


MOLLUSCA

Dr. Dewi Lengkana, M. Sc.
Ismi Rakhmawati, M. Pd.
Berti Yolida, M.Pd.



A

B

C

Figure 16.1

Molluscs: a diversity of life-forms. The basic body plan of this ancient group has become variously adapted for different habitats.
A, A chiton *(Tonicella lineata),* class Polyplacophora. **B,** A marine snail *(Calliostoma annulata),* class Gastropoda. **C,** A nudibranch (*Chromodoris* sp.) class Gastropoda. **D,** Pacific giant clam *(Panope abrupta),* with siphons to the left, class Bivalvia. **E,** An octopus *(Octopus briareus),* class Cephalopoda, forages at night on a Caribbean coral reef.

D

E

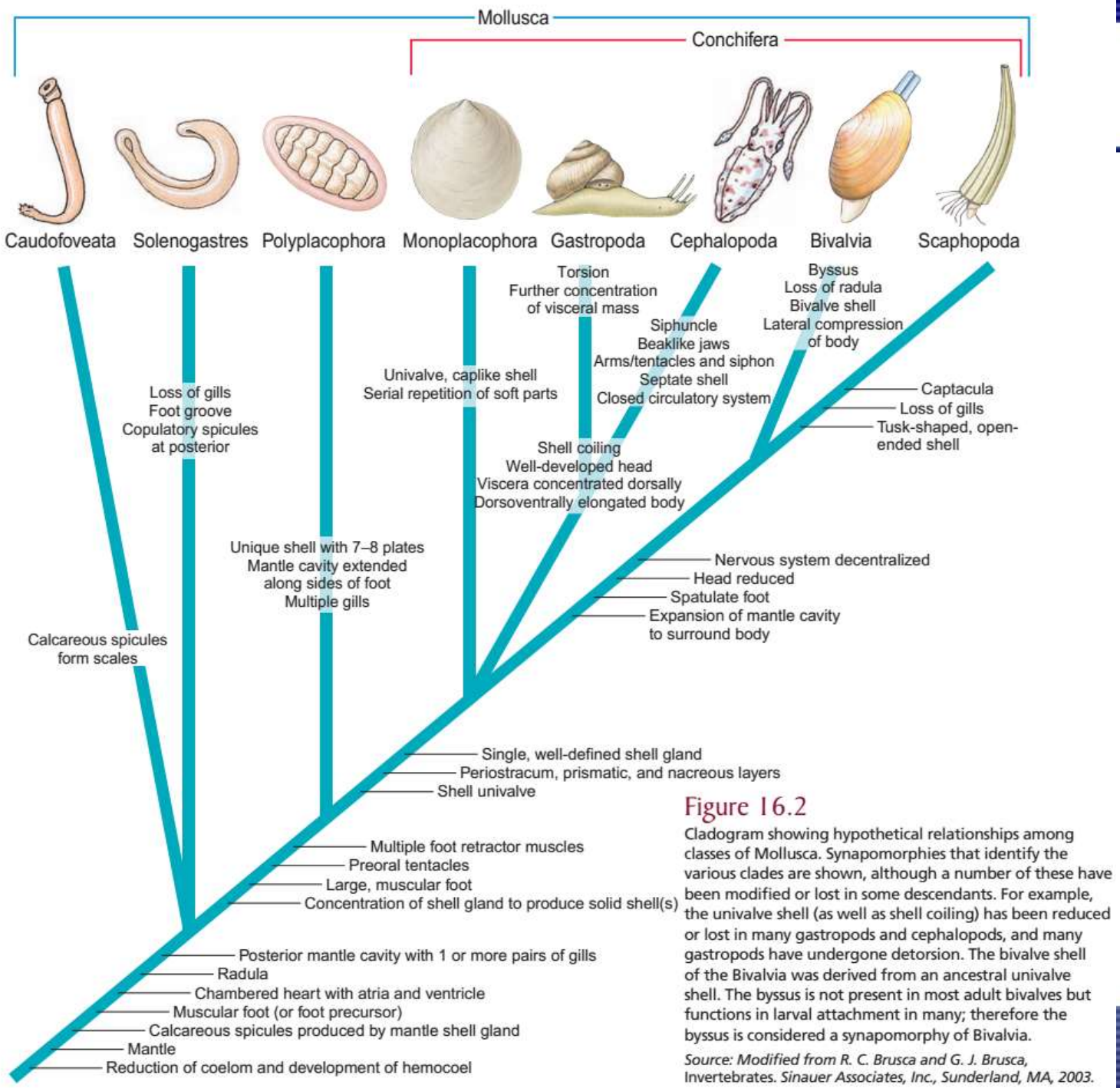


Figure 16.2

Cladogram showing hypothetical relationships among classes of Mollusca. Synapomorphies that identify the various clades are shown, although a number of these have been modified or lost in some descendants. For example, the univalve shell (as well as shell coiling) has been reduced or lost in many gastropods and cephalopods, and many gastropods have undergone detorsion. The bivalve shell of the Bivalvia was derived from an ancestral univalve shell. The byssus is not present in most adult bivalves but functions in larval attachment in many; therefore the byssus is considered a synapomorphy of Bivalvia.

Source: Modified from R. C. Brusca and G. J. Brusca, Invertebrates. *Sinauer Associates, Inc., Sunderland, MA, 2003.*

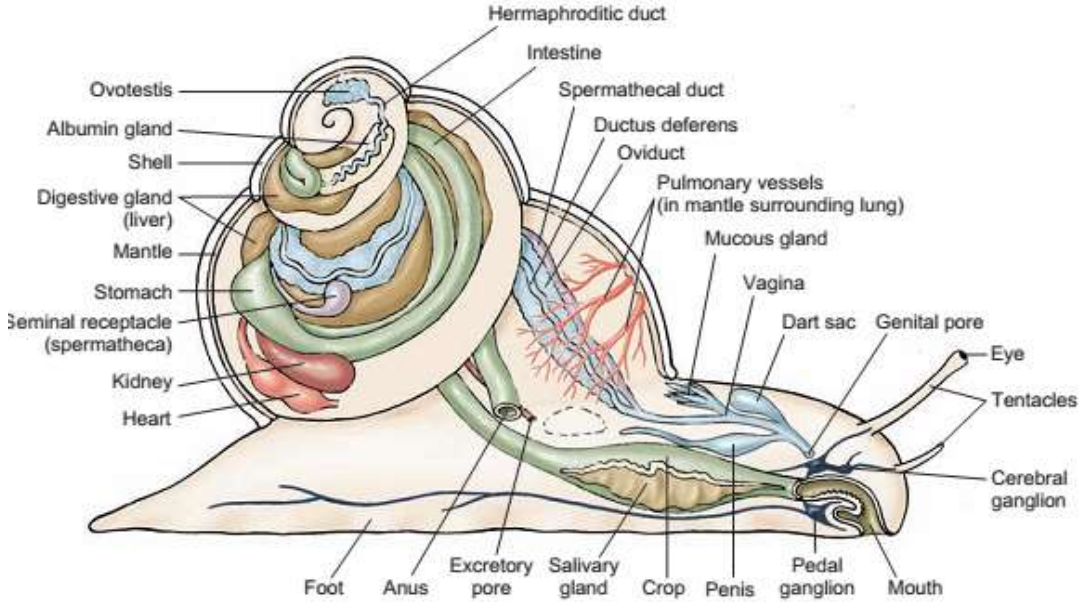
MOLLUSCA

- Dorsal body wall forms pair of mantle: mantle cavity -> gills/lungs, secrete shell, muscular foot, radula
- Live in marine, freshwater, terrestrial
- Free living or parasitic
- Billateral symmetrical & triploblastic, some asymmetry
- Survace epithelium usually cilliated & bearing mucous
- Complex digestive system: radula, ciliary tracts
- Nervous system paired of cerebral, pleural, visceral ganglia, with nerve cords and subepidermal plexus, ganglia centralized in nerve ring in gastropods & cephalopods

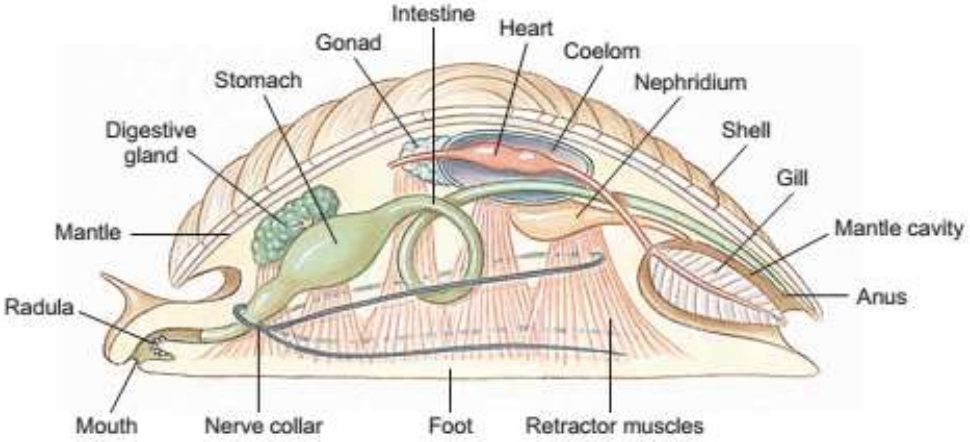
Sumber: Hickman

Characteristics of Phylum Mollusca

1. Dorsal body wall forms pair of folds called the **mantle,** which encloses the **mantle cavity,** is modified into **gills** or **lungs,** and secretes the **shell** (shell absent in some); ventral body wall specialized as a muscular **foot,** variously modified but used chiefly for locomotion; radula in mouth
2. Live in marine, freshwater, and terrestrial habitats
3. Free-living or occasionally parasitic
4. Body bilaterally symmetrical (bilateral asymmetry in some); unsegmented; often with definite head
5. Triploblastic body
6. **Coelom** limited mainly to area around heart, and perhaps lumen of gonads, part of kidneys, and occasionally part of the intestine
7. Surface epithelium usually ciliated and bearing mucous glands and sensory nerve endings
8. Complex digestive system; rasping organ **(radula)** usually present; anus usually emptying into mantle cavity; internal and external **ciliary tracts** often of great functional importance
9. Circular, diagonal, and longitudinal muscles in the body wall; mantle and foot highly muscular in some classes (for example cephalopods and gastropods)
10. Nervous system of paired cerebral, pleural, pedal, and visceral ganglia, with nerve cords and subepidermal plexus; ganglia centralized in nerve ring in gastropods and cephalopods
11. Sensory organs of touch, smell, taste, equilibrium, and vision (in some); the highly developed direct **eye** (photosensitive cells in retina face light source) of cephalopods is similar to the indirect eye (photosensitive cells face away from light source) of vertebrates but arises as a skin derivative in contrast to the brain eye of vertebrates
12. No asexual reproduction
13. Both **monoecious** and **dioecious** forms; **spiral cleavage;** ancestral larva a **trochophore,** many with a **veliger** larva, some with direct development
14. One or two kidneys **(metanephridia)** opening into the pericardial cavity and usually emptying into the mantle cavity
15. Gaseous exchange by **gills, lungs, mantle,** or **body surface**
16. **Open circulatory system** (secondarily closed in cephalopods) of heart (usually three chambered), blood vessels, and sinuses; respiratory pigments in blood



