. **Body and Mantle** (Figure 10.23)
 - 1) A visceral mass is suspended from the dorsal midline; a foot is attached anteroventrally.
 - 2) The gills hang down on each side, each covered by a fold of the mantle.
 - 3) Posterior edges of the mantle folds form excurrent and incurrent openings (Figure 10.26)
 - 4) In burrowing clams, the mantle forms long siphons to reach the water above (Figure 10.24).
 - 5) Cilia on the gill and mantle direct water flow over the gills.
 - 6) Bivalves have a three-chambered heart that pumps blood to the gills, mantle, and kidney (Figure 10.27).
 - 7) Three pairs of ganglia and ocelli are present; sense organs are poorly developed (Figure 10.25)
 - c. **Feeding and Digestion**
 - 1) Suspended organic matter enters the incurrent siphon in most bivalves.
 - 2) Gland cells on the gills and labial palps secrete mucus to entangle particles.
 - 3) Food in mucous masses slides to food grooves at the lower edge of the gills.
 - 4) Cilia and grooves on the labial palps direct the mucous mass into the mouth (Figure 10.22).
 - 5) In the stomach the mucus and food particles are kept whirling by a rotating gelatinous rod, called a **cystalline style**.
 - 6) Ciliated ridges of the stomach sort food particles and direct suitable particles to the **digestive gland** for intracellular digestion.
 - 7) Shipworms feed on the particles they excavate as they burrow into wood (see Figure 10.24).
 - 8) Other bivalves such as giant clams gain much of their nutrition from zooxanthellae (see Figure 10.21).
 - d. **Locomotion**
 - 1) The slender foot is extended out from between the valves (see Figure 10.23A).
 - 2) Blood is pumped into the foot; it swells and anchors the bivalve in the mud.
 - 3) Shortening the foot then pulls the clam forward.
 - 4) Scallops clap their valves to create a jet propulsion; the mantle edges direct the stream.
 - 5) Mussels attach themselves by secreting a number of slender **byssal threads** (Figure 10.28).
 - i. **Reproduction and Development**
 - 1) Sexes are usually separate.
 - 2) Gametes discharged in the suprabranchial chamber are carried out in the excurrent flow.
 - 3) Fertilization is usually external.
 - 4) Embryos develop as **trochophore**, the **veliger**, and lastly **spat** larval stages.
 - 5) Freshwater clams have internal fertilization where sperm enter the incurrent siphon to fertilize eggs i

the water tubes of the gills.

- 6) Larvae develop into a bivalved **glochidia** stage that is discharged and attaches to the gills of passir fish where they live briefly as parasites (Figure 10.29).
- 7) They eventually sink to begin independent life on the streambed; the “hitchhiking” helped distribute the species.
- 8) Freshwater clams are the most jeopardized group of animals in the country (see Inset, page).
- 9) Zebra mussels, *Dreissena polymorpha* are a recent and potentially disastrous biological introduction into North America, particularly in the Great Lakes basin.

G. Class Cephalopoda

1. This class includes squids, octopuses, nautiluses, devilfish and cuttlefish.
 - a. **Architeuthis**, the giant squid has eyes up to 10 inches in diameter—the largest in the Animal Kingdom.
 - b. The mantle alone is up to 6 meters in length.
 - c. The squid **Loligo** (cuttlefish) is only about 30 centimeters long.
 - d. Squid form and anatomy is shown in Figure 10.30A,B.
 - e. All are marine predators.
 - f. The foot is in the head region and is modified for expelling water from the mantle cavity.
 - g. They range from 2 cm to the giant squid that is the largest invertebrate known.
 - h. Cephalopods feed on small fishes, mollusks, crustaceans, and worms.
 - i. The muscular arms are capable of delicately controlled movements.
 - j. Octopods and cuttlefishes secrete venom from salivary glands.
 - k. Beaklike jaws grasp prey, the radula tears off pieces of flesh.

12. Form and Function

a. Shell

- 1) The cephalopod fossil record goes back to the Cambrian; earliest shells were straight.
- 2) A **Nautilus** is the culmination of shell coiling; a remaining survivor of nautiloids (Figure 10.31A).
3. Ammonoids, prevalent in the Mesozoic era, are now extinct but had quite elaborate shells.
- 4) Nautiloid and ammonoid shells had gas chambers allowing them to swim.
- 5) Unlike gastropod shells, the nautilus shell is divided into **gas chambers** (Figure 10.31B).
- 6) The living animal only inhabits the last chamber.
- 7) A cord of living tissue, the **siphuncle**, connects the chambers to the visceral mass.
- 8) The cuttlefish shell is enclosed in the mantle.
- 9) The squid shell is a thin strip called the **pen**, enclosed in mantle.
- 10) The octopus has completely lost the shell.
- 11) Gas pressure in the nautilus chambers is only one atmosphere compared to the 41 atmospheres of pressure in the surrounding deep ocean.
- 12) After secreting a new septum, the new chamber of *Nautilus* is filled with fluid similar to the osmotic composition of seawater.
- 13) The gas in the chamber is only the respiratory gas from the siphuncle tissue that diffuses into the chamber as the fluid is removed.
- 14) Octopuses and squids apparently evolved from early straight-shelled ancestors.

