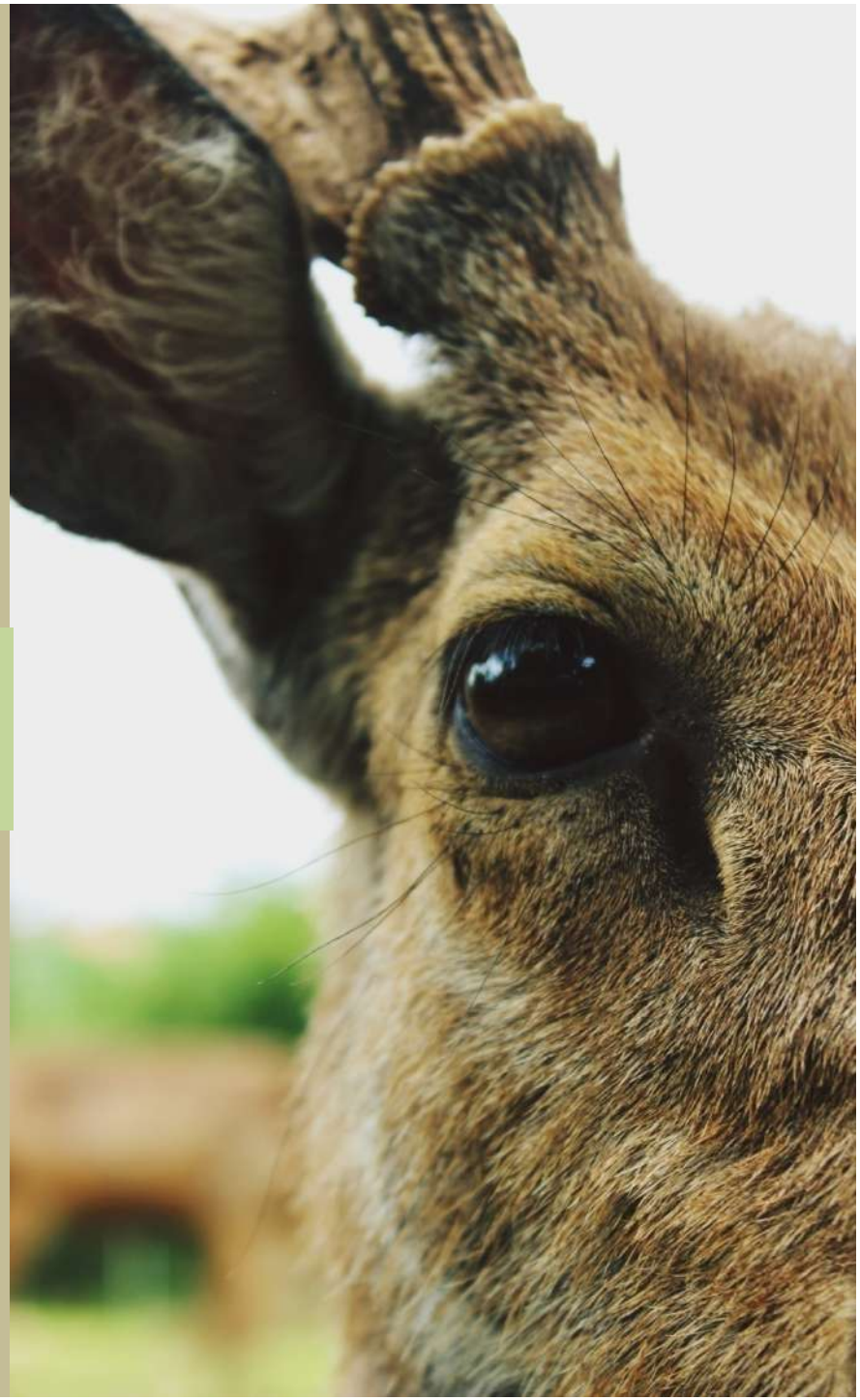
TAKSONOMI HEWAN

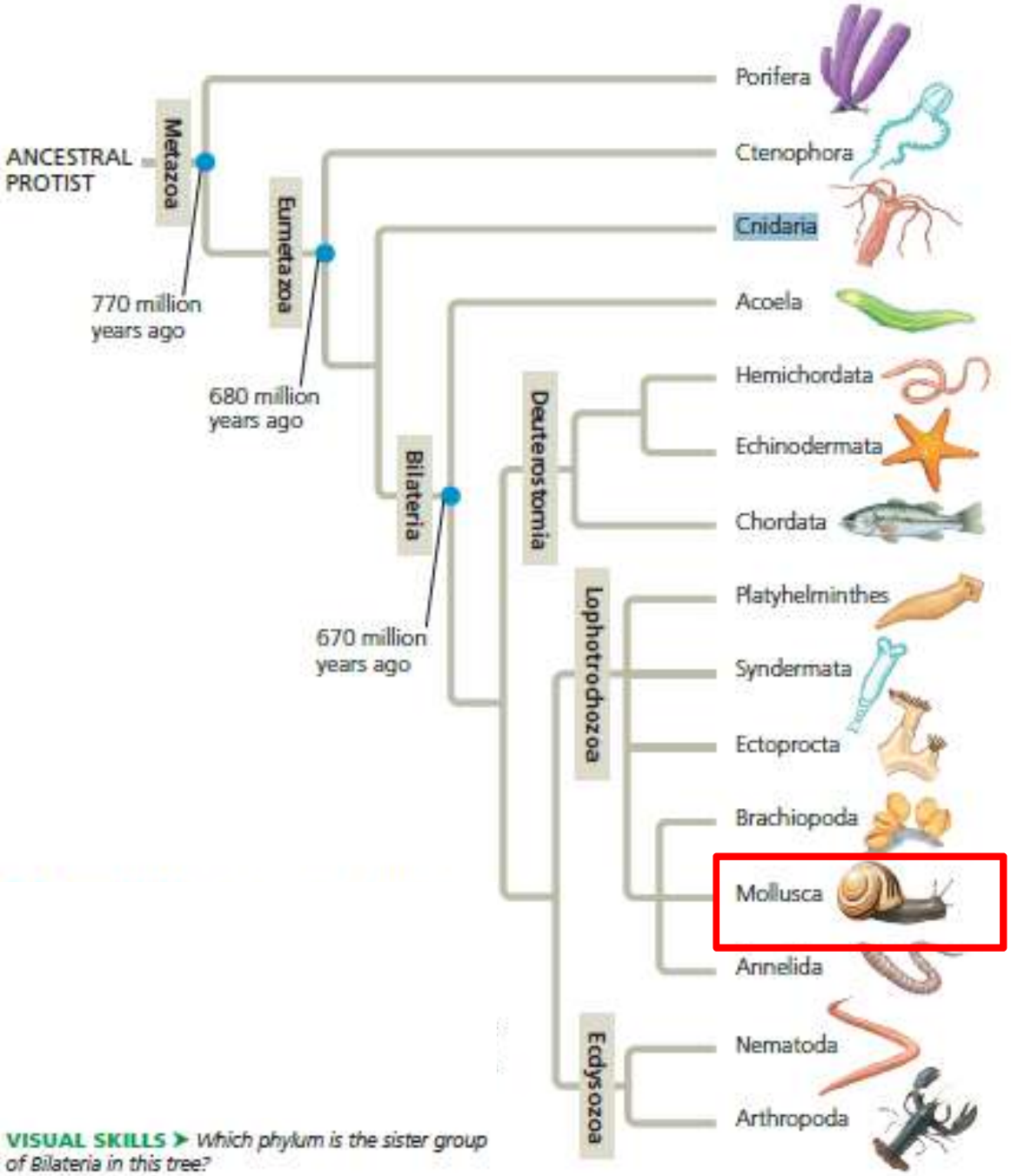
CHAPTER 7: MOLLUSCA



Husni Mubarok, S.Pd., M.Si.
Tadris Biologi
IAIN Jember

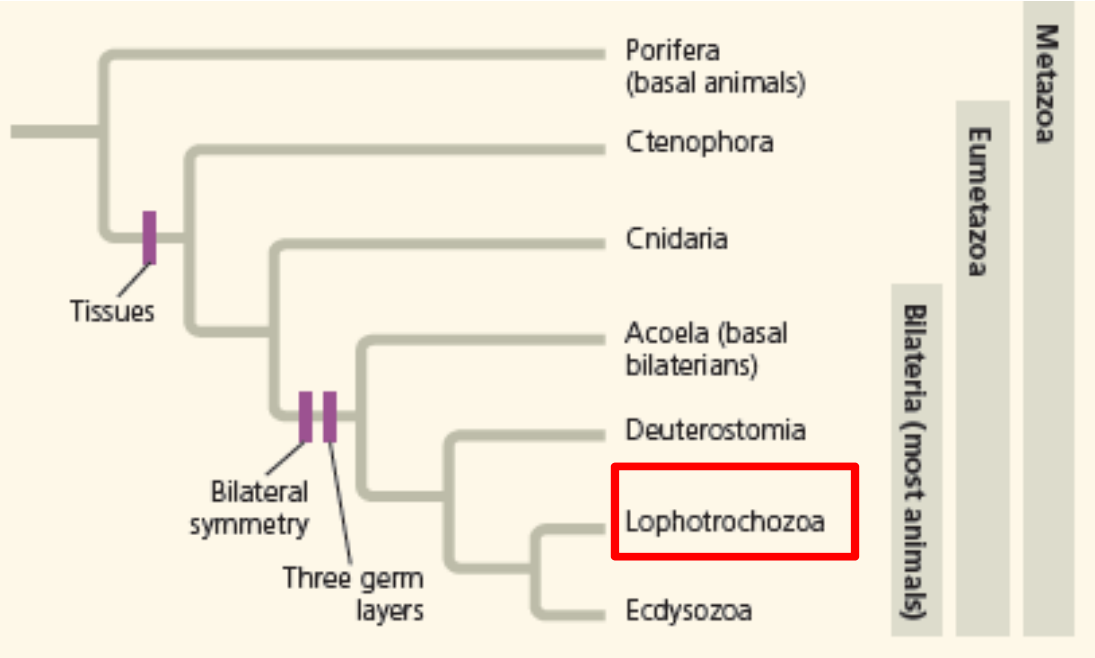

spongegifs
tumblr
com
GARY


Oh Kerang Ajaib,siapakah cewek yang akan menjadi Jodohku Nanti?
Sreeetttttt
MEME COMIC - ID
TIDAK ADA
Puja Kerang Ajaib...



VISUAL SKILLS ➤ *Which phylum is the sister group of Bilateria in this tree?*

Lophotrochozoa



Mollusca (100,000 species)

Moluska (termasuk **siput, kerang, cumi-cumi** dan **gurita**) memiliki tubuh yang lunak dan pd banyak spesies dilindungi oleh cangkang yg keras

An octopus

Some lophotrochozoans develop a structure called a ***lophophore,*** **a crown of ciliated tentacles that functions in feeding**

PLOS ONE

CORRECTION

Correction: A Higher Level Classification of All Living Organisms

Michael A. Ruggiero, Dennis P. Gordon, Thomas M. Orrell, Nicolas Bailly, Thierry Bourgoin, Richard C. Brusca, Thomas Cavalier-Smith, Michael D. Guiry, Paul M. Kirk

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click for updates

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Rank
Superkingdom
Kingdom
Subkingdom
Infrakingdom
Superphylum
Phylum
Subphylum
Infraphylum
Superclass
Class
Subclass
Infraclass
Superorder
Order

Main ranks are in bold type; unnamed taxa are not counted.

doi:10.1371/journal.pone.0130114.t001

KLASIFIKASI MOLLUSCA


Phylum Mollusca
Class Bivalvia
Subclass Autobranchia
Superorder Heteroconchia
Order Carditida
Order Lucinida
Order Myida
Order Pholadomyida
Order Trigoniida
Order Unionida
Order Veneroida
Superorder Pteriomorphia
Order Arcida
Order Limida
Order Mytilida
Order Ostreida
Order Pectinida
Order Pteriida
Subclass Protobranchia
Order Nuculanida
Order Nuculida
Order Solemyoida
Class Caudofoveata
Order Chaetodermatida
Class Cephalopoda
Subclass Coleoidea

		Superorder Decabrachia
		Order Sepiida
		Order Sepiolida
		Order Spirulida
		Order Teuthida
		Superorder Octobrachia
		Order Octopoda
		Order Vampyromorphida
		Subclass Nautiloidea
		Order Nautilida
	Class Gastropoda	
		Subclass Caenogastropoda
		Order Littorinimorpha
		Order Neogastropoda
		Subclass Cocculiniformia (e.g., Cocculinidae)
		Subclass Heterobranchia
		Order Acochlidioidea
		Order Anaspidea
		Order Cephalaspidea
		Order Gymnosomata
		Order Hygrophila
		Order Nudibranchia
		Order Pleurobranchomorpha
		Order Runcinacea
		Order Sacoglossa
		Order Stylommatophora
		Order Systellommatophora
		Order Thecosomata
		Order Umbraculida

	Subclass Neomphalina
	Order N.N. (e.g., Neomphalidae)
	Subclass Neritimorpha
	Order Cycloneritimorpha
	Subclass Patellogastropoda
	Order N.N. (e.g., Patellidae)
	Subclass Vetigastropoda
	Order N.N. (e.g., Ataphridae)
Class Monoplacophora	
	Order Tryblidiida
Class Polyplacophora	
	Order Chitonida
	Order Lepidopleurida
Class Scaphopoda	
	Order Dentaliida
	Order Gadilida
Class Solenogastres	
	Superorder Aplotegmentaria
	Order Cavibelonia
	Order Sterrofustia
	Superorder Pachytegmentaria
	Order Neomeniamorpha
	Order Pholidoskepia

PHYLUM MOLLUSCA

A

B

C

D

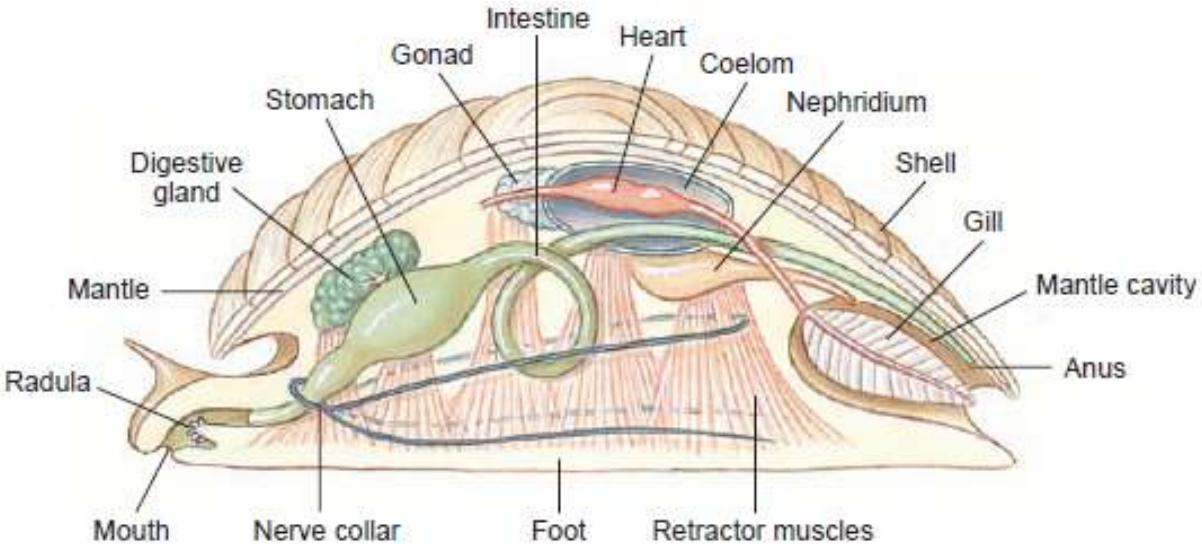
E

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.

BODY FORM

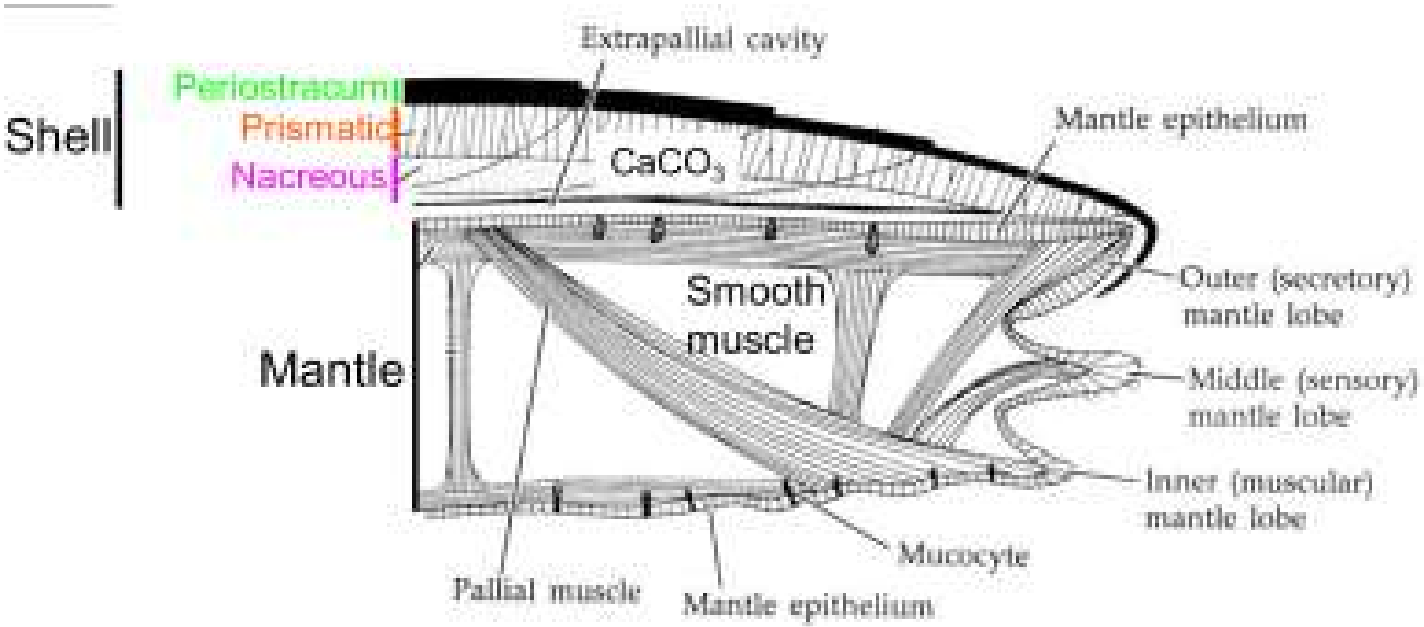
- Dorsal body wall forms **pair of folds** called the **mantle,** which encloses the **mantle cavity,** is modified into **gills or lungs,** and **secretes the shell (shell absent in some)**
- Ventral body wall specialized as a muscular **foot, variously modified** for locomotion
- Radula in mouth



- Live in marine, freshwater, and terrestrial habitats
- Free-living or occasionally parasitic

BODY FORM

- **Body bilaterally symmetrical** (bilateral asymmetry in some)
- Unsegmented; often with definite head
- Triploblastic body
- **COELOM limited mainly to area around heart,** and perhaps lumen of gonads, part of kidneys, and occasionally part of the intestine
- Surface epithelium usually **ciliated** and bearing **mucous glands** and **sensory nerve endings**



BODY FORM

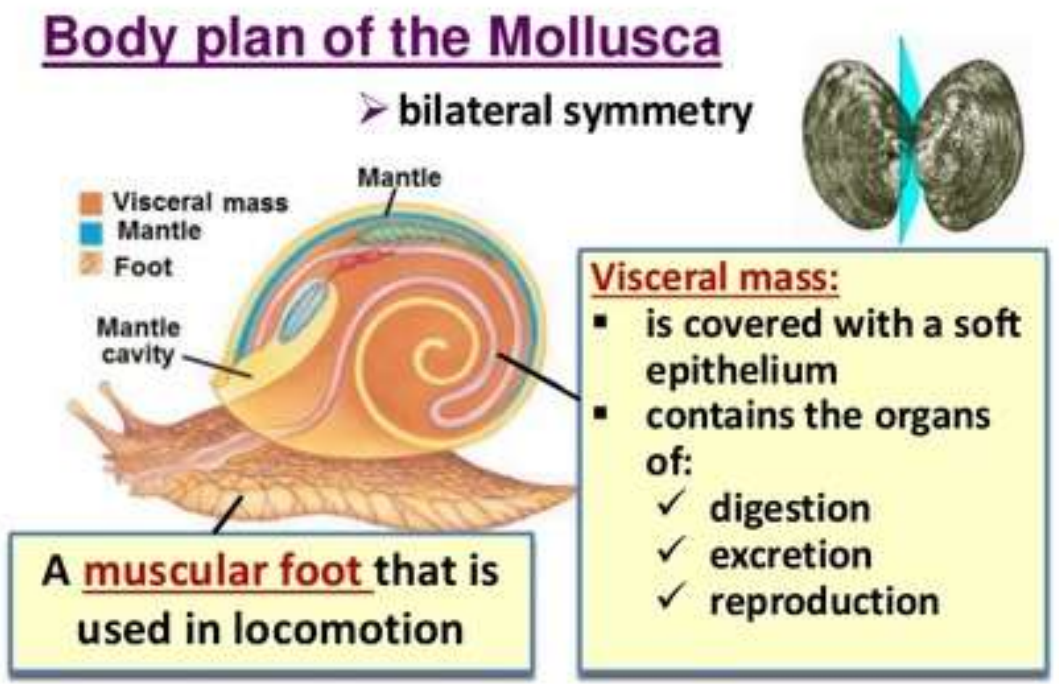
- The mollusc body plan may be said to consist of a **HEAD-FOOT portion** and a **VISCERAL MASS portion**

- **HEAD-FOOT**

  Well-developed heads, mouth and some specialized sensory organs. Photosensory receptors (simple ones to the complex eyes of cephalopod). Tentacles are often present. Structure unique to mouth, the **radula**, and usually posterior to the mouth is the chief locomotor organ, or **foot**.

- **VISCERAL MASS**

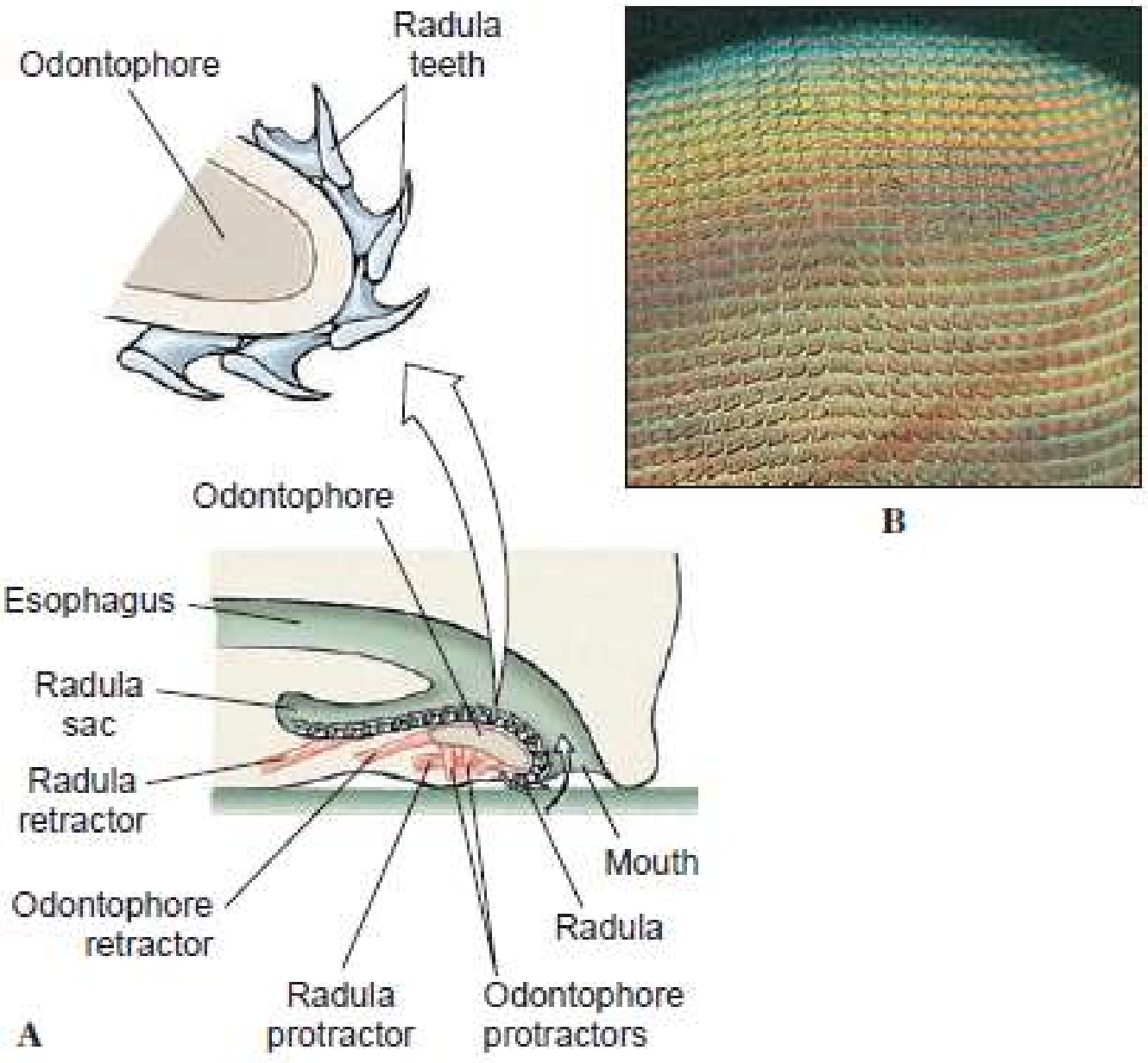
  Mantle and Mantle Cavity, Shell, Internal Structure



RADULA

- The radula is a rasping, protrusible, **tonguelike organ** found in all molluscs **except bivalves and most solenogasters.**
- for feeding and consists of a ribbonlike membrane on which are mounted rows of tiny teeth that point backward
- Complex muscles move the radula and its supporting cartilages **(odontophore)**
- May be a few or as many as 250,000 teeth, which, when protruded, can scrape, pierce, tear, or cut.
- **Function** :to rasp fine particles of food material from hard surfaces and to serve as a conveyor belt for carrying particles in a continuous stream toward the digestive tract.
- The pattern and number of teeth in a row are specific for each species and are used in the classification of molluscs.
- Very interesting radular specializations

RADULA


Odontophore
Radula teeth
Odontophore
Esophagus
Radula sac
Radula retractor
Odontophore retractor
Radula protractor
Odontophore protractors
Radula
Mouth
A
B

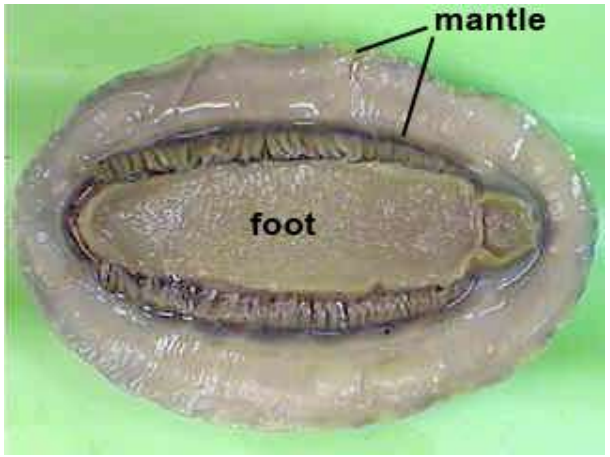
FOOT

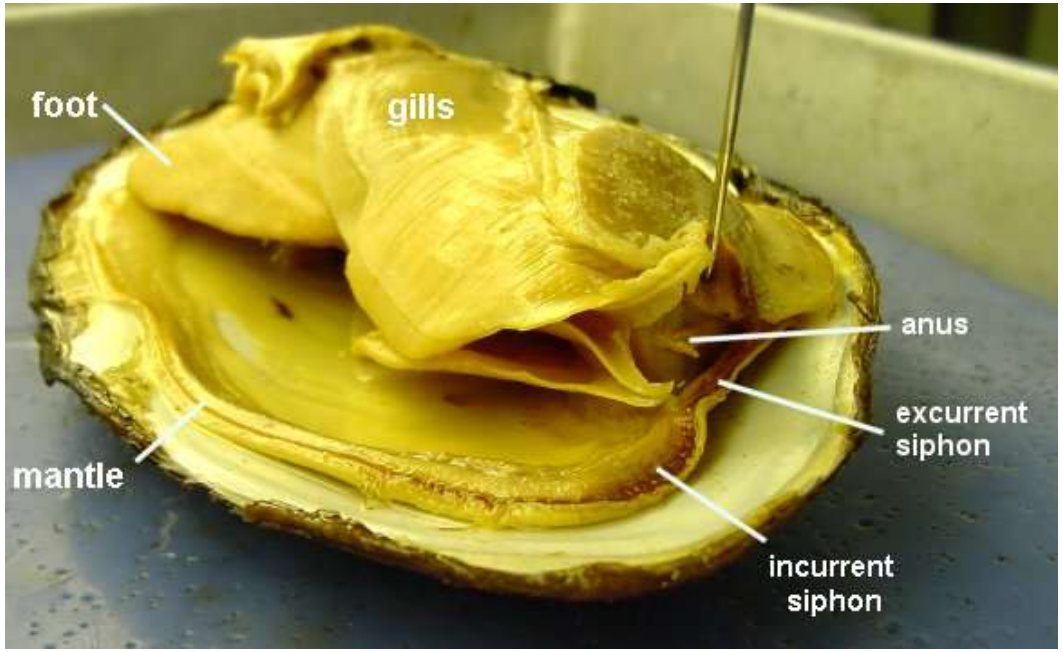
- The molluscan foot may be variously adapted for **locomotion (ex creeping)**, for **attachment to a substratum**, or for a combination of functions
- It is usually a ventral
- Many modifications, such as the **attachment disc** of limpets, the laterally compressed "**hatchet foot**" of bivalves, or the **siphon for jet propulsion** in squids and octopuses.
- **Secreted mucus** is often used as an aid to **adhesion** or as a slime tract by small molluscs that glide on cilia.
- In snails and bivalves the **foot is extended** from the body **hydraulically**, by **engorgement (pembengkakan) with blood**. Burrowing forms can extend the foot into the mud or sand, enlarge it with blood pressure, then use the engorged foot as an anchor to draw the body forward.
- In pelagic (free-swimming) forms the foot may be modified into **winglike parapodia**, or thin, **mobile fins** for swimming.

FOOT

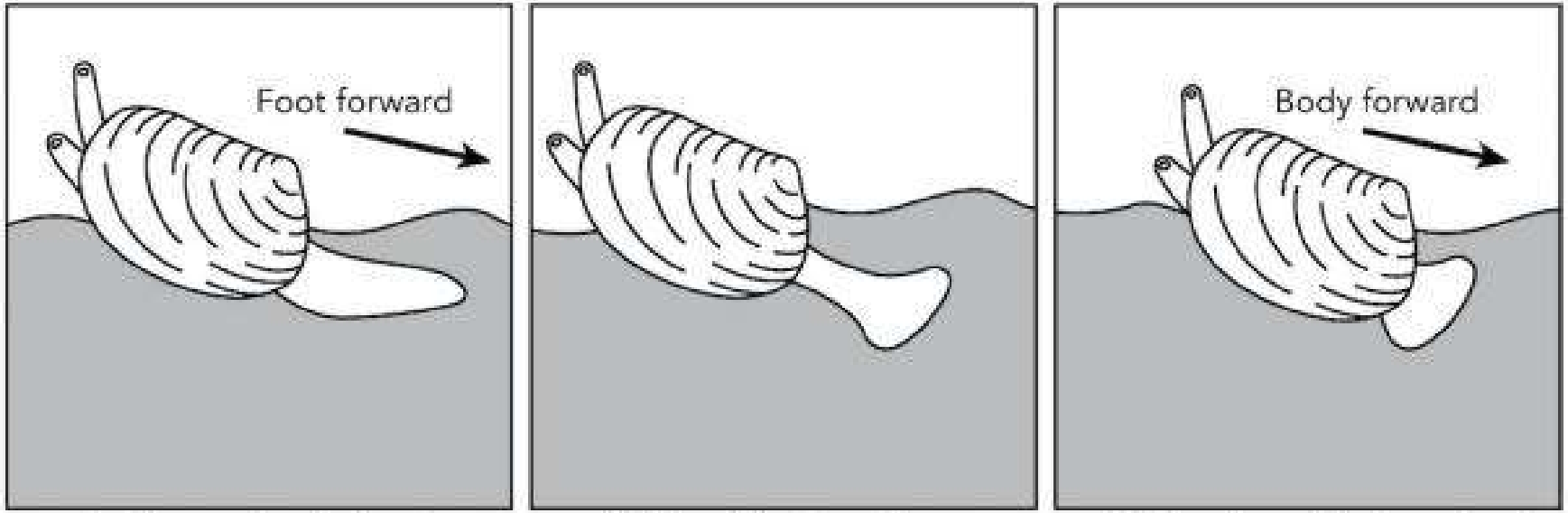
Attachment Disc of Limpets

FOOT


mantle
foot


foot
gills
anus
excurrent siphon
mantle
incurrent siphon

FOOT



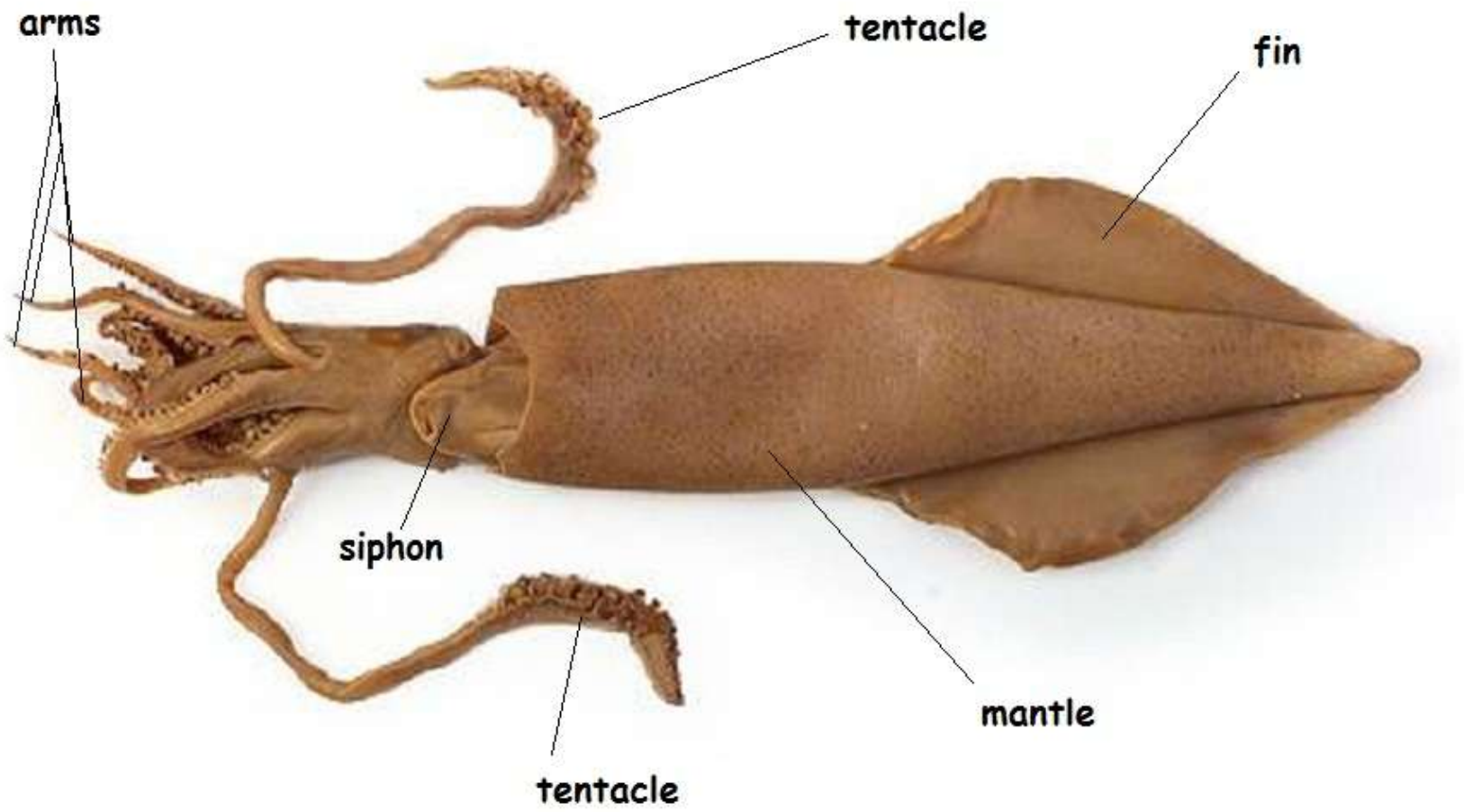
A. Clam extends foot.

B.Tip of foot swells up, acting as an anchor.