MOLLUSCA



- Sensory organs of touch, smell, taste, equilibrium and vision (in some); highly developed direct eye
- No asexual reproduction
- 1 or 2 kidney (metanephridia)
- Gaseous exchange by gills, lungs, mantle or body surface
- Open circulatory system, heart usually 3 chambered
- 90.000 living species
- Open circulatory system, cephalopod closed
- Metanephridia
- Pair of ganglia with connecting nerve cords
- Dioecious, some are hermaproditic

Sumber: Hickman

MOLLUSCA

CLASS

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

Sumber: Hickman

Classification of Phylum Mollusca

Class Caudofoveata (kaw′do-fo-ve-at′ a) (L. *cauda,* tail, + *fovea,* small pit). Wormlike; shell, head, and excretory organs absent; radula usually present; mantle with chitinous cuticle and calcareous scales; oral pedal shield near anterior mouth; mantle cavity at posterior end with pair of gills; sexes separate; formerly united with solenogasters in class Aplacophora. Examples: *Chaetoderma, Limifossor.*

Class Solenogastres (so-len′o-gas′ trez) (Gr. *solen,* pipe, + *gaster,* stomach): **solenogasters.** Wormlike; shell, head, and excretory organs absent; radula present or absent; mantle usually covered with calcareous scales or spicules; rudimentary mantle cavity posterior, without true gills, but sometimes with secondary respiratory structures; foot represented by long, narrow, ventral pedal groove; hermaphroditic. Example: *Neomenia.*

Class Monoplacophora (mon′o-pla-kof′o-ra) (Gr. *monos,* one, + *plax,* plate, + *phora,* bearing). Body bilaterally symmetrical with a broad flat foot; a single limpetlike shell; mantle cavity with three to six pairs of gills; large coelomic cavities; radula present; three to seven pairs of nephridia, two of which are gonoducts; separate sexes. Example: *Neopilina* (Figure 16.9).

Class Polyplacophora (pol′y-pla-kof′o-ra) (Gr. *polys,* many, several, + *plax,* plate, + *phora,* bearing): **chitons.** Elongated, dorsoventrally flattened body with reduced head; bilaterally symmetrical; radula present; shell of seven or eight dorsal plates; foot broad and flat; gills multiple along sides of body between foot and mantle edge; sexes usually separate, with a trochophore but no veliger larva. Examples: *Mopalia* (Figure 16.11), *Tonicella* (Figure 16.1A).

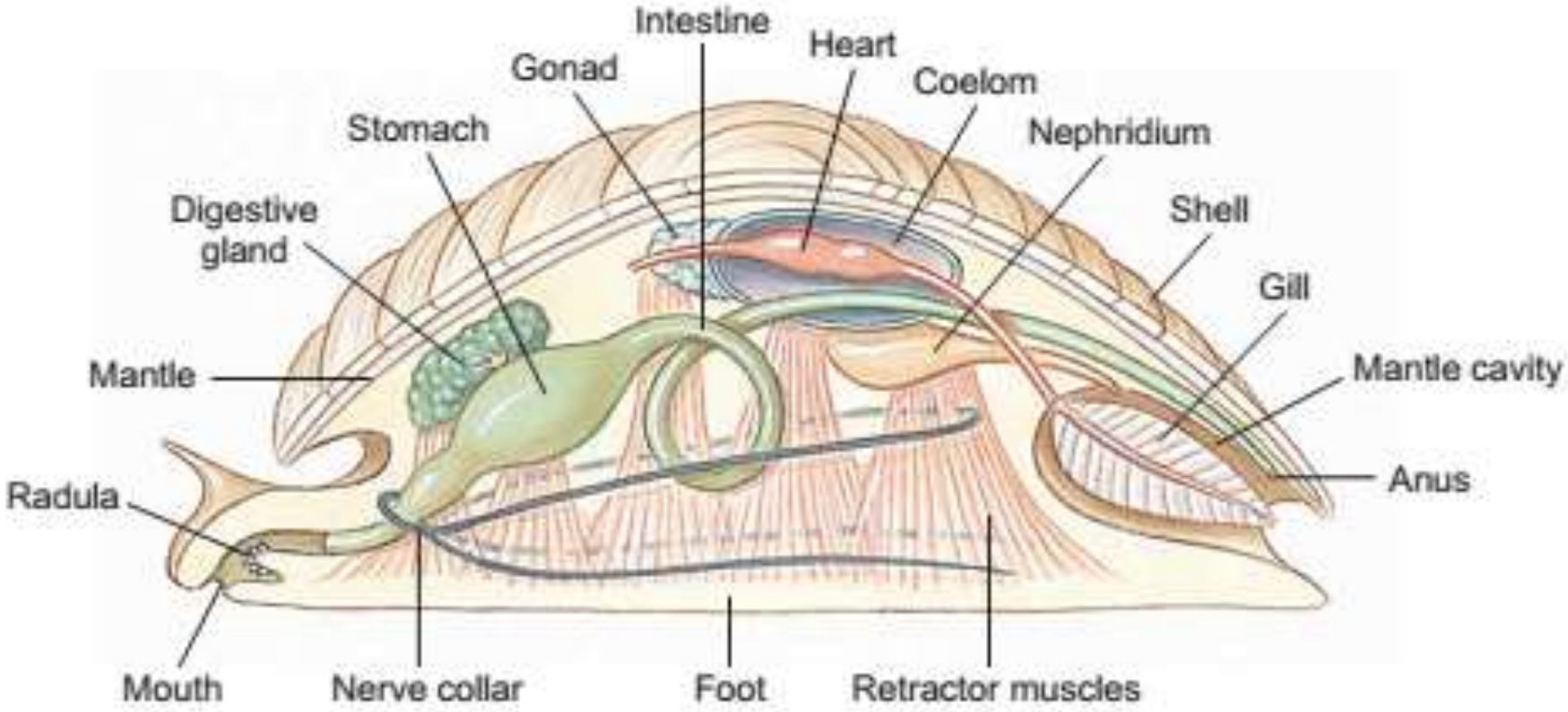
Class Scaphopoda (ska-fop′o-da) (Gr. *skaphē,* trough, boat, + *pous, podos,* foot): **tusk shells.** Body enclosed in a one-piece tubular shell open at both ends; conical foot; mouth with radula and contractile tentacles (captacula); head absent; mantle for respiration; sexes separate; trochophore larva. Example: *Dentalium* (Figure 16.12).

Class Gastropoda (gas-trop′o-da) (Gr. *gaster,* stomach, + *pous, podos,* foot): **snails and slugs.** Body asymmetrical and shows effects of torsion; body usually in a coiled shell (shell uncoiled or absent in some); head well developed, with radula; foot large and flat; one or two gills, or with mantle modified into secondary gills or a lung; most with single atrium and single nephridium; nervous system with cerebral, pleural, pedal, and visceral ganglia; dioecious or monoecious, some with trochophore, typically with veliger, some without pelagic larva. Examples: *Busycon, Polinices* (Figure 16.16B), *Physa, Helix, Aplysia* (Figure 16.22).

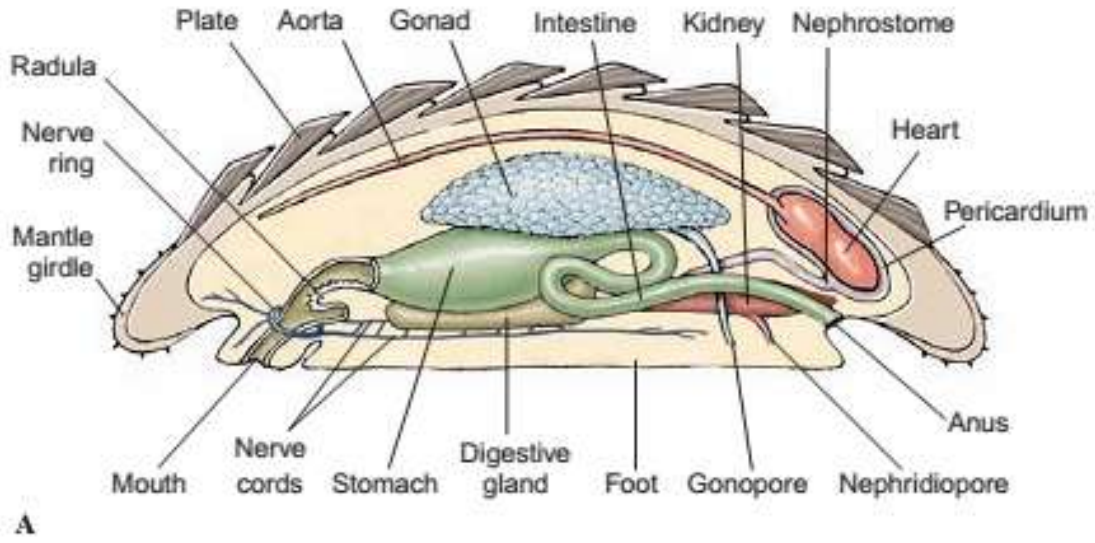
Class Bivalvia (bi-val′ve-a) (L. *bi,* two, + *valva,* folding door, valve) **(Pelecypoda): bivalves.** Body enclosed in a two-lobed mantle; shell of two lateral valves of variable size and form, with dorsal hinge; head greatly reduced, but mouth with labial palps; no radula; no cephalic eyes, a few with eyes on mantle margin; foot usually wedge shaped; gills platelike; sexes usually separate, typically with trochophore and veliger larvae. Examples: *Anodonta, Venus, Tagelus* (Figure 16.26), *Teredo* (Figure 16.32).