b. Body and Mantle

- 1) The nautilus head with 60-90 tentacles extrudes for a shell compartment.
- 2) Tentacles grasp food causing it to adhere with secretions, not suckers.
- 3) Beneath the head is the funnel.
- 4) The shell shelters the mantle, mantle cavity, and visceral mass.
- 5) Cephalopods other than nautiloids have only one pair of gills; octopods have 8 arms with suckers; squids and cuttlefishes (decapods) have 10 arms: 8 arms with suckers and a pair of long retractile tentacles.
- 6) Water enters the mantle cavity through the neck region
- 7) Contraction of mantle edges about the neck expels water through the funnel.
- 8) Water currents oxygenated gills, power jet propulsion, and carry wastes and sexual products away from the body.
- 9) The active life of cephalopods is reflected in their respiratory, circulatory and nervous systems.
- 10) With higher oxygen demands, cephalopods have a muscular pumping system to keep water flowing through the mantle cavity.
- 11) Their circulatory system has a network of vessels conducting blood through gill filaments.
- 12) Blood goes to the systemic circulation before it goes to the gills; accessory or branchial hearts at the base of each gill increase pressure to blood going through gill capillaries.
- 13) The cephalopod brain is the largest of any invertebrate.
- 14) Sense organs are well developed; eyes are complex, complete with cornea, lens and retina (Figure

10.32)

C. Color Changes

- 1) Special pigment cells called **chromatophores** in the skin of most cephalopods.
- 2) The chromatophores expand and contract to produce color change.
- 3) The expansion and contraction is controlled by the nervous system and hormones.
- 4) Many are behavioral colors associated with alarm or mating.
- 5) Some deep-sea squids are bioluminescent.

D. Ink Production

- 1) Most cephalopods other than nautiloids have an ink sac that empties into the rectum
- 2) The ink gland is filled with a fluid containing melanin, forming a smokescreen that may confuse an enemy when released.

E. Locomotion

- 1) Cephalopods swim by forcefully expelling water through a **funnel** or siphon.
- 2) It can control the direction and the force of the water, thus determining its speed.
- 3) Squids and cuttlefishes are excellent swimmers (Figure 10.33).
- 3) Lateral fins of squids and cuttlefishes are stabilizers.
- 4) The gas-filled chambers of *Nautilus* keep the shell upright.
- 5) Octopuses mainly crawl on the bottom but can swim backward by spurting jets of water; some with webbing between their arms swim with a medusa-like action.

F. Reproduction

- 1) Sexes are separate (Figure 10.34).
- 2) Males display and court females.
- 3) In the male seminal vesicle, spermatozoa are packaged in **spermatophores** and stored.
- 4) One arm of the male plucks a spermatophore from the mantle cavity and inserts it into the female.
- 5) Fertilized eggs leave the oviduct and are attached to stones, etc.

18. Major Groups of Cephalopods (In Instructor's Manual only; no text counterpart)

- a. There are three subclasses of cephalopods.
 - 1) **Nautiloidea** have two pairs of gills.
 - 2) The **Ammonoidea** are entirely extinct.
 - 3) **Coleoidea** have one pair of gills.
- b. *Nautilus* is the only surviving genus in Nautiloidea that populated the Paleozoic seas.
 - 1) There are five or six living species.
 - 2) The head of a nautilus has 60-90 tentacles that can extend from the opening of the shell.
 - 3) The tentacles lack suckers but have adhesive secretions.
- c. The ammonoids became extinct at the end of the Cretaceous.
 - 1) Chambers resembled those of the nautiloids but septa were more complex and frilled.
 - 2) The reason for their extinction is unknown, but unrelated to the asteroid bombardment.

10.5 Phylogeny and Adaptive Radiation**A. Phylogeny**

1. The first mollusc probably arose in Precambrian times.
2. The "**Hypothetical Ancestral Mollusc**" (see Figure 10.2).
 - a. It probably lacked a shell or crawling foot.
 - b. It likely was a worm-like organism with a ventral gliding surface.
 - c. It probably possessed a dorsal mantle, a chitinous cuticle and calcareous scales (Figure 10.35).
 - d. It also possessed two gills, a radula, a ladder-like nervous system, and an open circulatory system.
3. Among living mollusks, caudofoveates represent the primitive condition.
4. Caudofoveates and solenogasters both probably branched off before development of a solid shell.
5. Polyplacophorans then branched off before the veliger was established as a larva.
6. Polplacophora and Conchifera are sister groups.
7. Cladistic analysis suggests that Gastropoda and Cephalopoda form the sister group to Monoplacophora (Figure 10.36).
8. Scaphopods and bivalves have an expanded mantle cavity that essentially envelops the body.
9. The Scaphopod clade has spatulate feet and reduced head and sense organs.
10. Molluscs have an enormous diversity of food gathering adaptations.
11. The versatile glandular mantle modified into gills, lungs, siphons, and apertures.
12. It sometimes functions in locomotion, in feeding processes, or in a sensory capacity.
13. Due to spiral cleavage, mesoderm from the 4d blastomere, and a trochophore larva, Mollusca is considered a **protostome** allied with annelids and arthropods.
14. Zoologists consider the replication of body parts in monoplacophorans as **pseudometamerism**
15. This suggests that molluscs branched off from an annelid line after the coelom arose but before the advent of

metamerism.

16. Molecular evidence strengthens the idea that molluscs and annelids are more closely related to each other than either is to arthropods.
 - a. Molecular evidence places annelids and molluscs in **Lophotrochozoa** and arthropods in **Ecdysozoa**.
 - b. The Lophotrochozoa/Ecdysozoa hypothesis, however, requires that metamerism arose at least twice independently.

B. Classification

- Class Caudofoveata
- Class Solenogastres
- Class Monoplacophora
- Class Polyplacophora
- Class Scaphopoda
- Class Gastropoda
- Class Bivalvia
- Class Cephalopoda