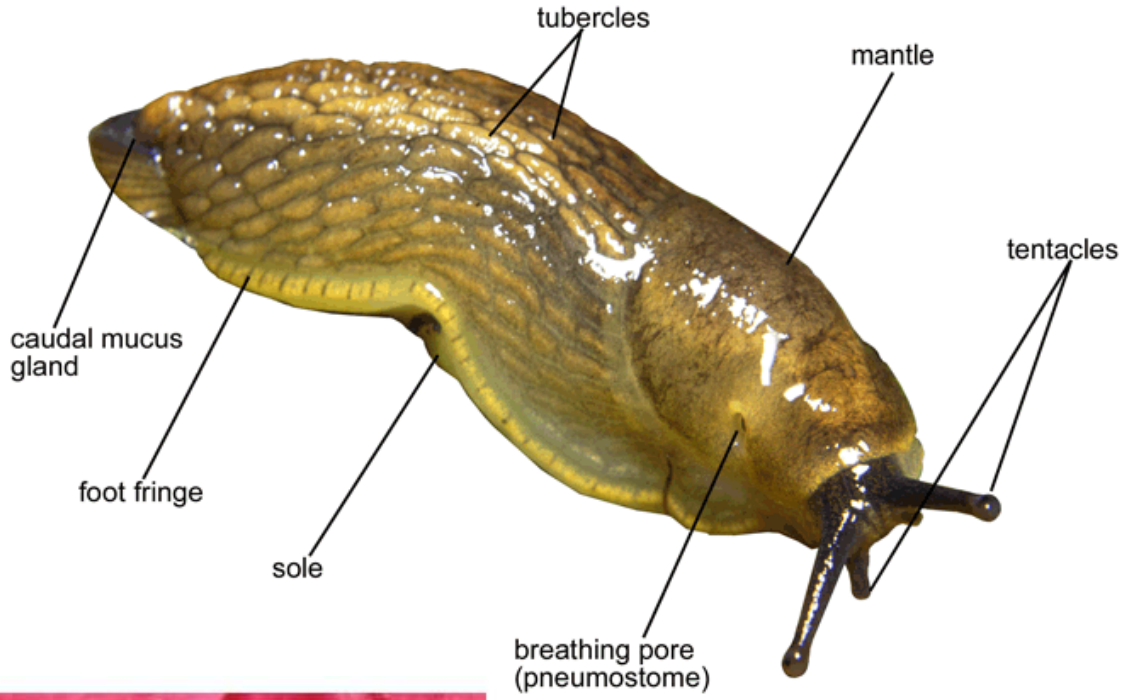
C. Muscles of feet contract, drawing the clam forward.

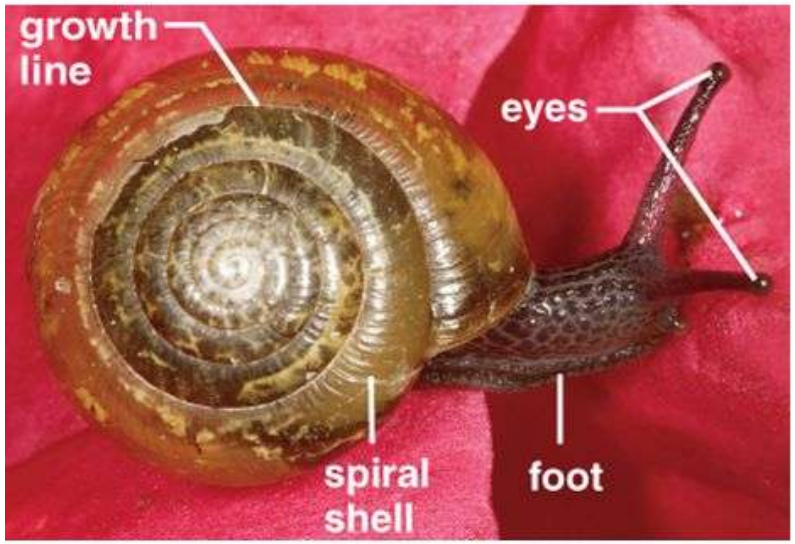
Winglike Parapodia

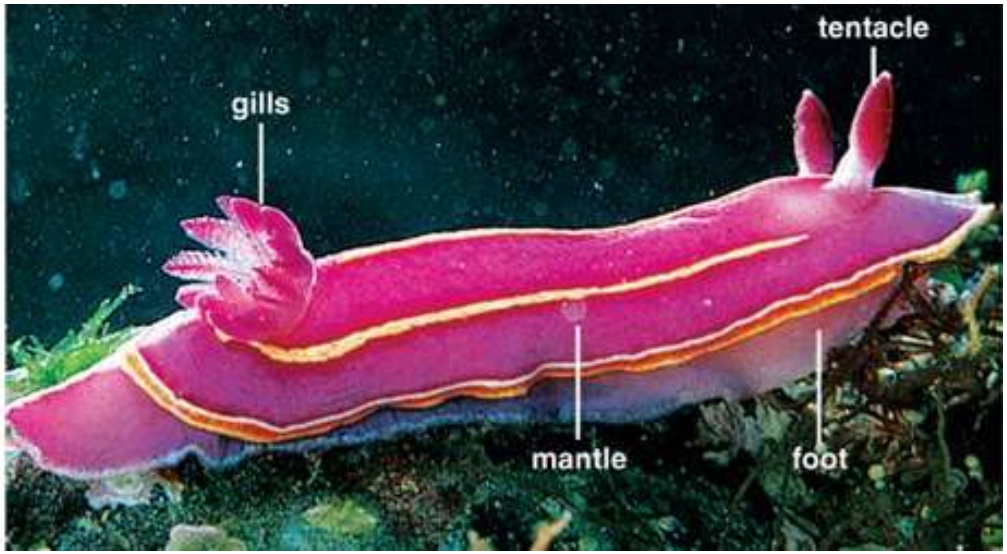
FOOT



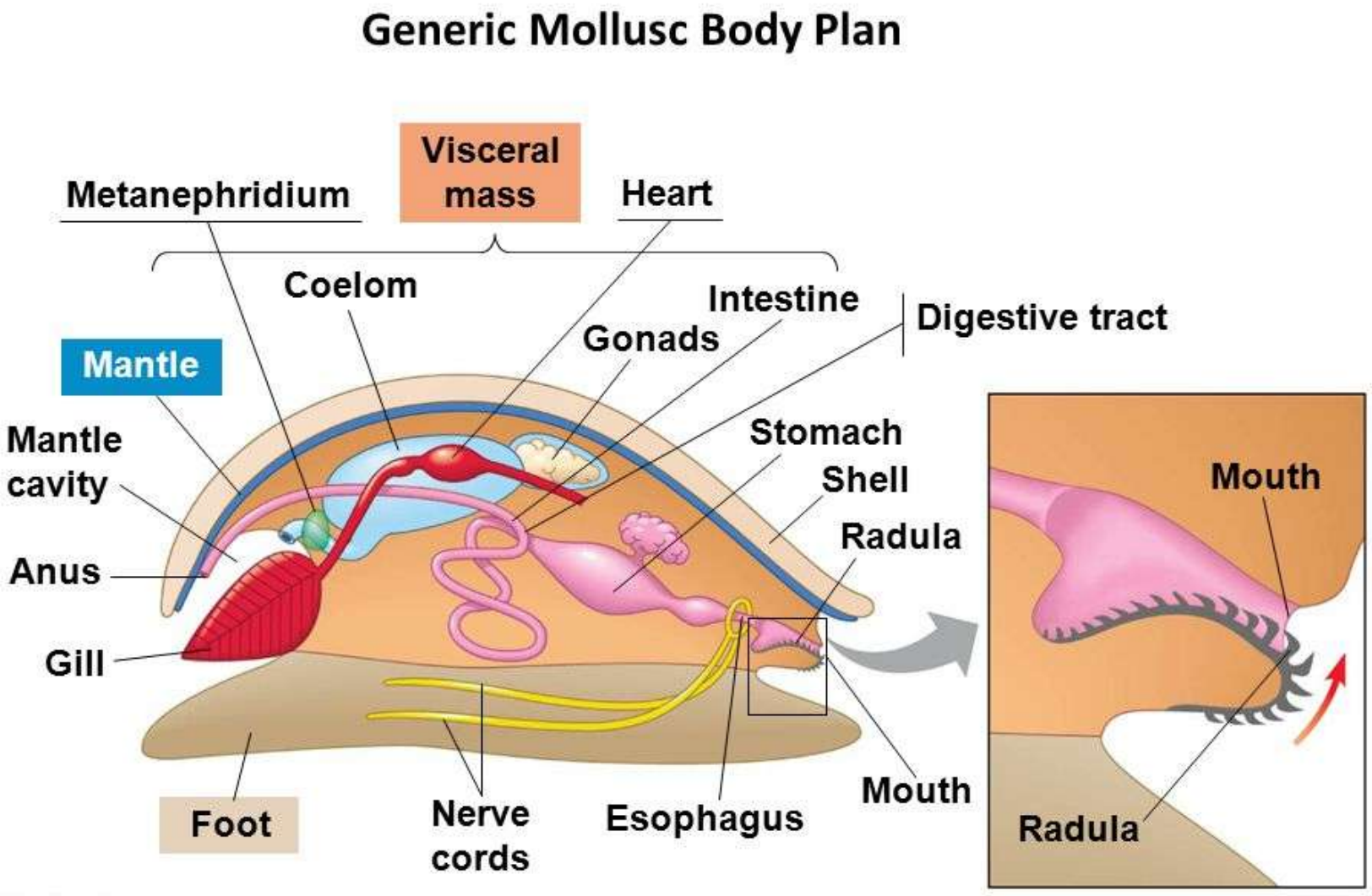
FOOT


tubercles
mantle
tentacles
caudal mucus gland
foot fringe
sole
breathing pore (pneumostome)


growth line
eyes
spiral shell
foot

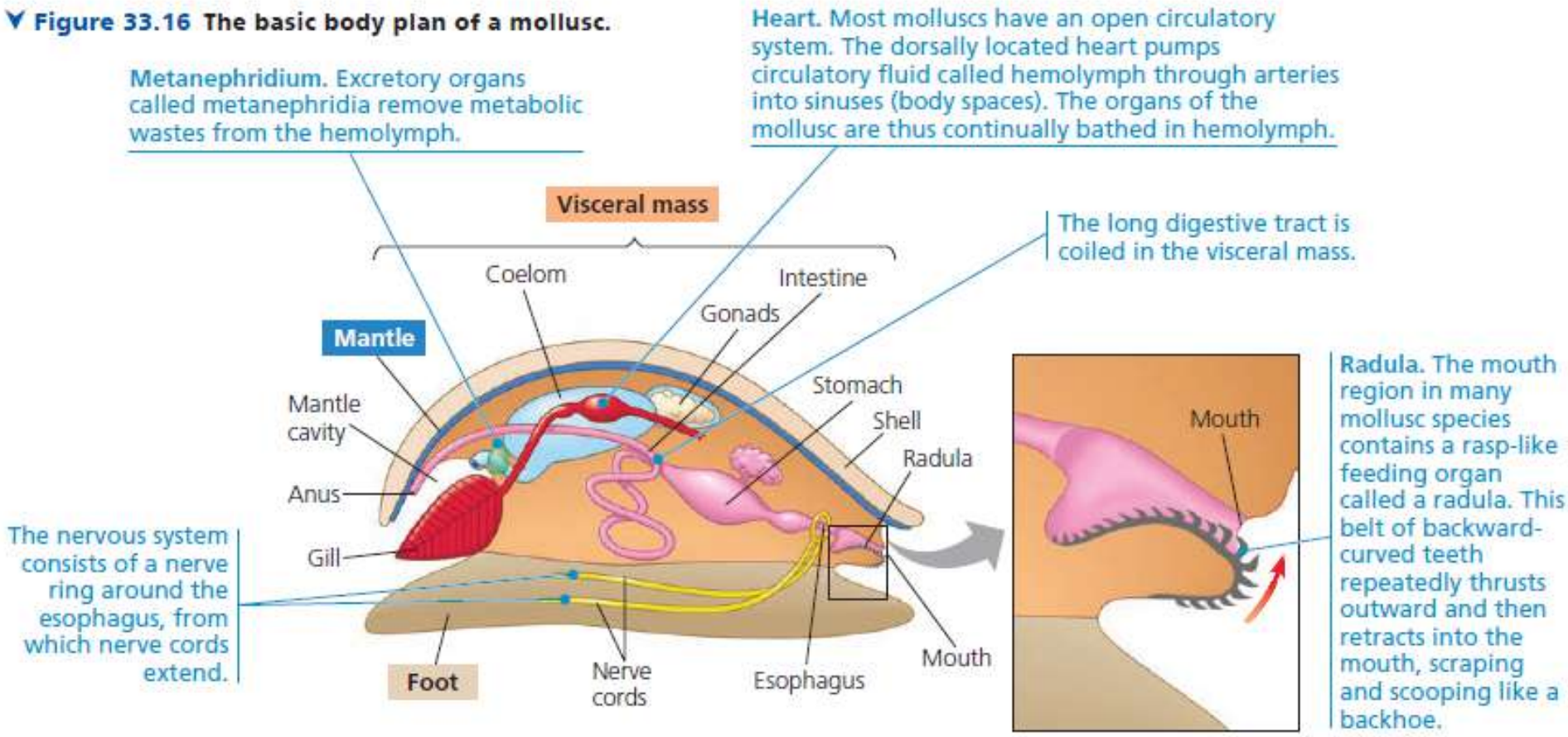

tentacle
gills
mantle
foot

BODY FORM


Generic Mollusc Body Plan
Visceral mass
Metanephridium
Heart
Coelom
Intestine
Digestive tract
Gonads
Mantle
Mantle cavity
Stomach
Shell
Radula
Anus
Gill
Foot
Nerve cords
Esophagus
Mouth
Mouth
Radula

BODY FORM

Figure 33.16 The basic body plan of a mollusc.



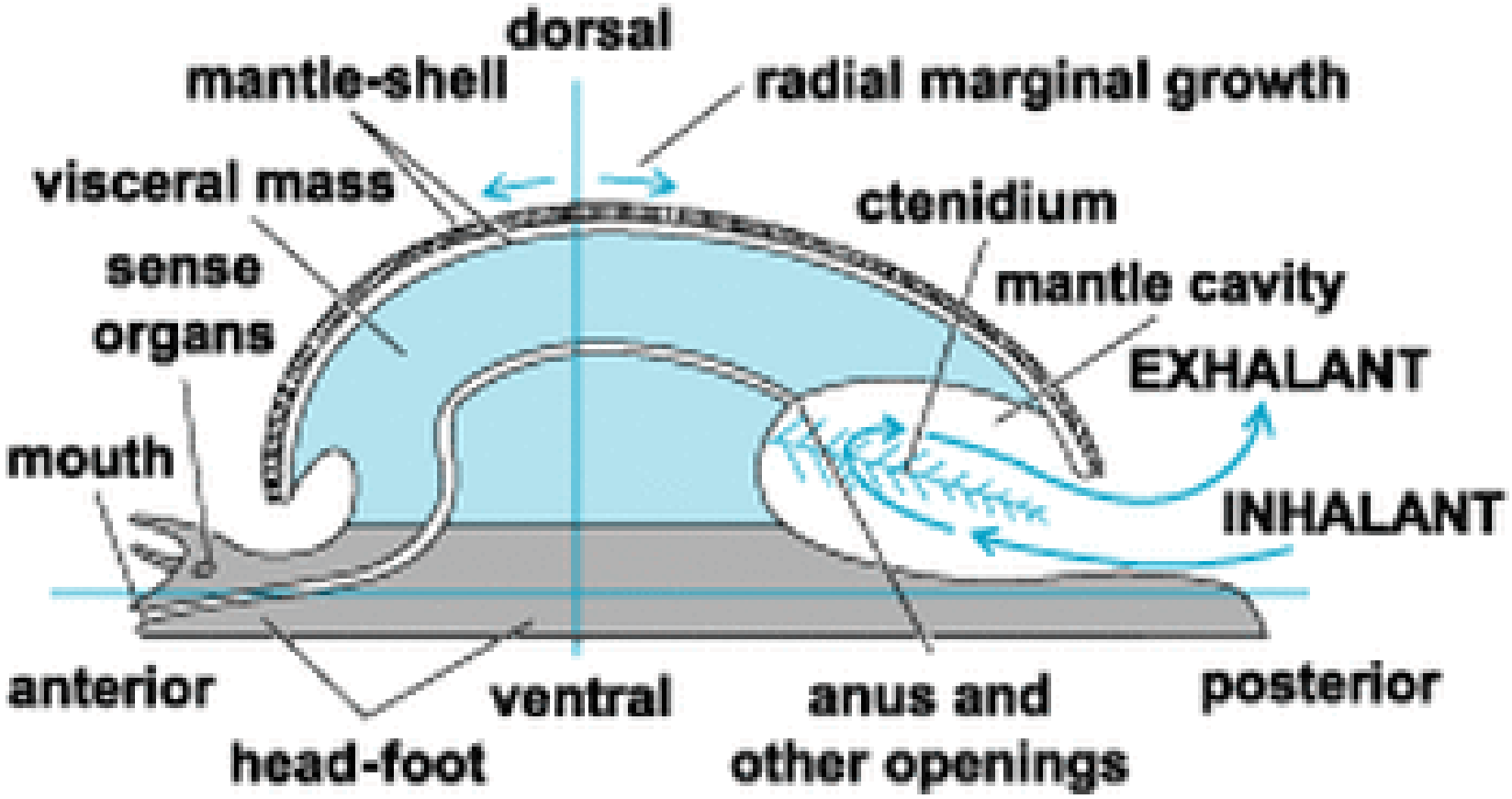
MANTLE AND MANTLE CAVITY

- The mantle is a **sheath of skin**, extending from the visceral mass
- **Protecting** the soft parts and creating between itself and the visceral mass a space called the **mantle cavity**.
- The outer surface of the mantle secretes the **shell**.
- The **mantle cavity** . It usually houses respiratory organs (gills or lung), which develop from the mantle, and the mantle's own exposed surface serves also for gaseous exchange.
- Products from the digestive, excretory, and reproductive systems are emptied into the mantle cavity.
- In aquatic Mollusca a continuous current of water, kept moving by **surface cilia** or by **muscular pumping**, brings in oxygen and, in some forms, food. This same water current also flushes out wastes and carries reproductive products out to the environment

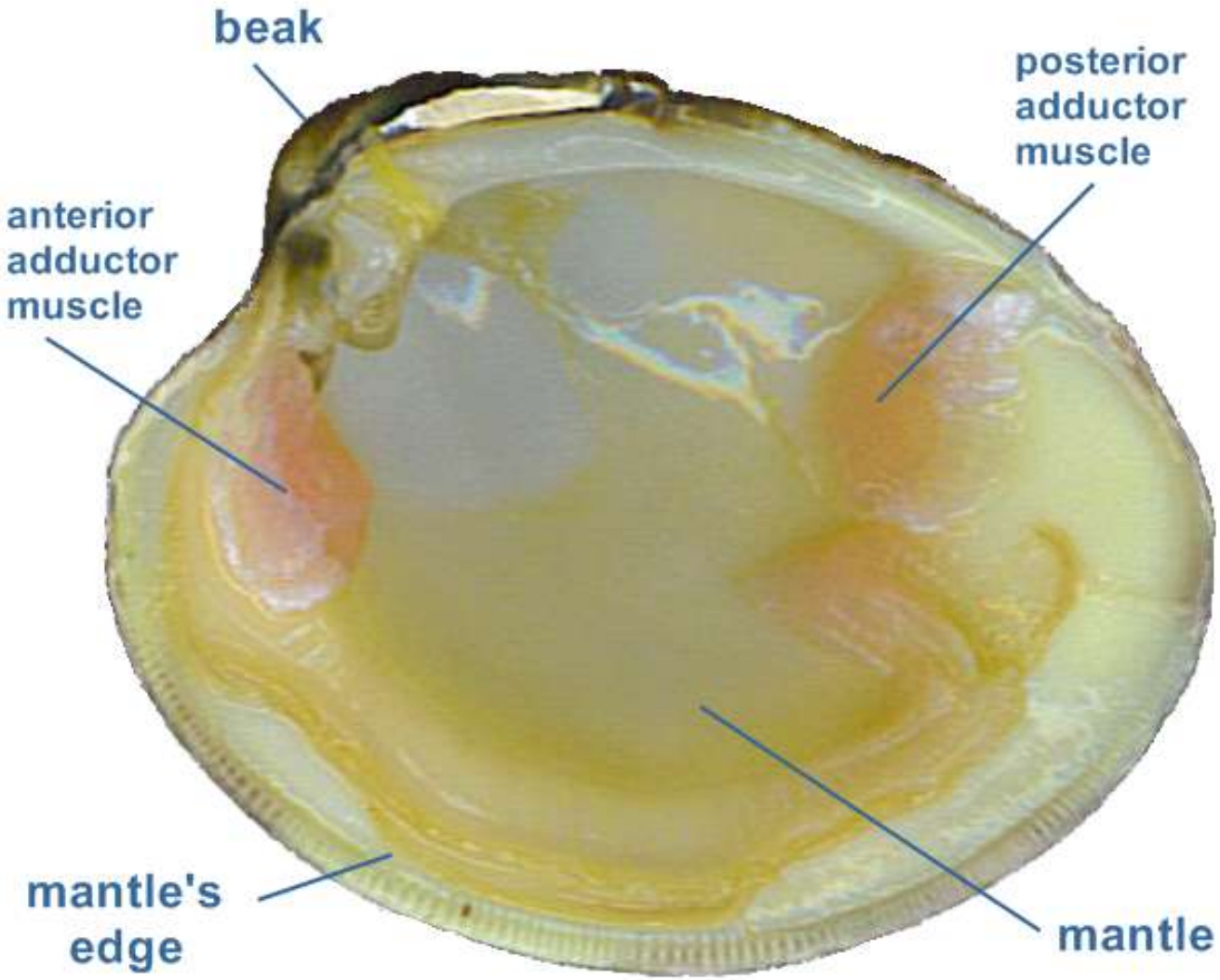
MANTLE AND MANTLE CAVITY

- **In aquatic forms** the mantle is usually **equipped with sensory receptors** for sampling environmental water.
- In cephalopods (squids and octopuses) the muscular mantle and its cavity create **jet propulsion** used in locomotion.
- Many molluscs can withdraw their head or foot into the mantle cavity, which is surrounded by the **shell**, for **protection.**
- A mollusc **ctenidium (gill)** consists of a long, flattened axis **extending from the wall of the mantle cavity**. Many leaflike gill filaments project from the central axis.
- Water is propelled by cilia between gill filaments, and **blood diffuses** from an afferent vessel in the central axis through the filament to an efferent vessel.
- **Direction of blood movement is opposite** to the direction of water movement
- The two ctenidia are located on opposite sides of the mantle cavity and are arranged so that the cavity is functionally divided into an incurrent chamber and an excurrent chamber.
- The basic arrangement of gills is variously modified in many molluscs.

MANTLE AND MANTLE CAVITY



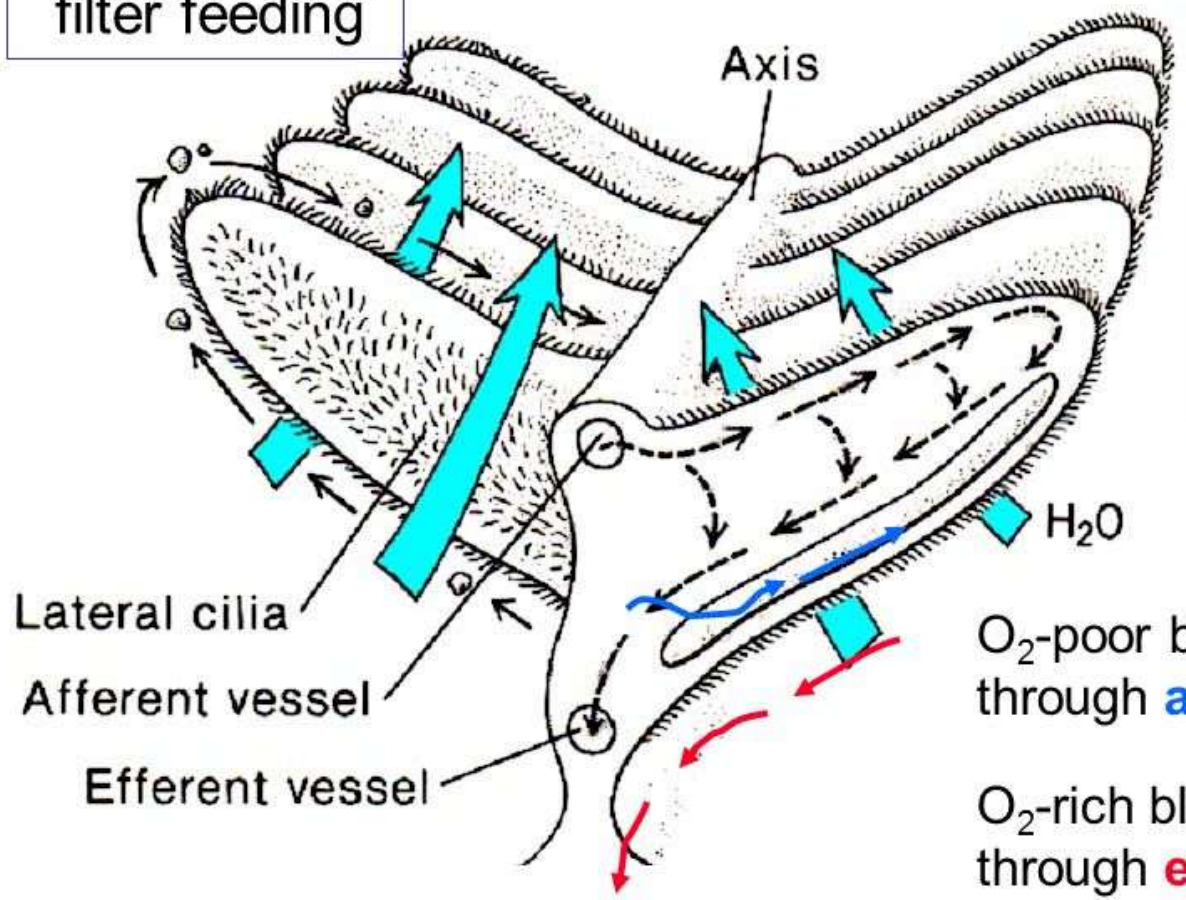
MANTLE AND MANTLE CAVITY



Mantle and Mantle Cavity

- also used in filter feeding

Ctenidia



Ctenidia (gills) grow from wall of mantle cavity

O_2-poor blood enters through **afferent** vessel

O_2-rich blood leaves through **efferent** vessel

Ciliary beating moves water past incoming O_2-poor blood

SHELL

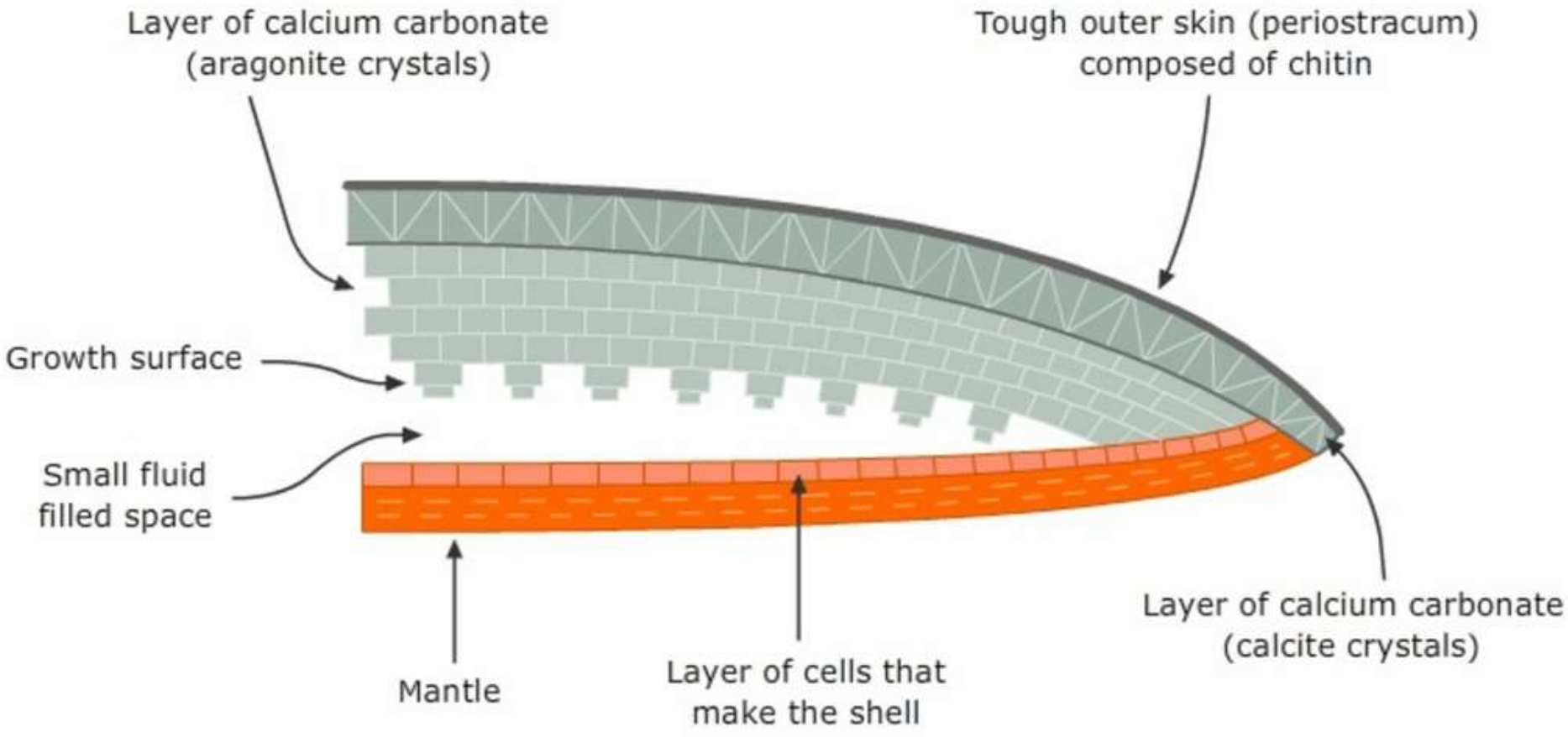
- The shell of a mollusc, when present, is secreted by the mantle and is lined by it. Typically there are three layers
- **PERIOSTRACUM is the OUTER organic layer,** composed of an organic substance: **Conchiolin**, which consists of quinonetanned protein. It helps to protect underlying calcareous layers from erosion by boring organisms.
- It is secreted by a fold of the mantle edge, and growth occurs only at the margin of the shell.
- On the older parts of the shell, periostracum often becomes worn away.
- The **MIDDLE PRISMATIC LAYER is composed of densely packed prisms of calcium carbonate (either aragonite or calcite)** laid down in a protein matrix. It is secreted by the glandular margin of the mantle, and increase in shell size occurs at the shell margin as the animal grows.
- The **INNER NACREOUS LAYER** of the shell lies next to the mantle and is secreted continuously by the mantle surface, so that **it increases in thickness** during the life of the animal.

SHELL

- **The calcareous nacre** is laid down in thin layers. Very thin and wavy layers produce the iridescent mother-of-pearl found in abalones *(Haliotis), chambered nautiluses (Nautilus*), and many bivalves.
- Such shells may have 450 to 5000 fine parallel layers of **crystalline calcium carbonate for each centimeter of thickness.**
- There is **great variation** in shell structure among molluscs.
- Freshwater molluscs usually have a **thick periostracum** that gives some protection against acids produced in the water by decay of leaf litter.
- In many marine molluscs the **periostracum is relatively thin**, and in some it is absent. Calcium for the shell comes from environmental water or soil or from food.
- The first shell **appears during the larval period** and grows continuously throughout life.

SHELL

Structure of a typical mollusc shell



SHELL

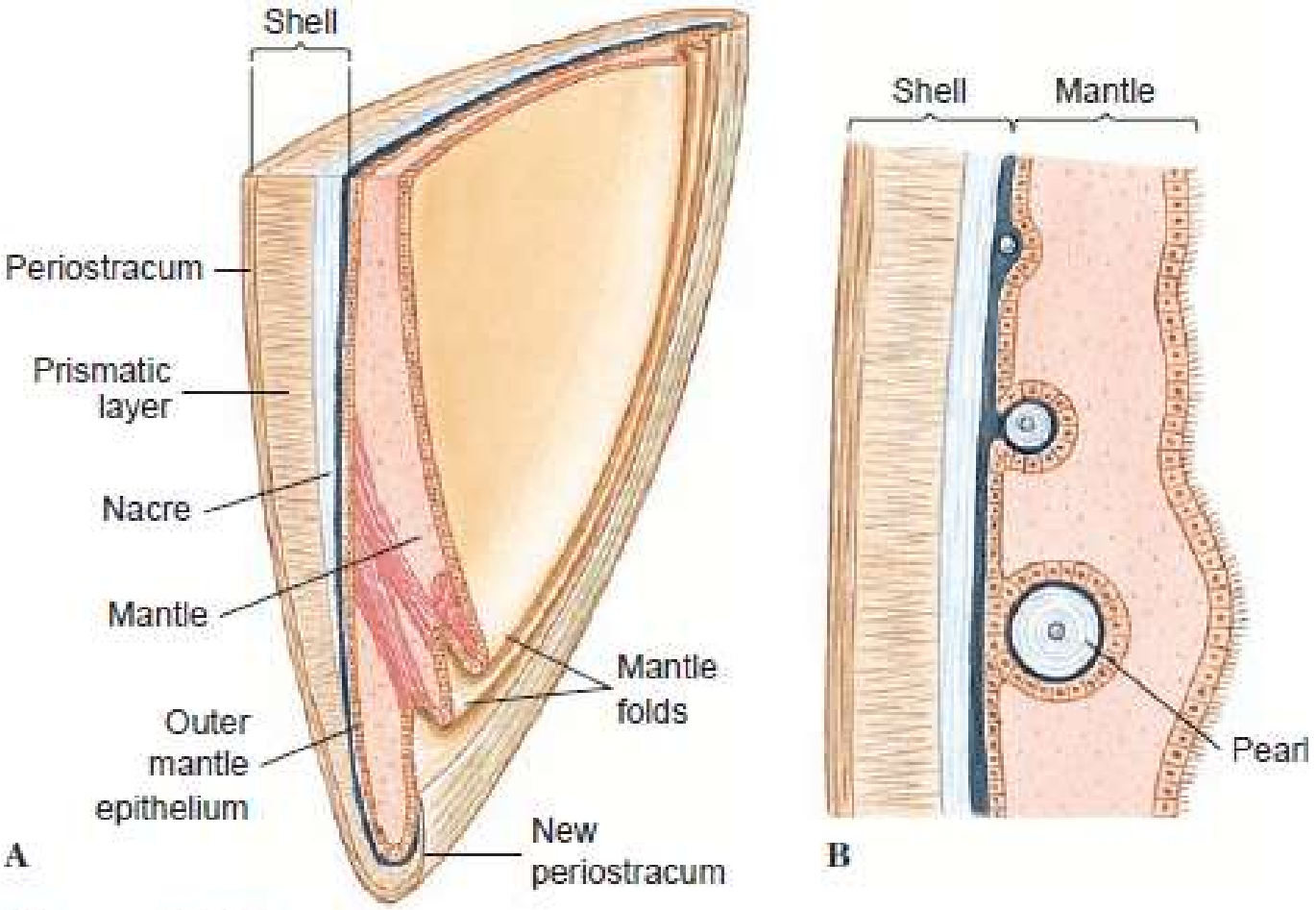
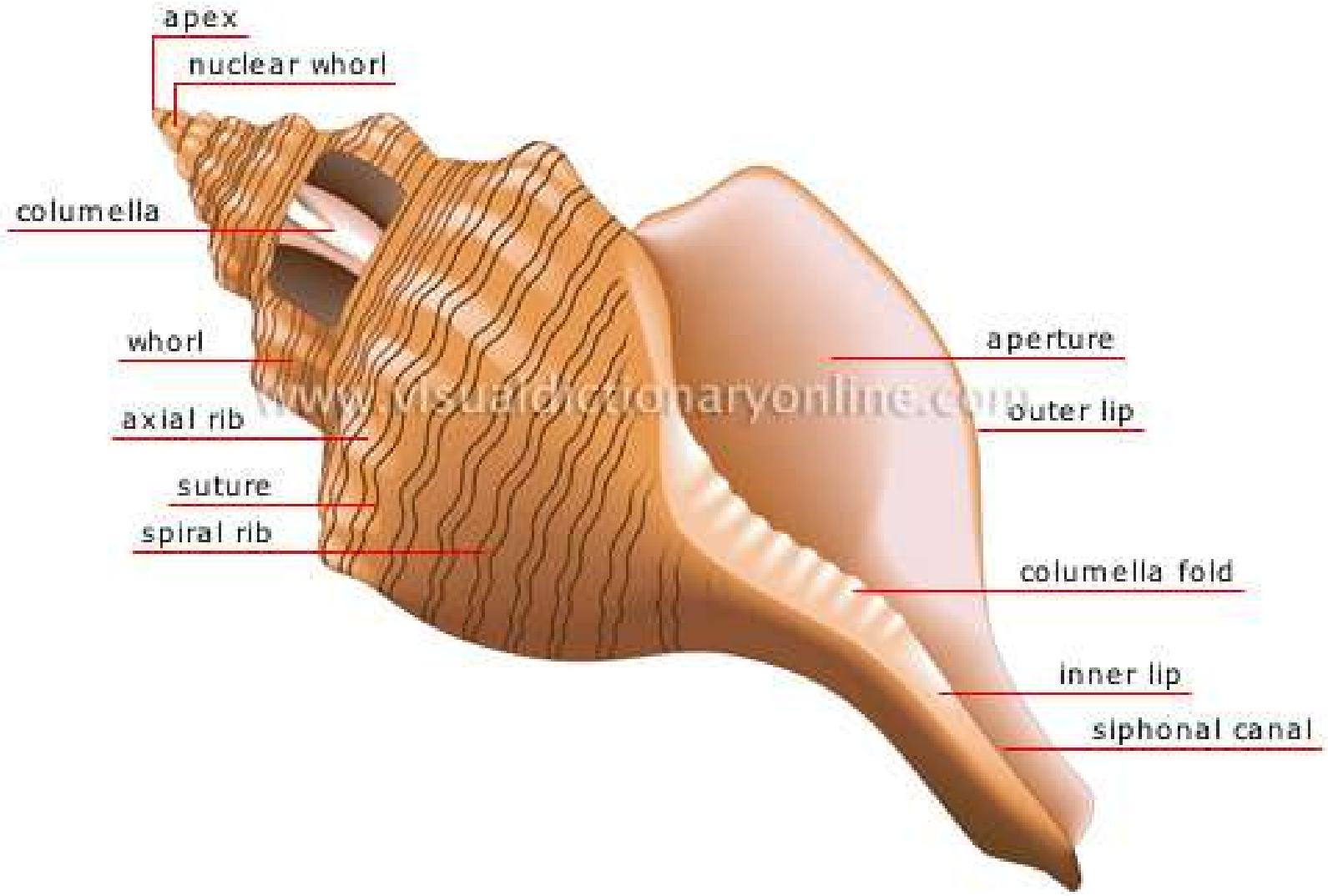