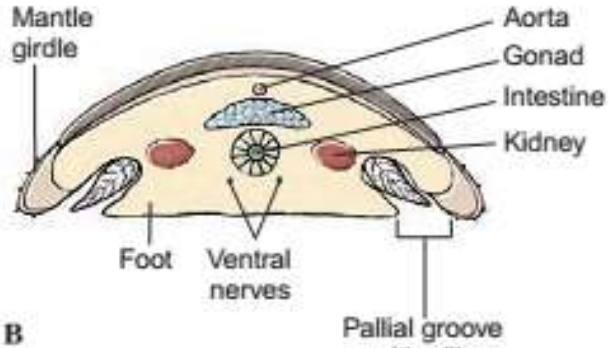
Class Cephalopoda (sef′a-lop′o-da) (Gr. *kephalē,* head, + *pous, podos,* foot): **squids, cuttlefish, nautilus, and octopuses.** Shell often reduced or absent; head well developed with eyes and a radula; head with arms or tentacles; foot modified into siphon; nervous system of well-developed ganglia, centralized to form a brain; sexes separate, with direct development. Examples: *Sepioteuthis* (Figure 16.39), *Octopus* (Figure 16.1E), *Sepia* (Figure 16.38).

Polyplacophora	Gastropoda	Bivalvia	Cephalopoda
Hidup di laut	Hidup di laut, air tawar, darat	Hidup di laut & air tawar	Hidup di laut
Cangkang 8 lempeng	Cangkang memelintir, ada yg tereduksi	Cangkang pipih, 2 katup, matel sifon	Cangkang external, internal, absen
Kaki lokomosi	Kaki lokomosi	Kaki otot	Lokomosi dorongan jet
Kepala tereduksi	Radula	Kepala tereduksi	Kepala dikelilingi tentakel penyedot
insang	Paru2 / insang	Insang berpasangan	Insang
Chiton	Keong, bekicot, slug	Remis, kerang, scallop, tiram	Cumi2, gurita, *Nautilus*


Intestine
Heart
Gonad
Coelom
Stomach
Nephridium
Digestive gland
Shell
Gill
Mantle
Mantle cavity
Radula
Anus
Mouth
Nerve collar
Foot
Retractor muscles

Hickman





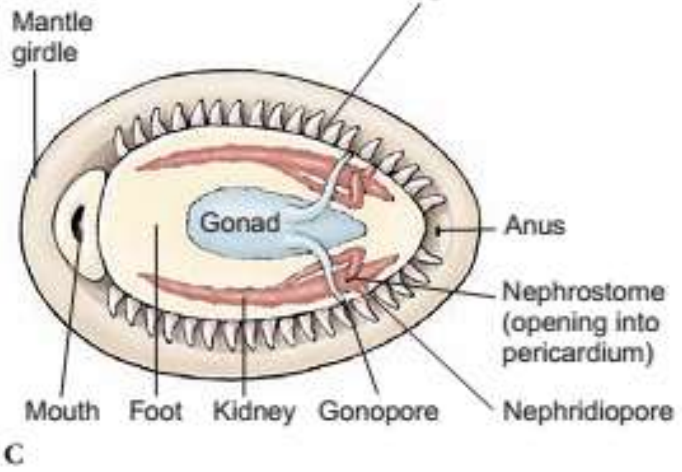


Figure 16.10

Anatomy of a chiton (class Polyplacophora). **A,** Longitudinal section. **B,** Transverse section. **C,** External ventral view.

Sumber: Hickman

SCAPHOPODA

- Tooth shells
- Benthic marine

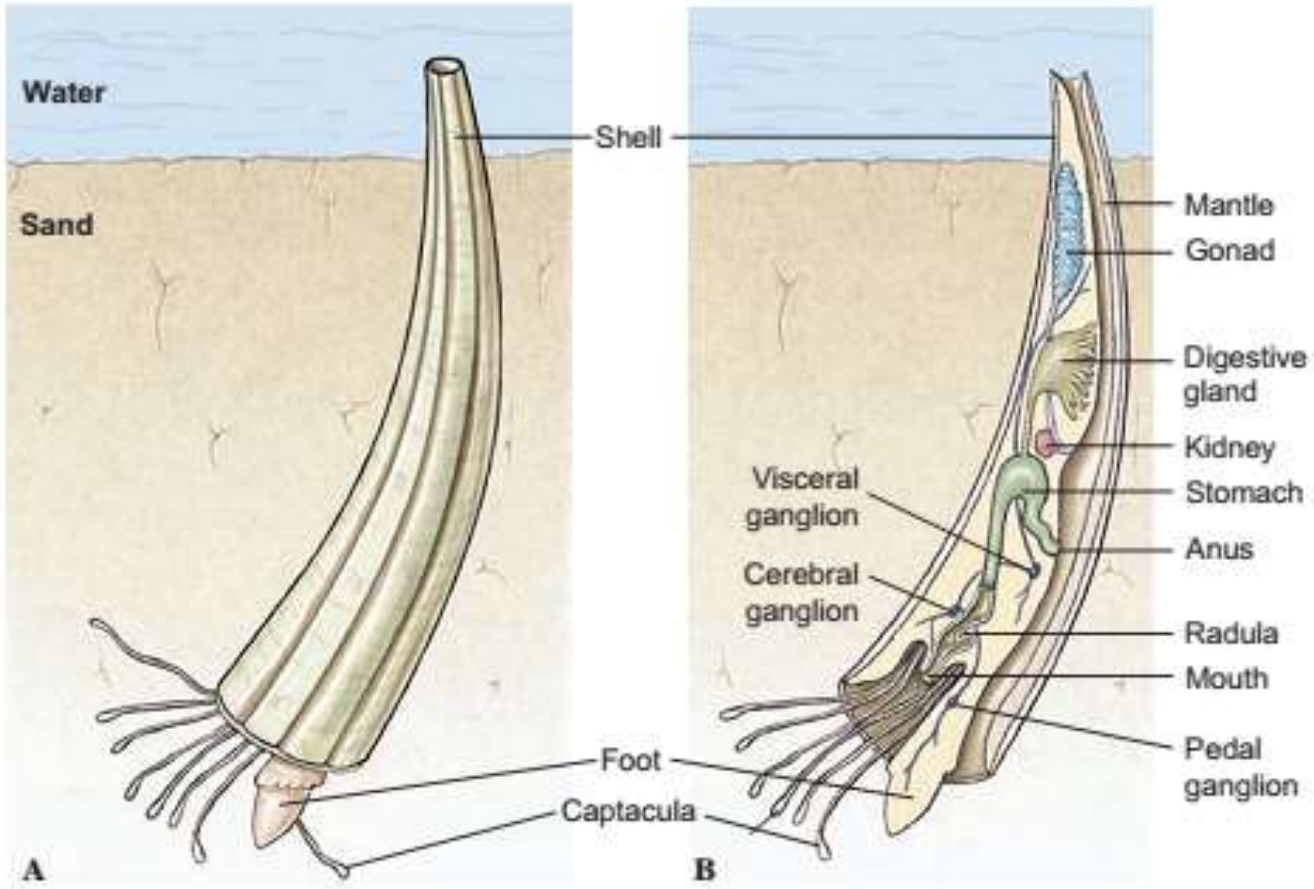


Figure 16.12

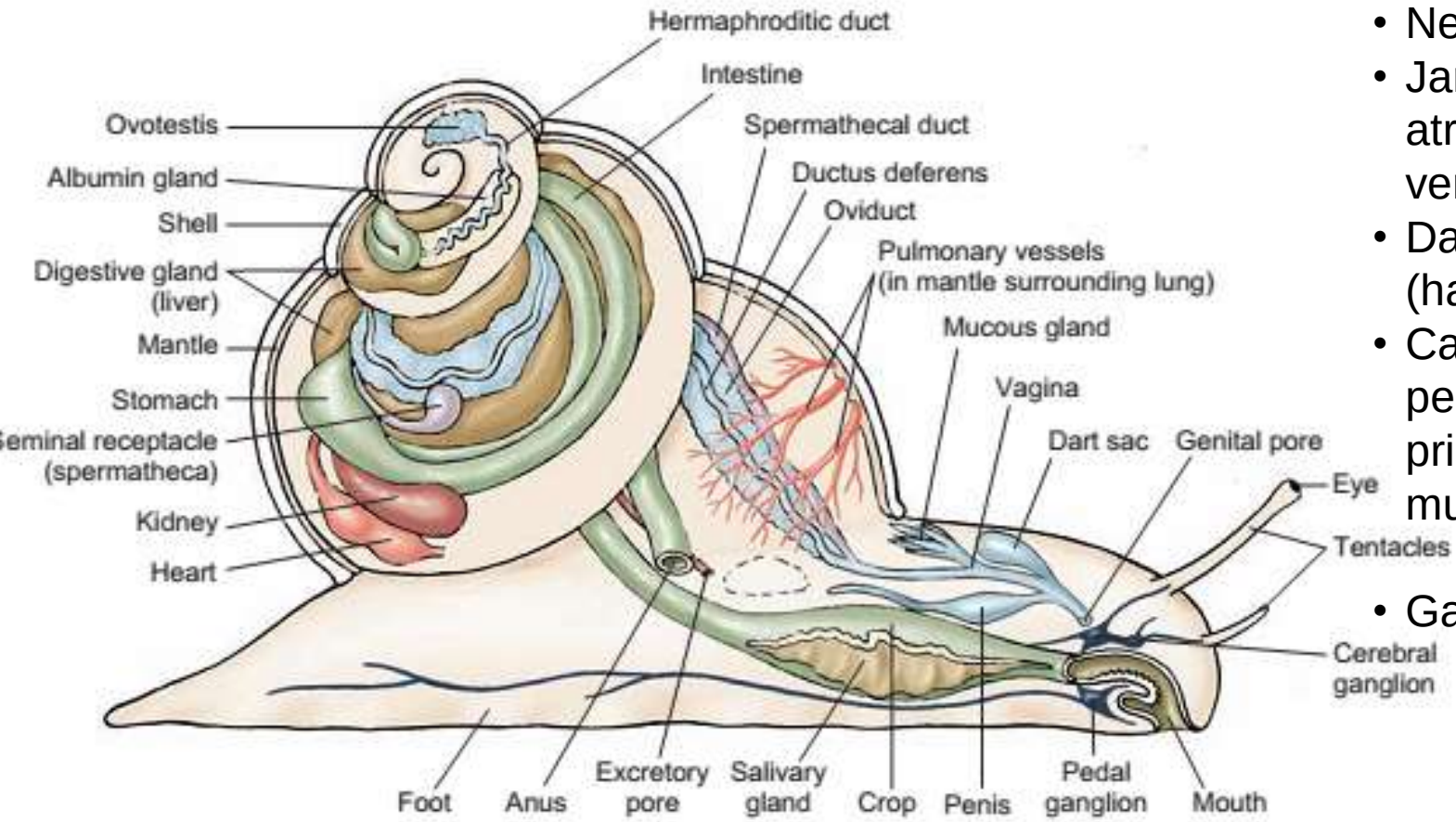
The tusk shell, *Dentalium* (class Scaphopoda). **A,** It burrows into soft mud or sand and feeds by means of its prehensile tentacles (captacula). Respiratory currents of water are drawn in by ciliary action through the small open end of the shell, then expelled through the same opening by muscular action. **B,** Internal anatomy of *Dentalium*.