Figure 16.6

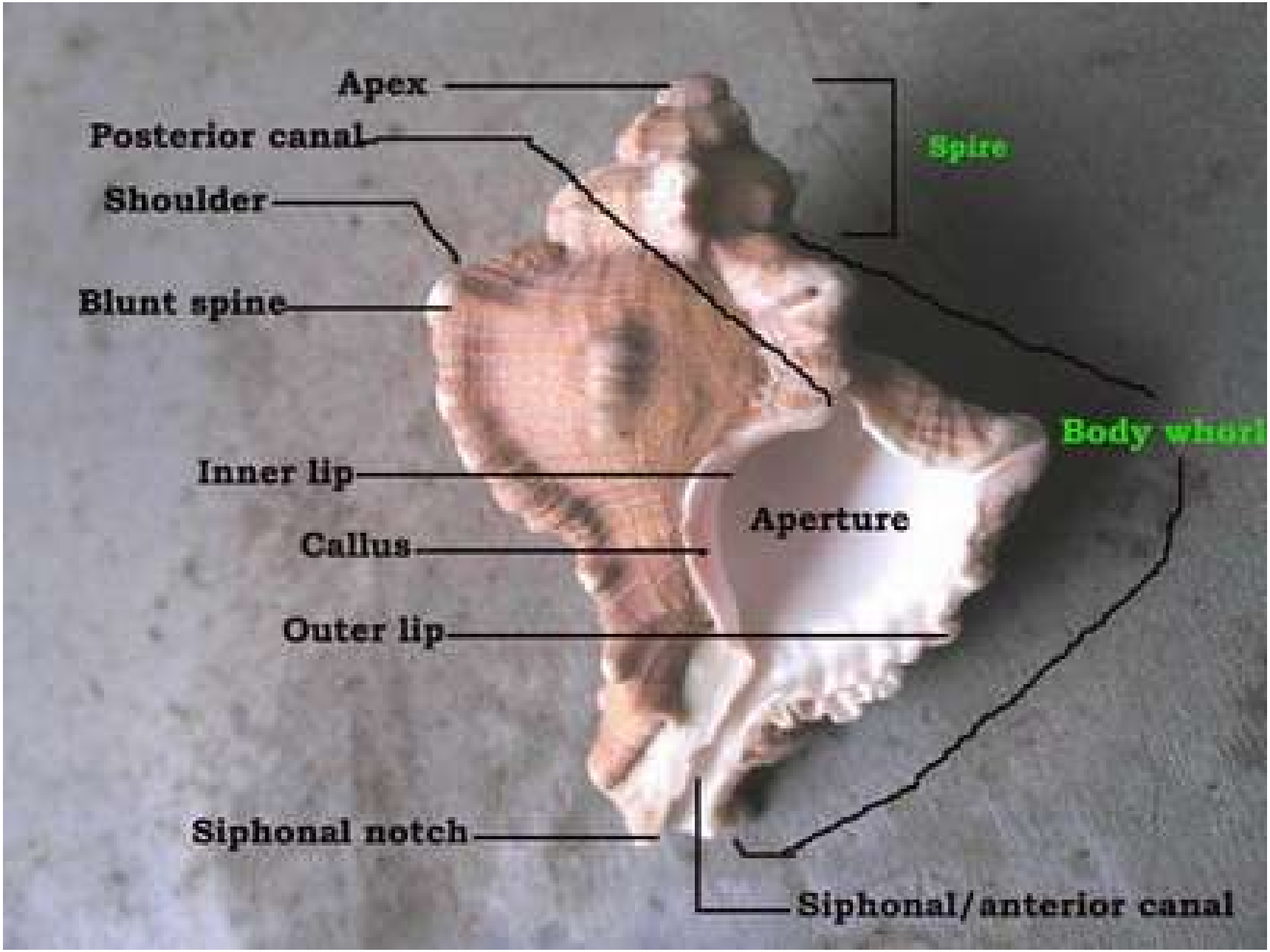
A, Diagrammatic vertical section of shell and mantle of a bivalve. The outer mantle epithelium secretes the shell; the inner epithelium is usually ciliated. **B,** Formation of pearl between mantle and shell as a parasite or bit of sand under the mantle becomes covered with nacre.

SHELL

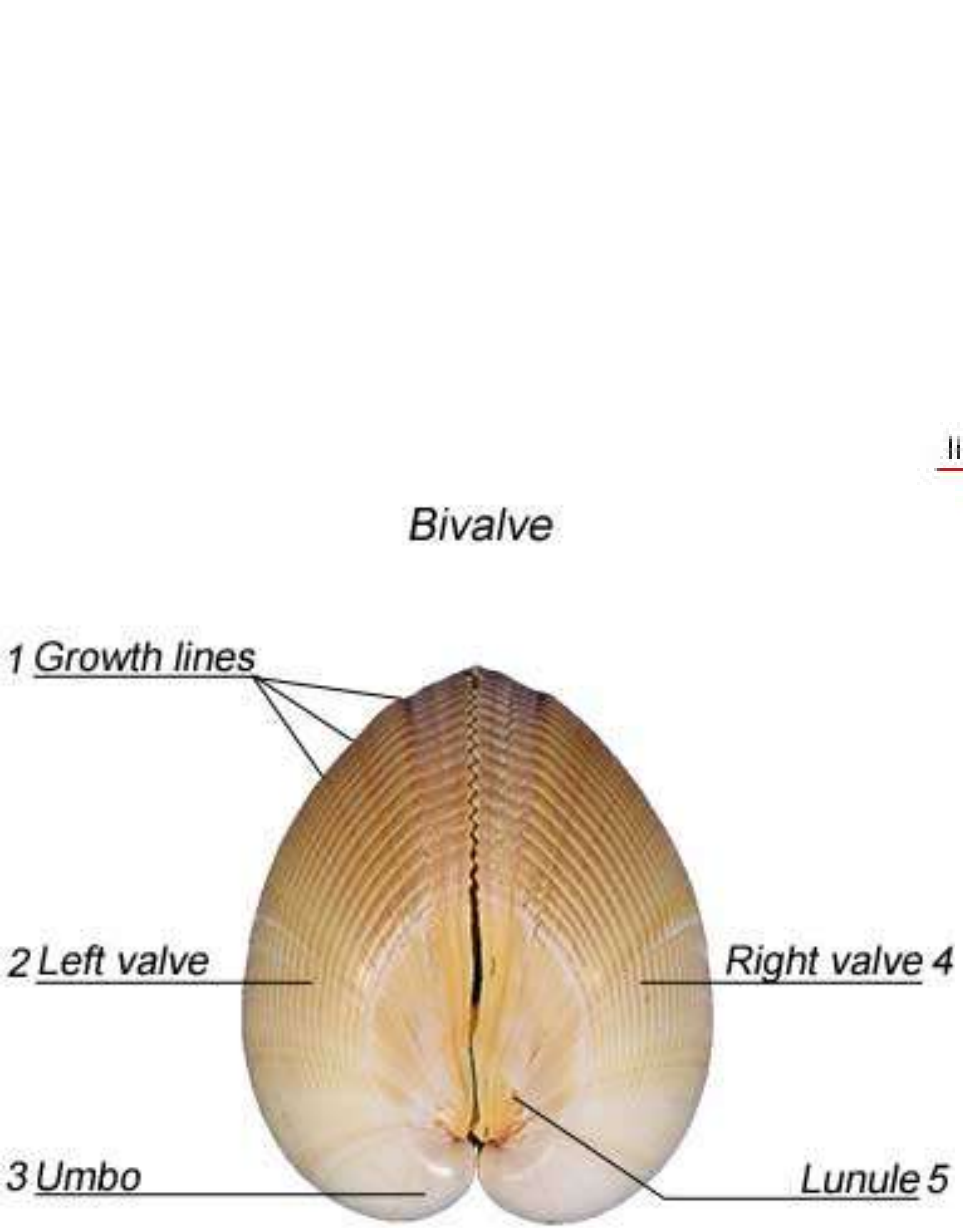
+ morphology of a univalve shell

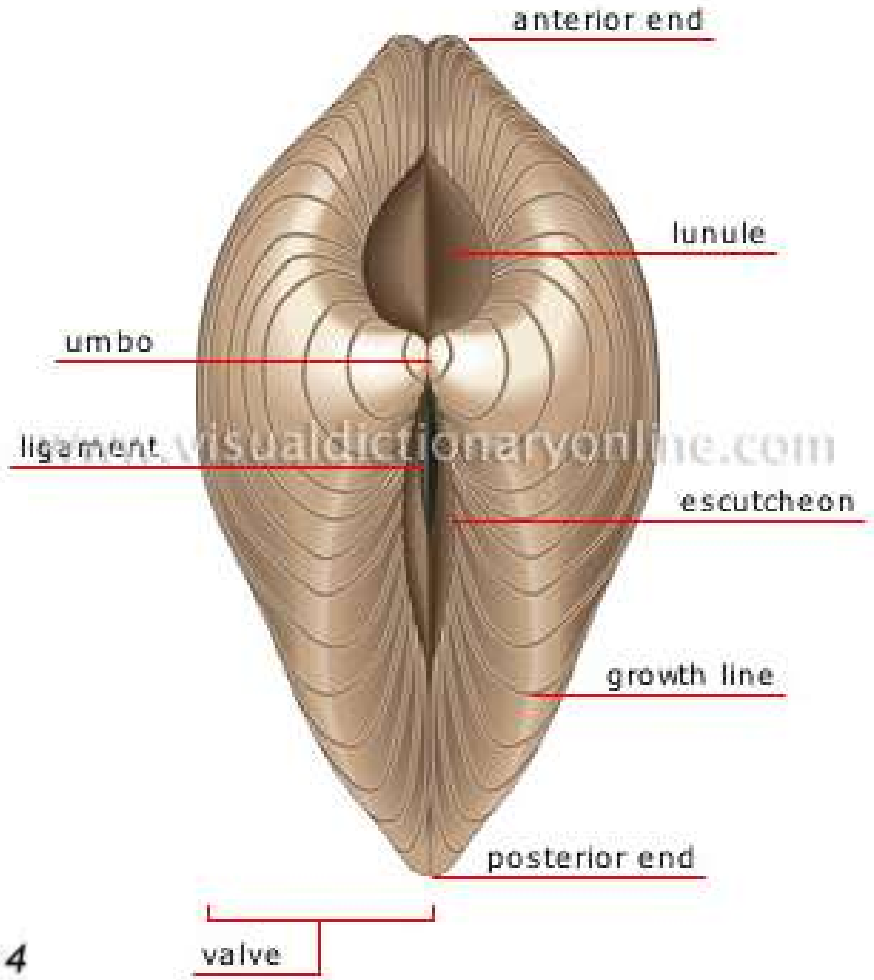


SHELL

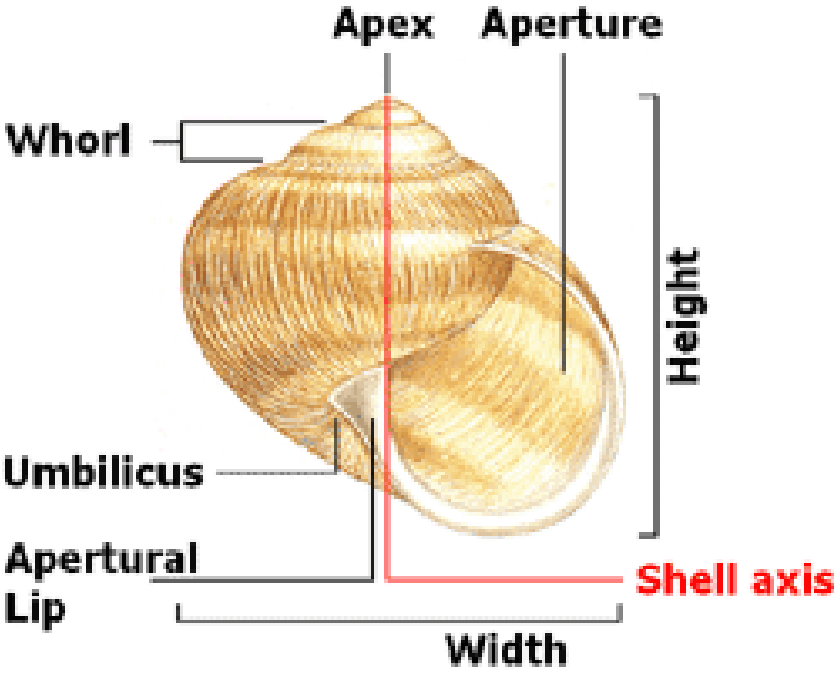

Apex
Posterior canal
Shoulder
Blunt spine
Spire
Body whorl
Inner lip
Aperture
Callus
Outer lip
Siphonal notch
Siphonal/anterior canal

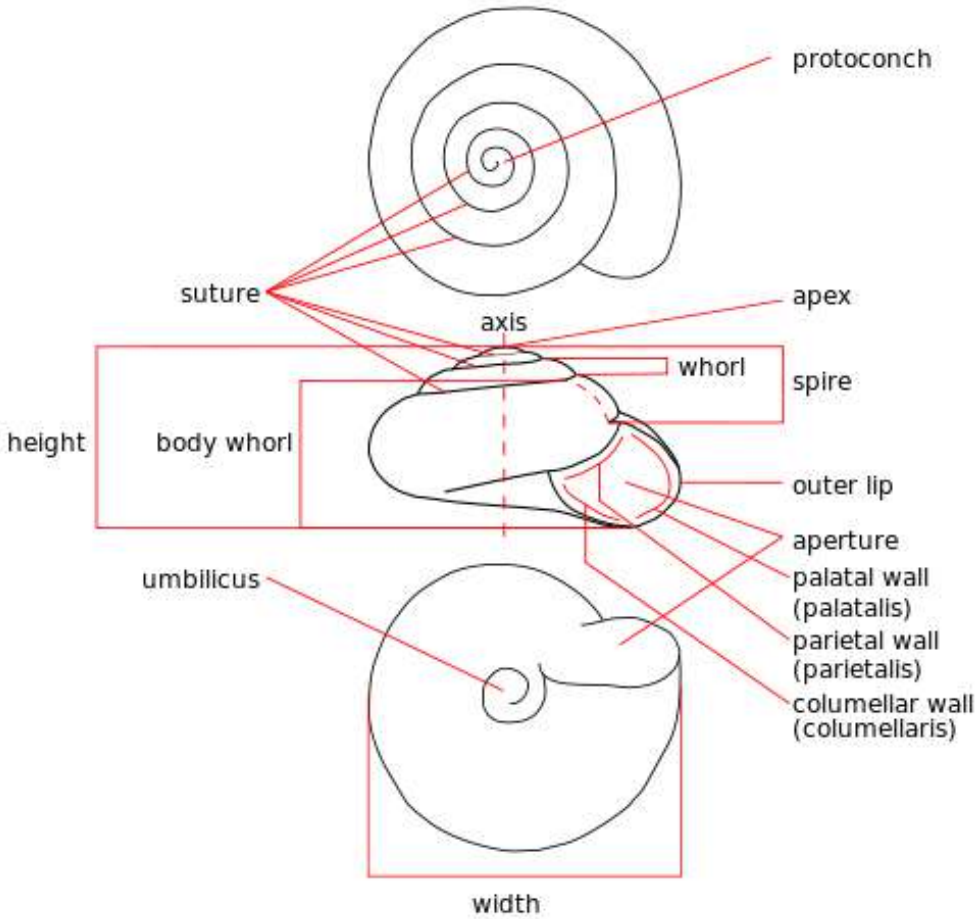
SHELL


Bivalve
1 Growth lines
2 Left valve
Right valve 4
3 Umbo
Lunule 5

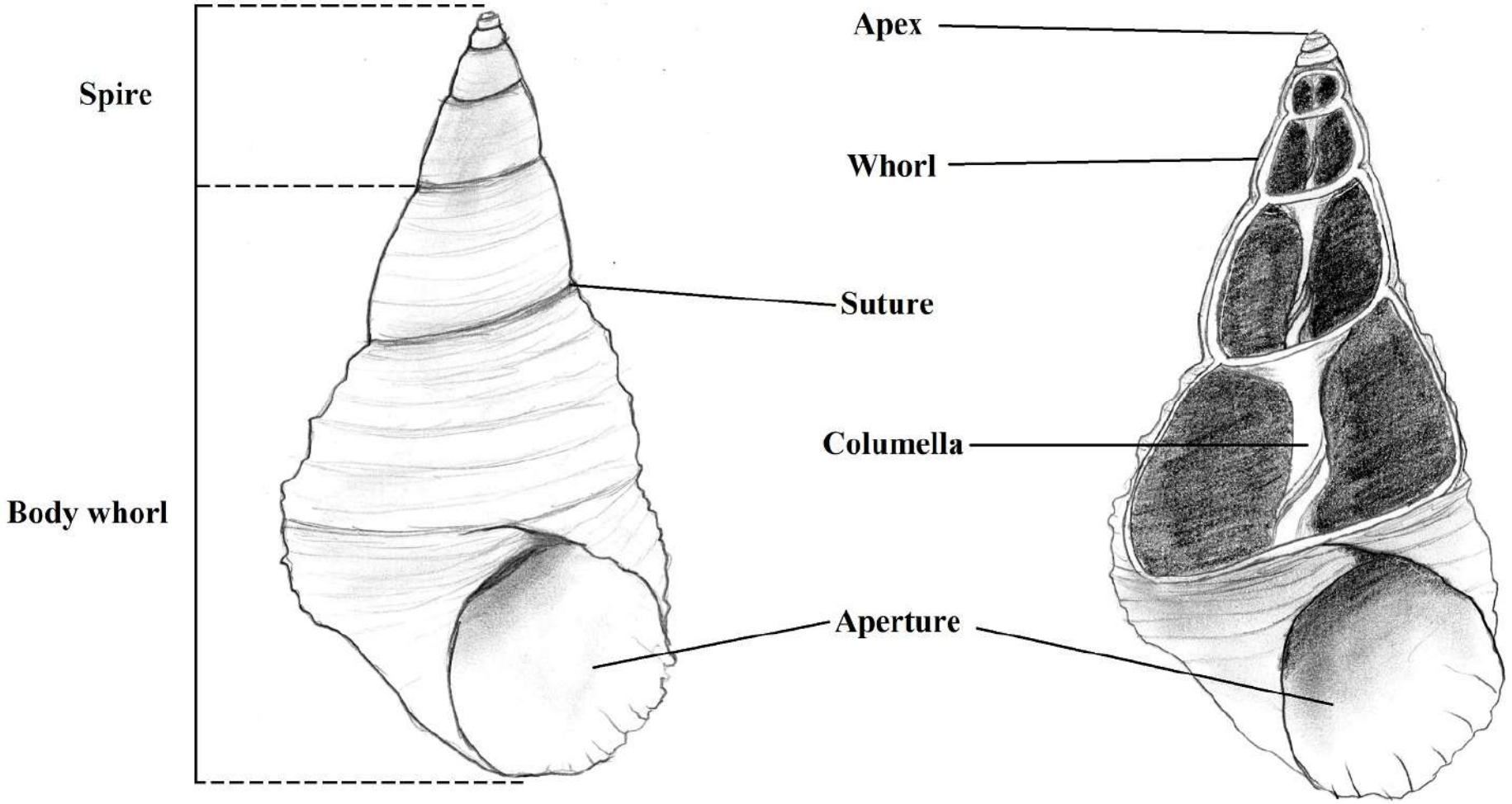

anterior end
lunule
umbo
ligament
escutcheon
growth line
posterior end
valve

SHELL


Apex
Aperture
Whorl
Height
Umbilicus
Apertural
Lip
Shell axis
Width

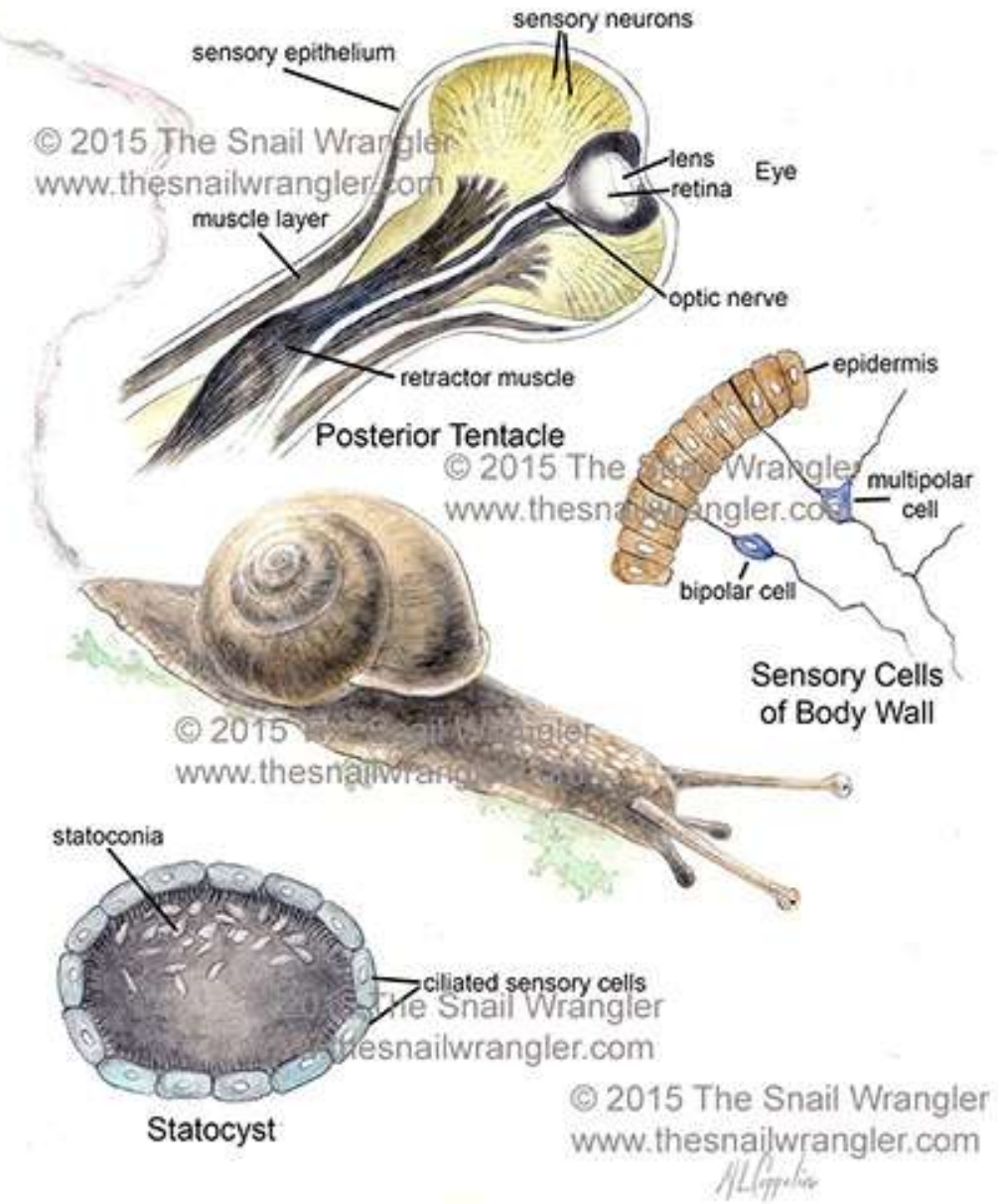

protoconch
suture
apex
axis
whorl
spire
height
body whorl
outer lip
aperture
umbilicus
palatal wall
(palatalis)
parietal wall
(parietalis)
columellar wall
(columellaris)
width

SHELL



NERVOUS SYSTEM

- Nervous system of **paired cerebral**, pleural, pedal, and visceral ganglia, with nerve cords and sub epidermal plexus; ganglia centralized in nerve ring in gastropods and cephalopods
- 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



NERVOUS SYSTEM

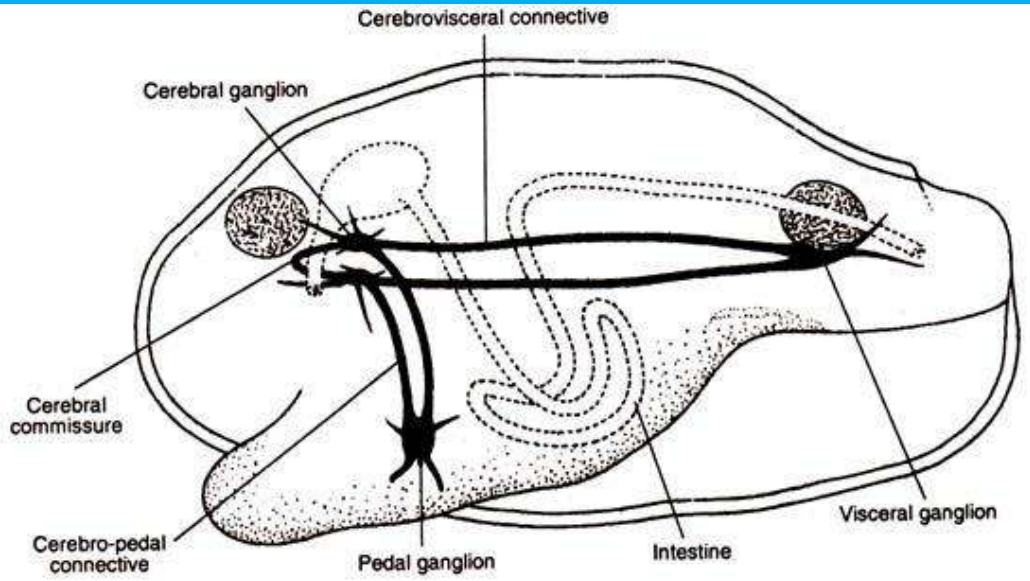
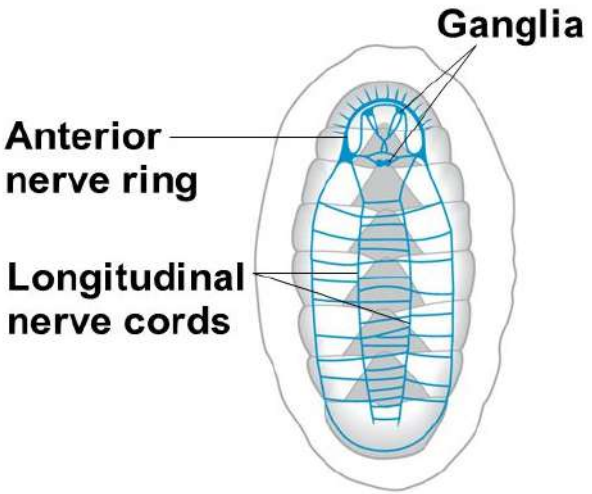
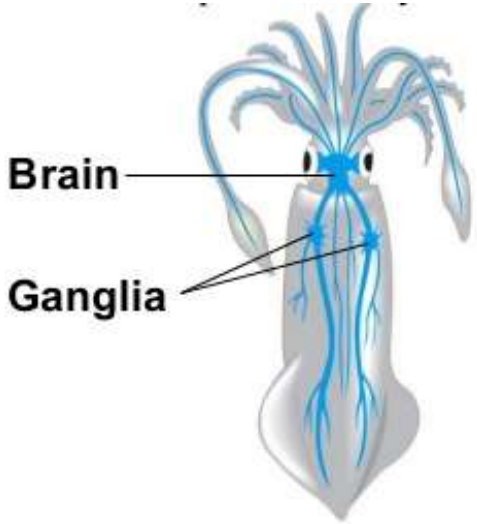


Fig. 16.35: Nervous system of *Unio*.



(f) Chiton (mollusc)



(g) Squid (mollusc)

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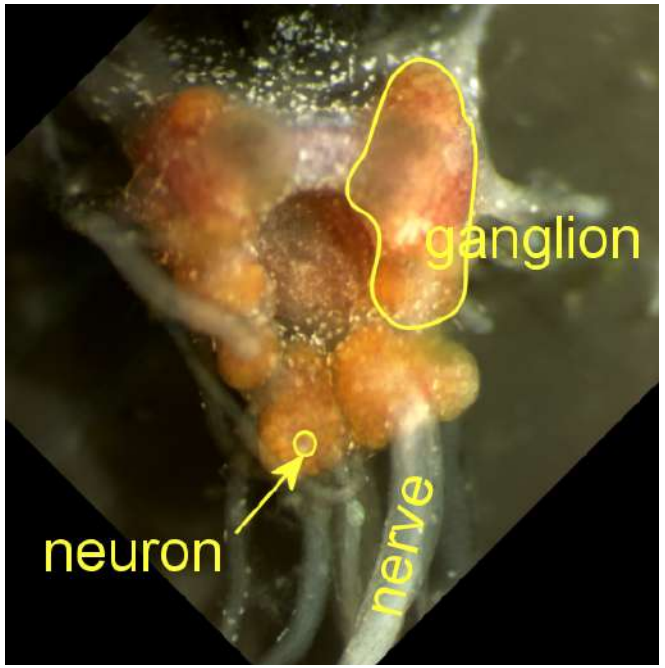
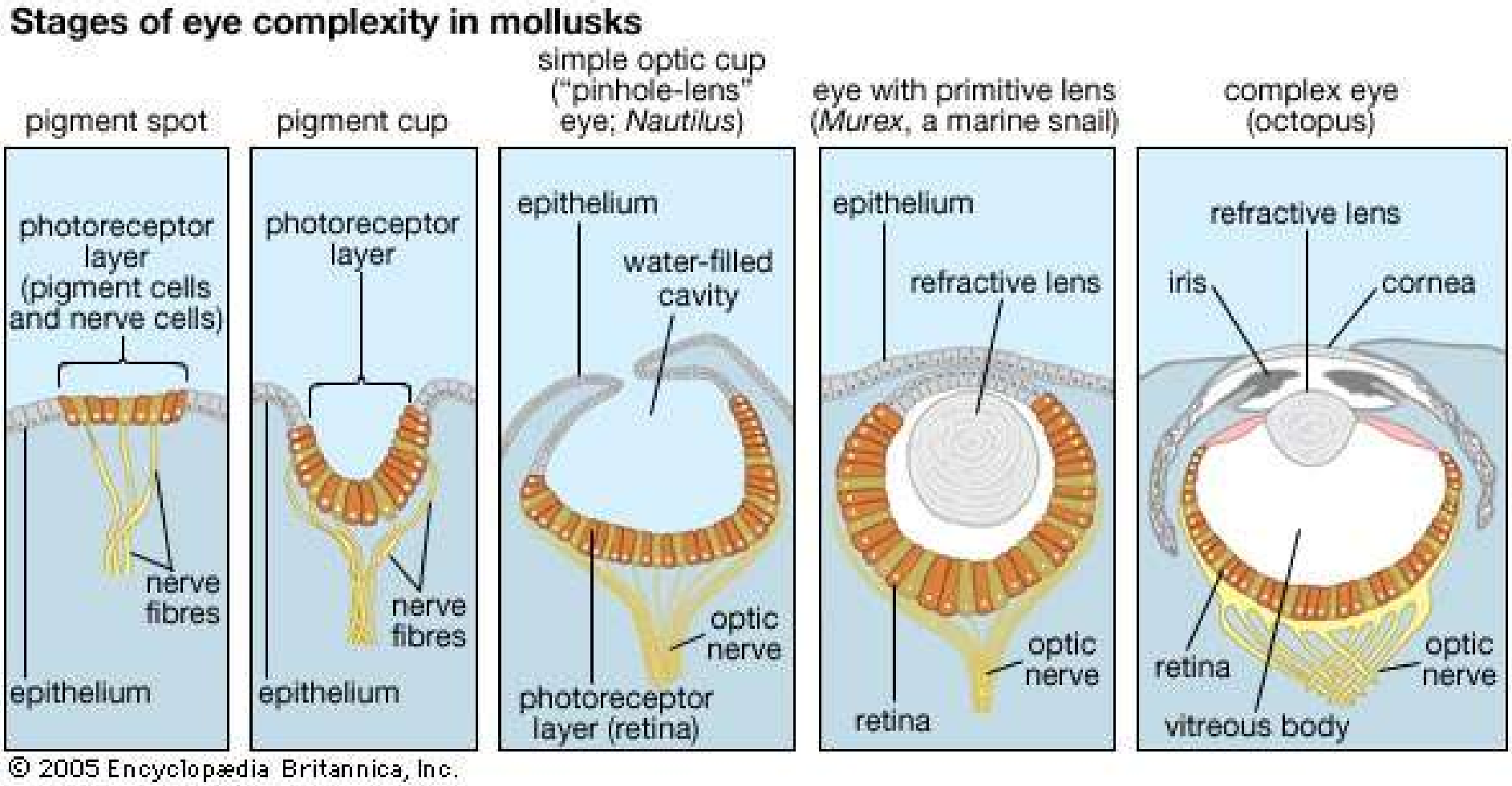
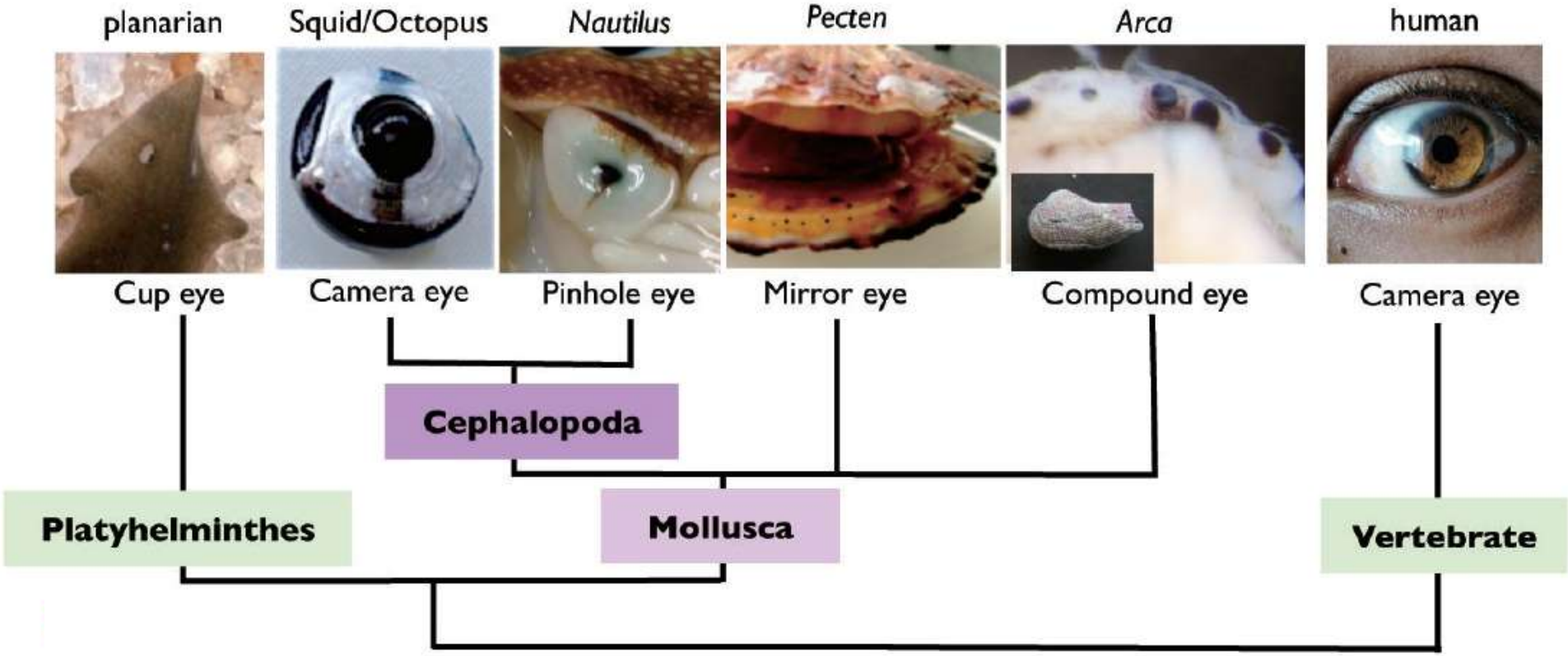