- Subtidal 6000md
- Shell both open
- 900 living spesies
- 2,5-5 cm long
- Respiratory mantle
- Food detritus n protozoa
- Insang
- Larva trocophora
- Sis saraf cincin sirkum esofagus
- Jangtung, aorta, sinus

Hickman

GASTROPODA

- 70.000 living
- Sedentary animals
- Slow locomotion
- Paru2 / insang
- Hermafrodit
- No autofertilisasi
- Dekstral sinistral
- Nephridia
- Jantung: 1 atrium & 1 ventrikel
- Darah biru (haemocyanin)
- Cangkang : peroistrakum, prismatik, lap mutiara
- Ganglion



Sumber: Hickman

GASTROPODA

Reseptor utama

- Kemoreseptor, tentakel pendek
- Photoreseptor, mata sederhana
- Statoreseptor, statokist

Mukus dari glandula pedalis untuk:

- Menjaga kaki tidak kering
- Menahan bagian kaki yg relaksasi

Sistematik

1. Ordo Prosobranchia
2. Ordo Opisthobranchia
3. Ordo Pulmonata

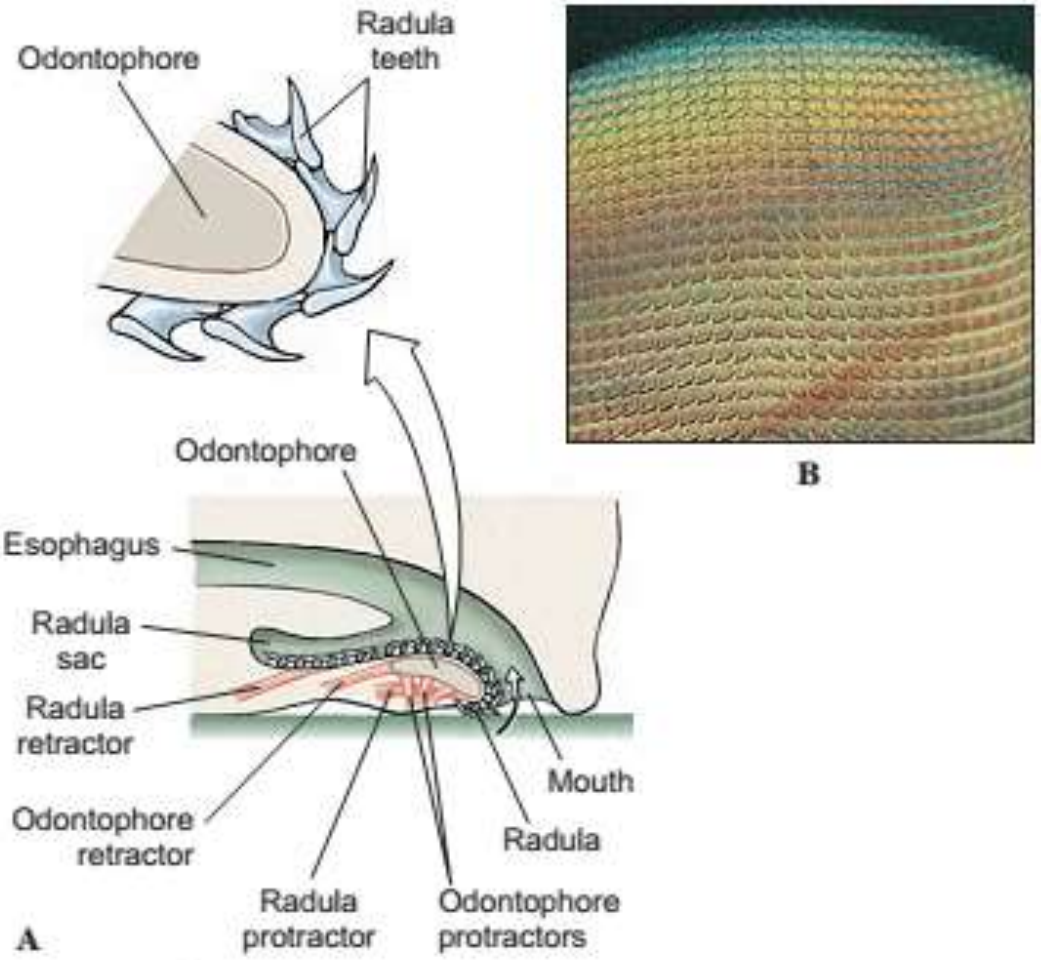


Figure 16.4

A, Diagrammatic longitudinal section of a gastropod head showing a radula and radula sac. The radula moves back and forth over the odontophore cartilage. As the animal grazes, the mouth opens, the odontophore is thrust forward, the radula gives a strong scrape backward bringing food into the pharynx, and the mouth closes. The sequence is repeated rhythmically. As the radula ribbon wears out anteriorly, it is continually replaced posteriorly. **B,** Radula of a snail prepared for microscopic examination.

- All mollusc except bivalve
- Rasping & conveyor
- Move by muscle
- Odontophore
- Few or 250.000 theeth
- Food algae/plant

Makanan dipotong rahang -> dikunyah radula -> diserap intestin

Sumber: Hickman

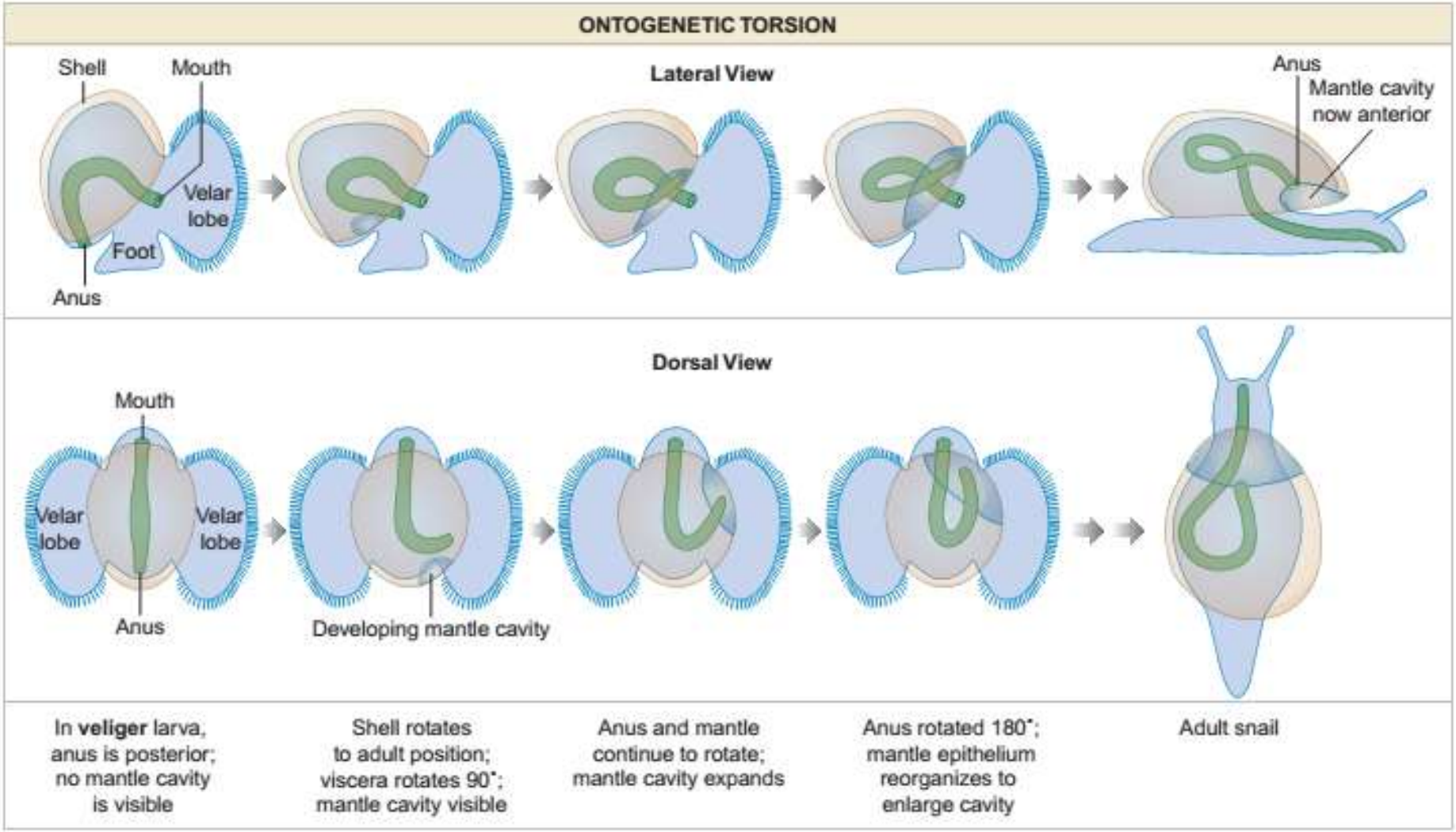
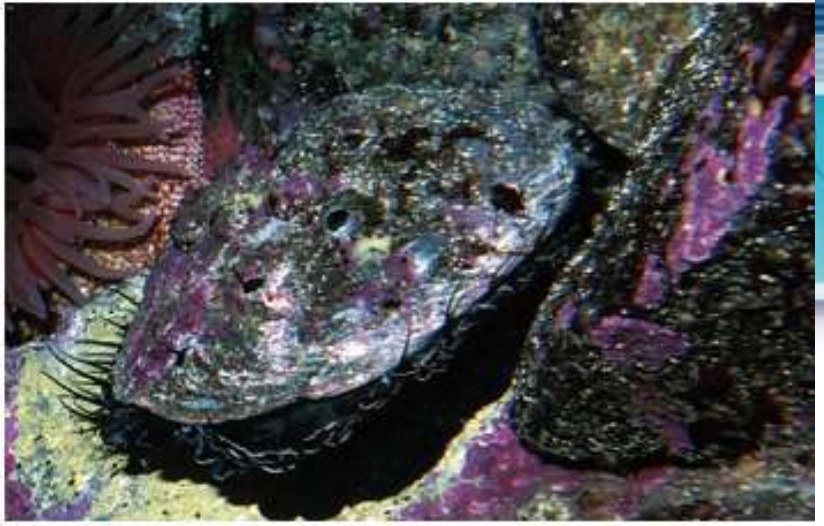


Figure 16.14

Ontogenetic torsion in a gastropod veliger larva.