Snail Brain

NERVOUS SYSTEM

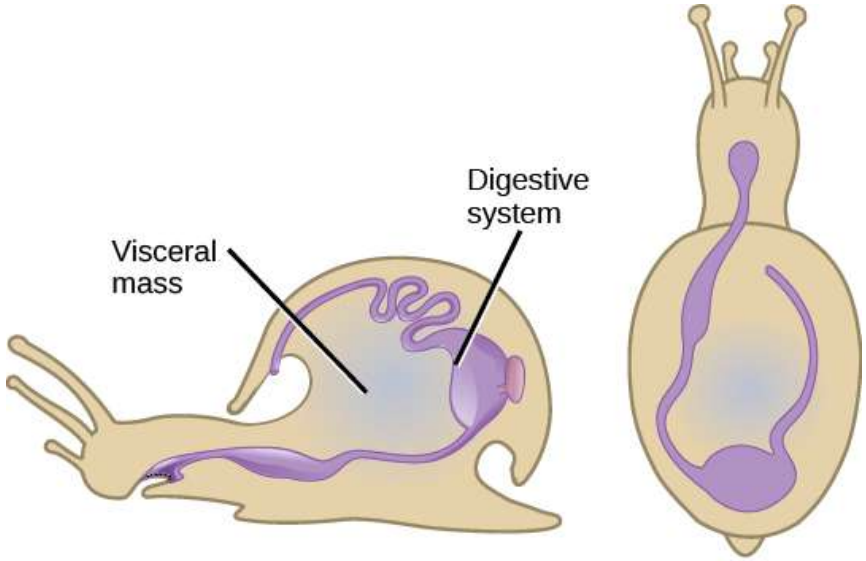


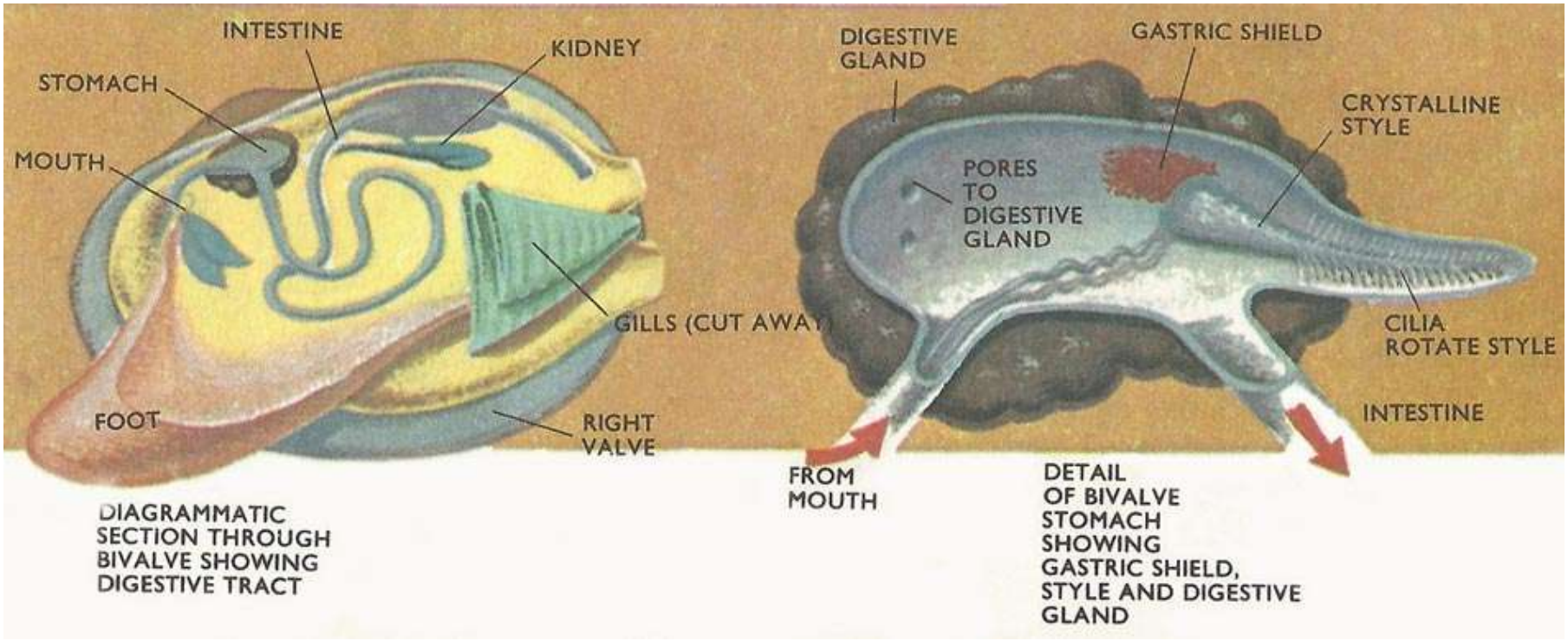
NERVOUS SYSTEM



DIGESTIVE SYSTEM

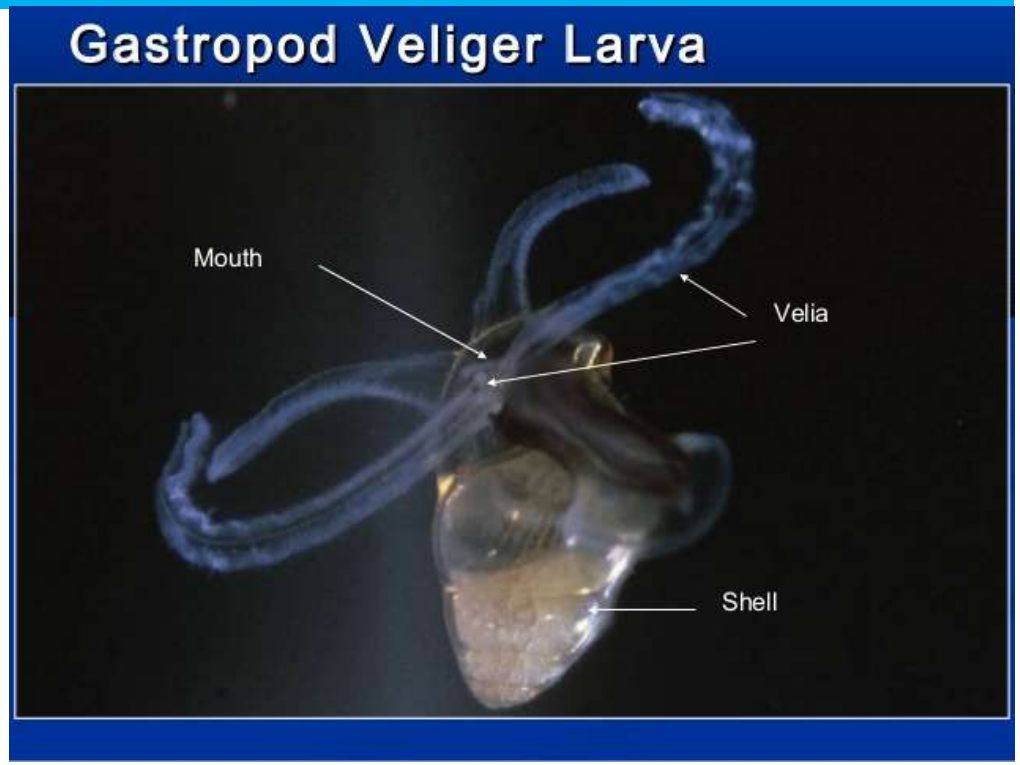
- Complex digestive system; rasping (memarut) organ **(radula)** usually present; anus usually emptying into mantle cavity;
- internal and external **ciliary tracts** often of great functional importance



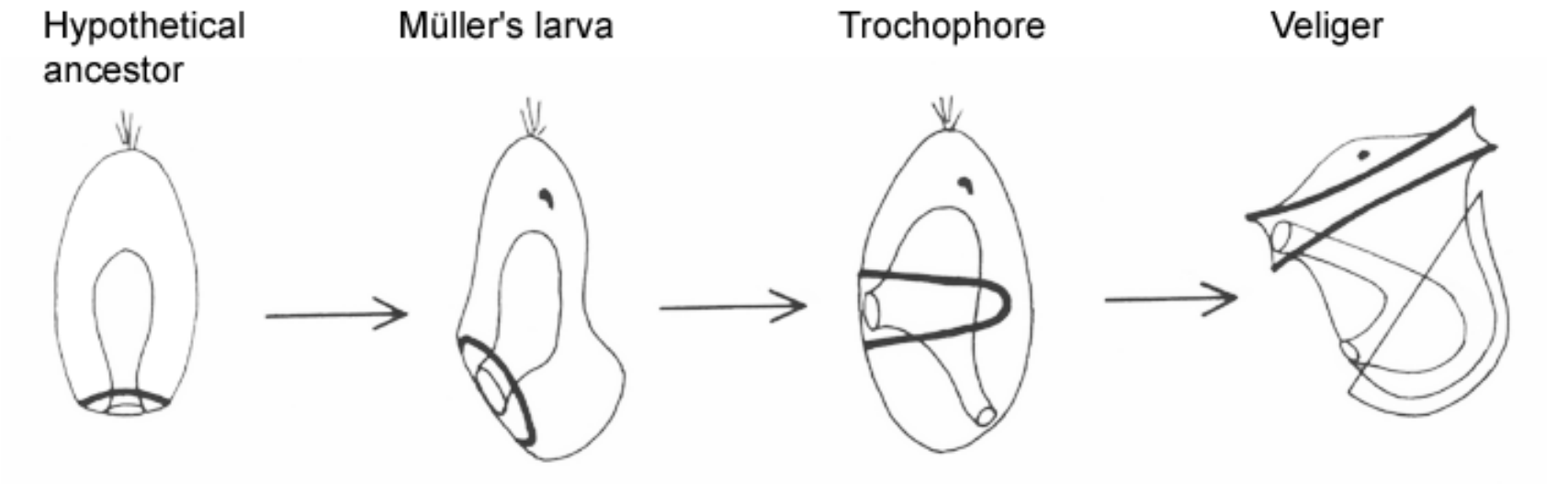


REPRODUCTIVE SYSTEM

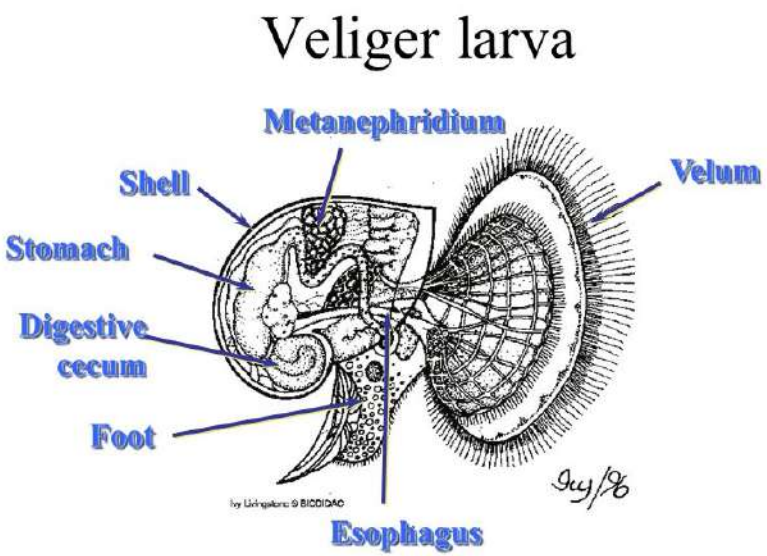
- No asexual reproduction
- Both **monoecious** and **dioecious forms; spiral cleavage;** ancestral larva a **TROCHOPHORE,** many with **a VELIGER larva,** some with direct development

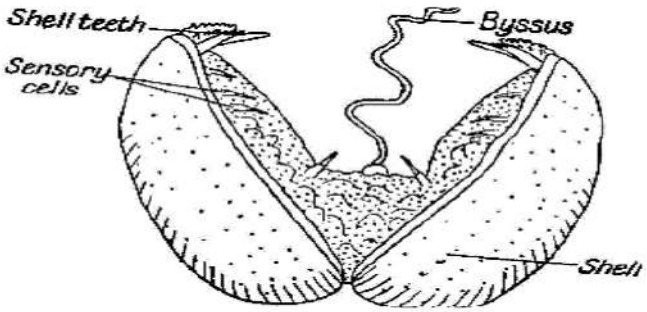


- **Veliger** – planktonic larval stage of mollusks
- **Trochophore** –Initial larval stage of mollusks



REPRODUCTIVE SYSTEM





Glochidium Larva

Unique in Bivalve

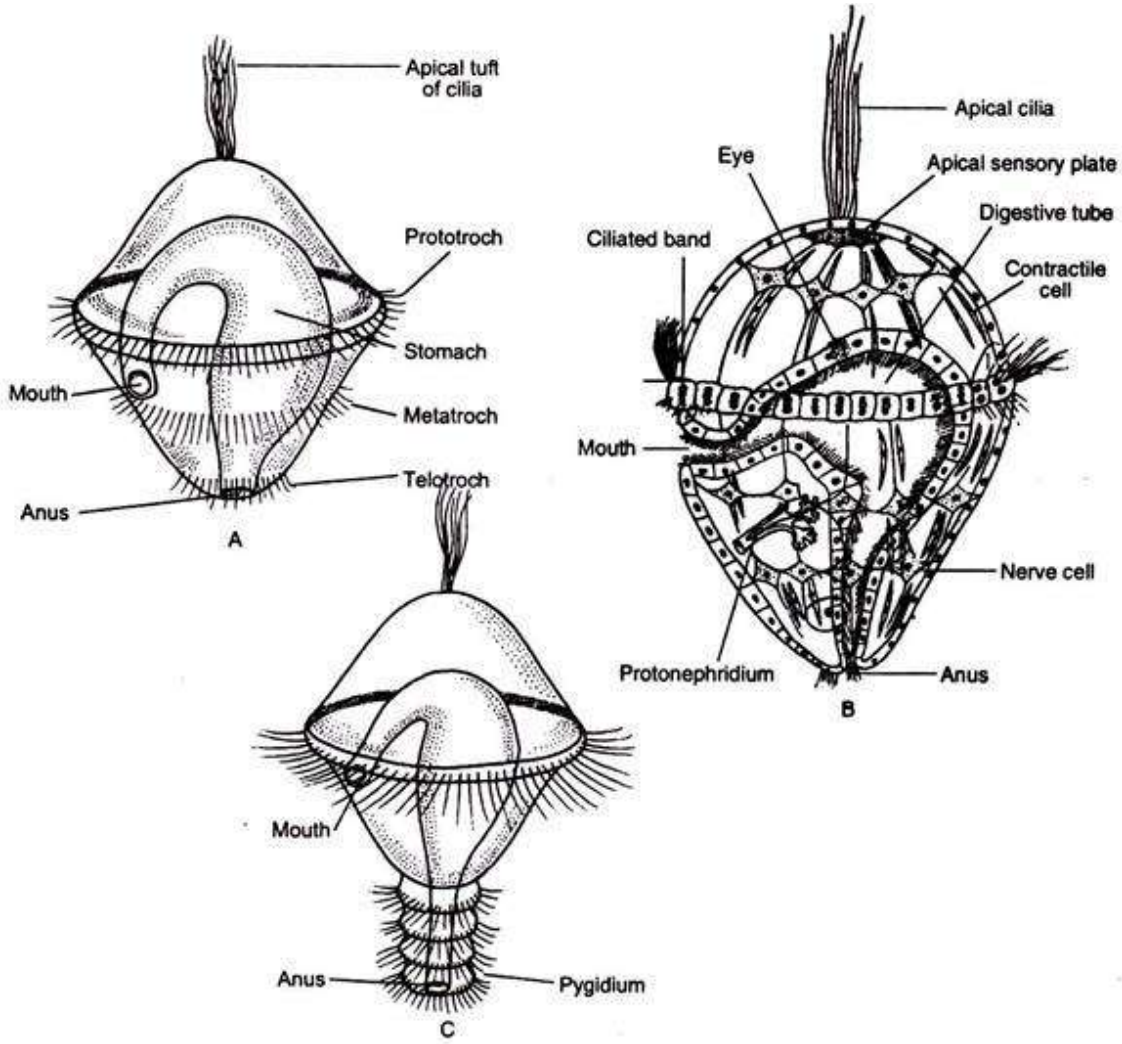
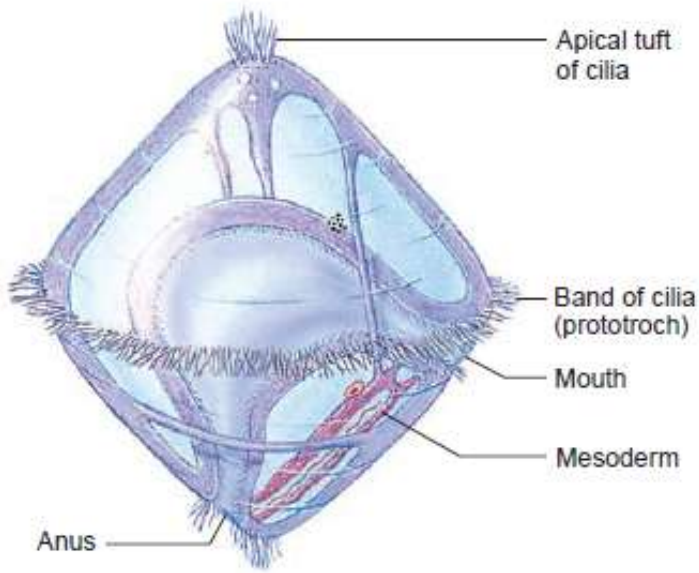


Fig. 17.12: A. External features of a trochophore larva. B. Internal organization of a trochophore larva. C. An advanced trochophore larva showing the additional ciliated segments at the posterior end.

REPRODUCTIVE SYSTEM

Figure 16.7

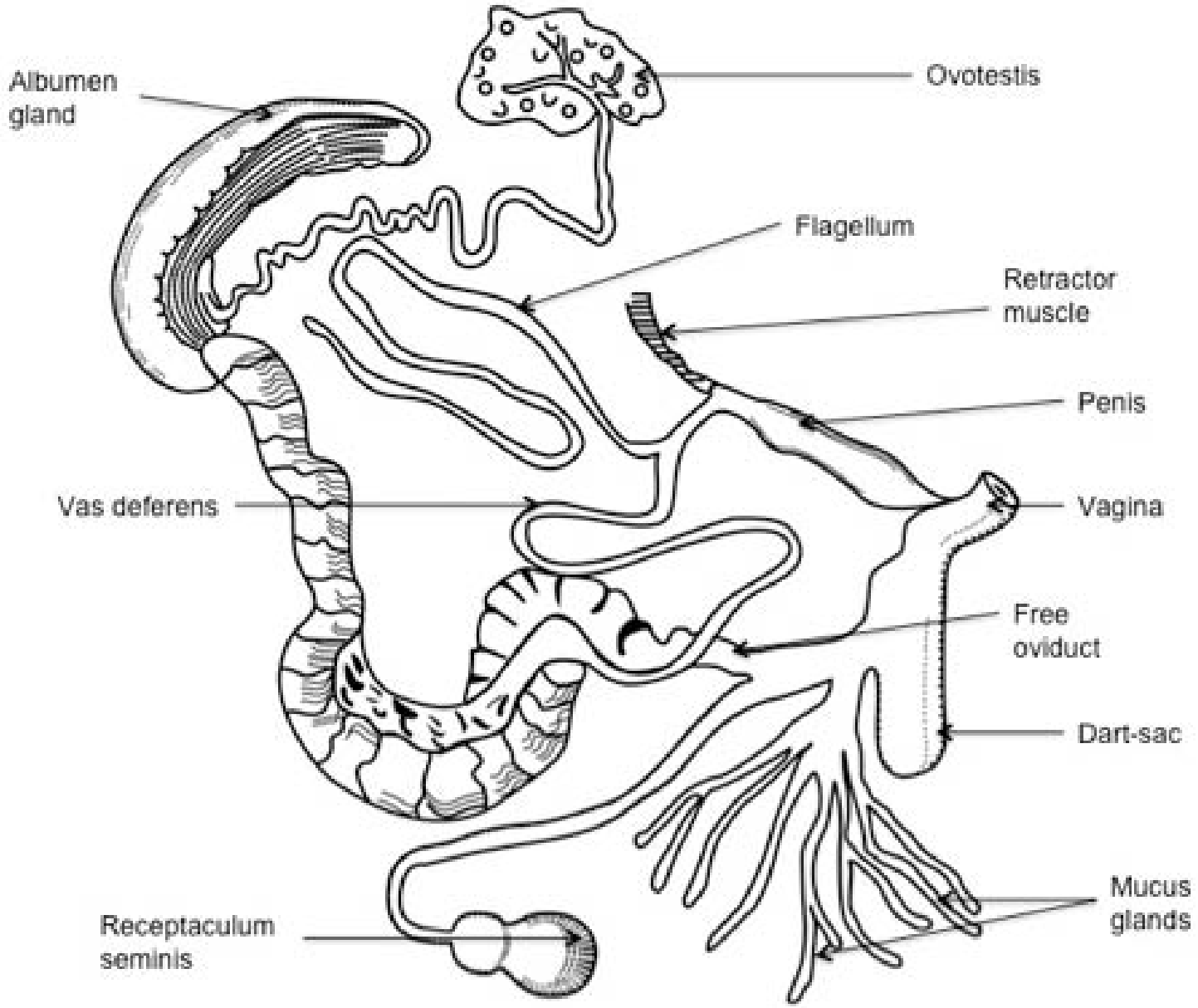
A, Generalized trochophore larva. Molluscs and annelids with an ancestral pattern of embryonic development have trochophore larvae, as do several other phyla. **B,** Trochophore of a Christmas tree worm, *Spirobranches spinosus* (Annelida).



A

B

REPRODUCTIVE SYSTEM



REPRODUCTIVE SYSTEM

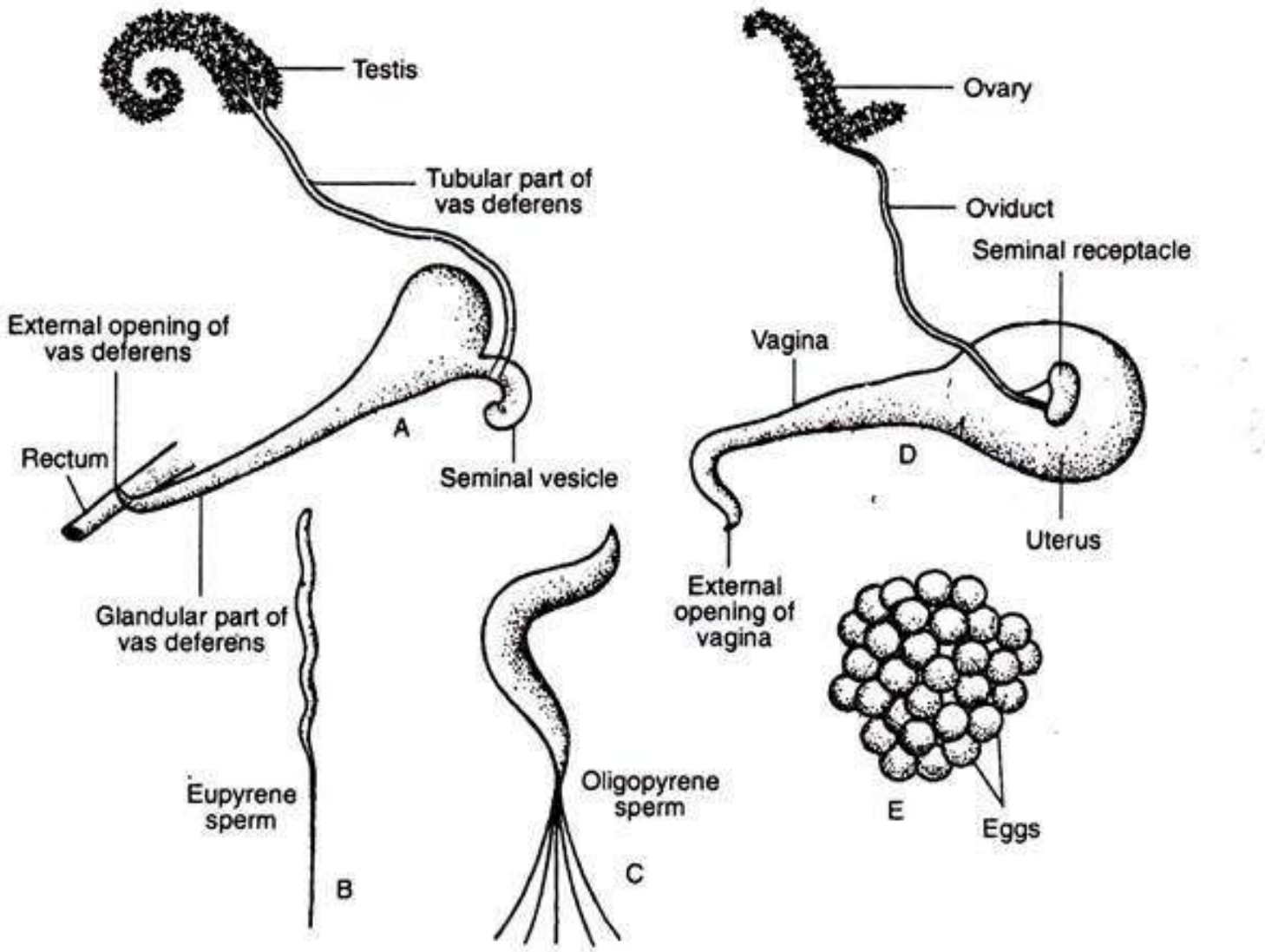
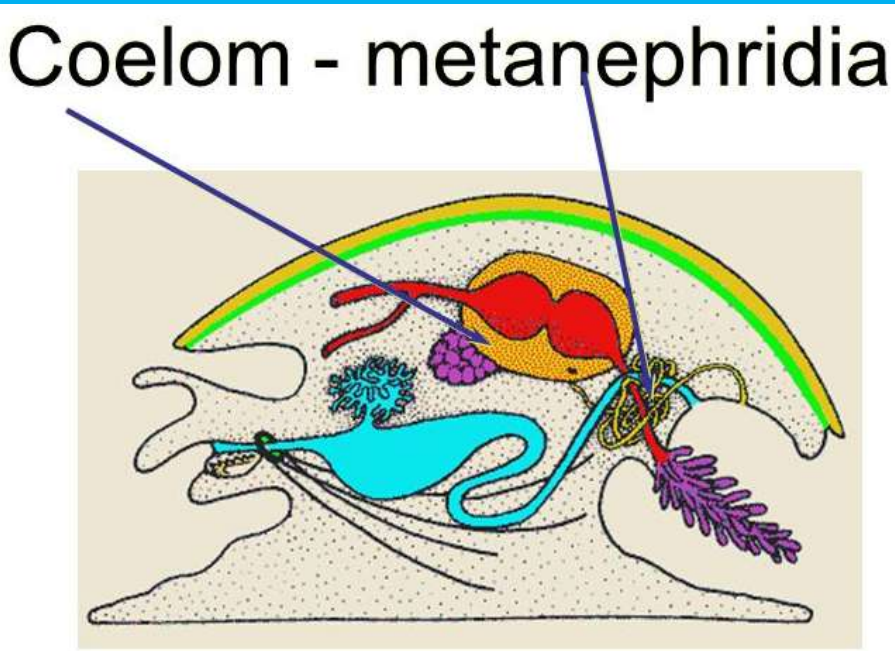
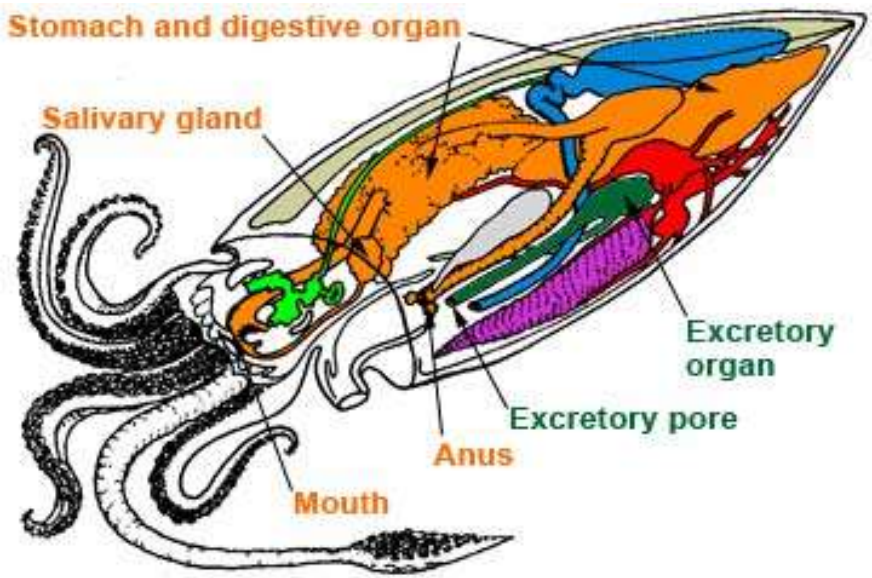


Fig. 16.20: Reproductive systems in *Pila* (after Baini Prashad). A. Male reproductive system. B. Eupyrene sperm. C. Oligopyrene sperm. D. Female genital system. E. Cluster of eggs.

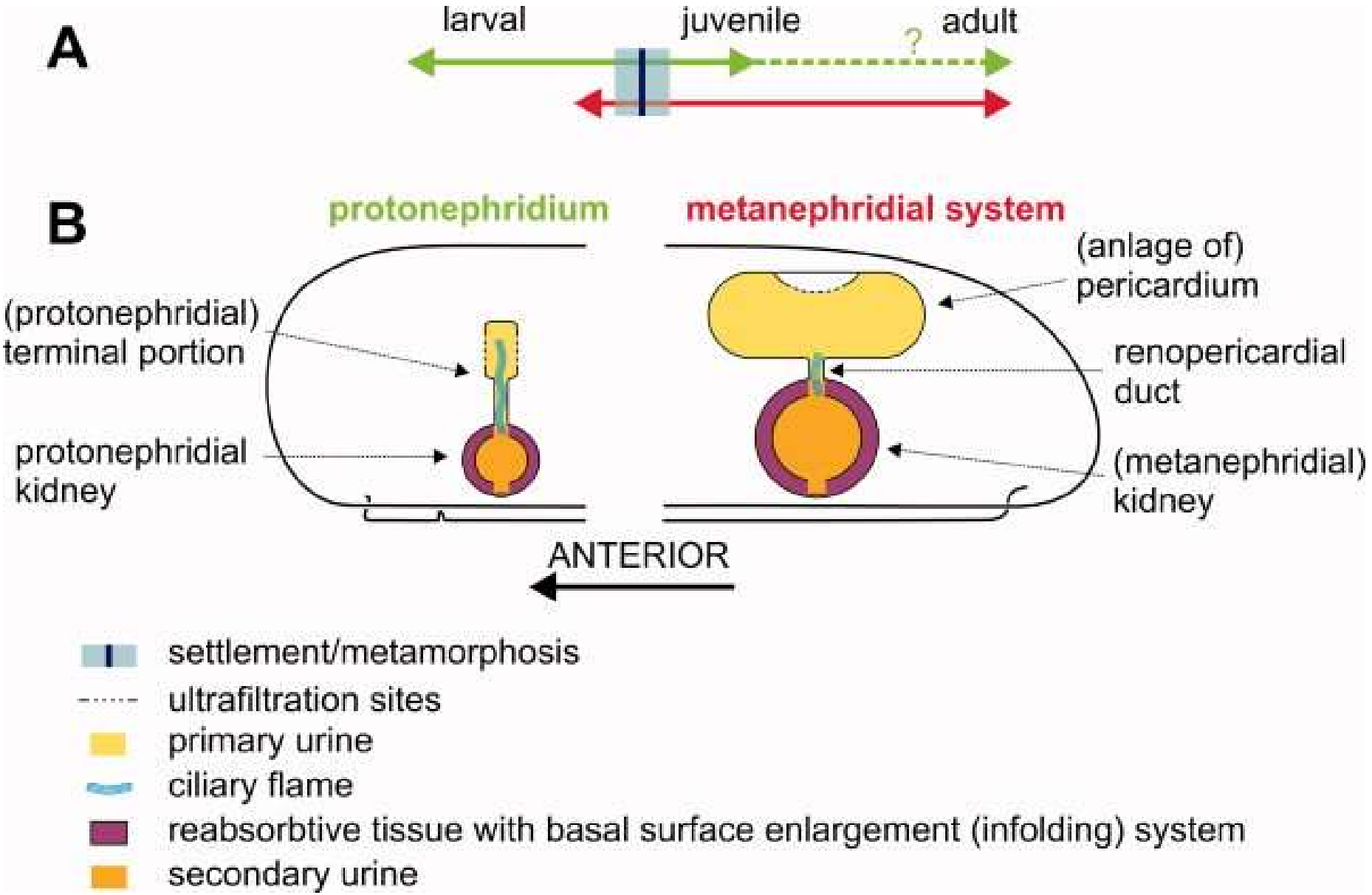
EXCRETORY SYSTEM

- One or two kidneys **(metanephridia)** opening into the **pericardial cavity** and usually emptying into the mantle cavity
- Gaseous exchange by **gills, mantle, or body surface**



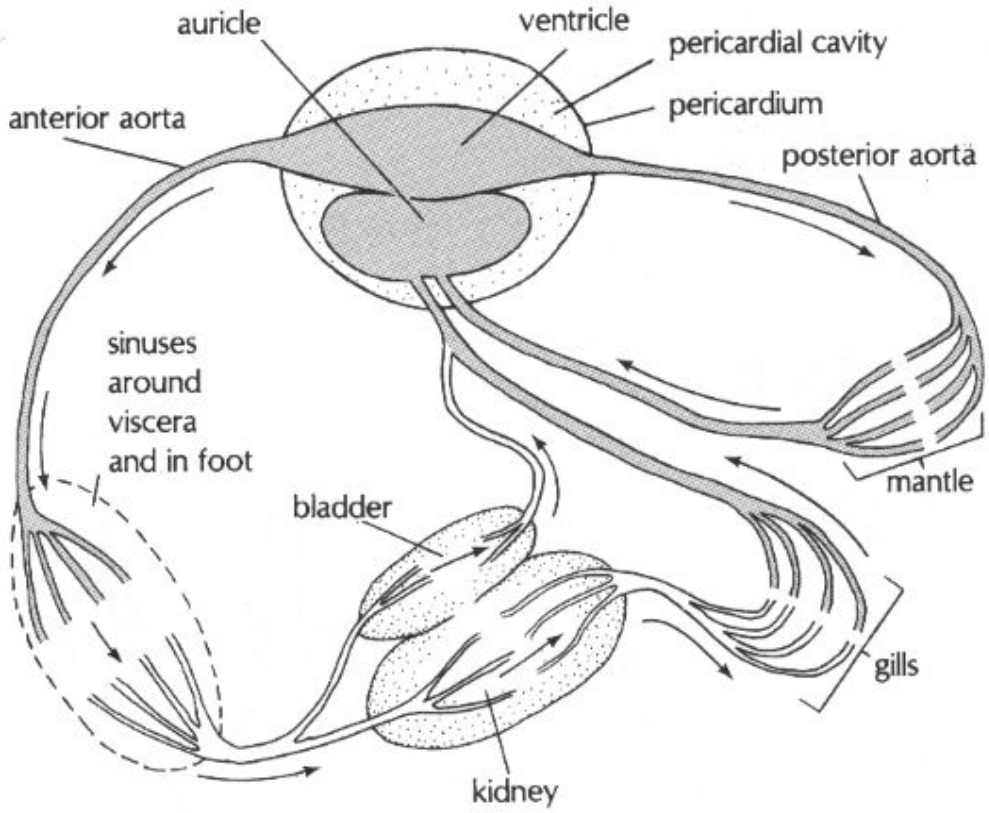


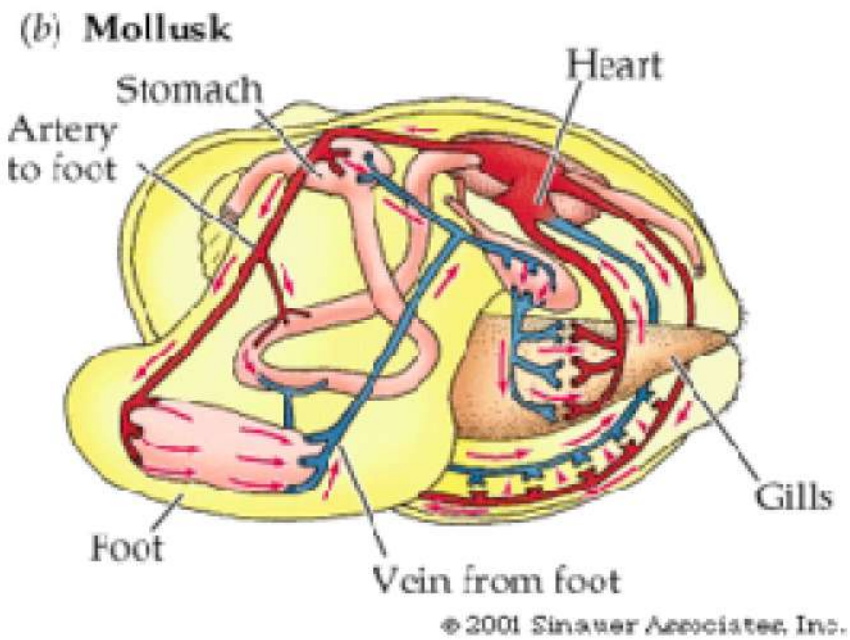
EXCRETORY SYSTEM

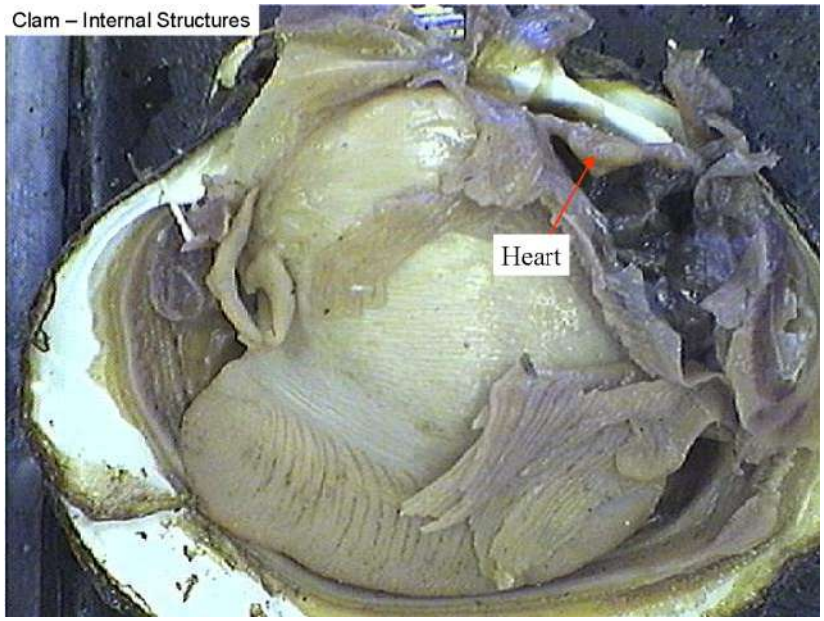


CIRCULATORY SYSTEM

- **Open circulatory system** (secondarily closed in cephalopods) of heart (usually three chambered), blood vessels, and sinuses; respiratory pigments in blood





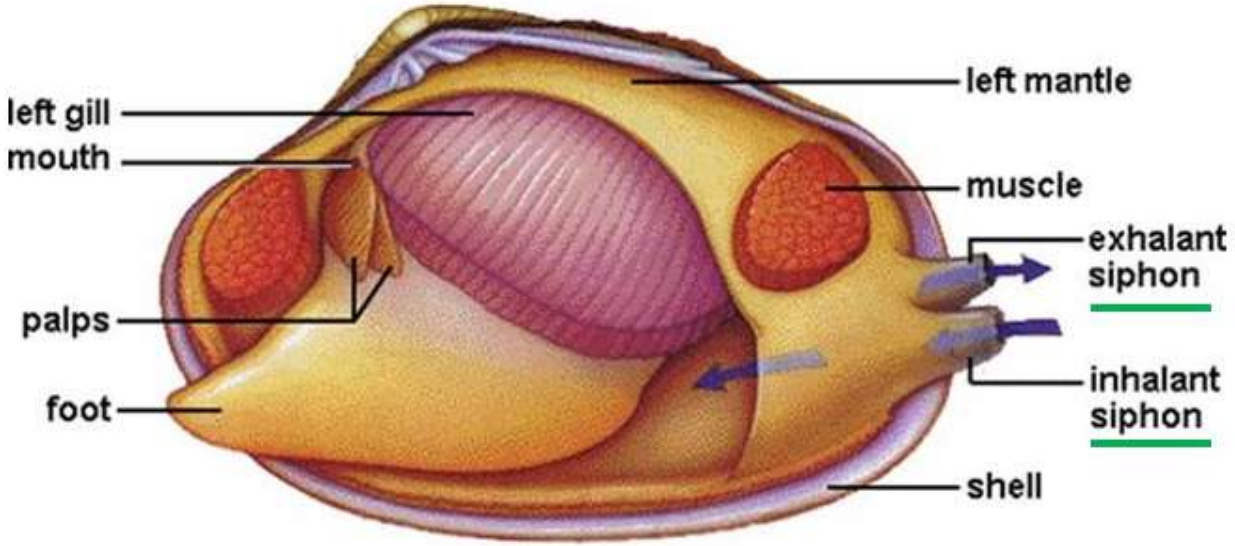


RESPIRATORY SYSTEM

Respiratory system:

- Aquatic mollusks have gills
- Terrestrial mollusks have a highly folded mantle for O_2/CO_2 exchange (must stay moist)

*A clam has incurrent and excurrent siphons → sea water passes through; location of gas exchange



MUSCULAR SYSTEM

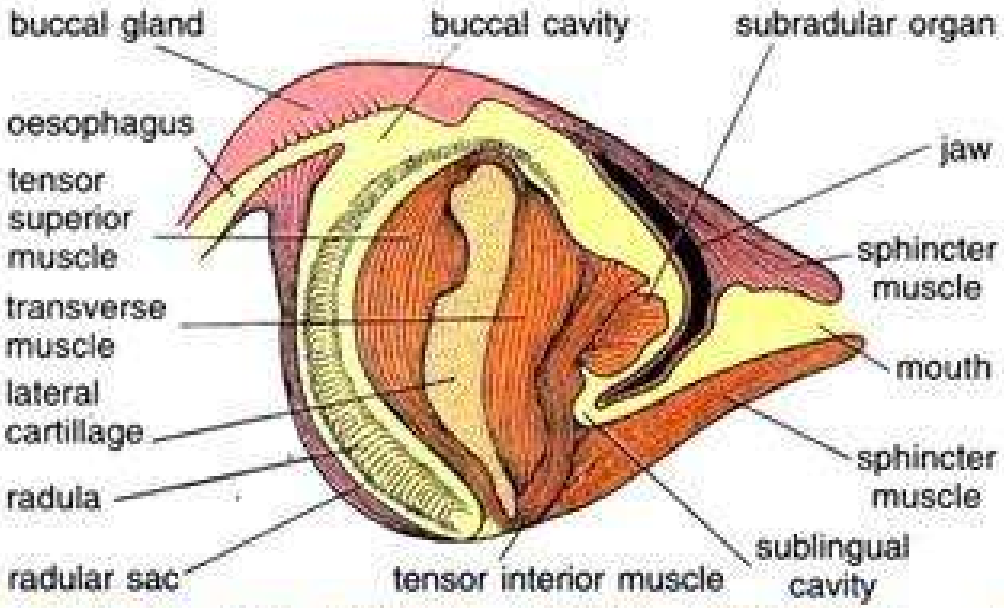


Fig. 60.8. *Pila globosa*. Vertical longitudinal section of the buccal mass about the middle.

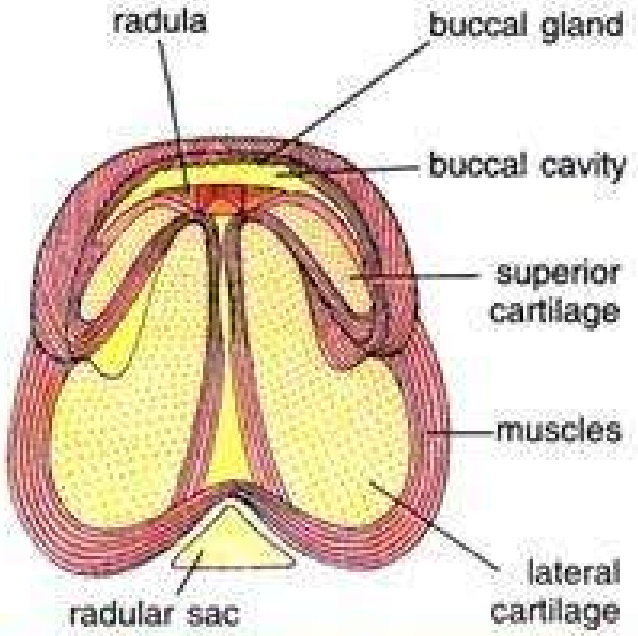


Fig. 60.9. *Pila globosa*. Buccal mass in T.S.

- **Circular**, **diagonal**, and **longitudinal** muscles in the body wall; mantle and foot highly muscular in some classes (for example cephalopods and gastropods)

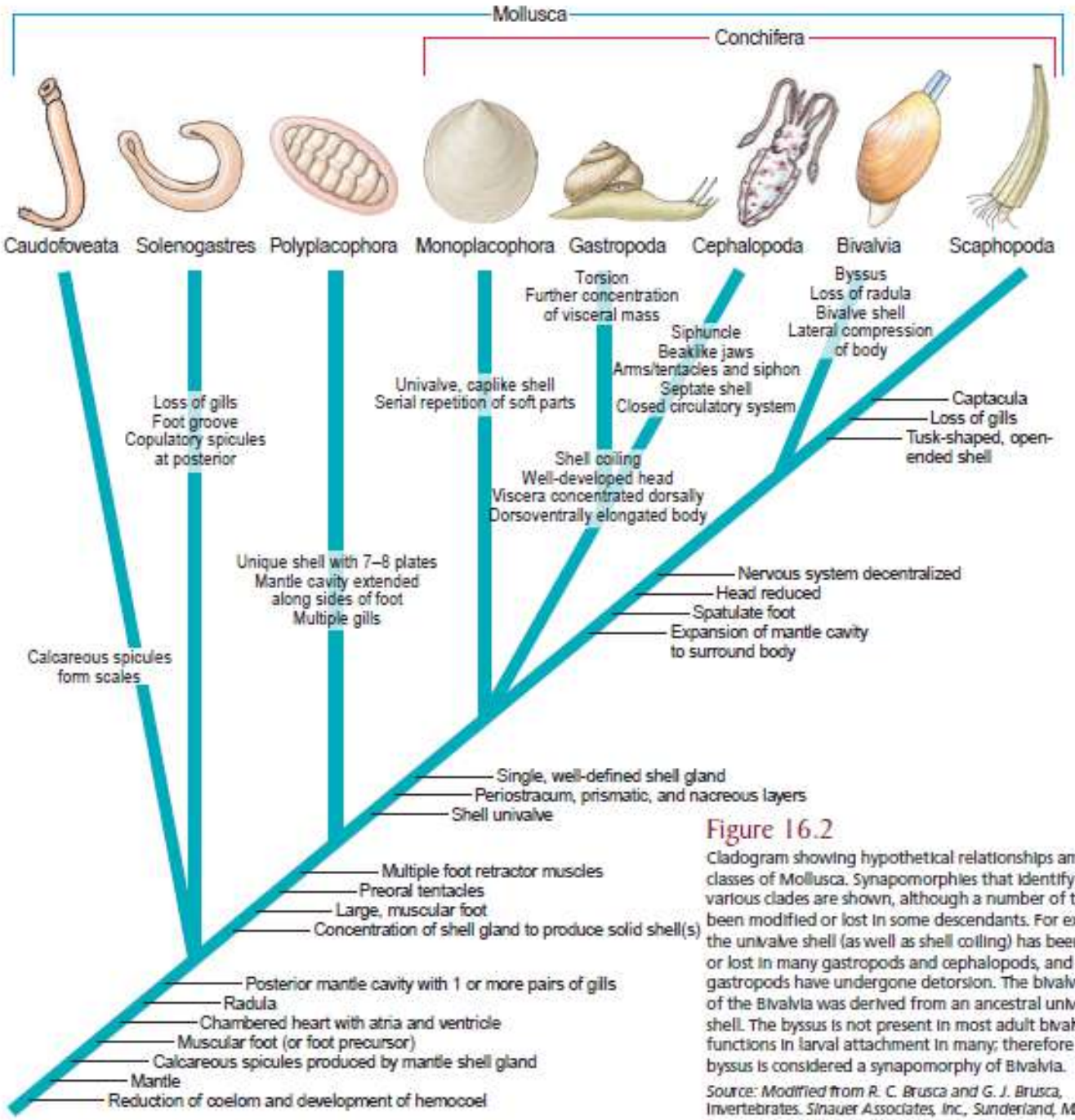


Figure 16.2

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.

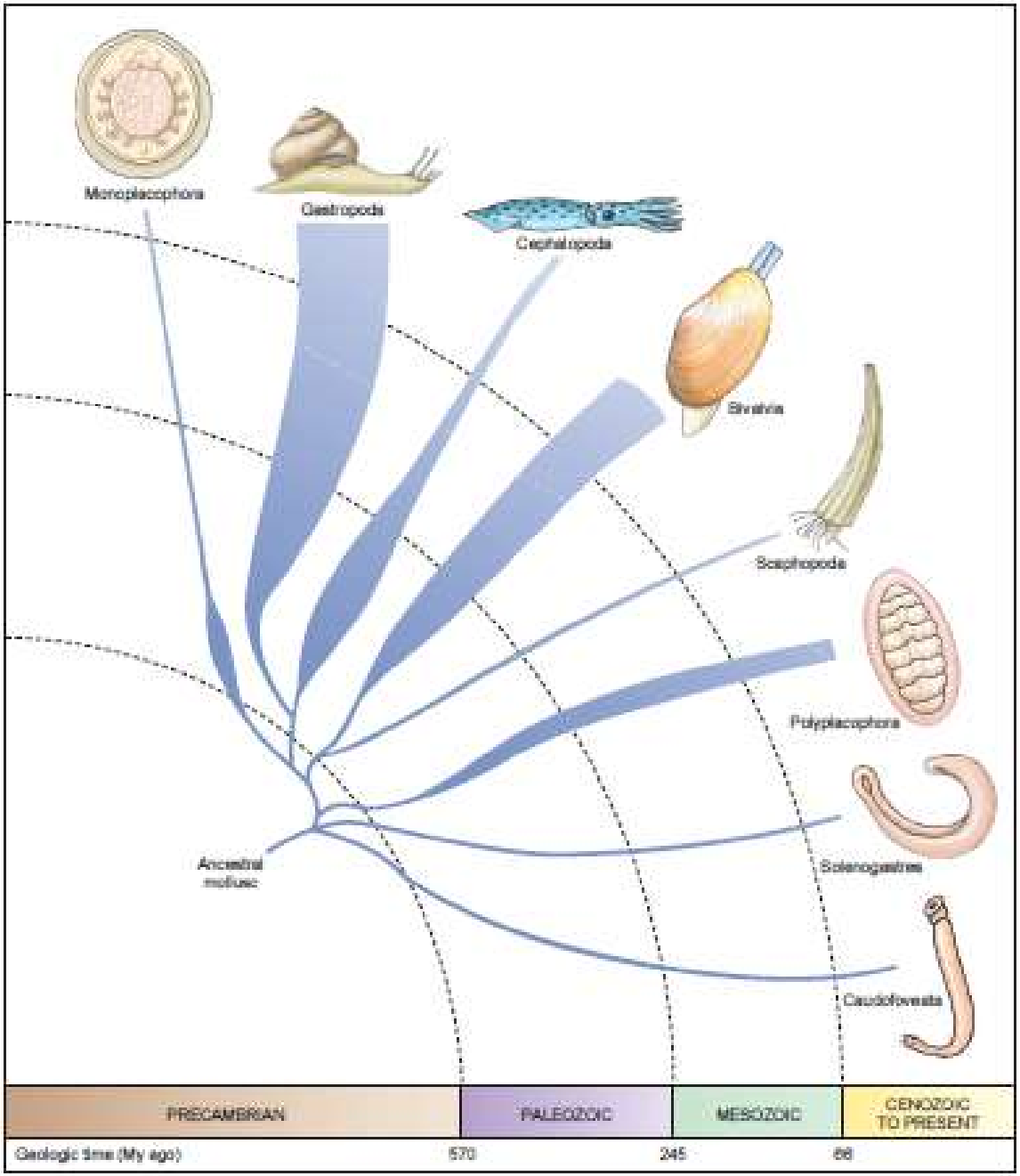
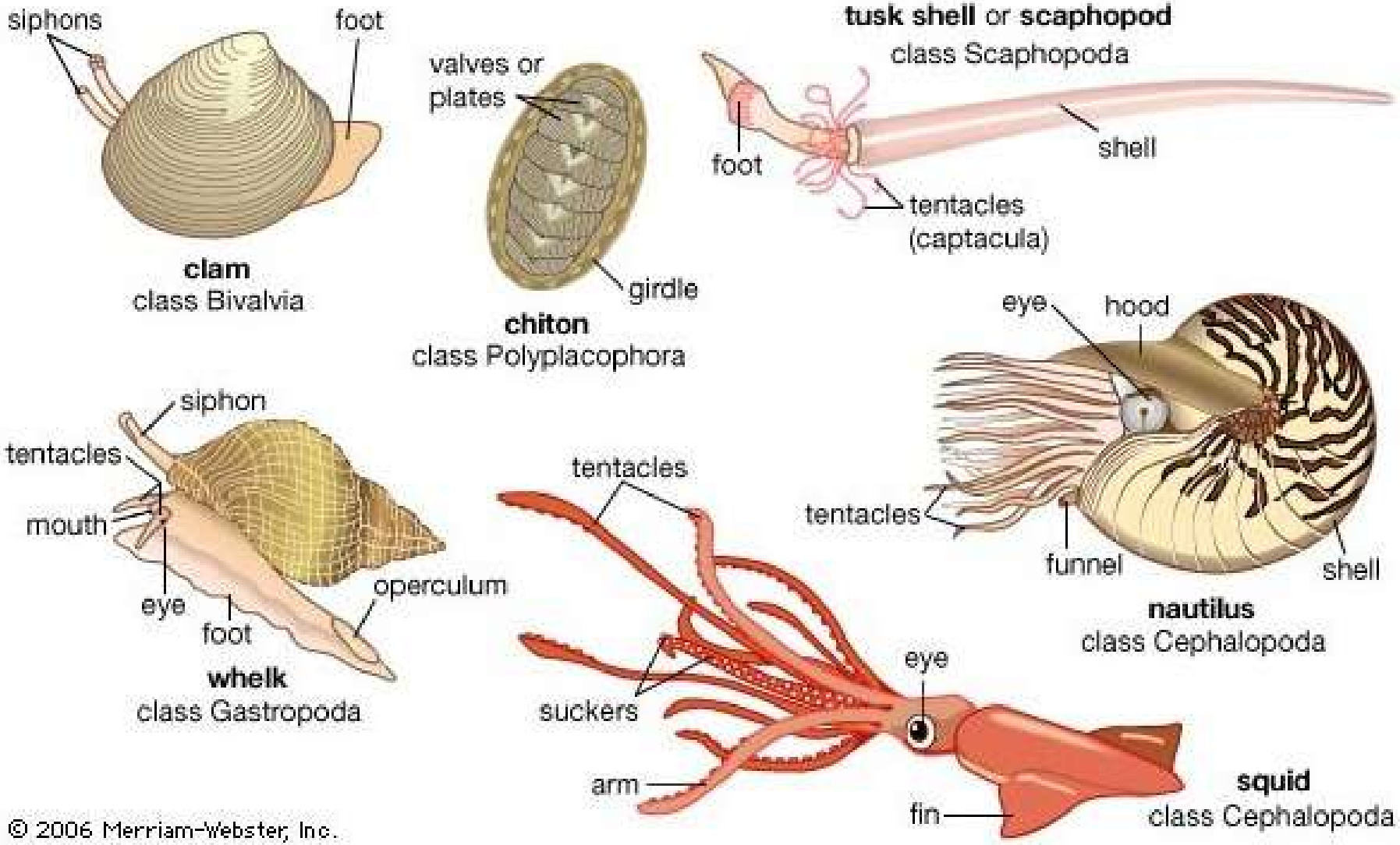


Figure 16.42
Classes of Mollusca, showing their derivations and relative abundance.



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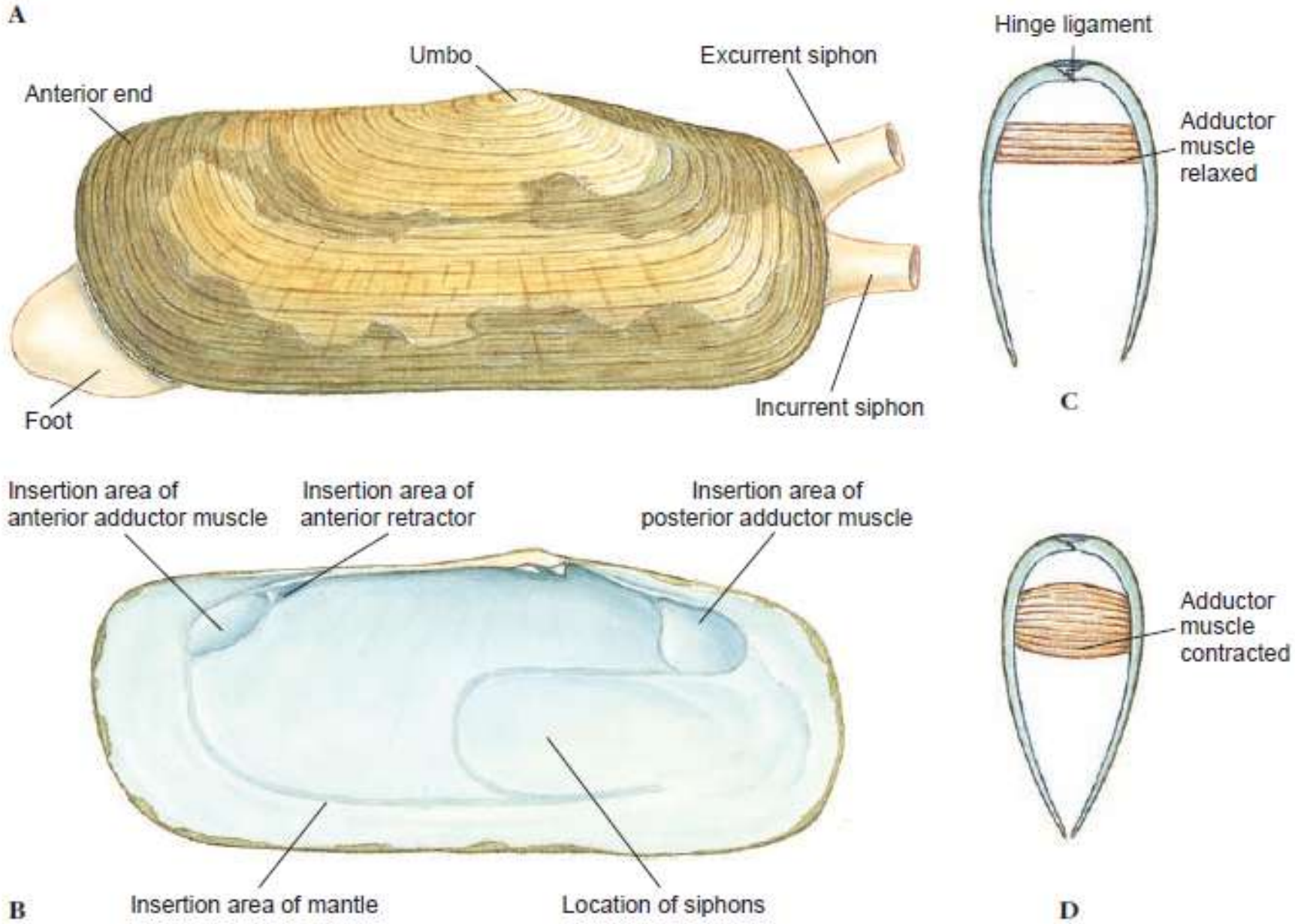
CLASS BIVALVIA

- Bivalves are laterally (right-left) compressed and their two shells are held together by a **hinge ligament** on the dorsal surface.
- The **Umbo** is the oldest part of the shell, growth occurs in concentric rings around it.


A
Umbo
Excurrent siphon
Anterior end
Foot
Incurrent siphon
Hinge ligament
Adductor muscle relaxed
C
Insertion area of anterior adductor muscle
Insertion area of anterior retractor
Insertion area of posterior adductor muscle
Insertion area of mantle
Location of siphons
B
Adductor muscle contracted
D

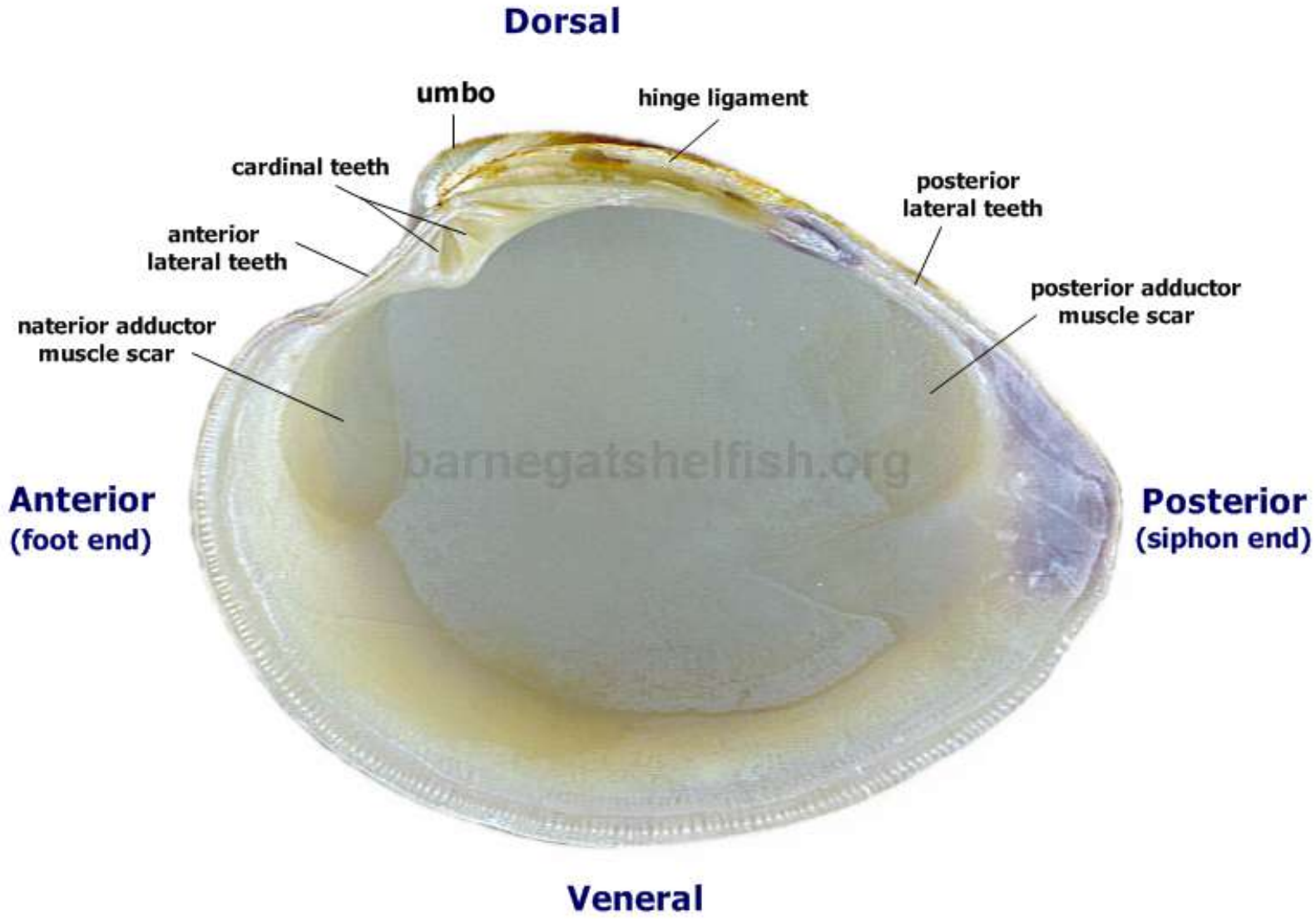
Veneridae

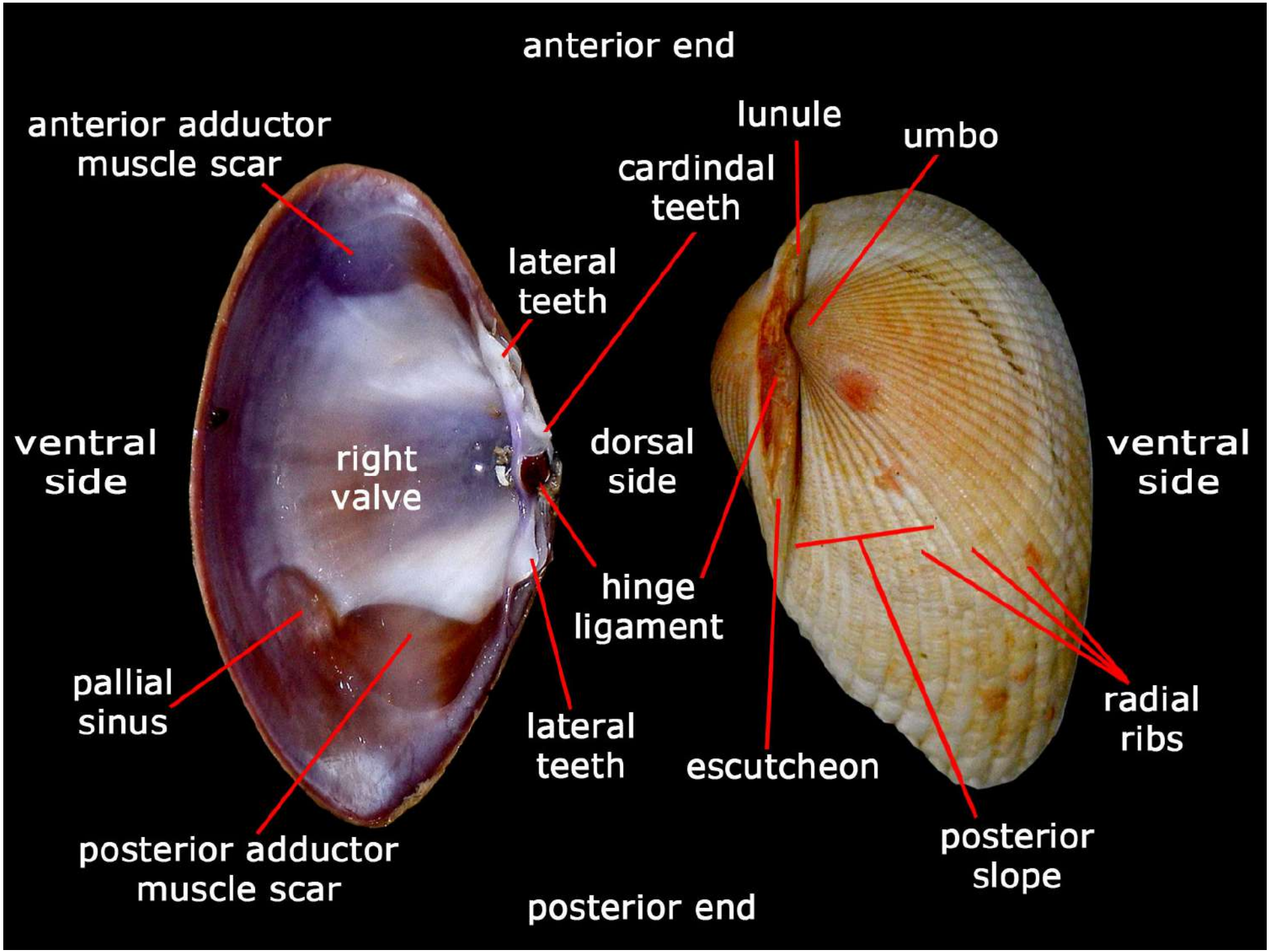
Ligament - structure that is horny, proteinaceous, acting as a spring tending to keep the valves opened in bivalve shells. Usually situated in the region of the hinge, either internally or externally.

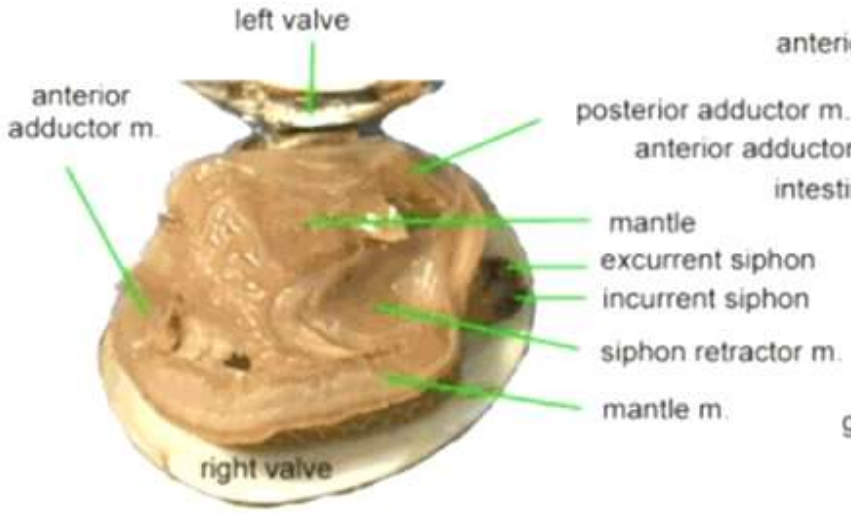
Lunule - impression on the external side of the hinge, anterior to the umbo, usually heart-shaped.

Umbo (pl. umbones) - projected portion of the hinge. First-formed part of the bivalve shell.