A

B

Figure 16.16

A, Red abalone, *Haliotis rufescens.* This huge, limpetlike snail is prized as food and extensively marketed. Abalones are strict vegetarians, feeding especially on sea lettuce and kelp. **B,** Moon snail, *Polinices lewisii.* A common inhabitant of West Coast sand flats, the moon snail is a predator of clams and mussels. It uses its radula to drill neat holes through its victim's shell, through which the proboscis is then extended to eat the bivalve's fleshy body.

A

Figure 16.20

Eggs of marine gastropods. **A,** The wrinkled whelk, *Nucella lamellosa,* lay **B,** Egg ribbon of a dorid nudibranch.

B

s egg cases resembling grains of wheat; each contains hundreds of eggs.

A

B

Figure 16.22

A, The sea hare, *Aplysia dactylomela,* crawls and swims across a tropical seagrass bed, assisted by large, winglike parapodia, here curled above the body. **B,** When attacked, sea hares squirt a copious protective secretion from their "purple gland" in the mantle cavity.

Figure 16.23

Phyllidia ocellata, a nudibranch. Like other *Phyllidia* spp., it has a firm body with dense calcareous spicules and bears its gills along the sides, between its mantle and foot.

A

B

Figure 16.24

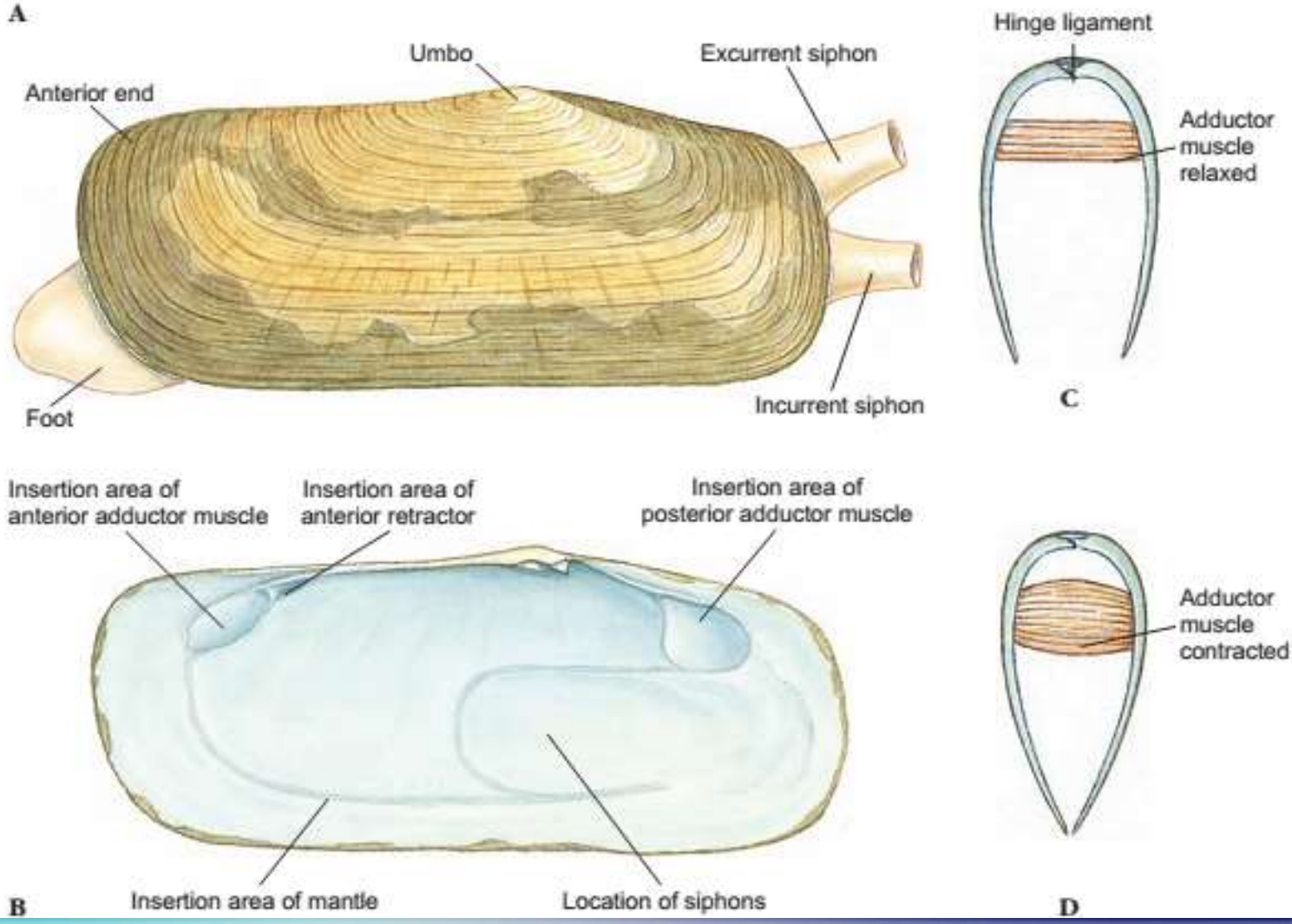
A, Pulmonate land snail. Note two pairs of tentacles; the second, larger pair bears the eyes. **B,** Banana slug, *Ariolimax columbianus*. Note pneumostome.

BIVALVIA

- Cangkang 2 bagian disatukan oleh hinge (sendi elastis)
- Cangkang: periostrakum, prismati, nakreas
- Pencernaan: mulut – esofagus – lambung – inestin, rectum, anus
- Jantung, pembuluh darah, sinus
- Respirasi insang & mantel
- Ekskresi 2 ginjal
- Syaraf 3 pasang ganglion
- Indera: penglihatan, statokist, ospradium
- Hermafrodit, berumah 2

Figure 16.26

Tagelus plebius, stubby razor clam (class Bivalvia). **A,** External view of left valve. **B,** Inside of right shell showing scars where muscles were attached. The mantle was attached at its insertion area. **C** and **D,** Sections showing function of adductor muscles and hinge ligament. In **C,** the adductor muscle is relaxed, allowing the hinge ligament to pull the valves apart. In **D,** the adductor muscle is contracted, pulling the valves together.



Shell

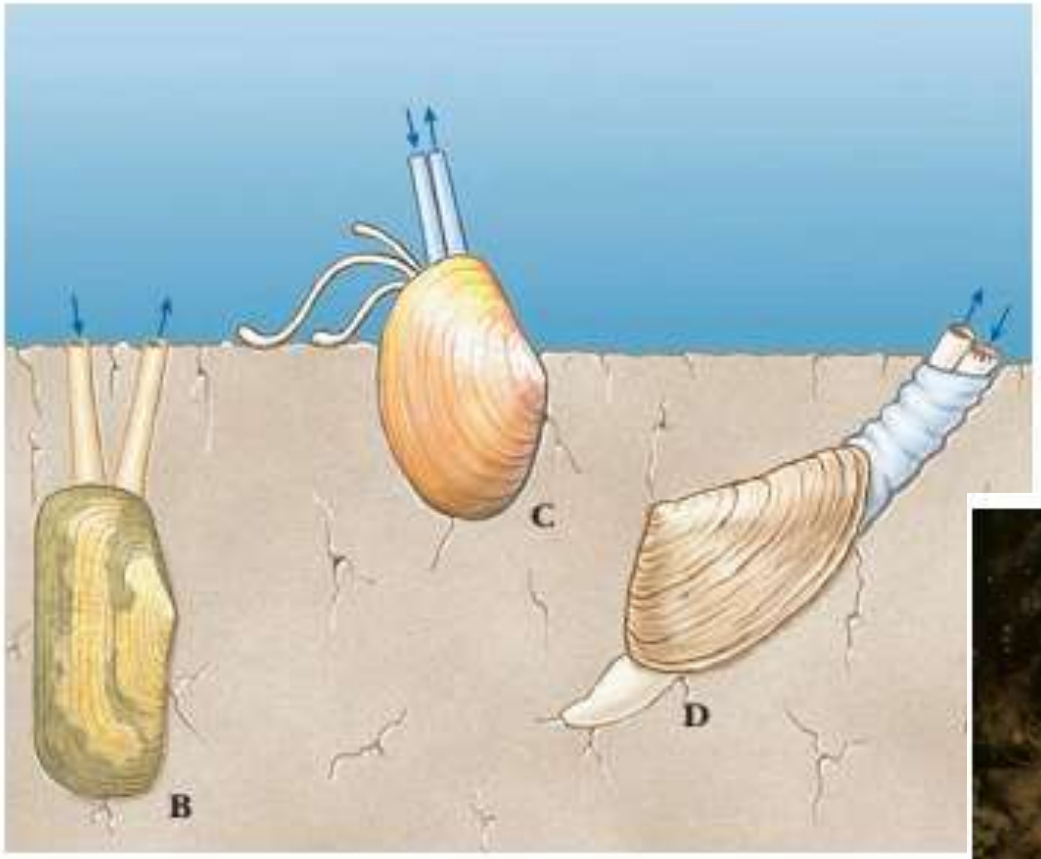


Figure 16.28

Adaptations of siphons in bivalves. **A,** In northwest ugly clams *Entodesma saxicola,* incurrent and excurrent siphons are clearly vi
B to **D,** In many marine forms the mantle is drawn out into long siphons. In **A, B,** and **D,** the incurrent siphon brings in both food a
oxygen. In **C,** *Yoldia,* the siphons are respiratory; long ciliated palp
feel about over the mud surface and convey food to the mouth.