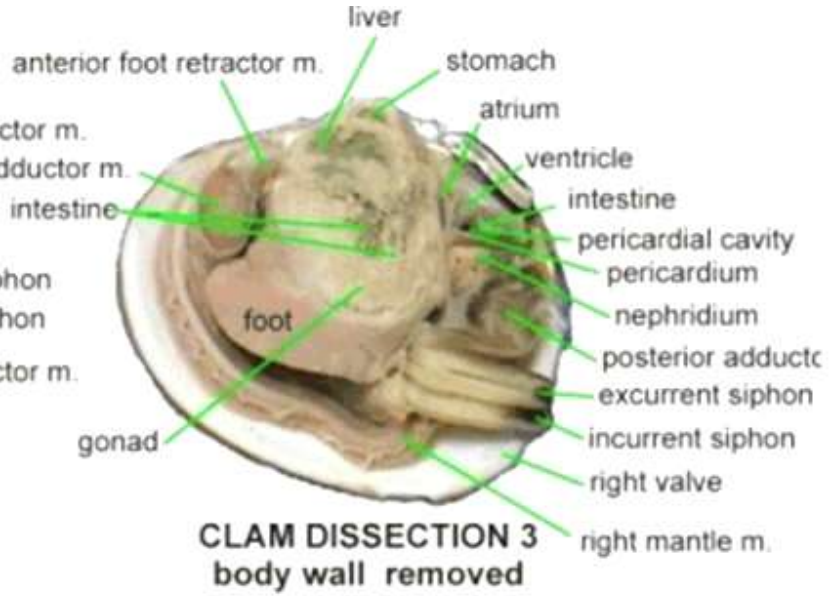
Mercenaria mercenaria form *notata* (Say, 1822)


Dorsal
umbo
hinge ligament
cardinal teeth
posterior
lateral teeth
anterior
lateral teeth
posterior adductor
muscle scar
naterior adductor
muscle scar
barnegatshelfish.org
Anterior
(foot end)
Posterior
(siphon end)
Veneral

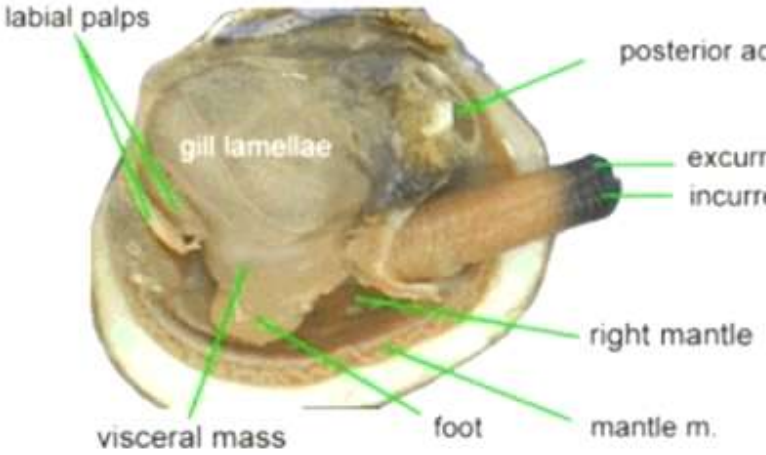

anterior end
anterior adductor muscle scar
lunule
umbo
cardindal teeth
lateral teeth
ventral side
right valve
dorsal side
ventral side
hinge ligament
pallial sinus
lateral teeth
escutcheon
radial ribs
posterior adductor muscle scar
posterior slope
posterior end



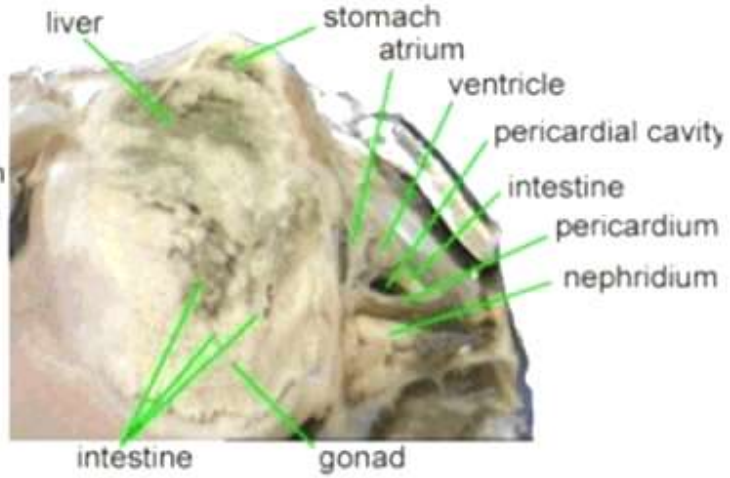
CLAM DISSECTION 1



CLAM DISSECTION 3
body wall removed



CLAM DISSECTION 2
left mantle removed



CLAM DISSECTION 3
visceral mass & pericardial cavity

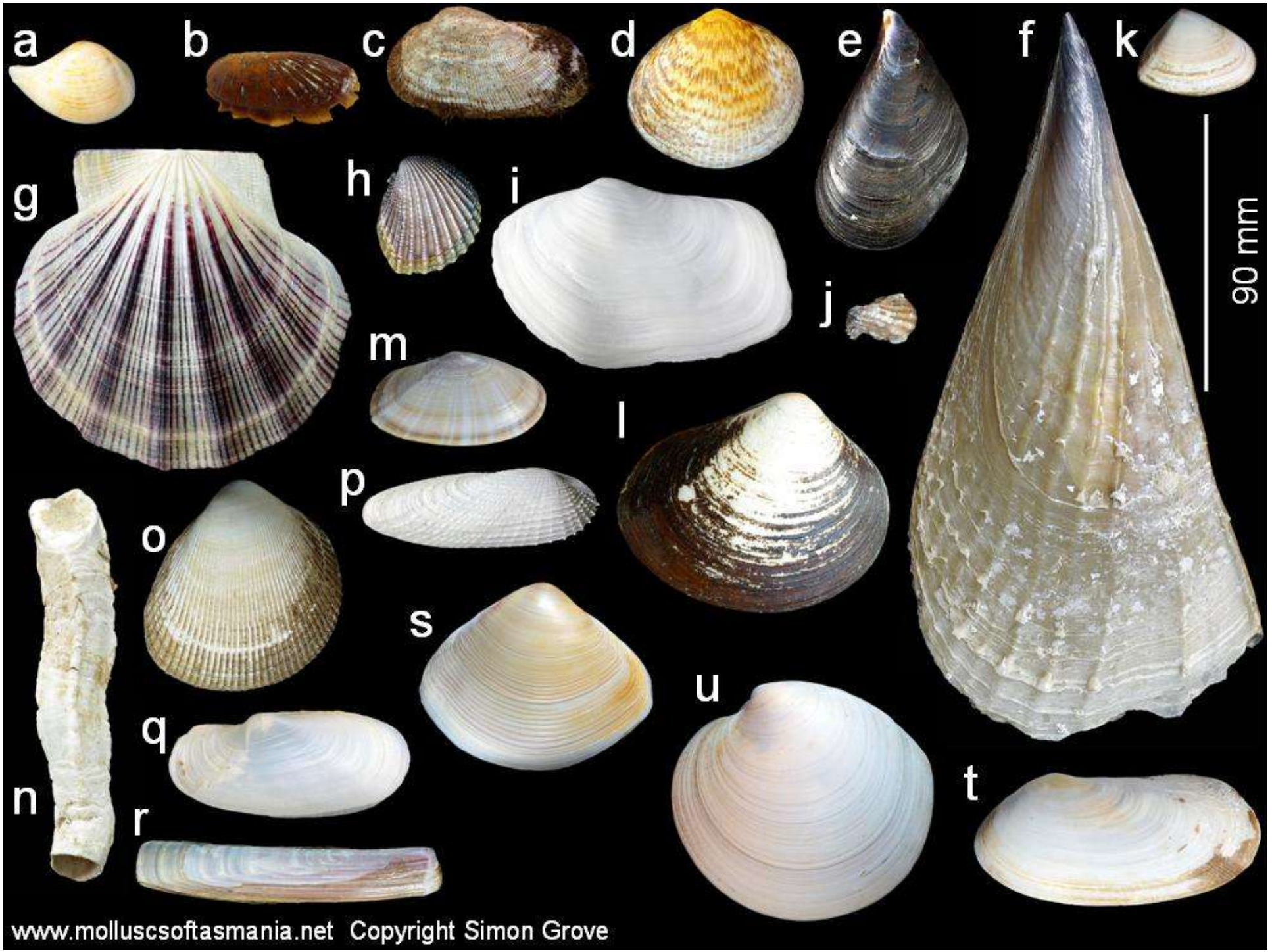
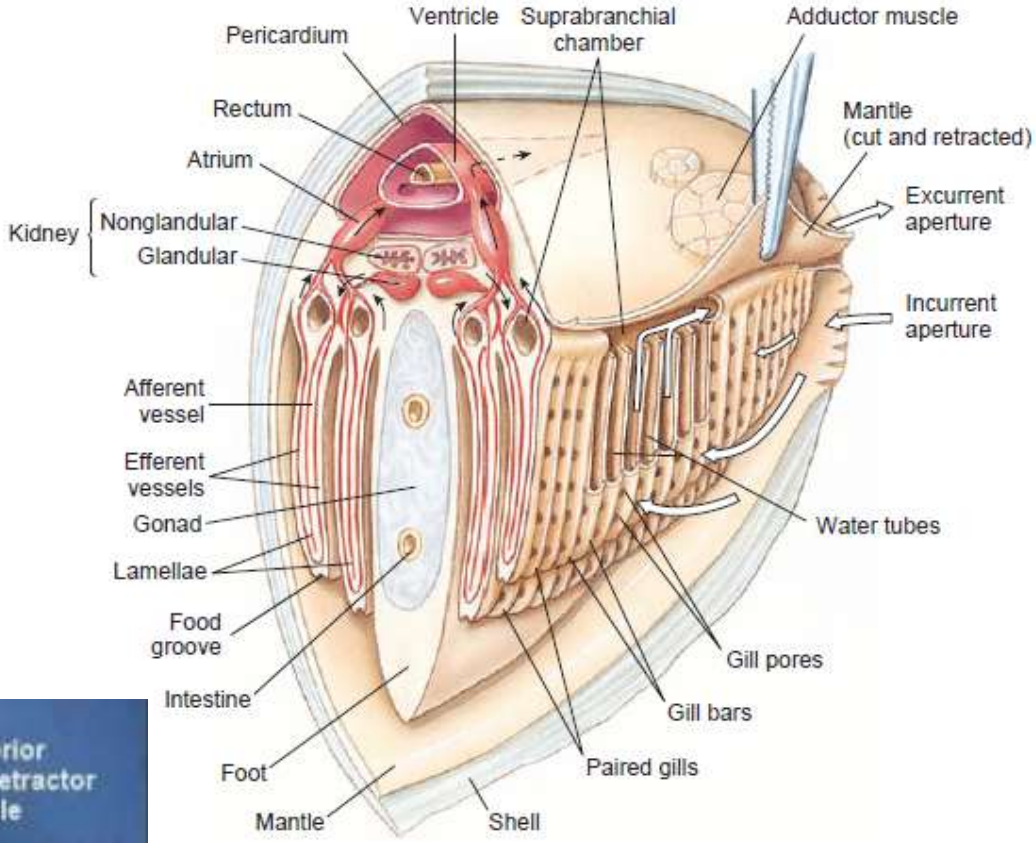
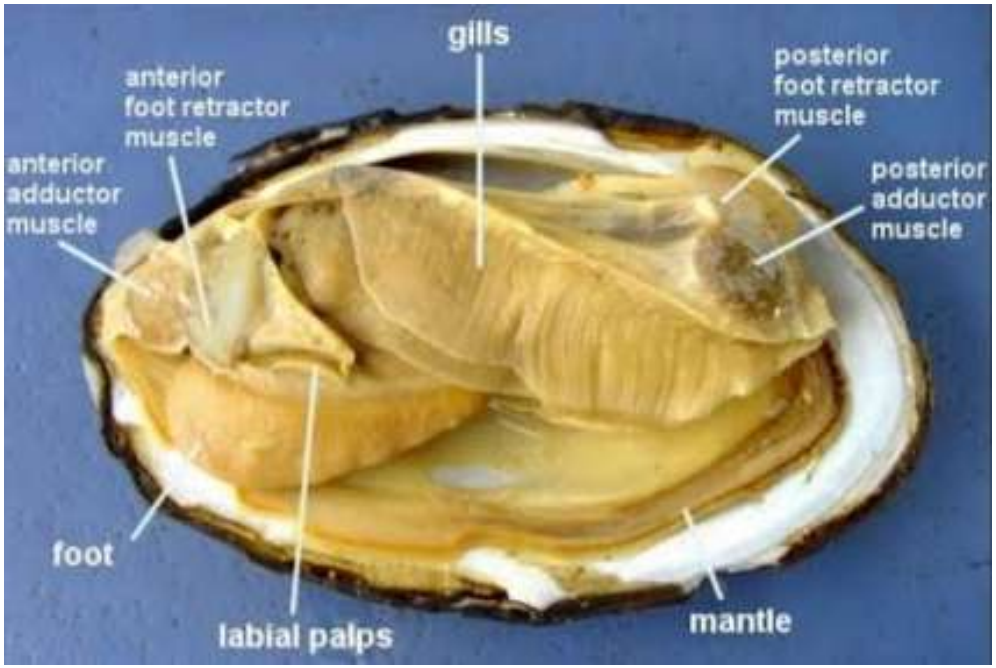

a
b
c
d
e
f
k
90 mm
g
h
i
j
m
l
p
o
s
u
q
n
r
t
www.molluscsoftasmania.net Copyright Simon Grove

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.





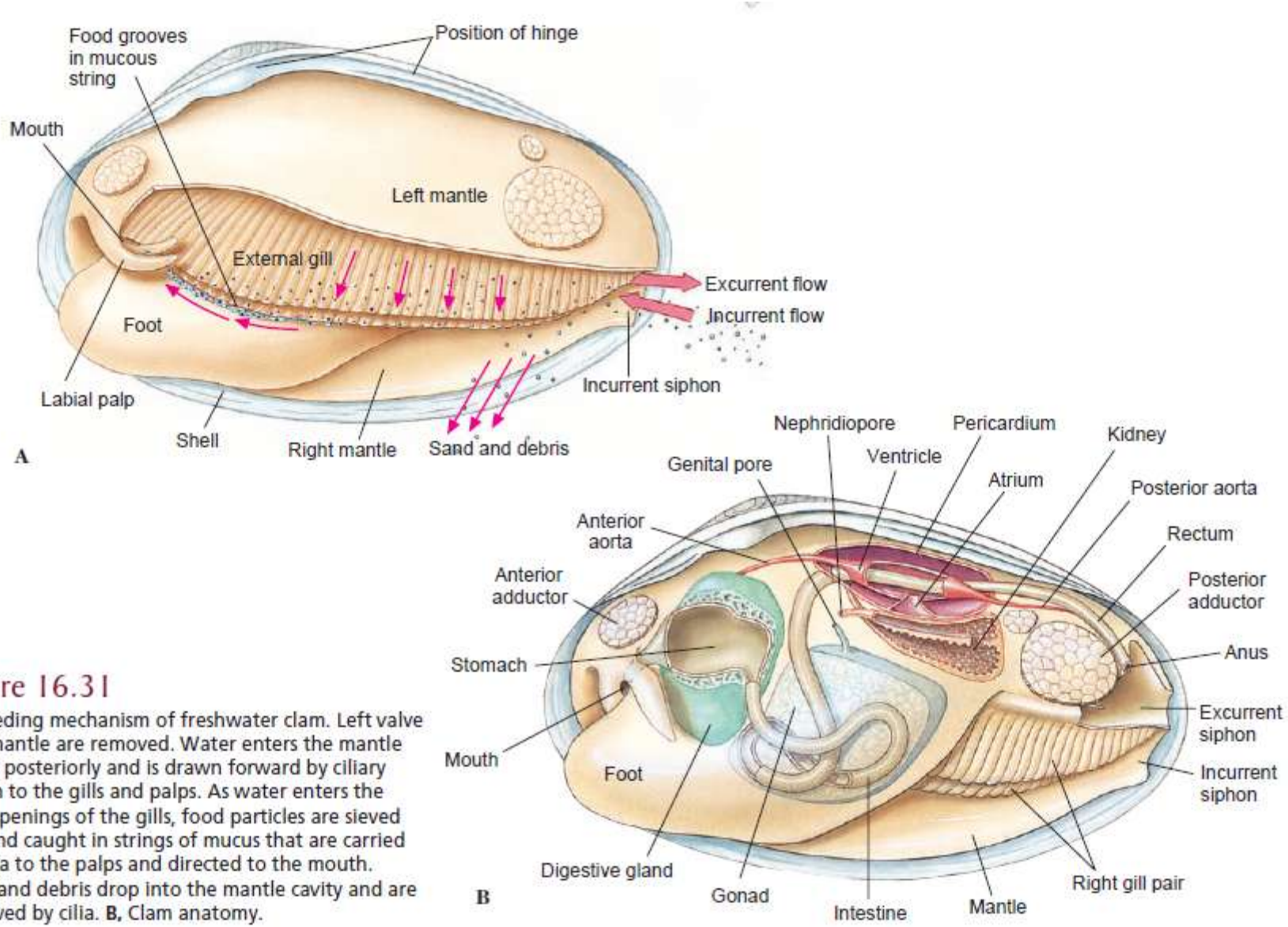
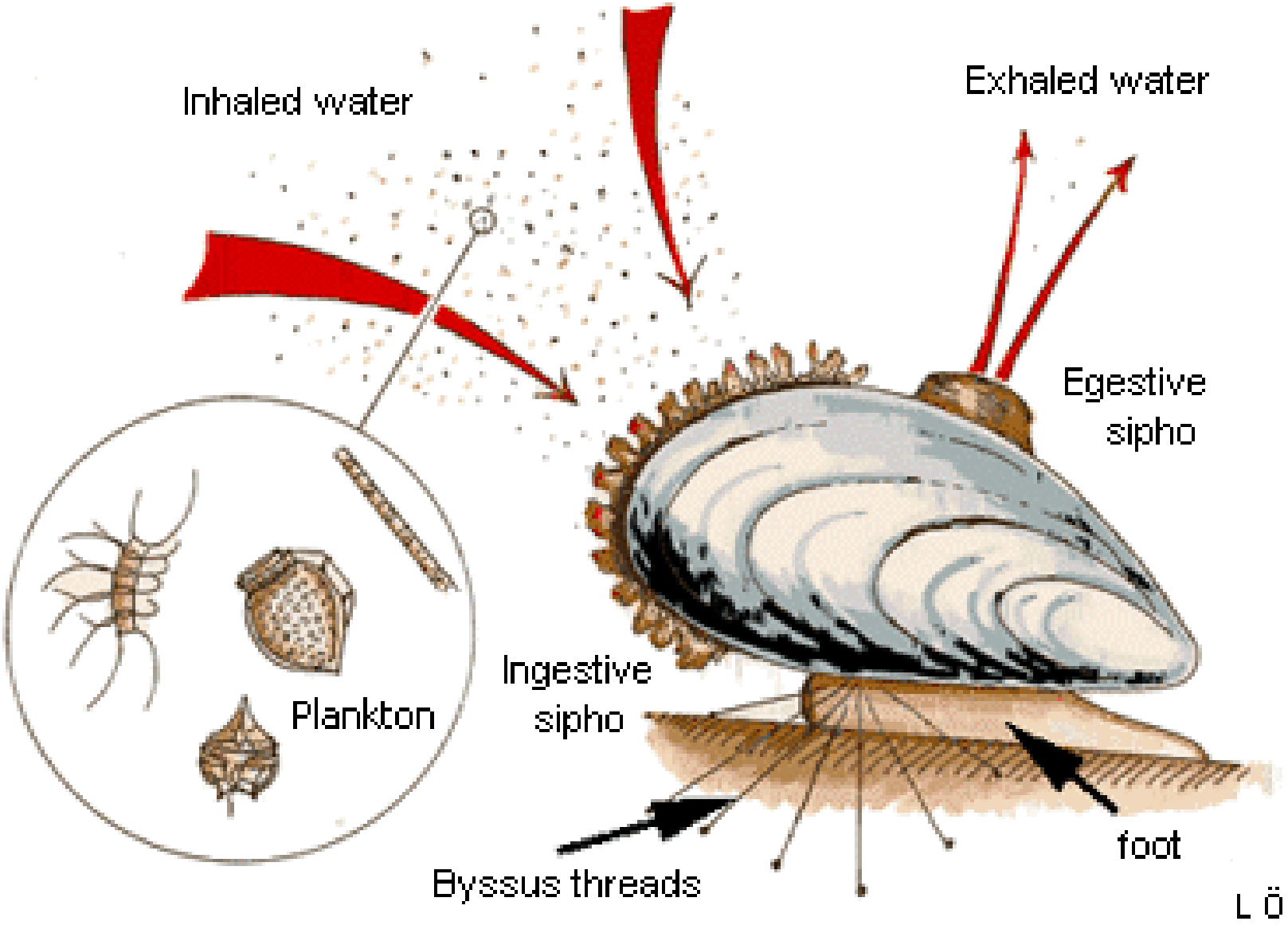
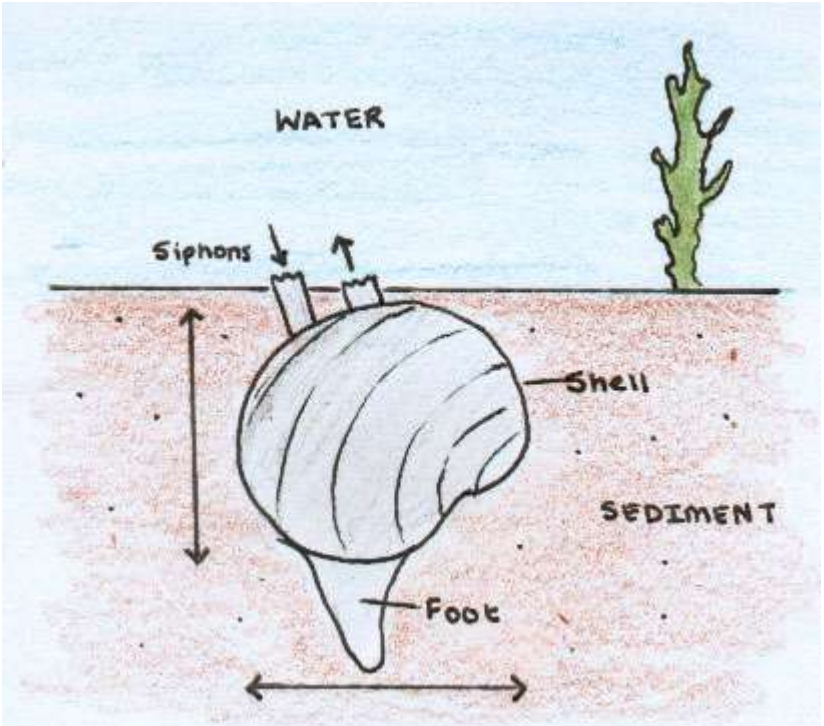
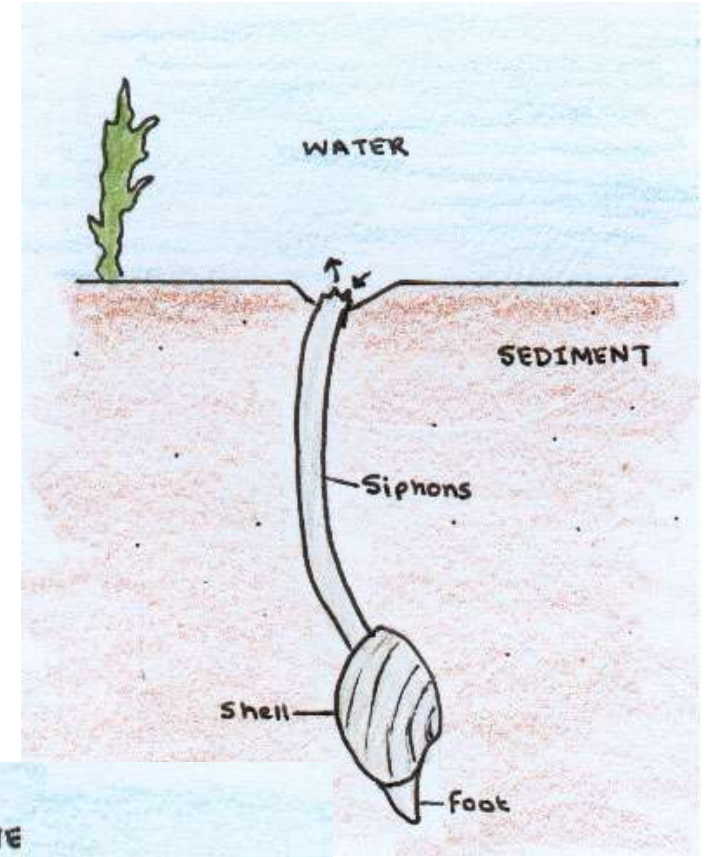


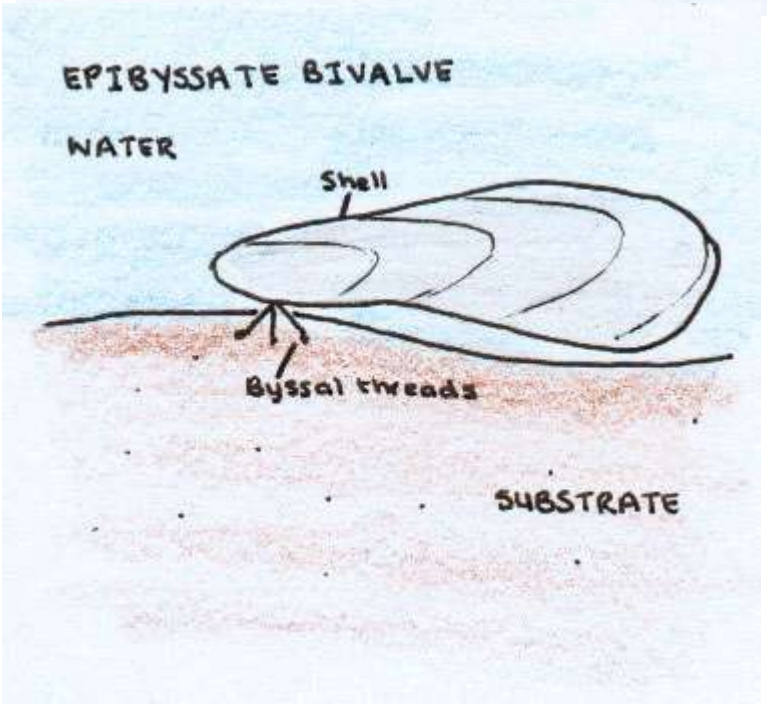
Figure 16.31

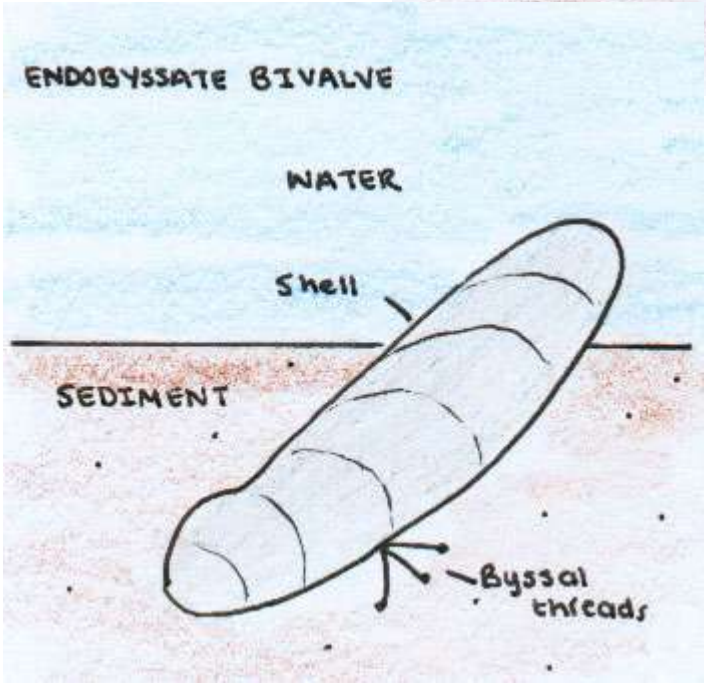
A, Feeding mechanism of freshwater clam. Left valve and mantle are removed. Water enters the mantle cavity posteriorly and is drawn forward by ciliary action to the gills and palps. As water enters the tiny openings of the gills, food particles are sieved out and caught in strings of mucus that are carried 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.


Inhaled water
Exhaled water
Egestive
sipho
Ingestive
sipho
Plankton
Byssus threads
foot
L Ö


WATER
Siphons
Shell
SEDIMENT
Foot

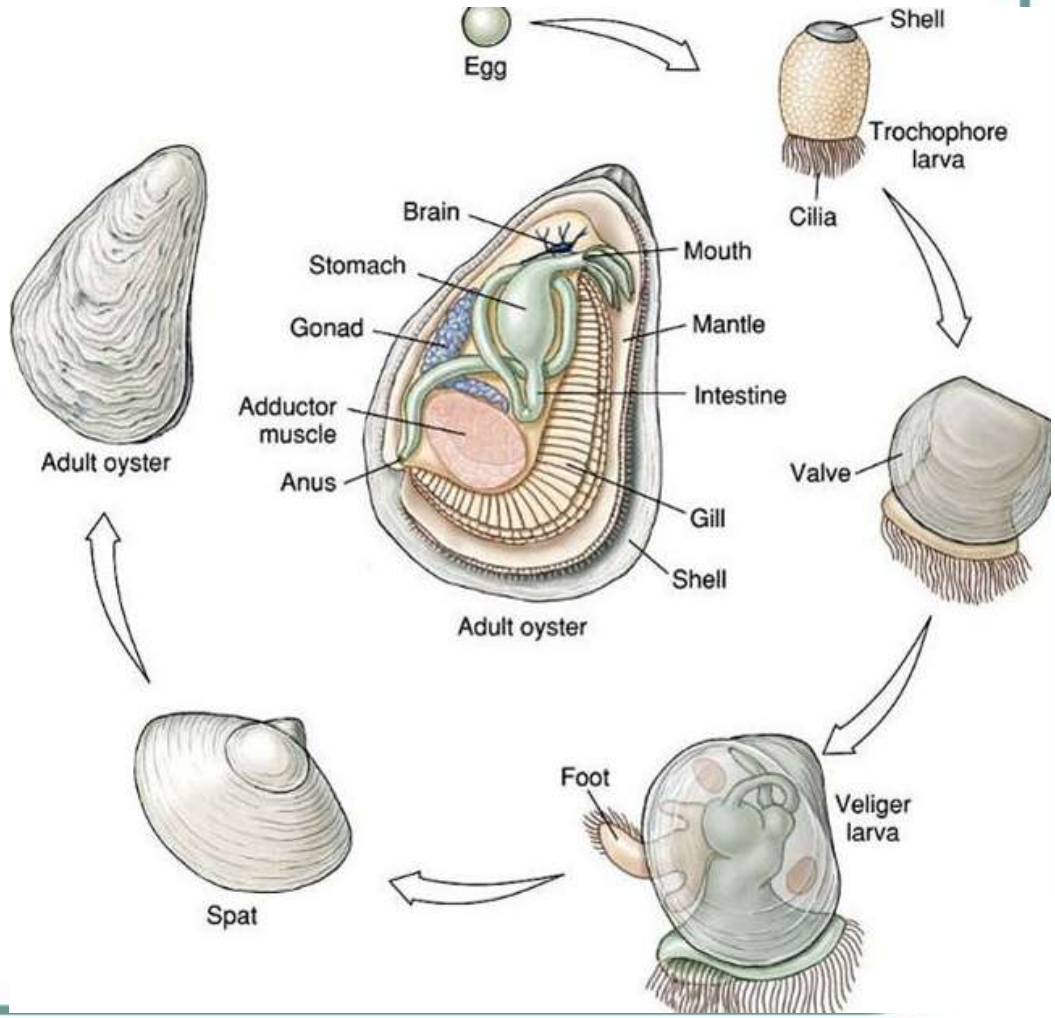

WATER
SEDIMENT
Siphons
Shell
Foot

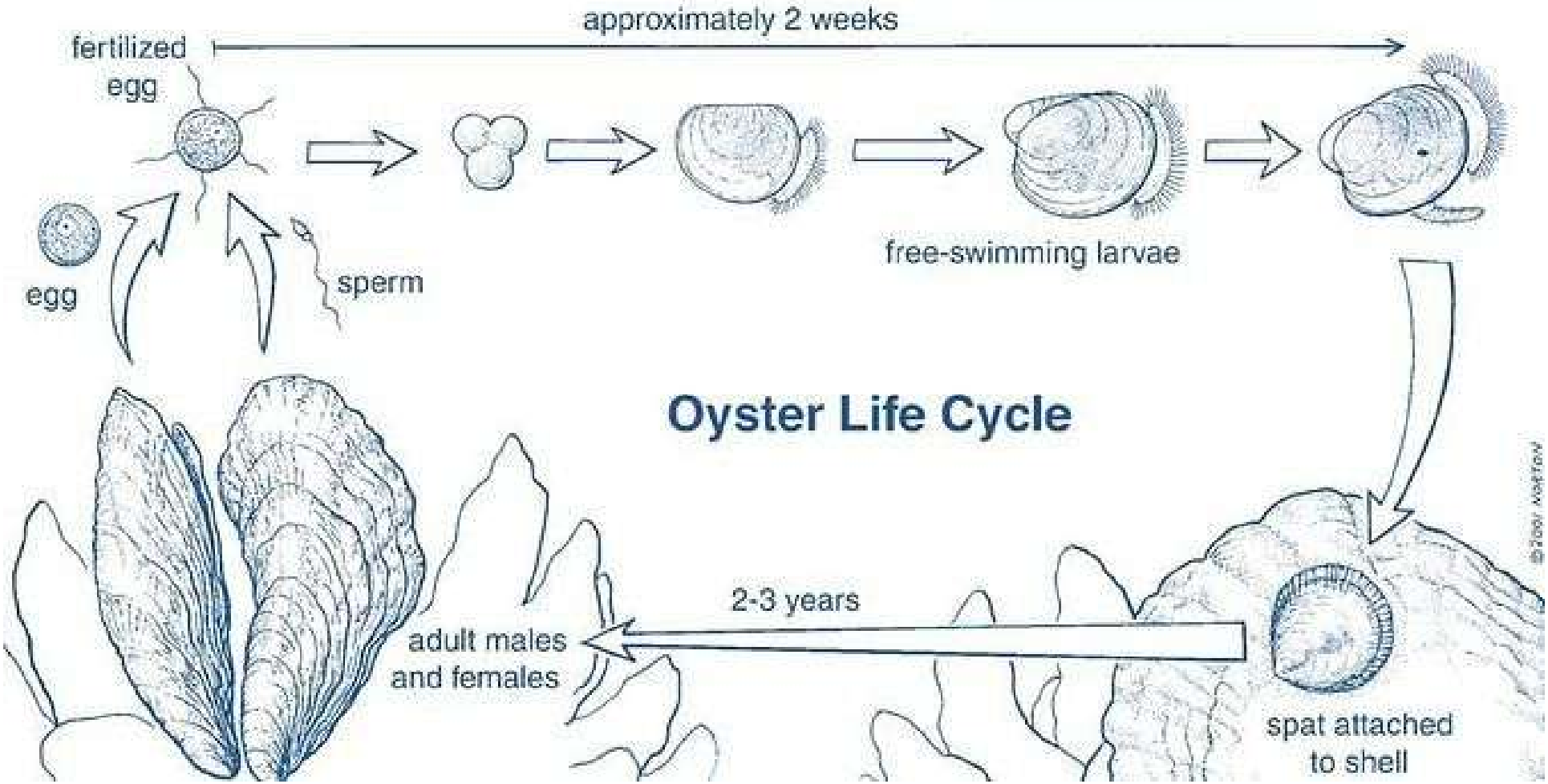

EPIBYSSATE BIVALVE
WATER
Shell
Byssal threads
SUBSTRATE

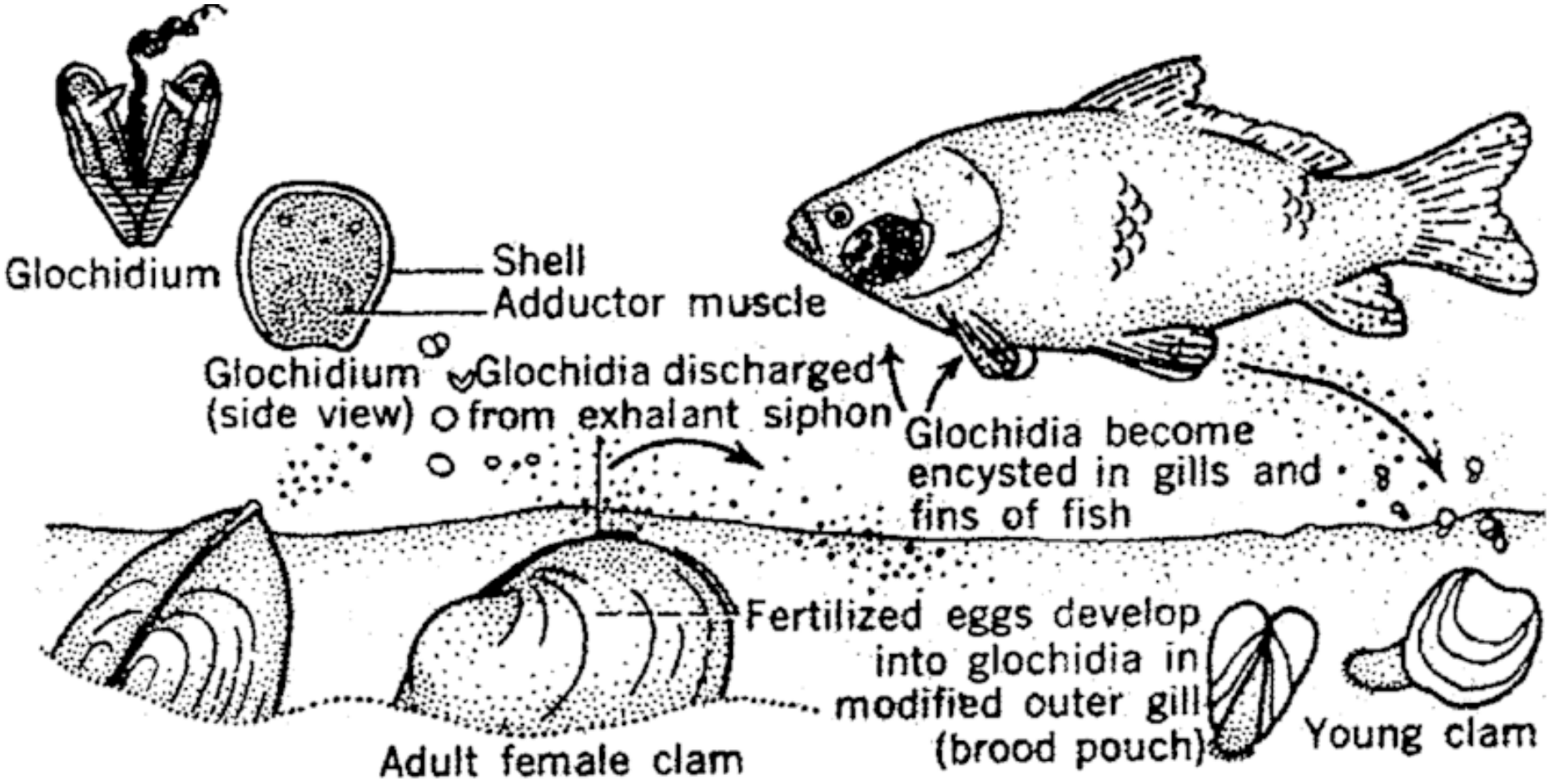

ENDOBYSSATE BIVALVE
WATER
Shell
SEDIMENT
Byssal threads

Class Bivalvia - Reproduction

- Bivalves usually have separate sexes.
- Zygotes develop into **trochophore**, **veliger**, and **spat** (tiny bivalve) stages.




approximately 2 weeks
fertilized egg
egg
sperm
free-swimming larvae
Oyster Life Cycle
2-3 years
adult males and females
spat attached to shell


Glochidium
Shell
Adductor muscle
Glochidium
(side view)
Glochidia discharged
from exhalant siphon
Glochidia become
encysted in gills and
fins of fish
Fertilized eggs develop
into glochidia in
modified outer gill
(brood pouch)
Young clam
Adult female clam

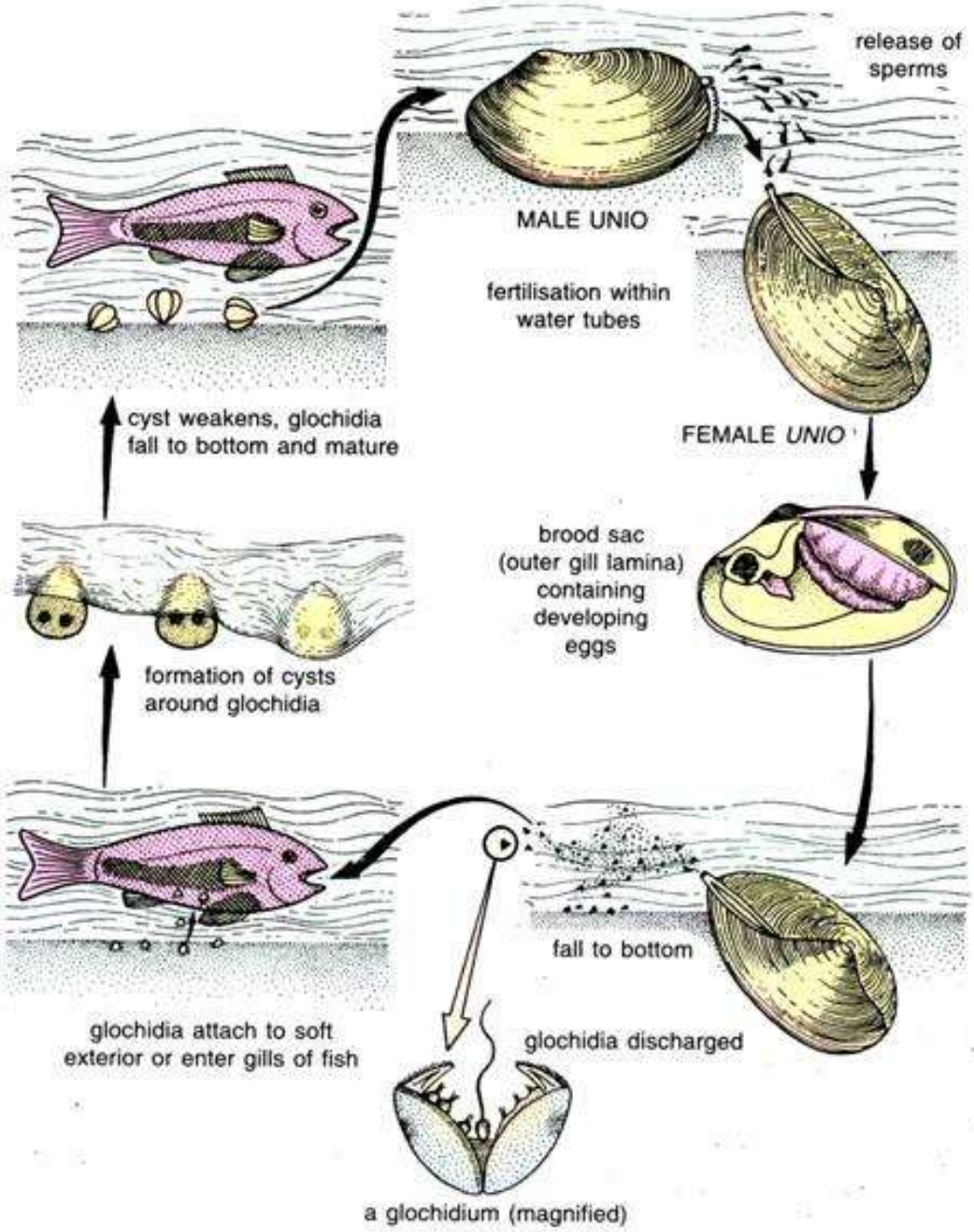
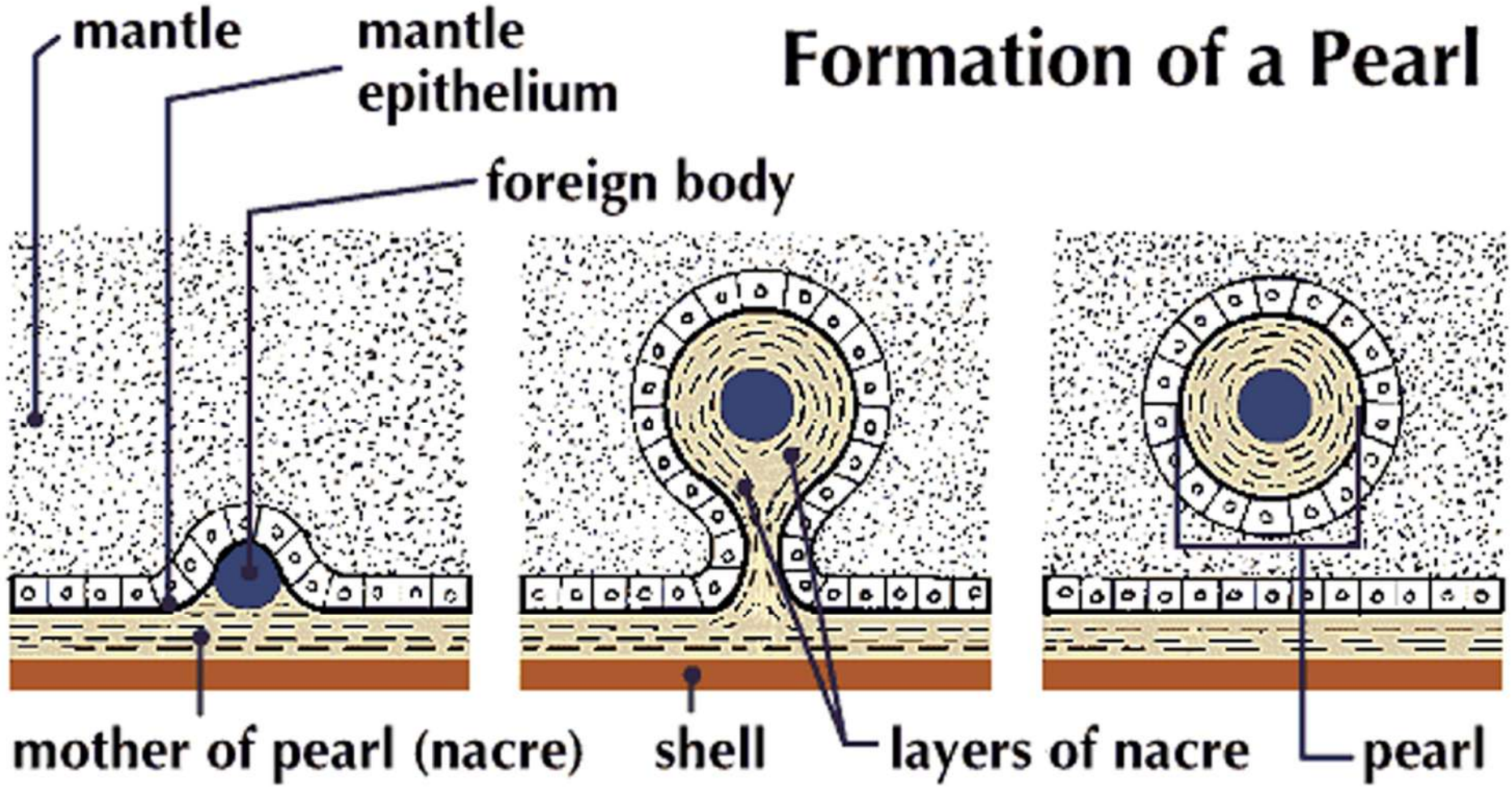


Fig. 61.20. *Unio*. Life cycle.



From Encyclopædia Britannica, Inc.

Sesungguhnya Allah memasukkan orang-orang beriman dan mengerjakan amal yang saleh ke dalam surga-surga yang di bawahnya mengalir sungai-sungai. Di surga itu mereka diberi perhiasan dengan gelang-gelang dari emas dan ***mutiara****, dan pakaian mereka adalah sutera*. **(Q.S. Al Hajj [22] : 23)**

laksana mutiara yang tersimpan baik.
(Q.S Al Waqia [56] : 23)

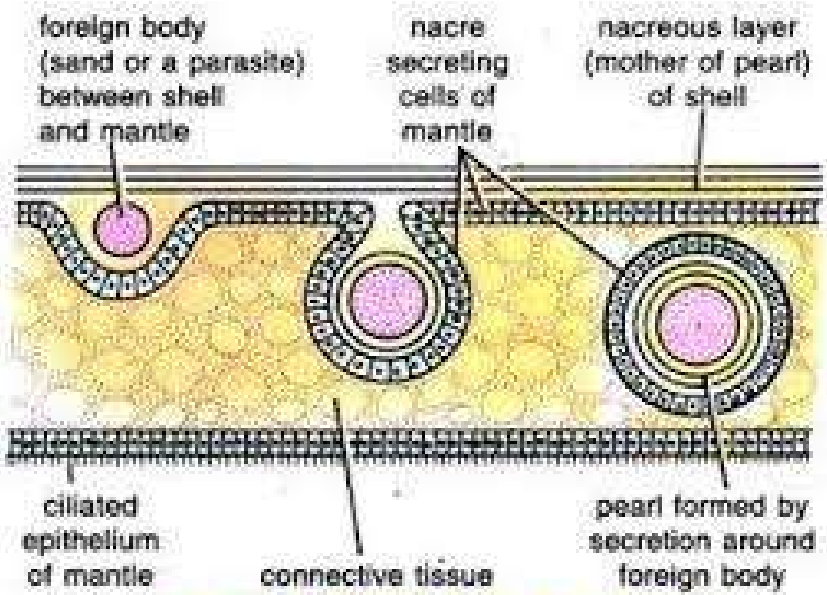


Fig. 63.3. Stages in pearl formation.

CLASS CAUDOFOVEATA

- Often combined with Solenogastres and termed Aplacophora. However, such grouping is not monophyletic; molecular data suggests that the Caudofoveata are a sister group to the cephalopods
- They are small (1-30 mm),mainly deep sea molluscs.
- They are worm-like, lacking shells or distinct muscular feet; they instead have scales and calcareous spines called sclerites, for movement.
- They live by burrowing through soft sediment, and feed by lying vertically in the sediment with just the mouthparts exposed and taking in passing organic detritus.
- During sexual reproduction, the female produces eggs which are fertilized and brooded, and then the larvae swim freely.

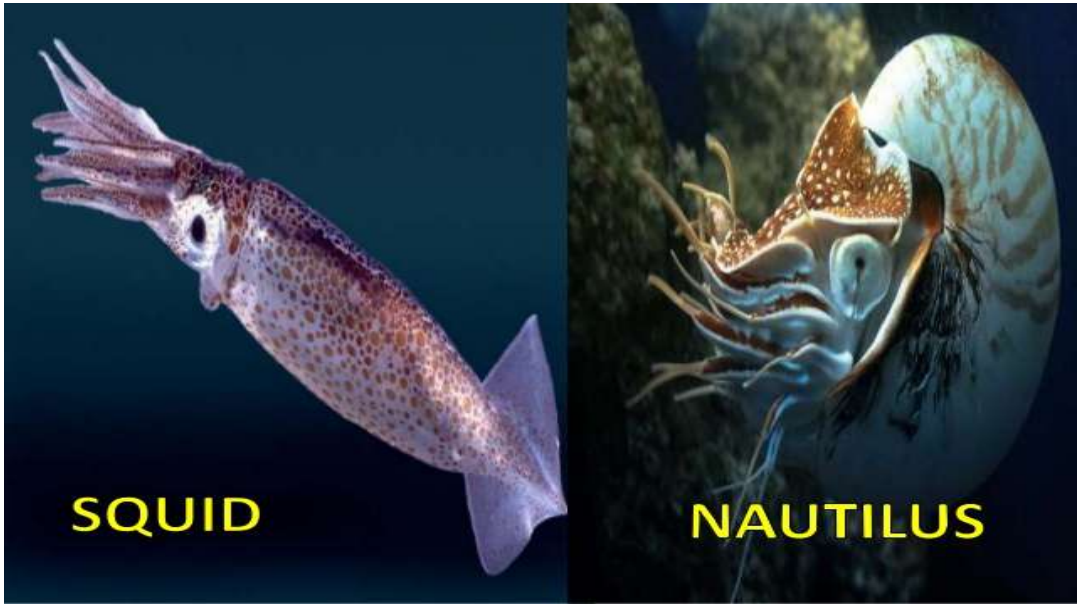
Fig. 10 Anterior 1.4 mm of a fixed and stained specimen of *Falcidens* sp.

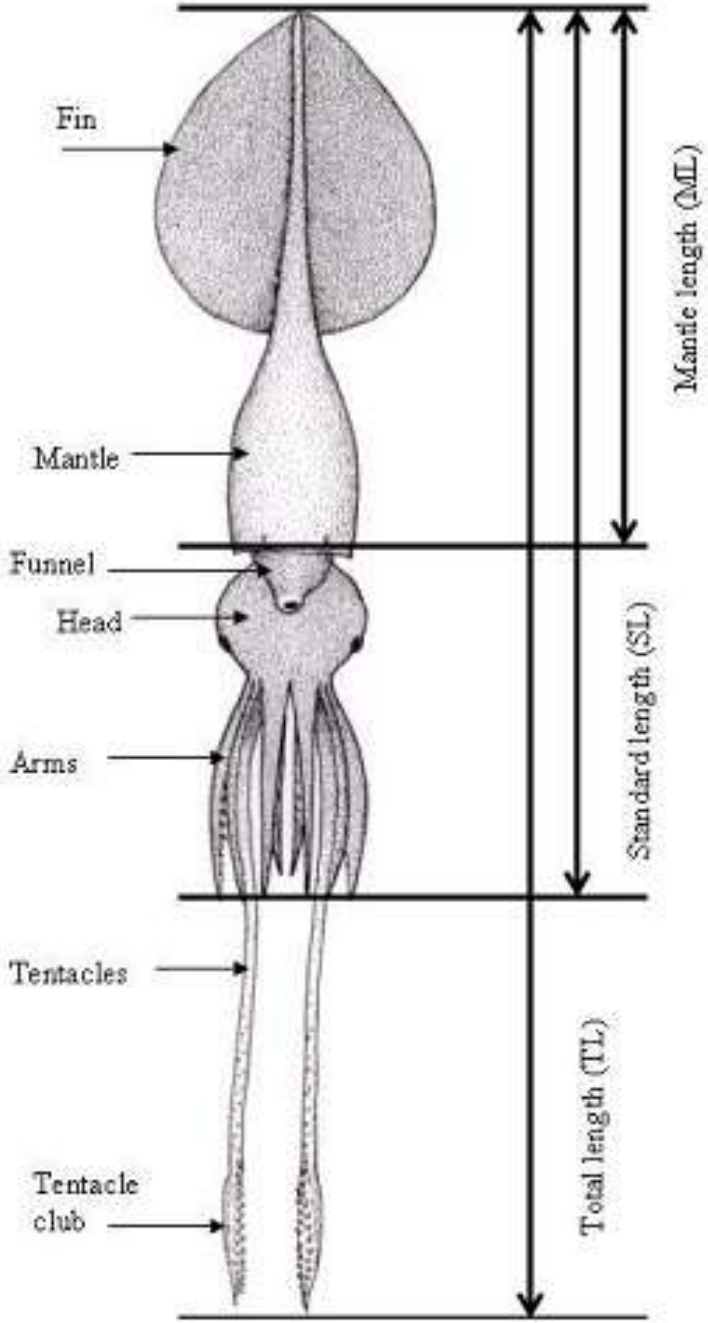
Fig. 11 Molluschi Aculiferi (Caudofoveata) molto piccoli


1 mm

CLASS CEPHALOPODA

- Agile swimmers
- Complex nervous system
- Shell is reduced or lost entirely
- Foot is modified into tentacles usually equipped with suckers
- Eyes are well developed
- Body protected by thick muscular mantle
- Move by forcing water out of the siphon, a flexible, funnel-shaped tube on the side of the head.





- Cephalopoda means "head foot"
  - Cephalopods are characterized by a completely merged head and foot
- Octopuses, squids, cuttlefish, and chambered nautiluses
- Well developed head
- Prominent foot divided into tentacles
- Free swimming
- Predatory - carnivorous
- Strong suckers
- A cephalopod is also characterized by a horny beak secreted by the walls of the buccal cavity, and a radula within the buccal cavity.
- The digestive tract consists of three parts: esophagus , which may contain a crop; stomach , which mashes food; and caecum , where most digestion and absorption occur

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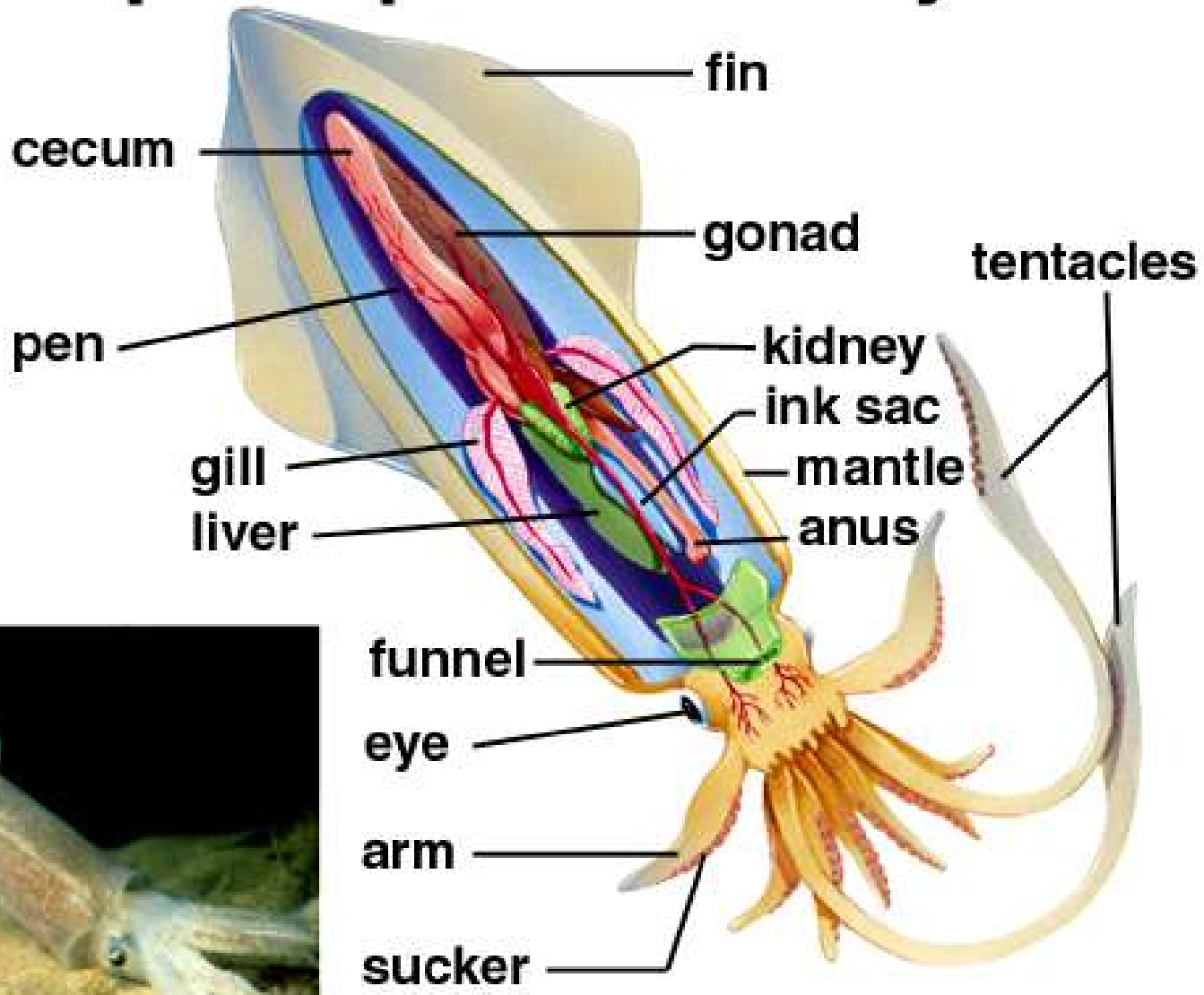
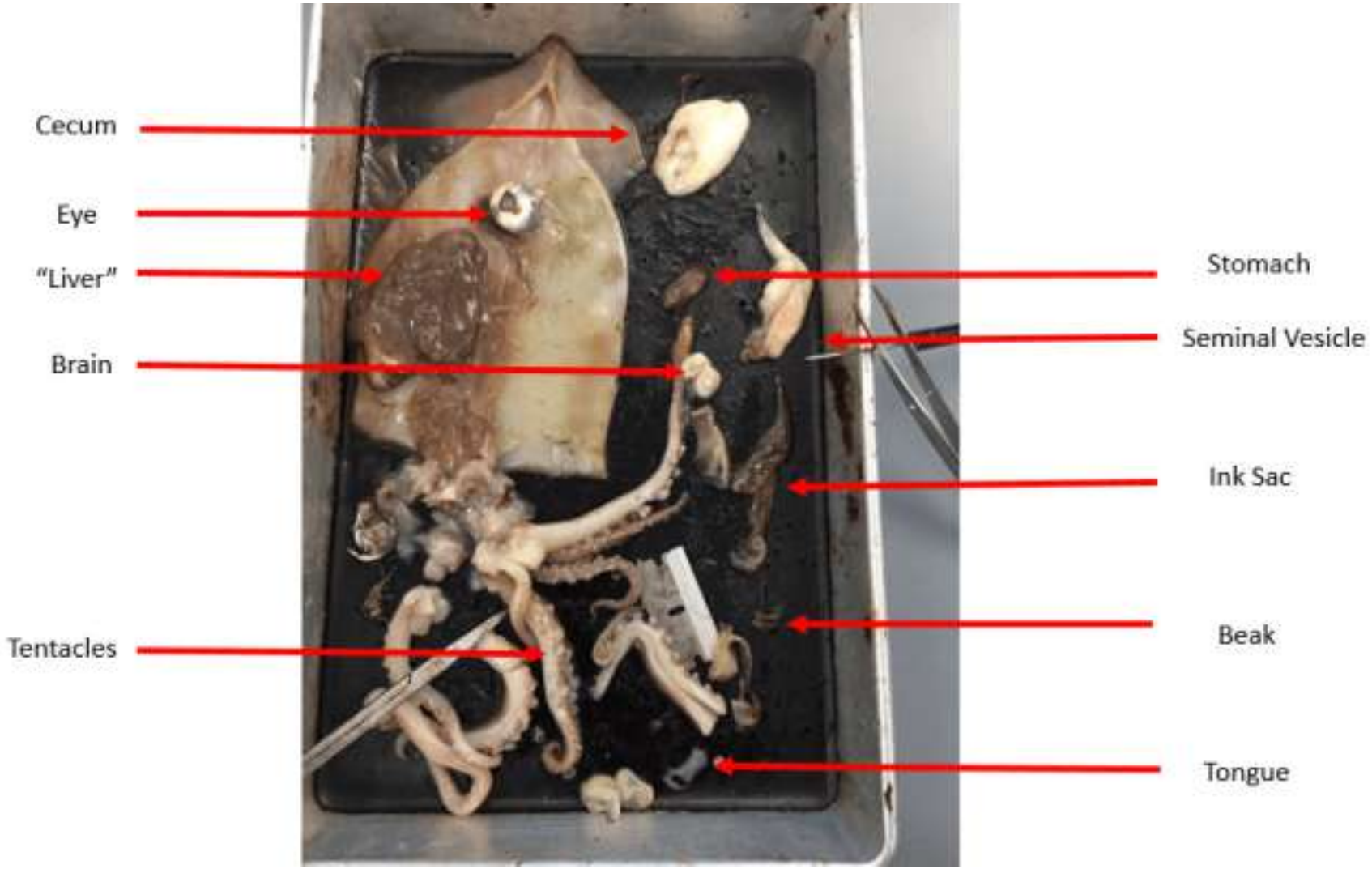
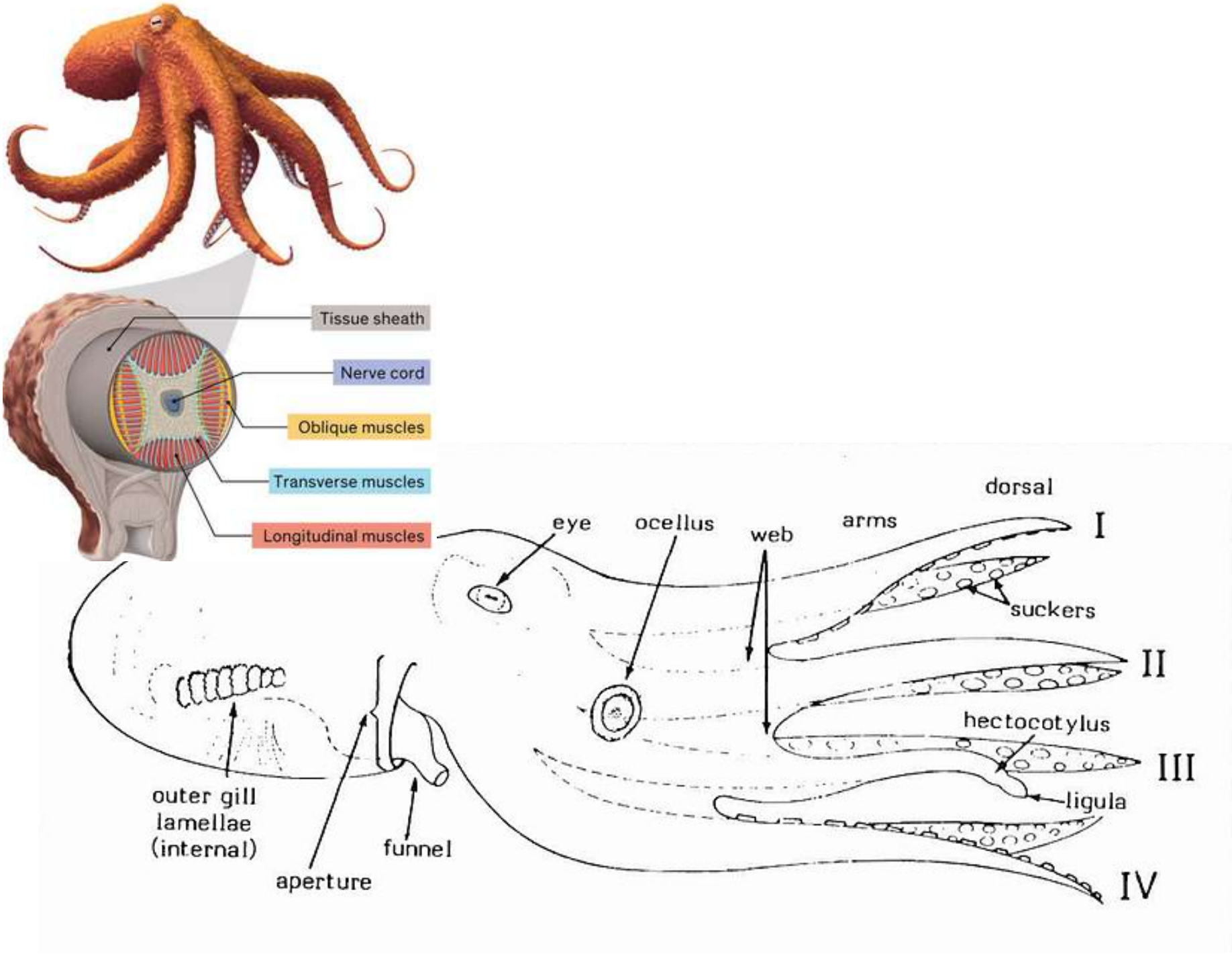
Cephalopod diversity

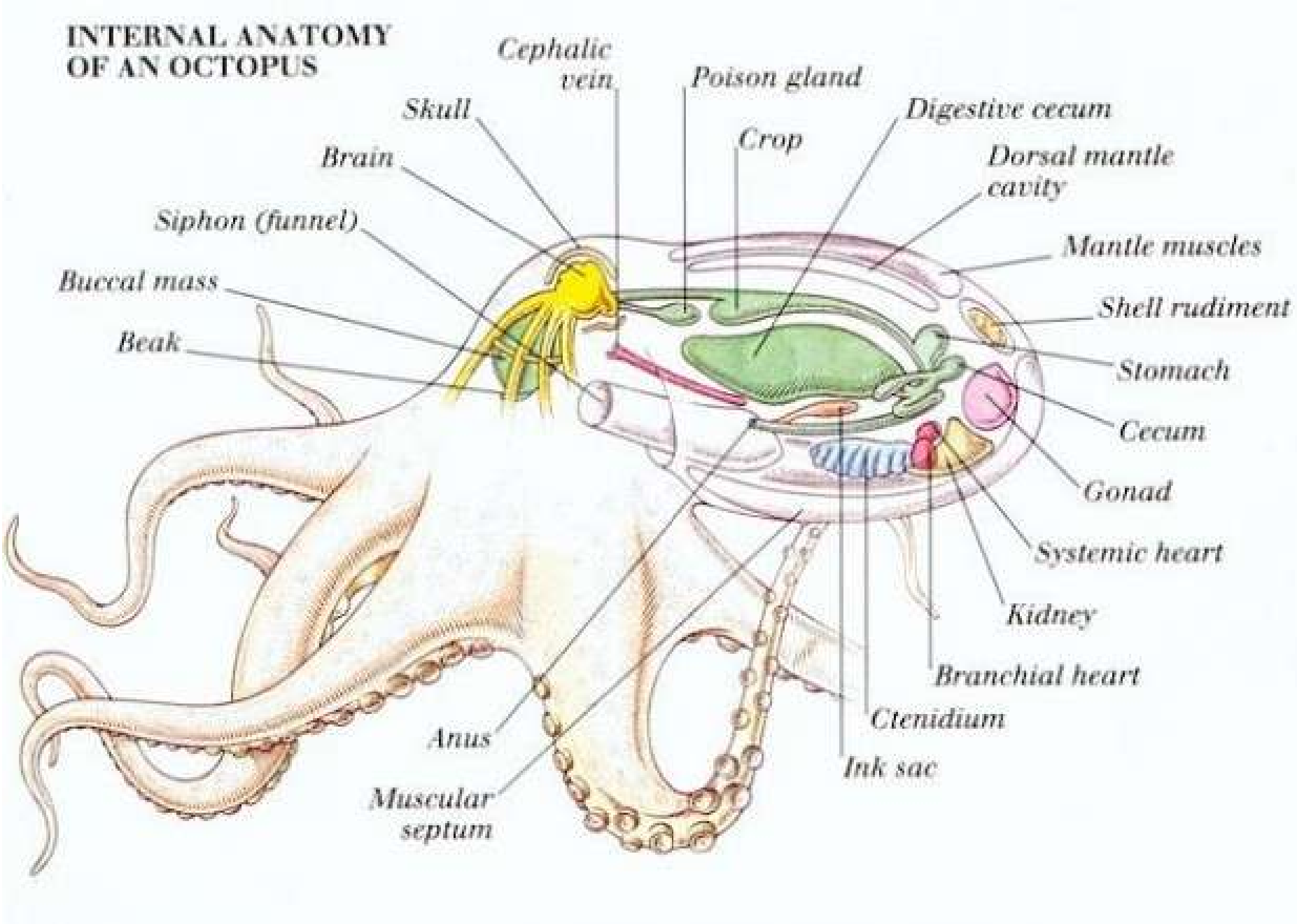
© Michael DiSpezio



c. Squid, *Loligo*


Cecum
Eye
"Liver"
Brain
Tentacles
Stomach
Seminal Vesicle
Ink Sac
Beak
Tongue


Tissue sheath
Nerve cord
Oblique muscles
Transverse muscles
Longitudinal muscles
dorsal
eye
ocellus
web
arms
I
suckers
II
hectocotylus
III
ligula
IV
outer gill
lamellae
(internal)
aperture
funnel


INTERNAL ANATOMY
OF AN OCTOPUS
Cephalic vein
Poison gland
Skull
Digestive cecum
Crop
Brain
Dorsal mantle cavity
Siphon (funnel)
Mantle muscles
Buccal mass
Shell rudiment
Beak
Stomach
Cecum
Gonad
Systemic heart
Kidney
Branchial heart
Ctenidium
Anus
Ink sac
Muscular septum

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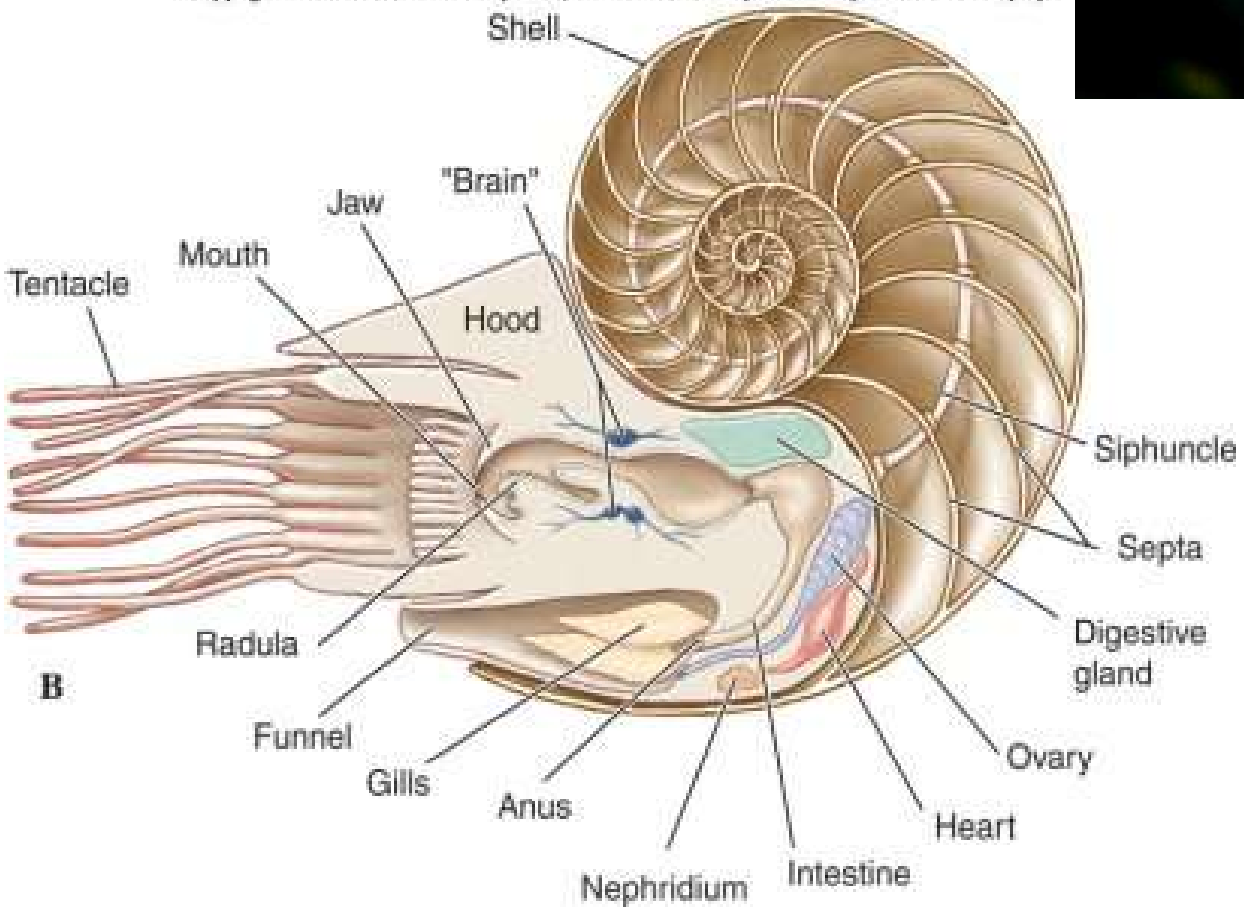
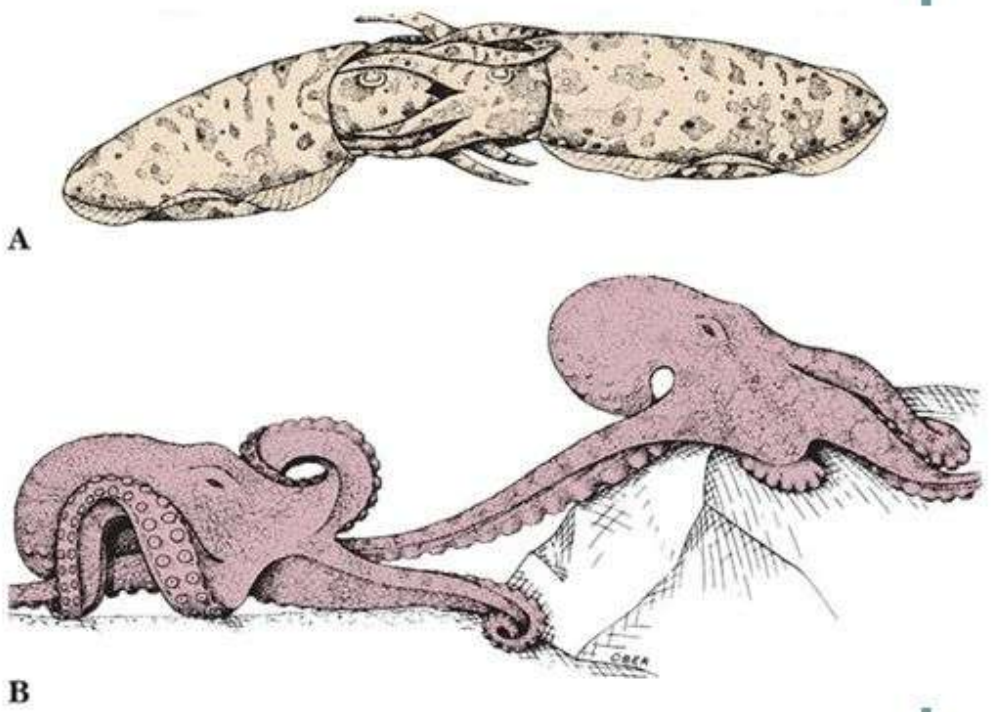


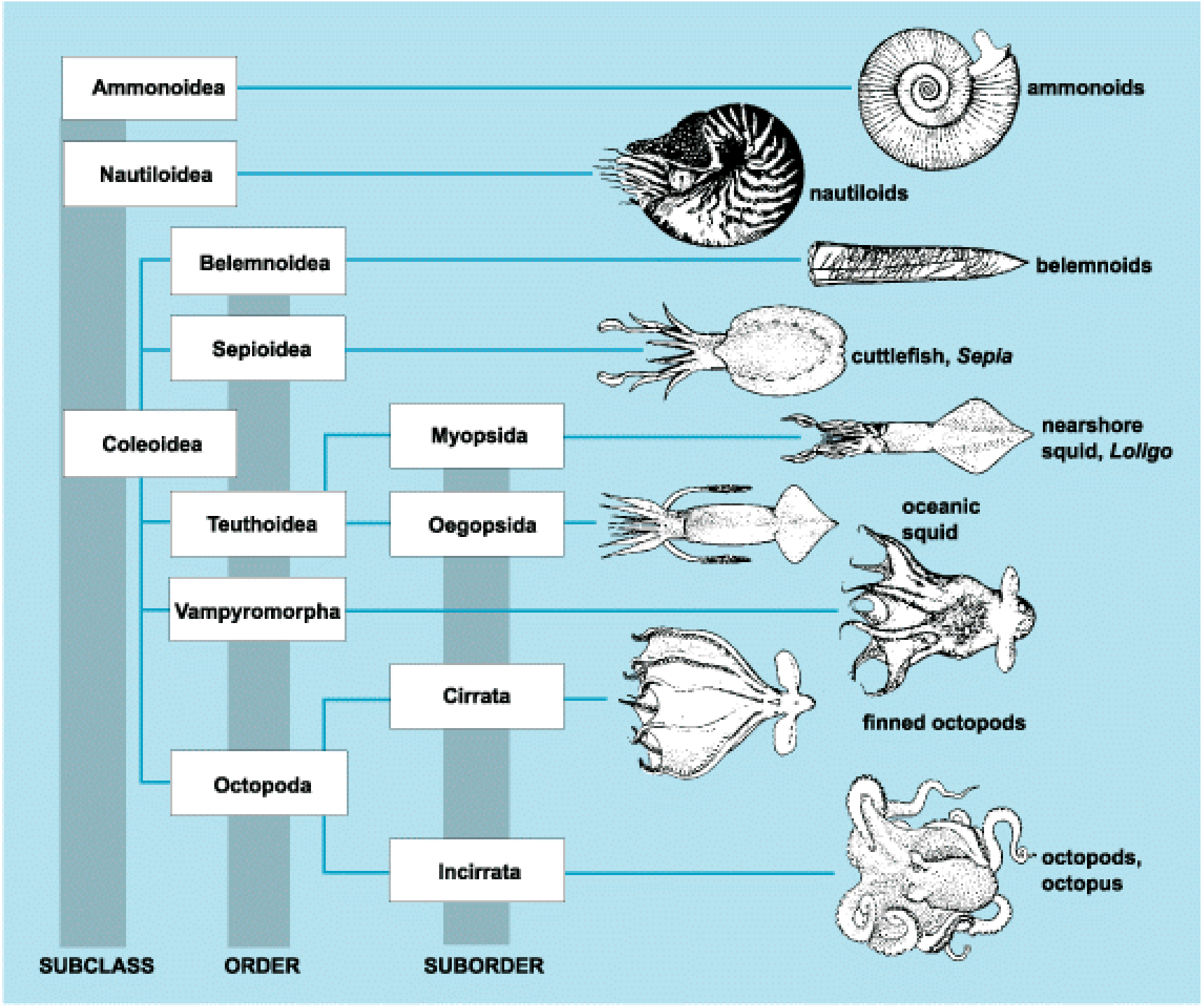
Class Cephalopoda - Reproduction

- Sexes are separate in cephalopods.
- Juveniles hatch directly from eggs – no free-swimming larvae.
- One arm of male is modified as an intromittent organ, the **hectocotylus**.
  - Removes a spermatophore from mantle cavity and inserts it into female.