Figure 16.29

Representing a group that has evolved from burrowing ancestors, the surface-dwelling scallop *Aequipecten irradians* has developed sensory organs along its mantle edges (tentacles and a series of blue eyes).

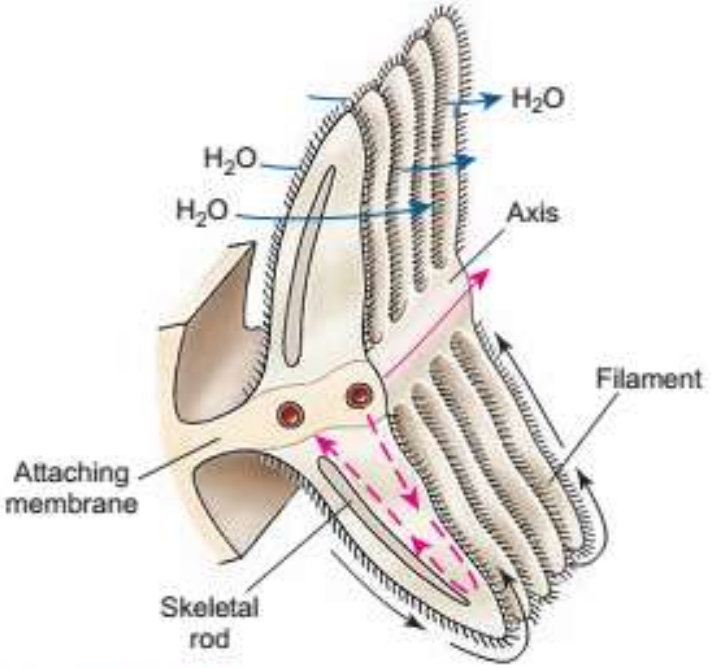


Figure 16.5

Primitive condition of mollusc ctenidium. Circulation of water between gill filaments is by cilia, and blood diffuses through the filament from the afferent vessel to the efferent vessel. Black arrows are ciliary cleansing currents.

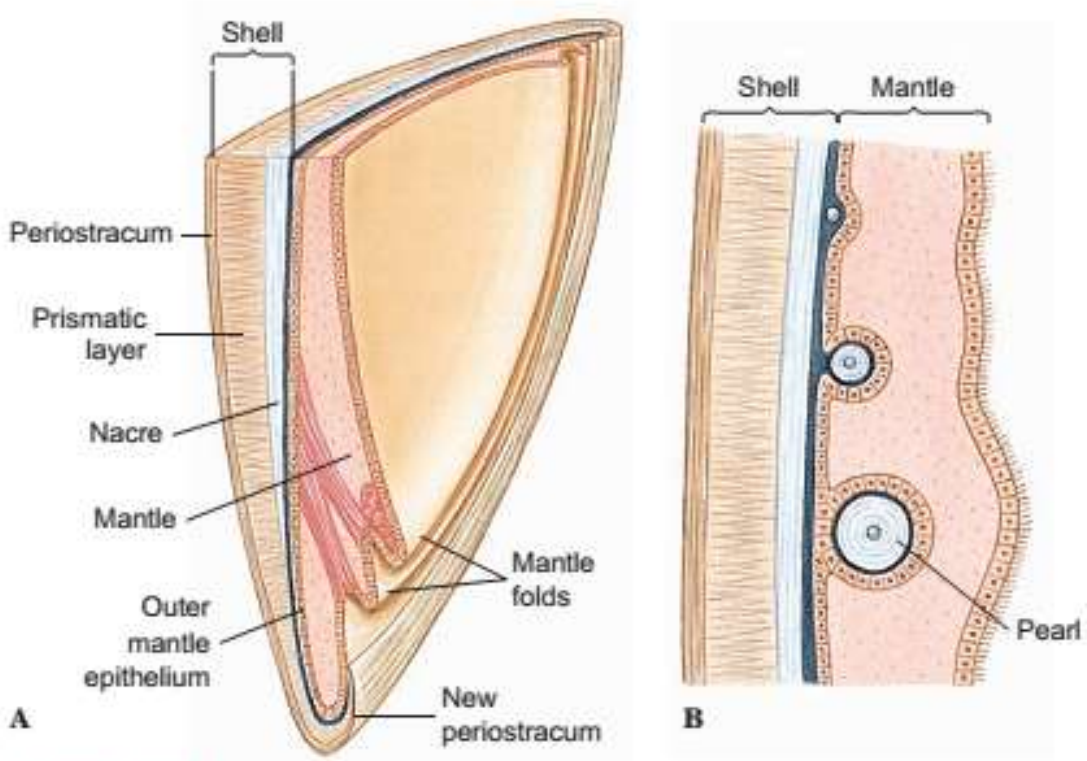


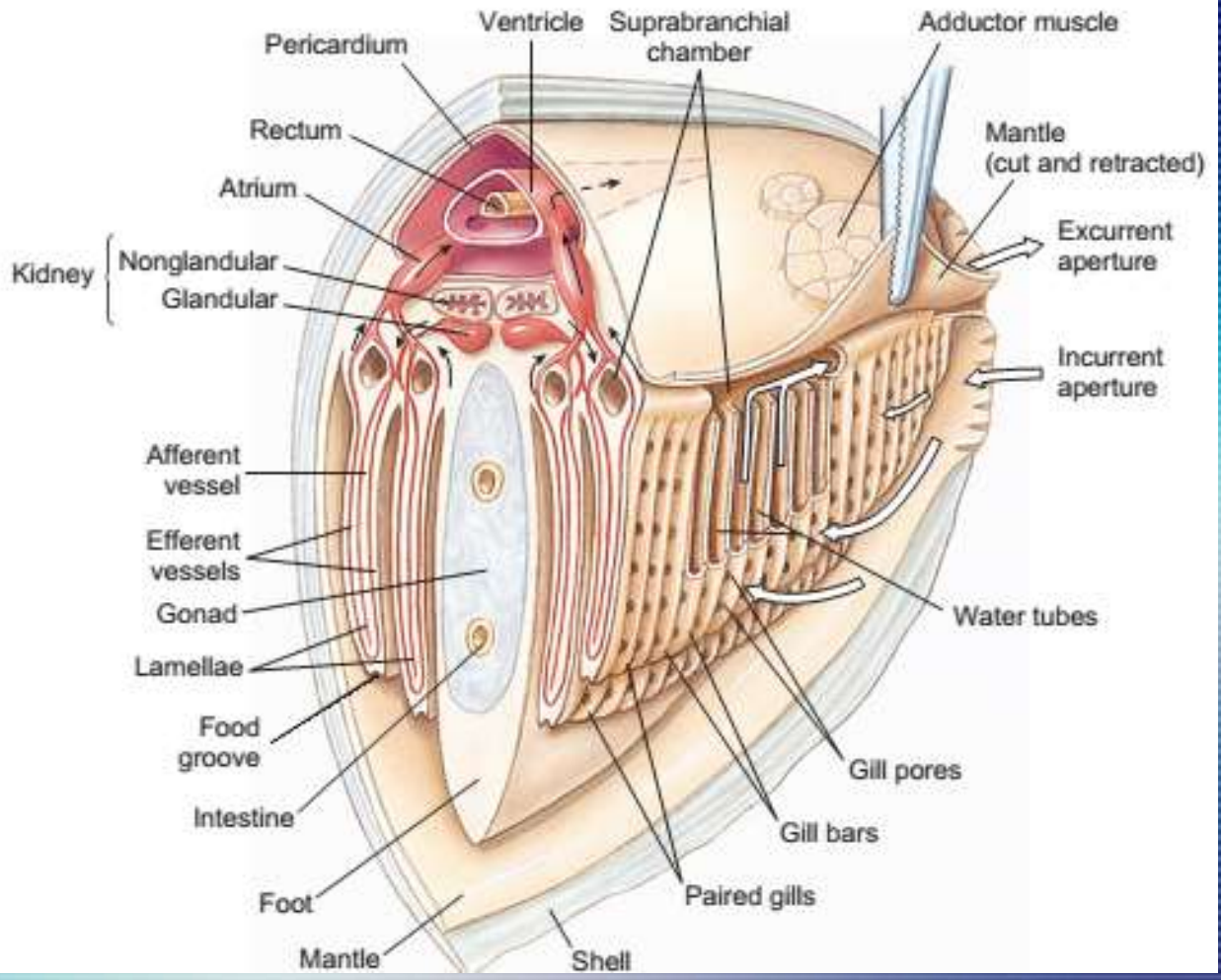
Figure 16.6

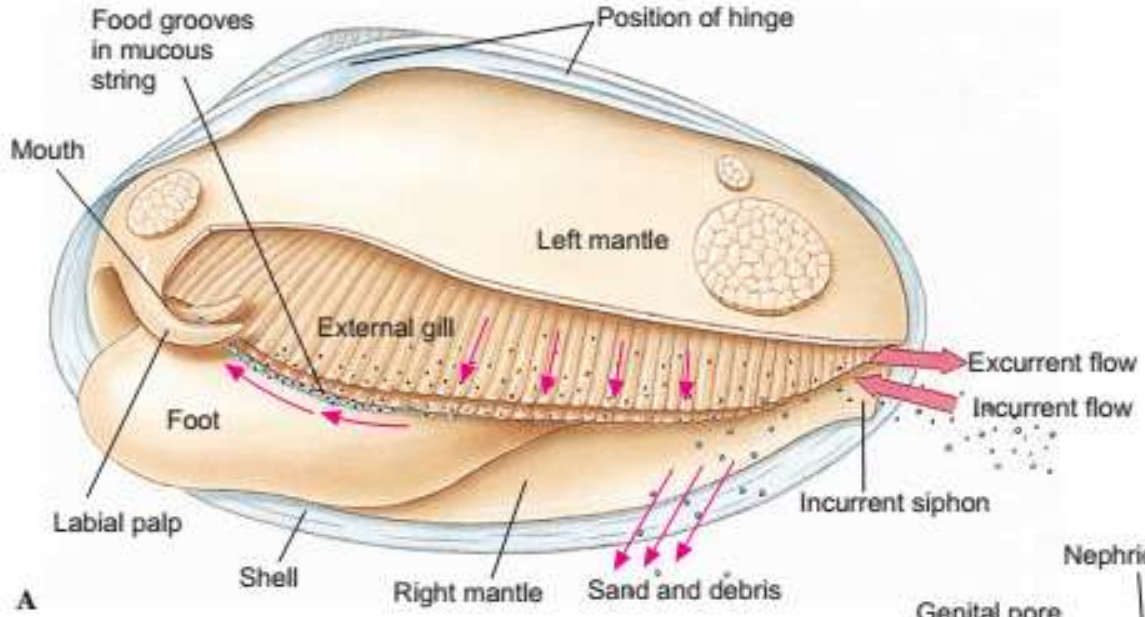
A, Diagrammatic vertical section of shell and mantle of a bivalve. The outer mantle epithelium secretes the shell; the inner epithelium is usually ciliated. **B,** Formation of pearl between mantle and shell as a parasite or bit of sand under the mantle becomes covered with nacre.

Sumber: Hickman

Figure 16.30

Section through heart region of a freshwater clam to show relation of circulatory and respiratory systems. Respiratory water currents: water is drawn in by cilia, enters gill pores, and then passes up water tubes to suprabranchial chambers and out excurrent aperture. Blood in gills exchanges carbon dioxide for oxygen. Blood circulation: ventricle pumps blood forward to sinuses of foot and viscera, and posteriorly to mantle sinuses. Blood returns from mantle to atria; it returns from viscera to the kidney, and then goes to the gills, and finally to the atria.





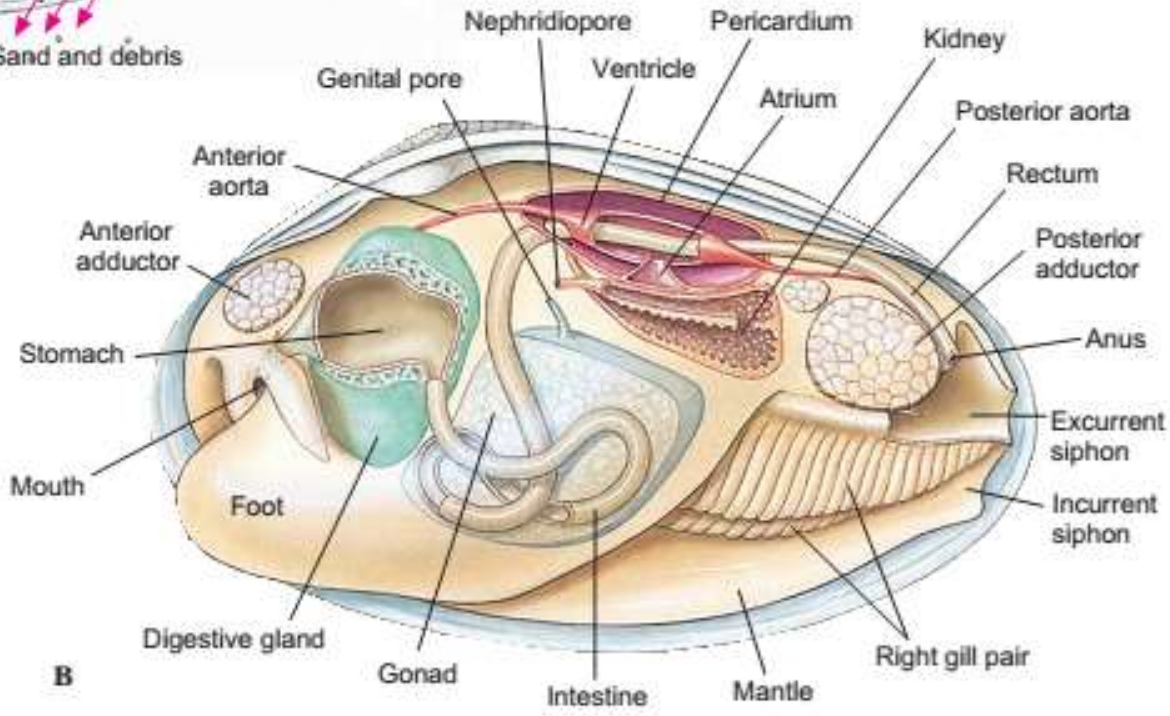


Figure 16.31

A, Feeding mechanism of freshwater clam. Left valve and mantle are removed. Water enters the mantle cavity posteriorly and is drawn forward by ciliary action to the gills and palps. As water enters the tiny openings of the gills, food particles are sieved out and caught in strings of mucus that are carried by cilia to the palps and directed to the mouth. Sand and debris drop into the mantle cavity and are removed by cilia. **B,** Clam anatomy.

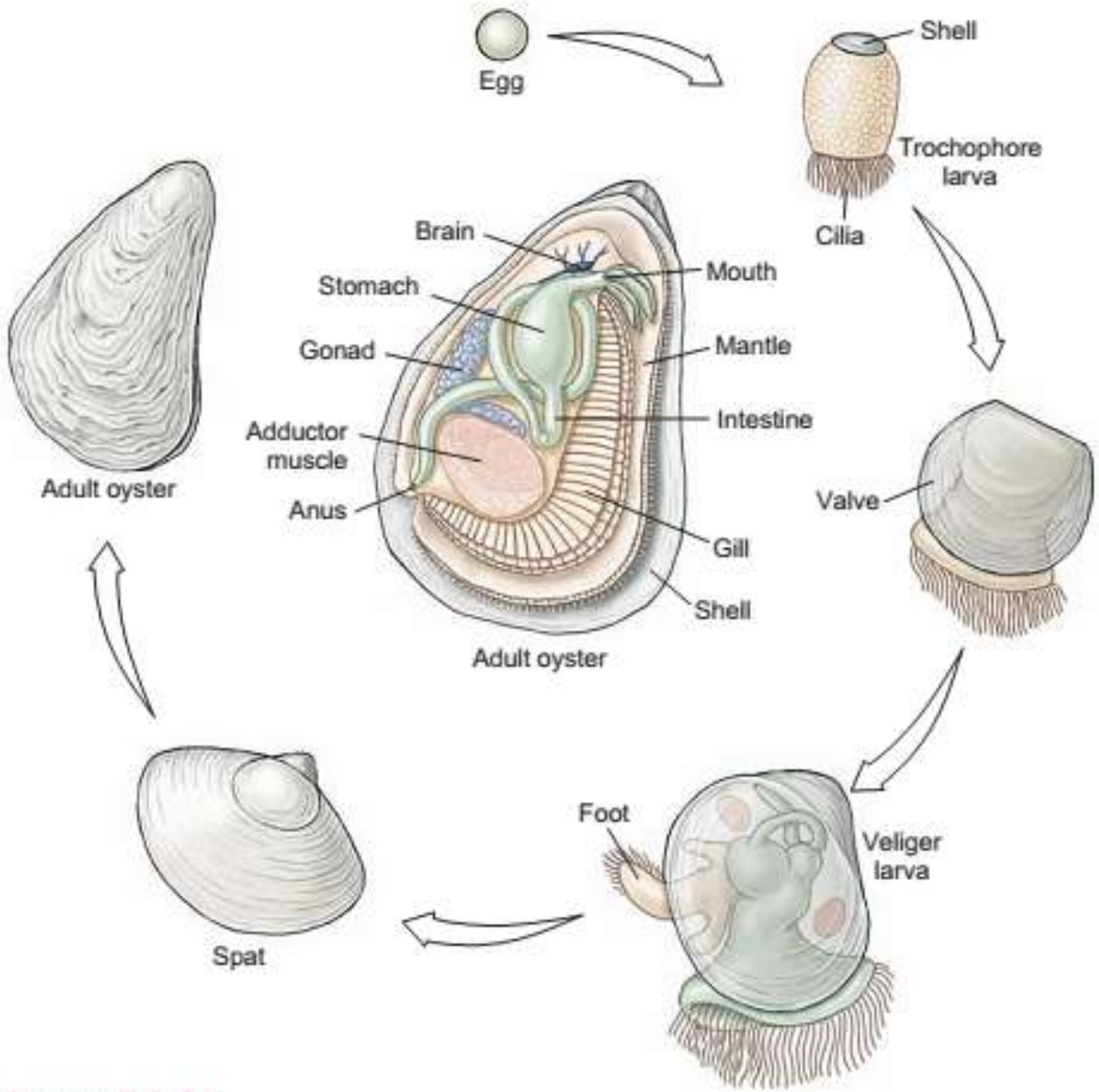


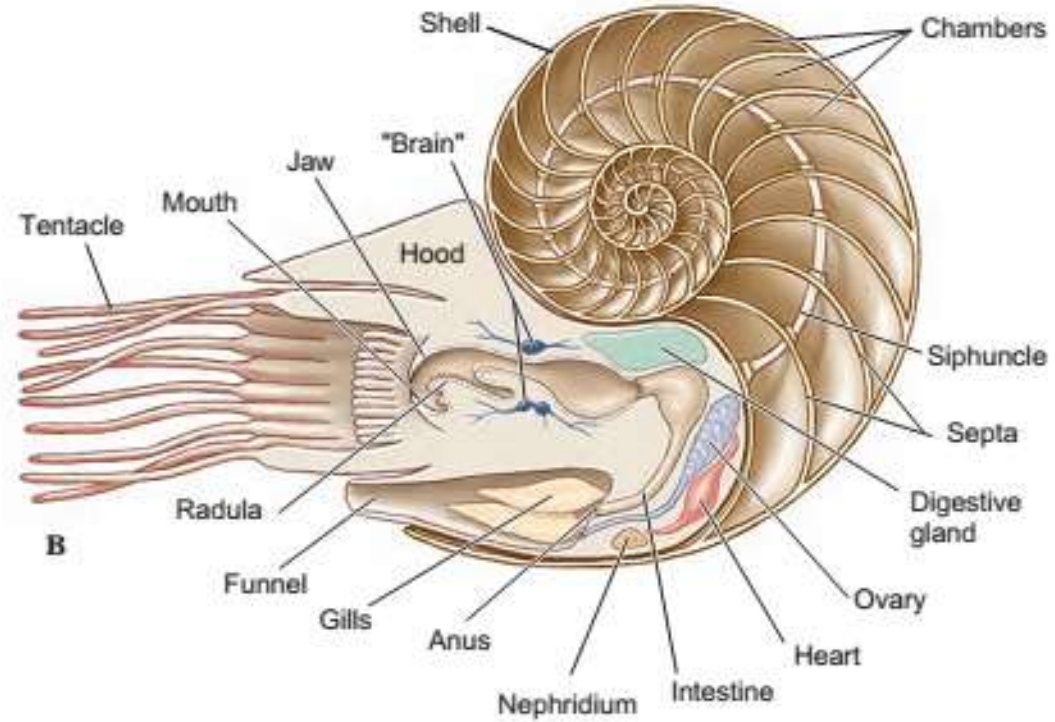
Figure 16.35

Life cycle of oysters. Oyster larvae swim about for approximately 2 weeks before settling down for attachment to become spats. Oysters take about 4 years to grow to commercial size.

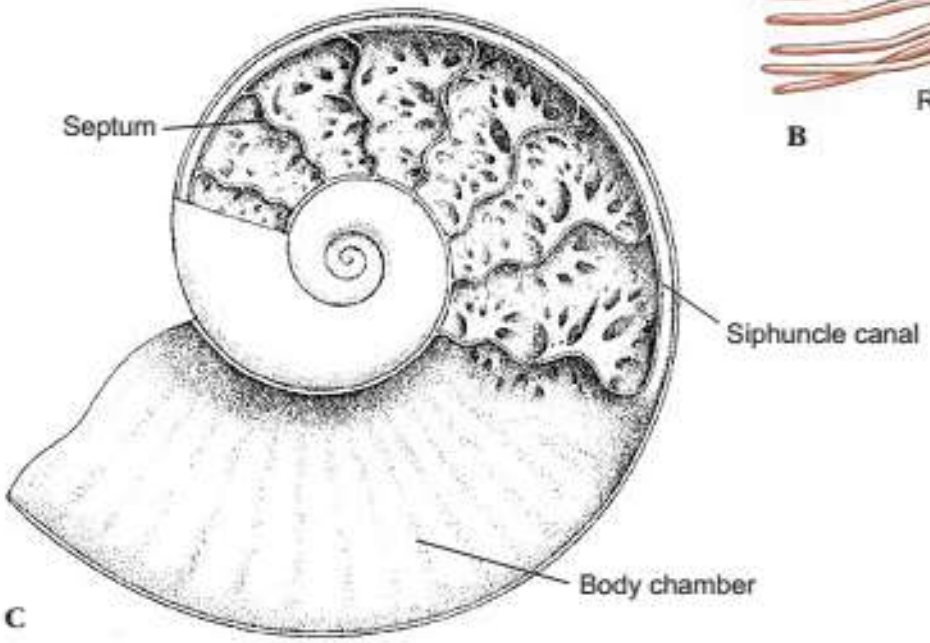
CEPHALOPODA

- Kepala, kaki
- 8 lengan, 2 tentakel lebih panjang, sbg alat gerak & penangkap mangsa
- Lidah parut
- Mata menyerupai vertebrata
- 7 pasang ganglia syaraf
- Peredaran darah ganda
- Kelamin terpisah
- Hektokotilus utk mentransfer sperma, ototomi

A



B



C

Figure 16.37

Nautilus, a cephalopod. **A,** Live *Nautilus*, feeding on a fish. **B,** Longitudinal section, showing gas-filled chambers of shell, and diagram of body structure. **C,** Longitudinal section through shell of an ammonoid.

Figure 16.38
Cuttlefish, *Sepia latimanus*, has an internal shell familiar to keepers of caged birds as "cuttlebone."

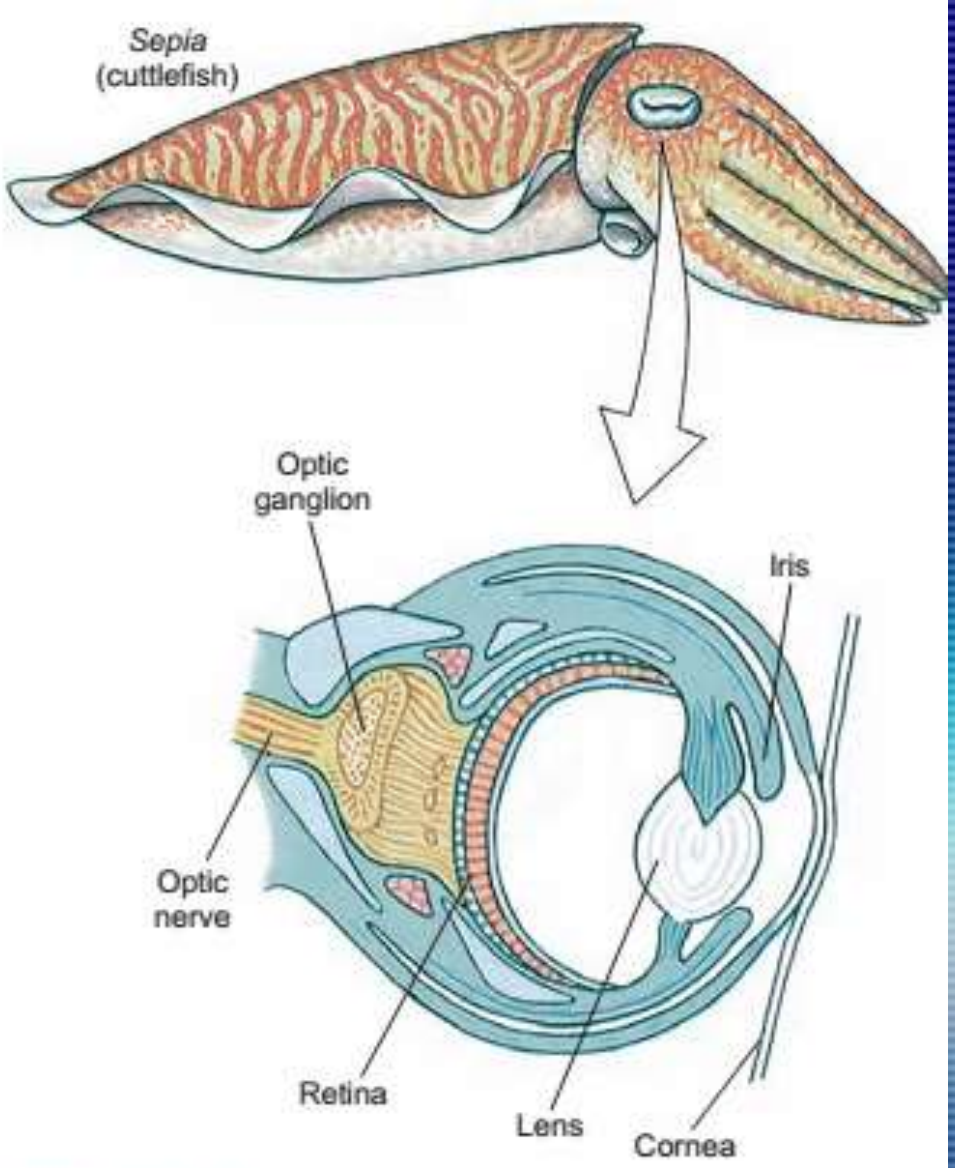


Figure 16.40
Eye of a cuttlefish *(Sepia)*. The structure of cephalopod eyes is very similar to that of eyes of vertebrates (see item 11, p. 334).

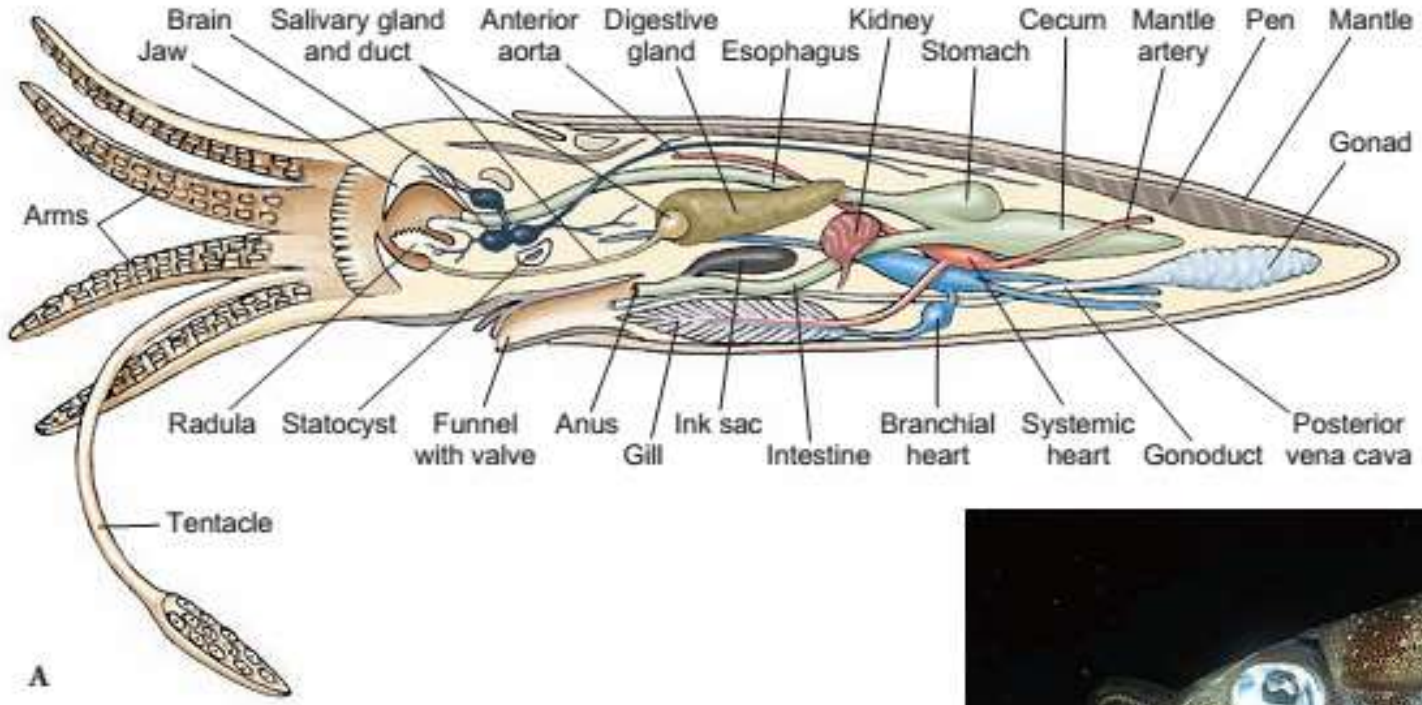


Figure 16.39

A, Lateral view of squid anatomy, with the left half of the mantle removed. **B,** Reef squid *Sepioteuthis lessoniana*.

1. Ordo Tetrabranchia
2. Ordo Dibranchia