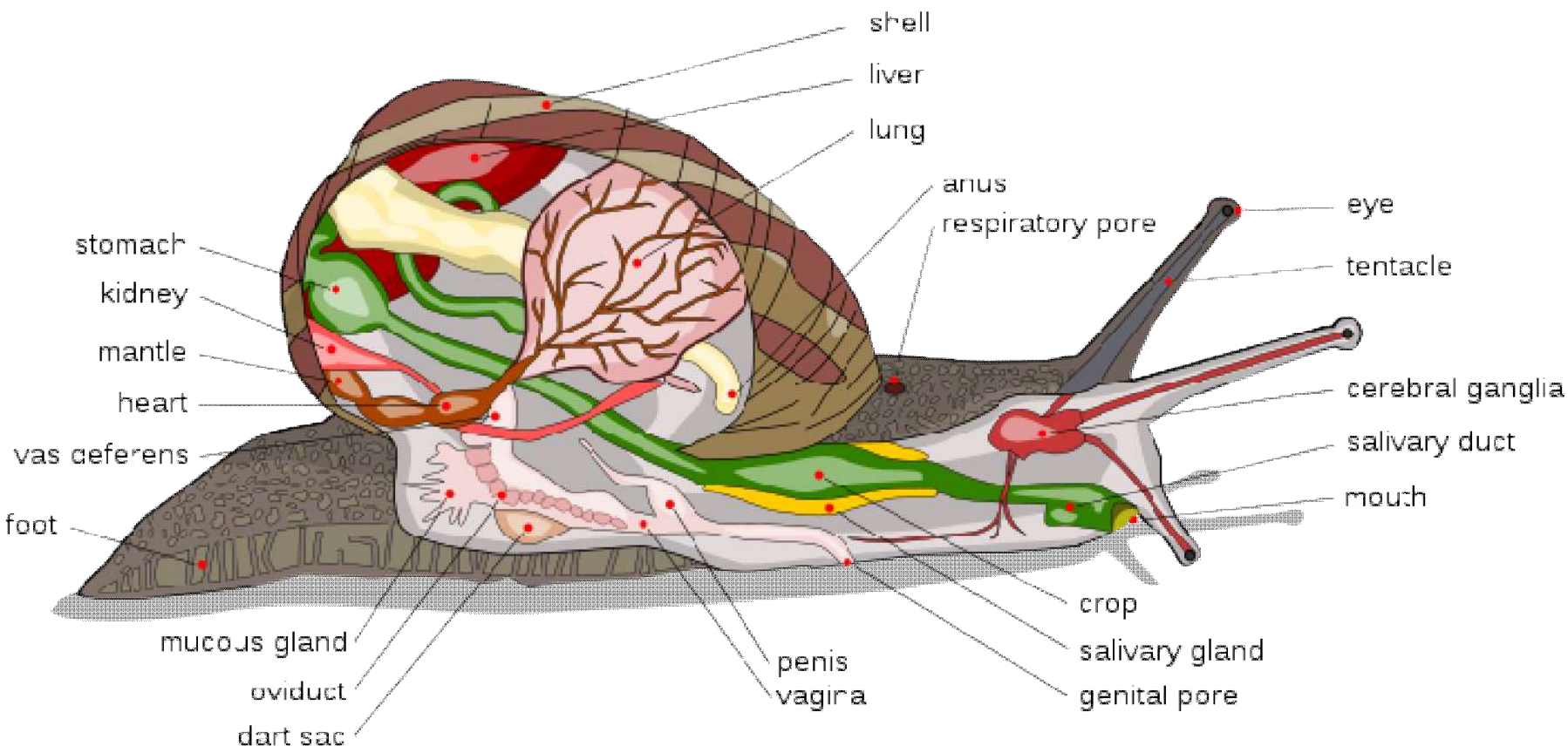


Class Cephalopoda

- Nautiloidea
  - Nautilus
- Coleoidea: Neocoleoidea
  - Octopodiformes
    - Octopoda - Octopuses
    - Vampiromorpha – Vampire “squid”
  - Decapodiformes
    - Teuthida – Squid
    - Sepiida, Sepiolida, Spirulida – Cuttle fishes

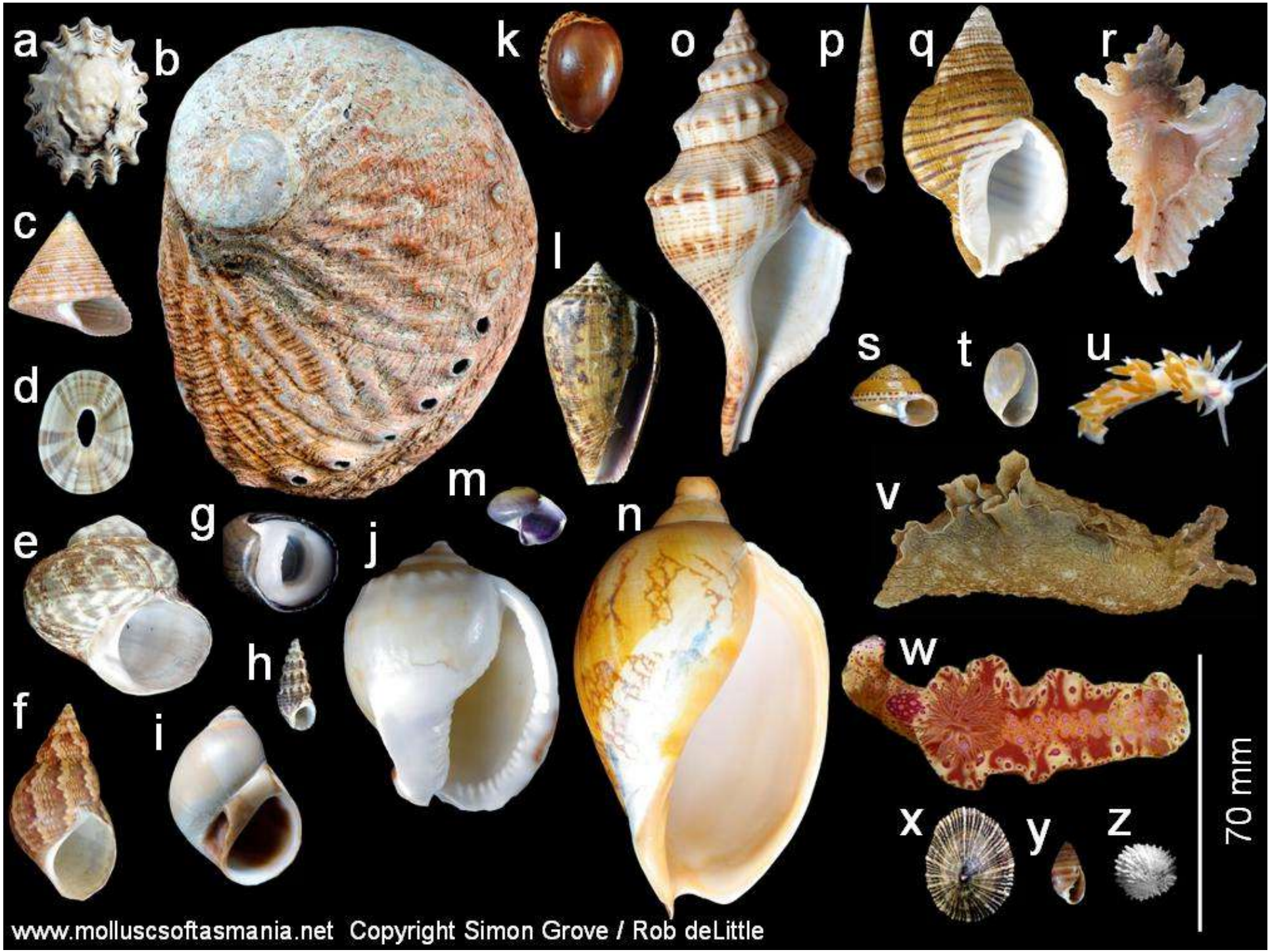

Ammonoidea
Nautiloidea
Belemnoidea
Sepioidea
Coleoidea
Teuthoidea
Vampyromorpha
Octopoda
Myopsida
Oegopsida
Cirrata
Incirrata
ammonoids
nautiloids
belemnoids
cuttlefish, Sepia
nearshore squid, Loligo
oceanic squid
finned octopods
octopods, octopus
SUBCLASS
ORDER
SUBORDER

CLASS GASTROPODA



Class Gastropoda

- Snails, slugs, limpets, whelks, conchs, periwinkles, sea slugs, sea hares, and sea butterflies
- ~ 70,000 species
- Well developed head
- Large flat foot
- Torsion - during development some body parts rotate relative to the mouth and head
- Coiling - the shell is coiled and typically conispiral


a
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t
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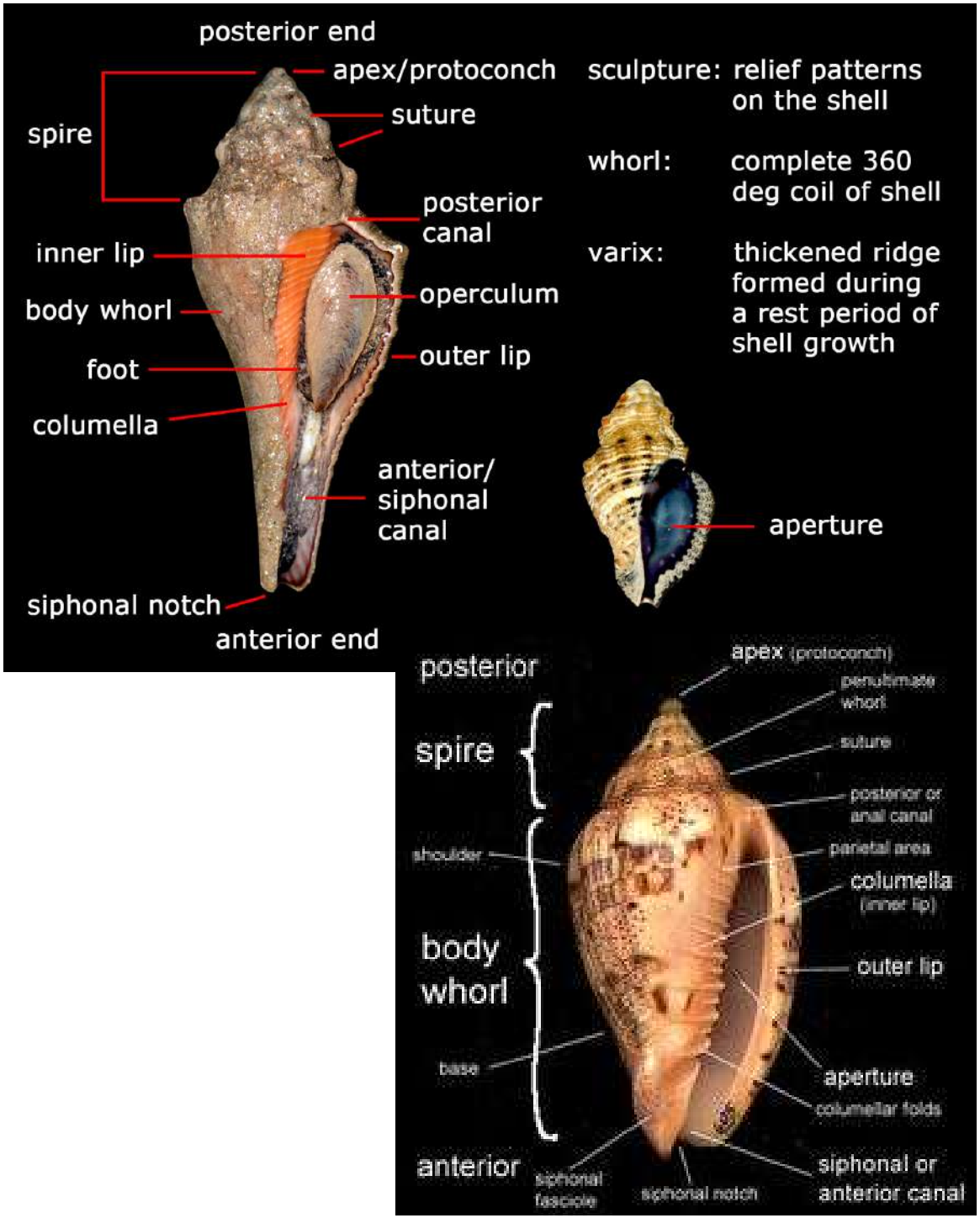
f
i
x
y
z
70 mm
www.molluscsoftasmania.net Copyright Simon Grove / Rob deLittle



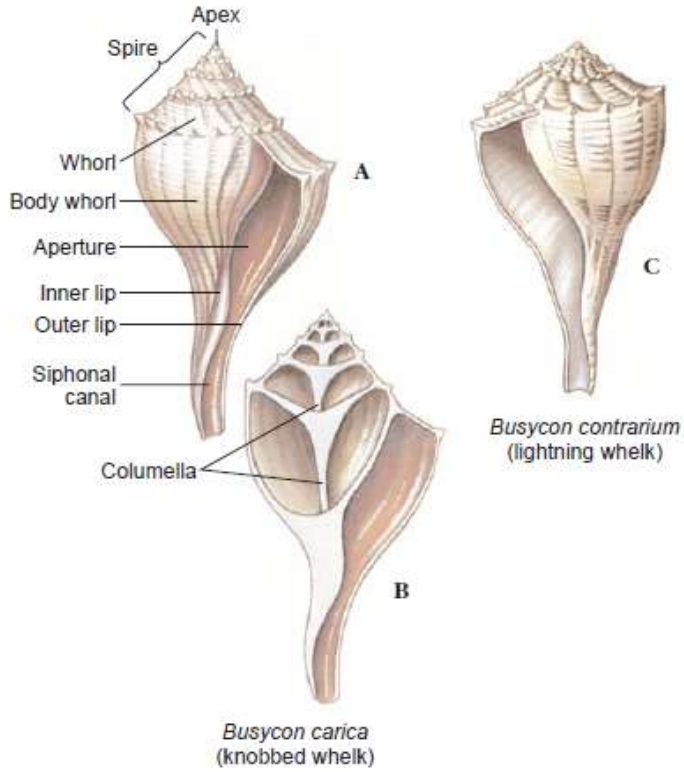


Figure 16.13

Shell of the whelk *Busycon*. **A** and **B**, *Busycon carica*, a dextral, or right-handed, shell. A dextral shell has the aperture on the right side when the shell is held with the apex up and the aperture facing the observer. **C**, *B. contrarium*, a sinistral, or left-handed, shell.

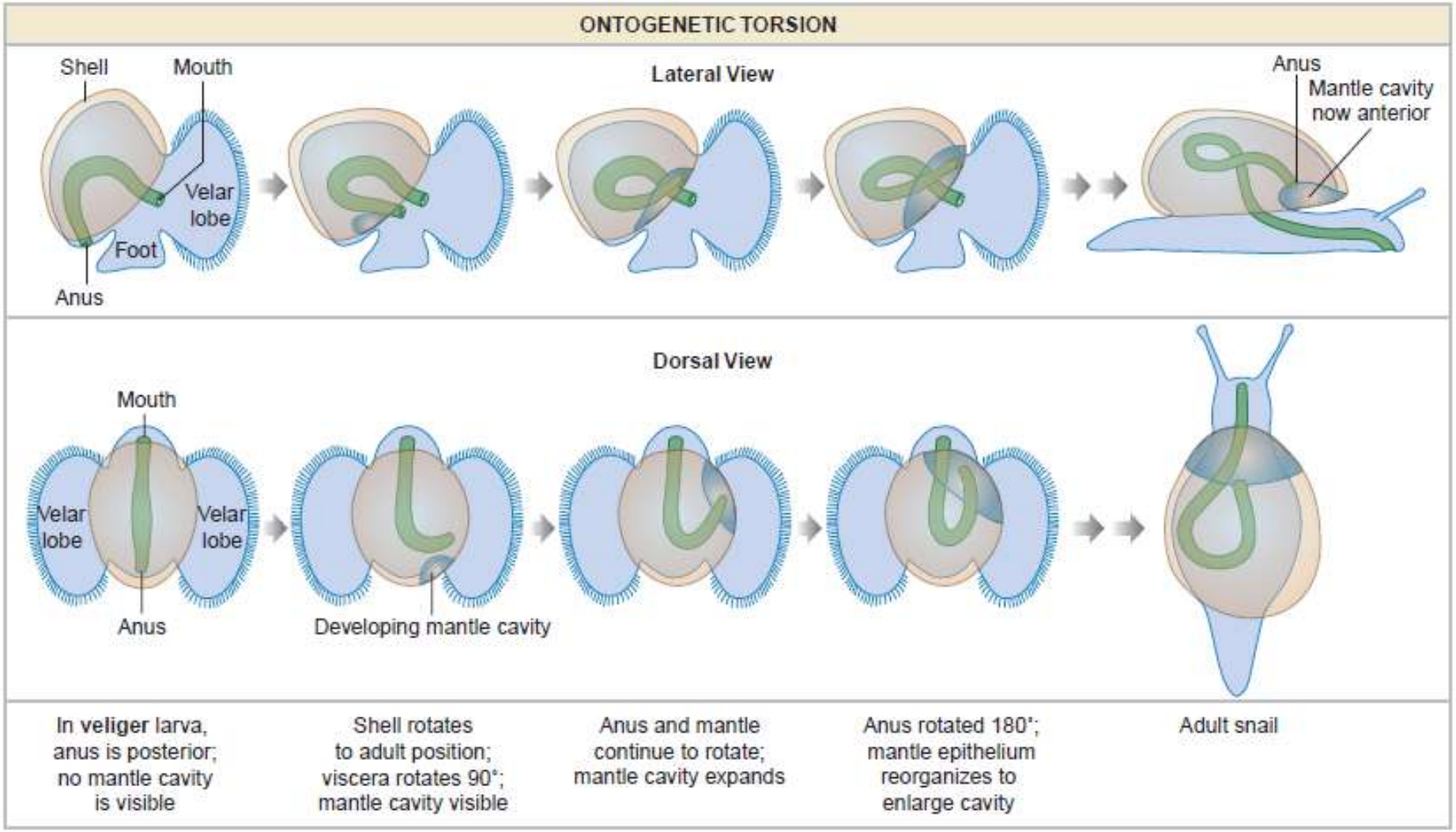


Figure 16.14

Ontogenetic torsion in a gastropod veliger larva.

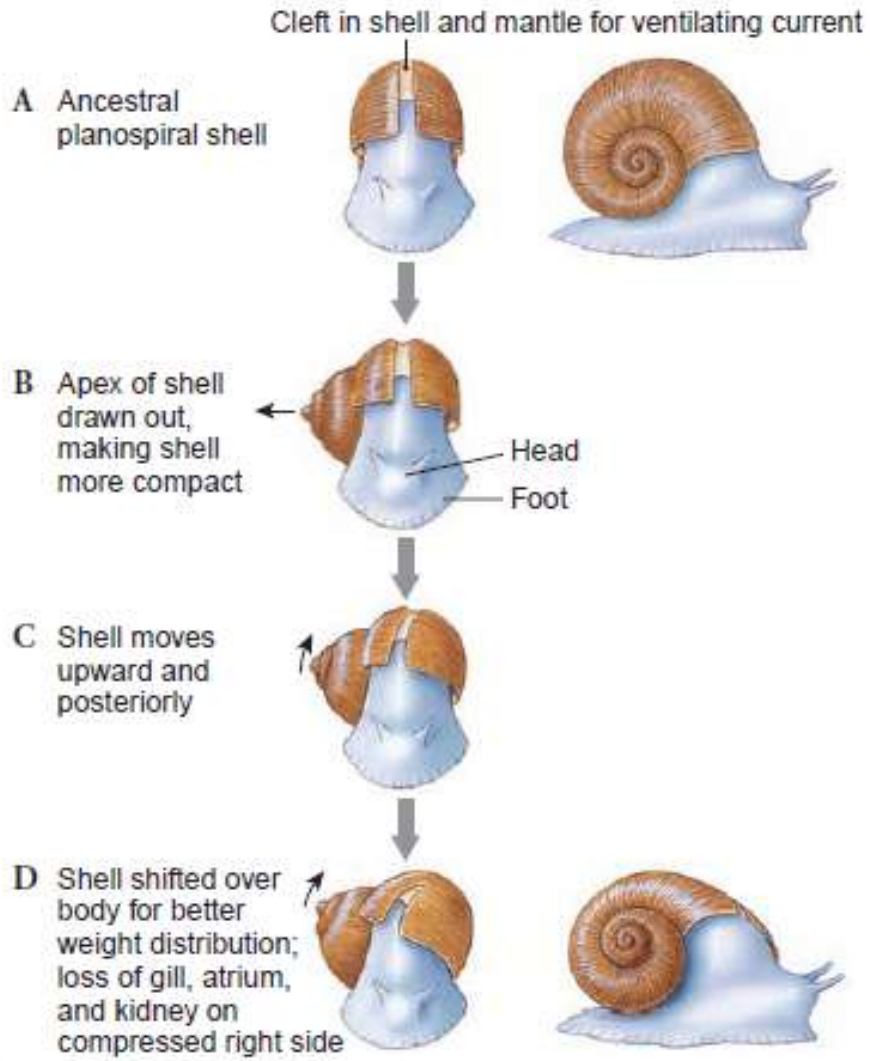
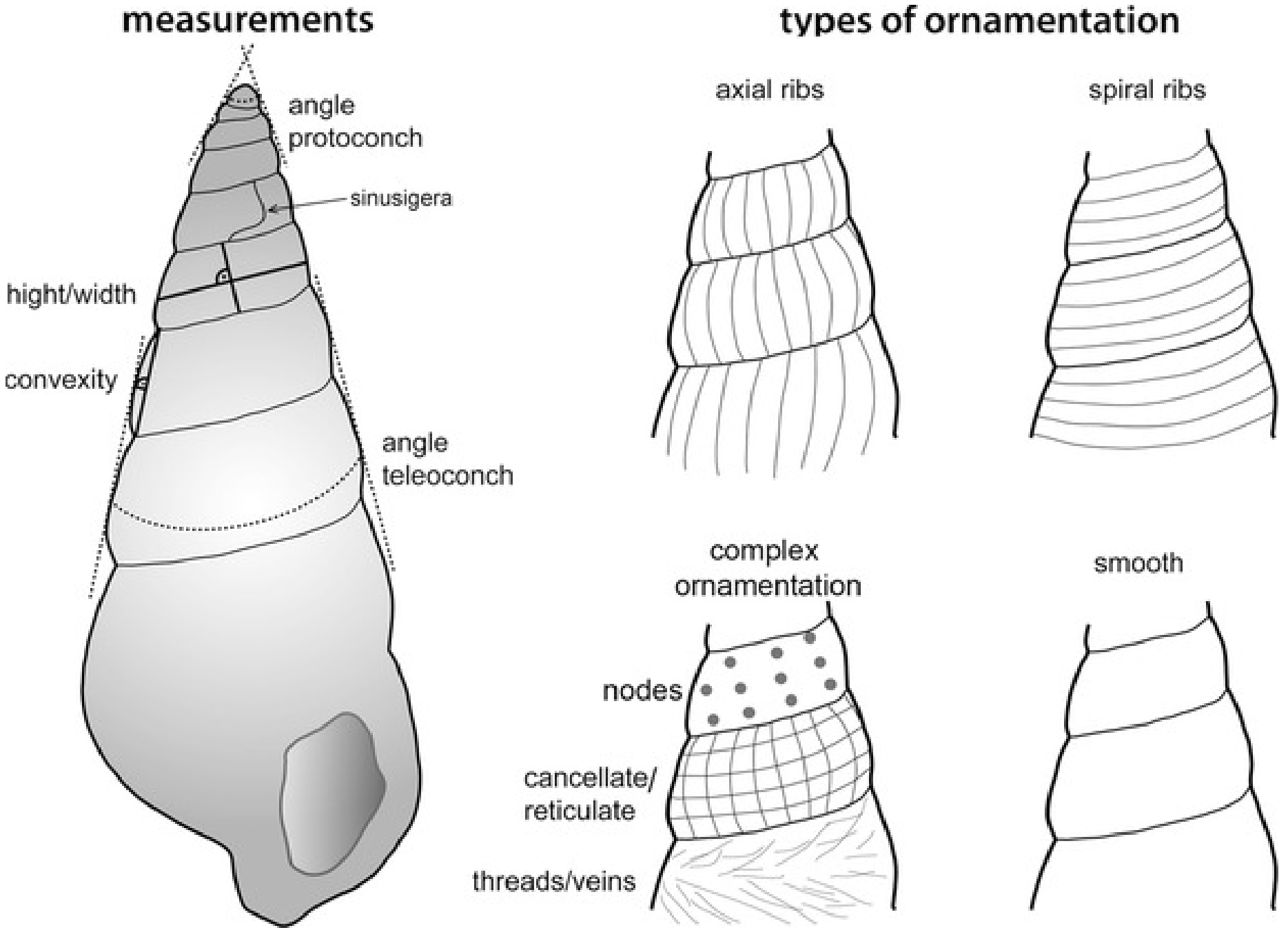


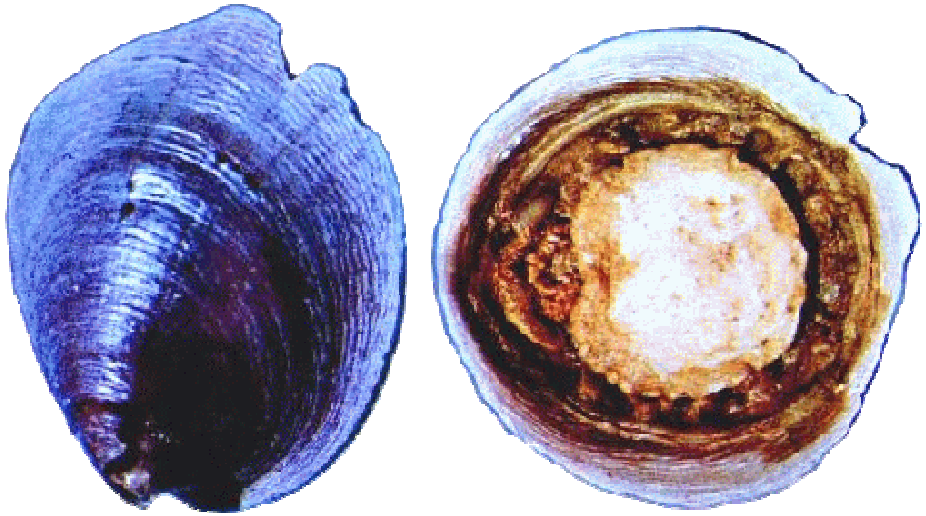
Figure 16.15

Evolution of shell in gastropods. **A,** Earliest coiled shells were planospiral, each whorl lying completely outside the preceding whorl. **B,** Better compactness was achieved by snails in which each whorl lay partially to the side of the preceding whorl. **C** and **D,** Better weight distribution resulted when shell was moved upward and posteriorly. However, some modern forms have reevolved the planospiral form.


measurements
angle
protoconch
sinusigera
hight/width
convexity
angle
teleoconch
types of ornamentation
axial ribs
spiral ribs
complex
ornamentation
nodes
cancellate/
reticulate
threads/veins
smooth

CLASS MONOPLACOPHORA

- Single shell resembling a flattened cone or cap.
- Soft part anatomy shows pseudo-segmented arrangement of gills, muscles, and other organs. Suggests that the primitive mollusc was a segmented animal. Segmentation was lost secondarily.
- Monoplacophorans are regarded as ancestral to bivalves, gastropods, and cephalopods.



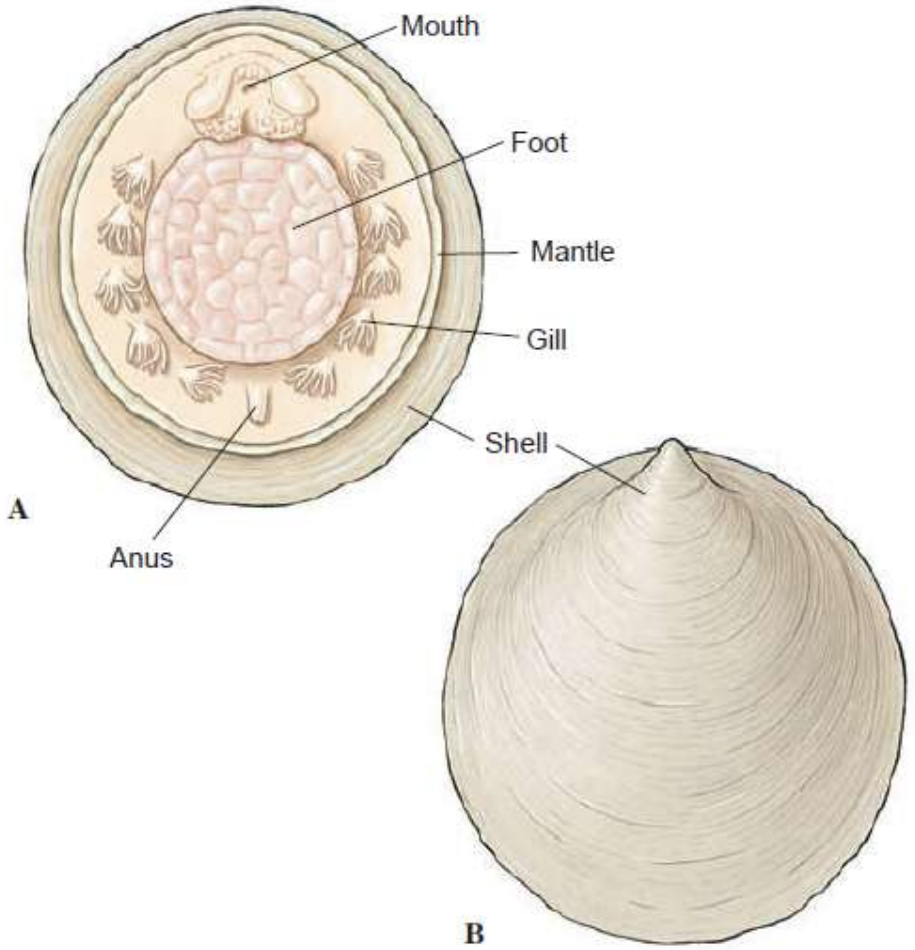


Figure 16.9

Neopilina, class Monoplacophora. Living specimens range from 3 mm to about 3 cm in length. **A**, Ventral view. **B**, Dorsal view.

CLASS POLYPLACOPHORA

– poly = many, plac = plate, phora = carry, ie: bearer of many plates

- Examples – Chitons
  - Characteristics
    - 8 piece segmented shell, bilateral symmetry
    - inhabit rocky shorelines and shallow ocean bottoms
    - rolls itself in a ball for protection
    - will create a vacuum for protection, to hold chiton in place
    - move in same fashion as snails, foot secretes small amount of mucous

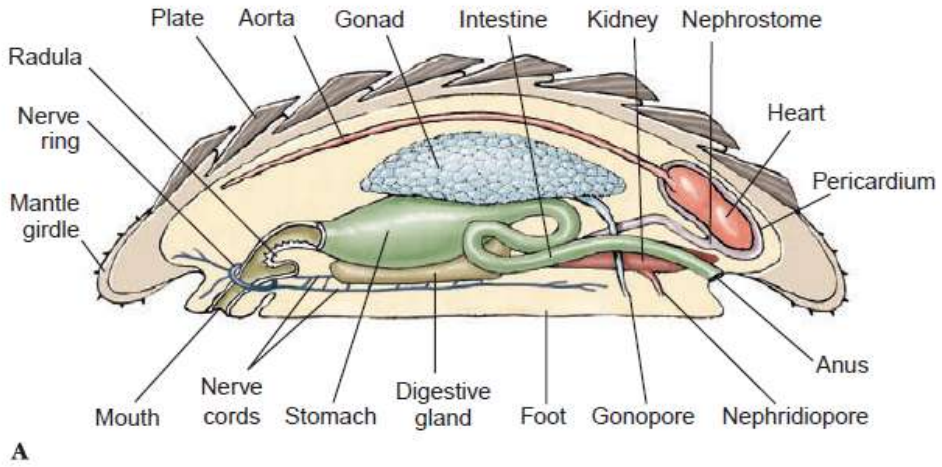
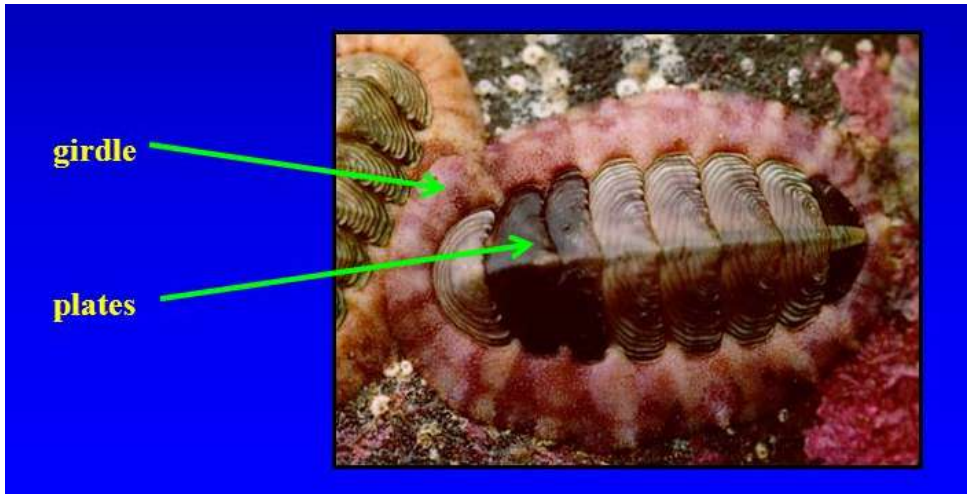
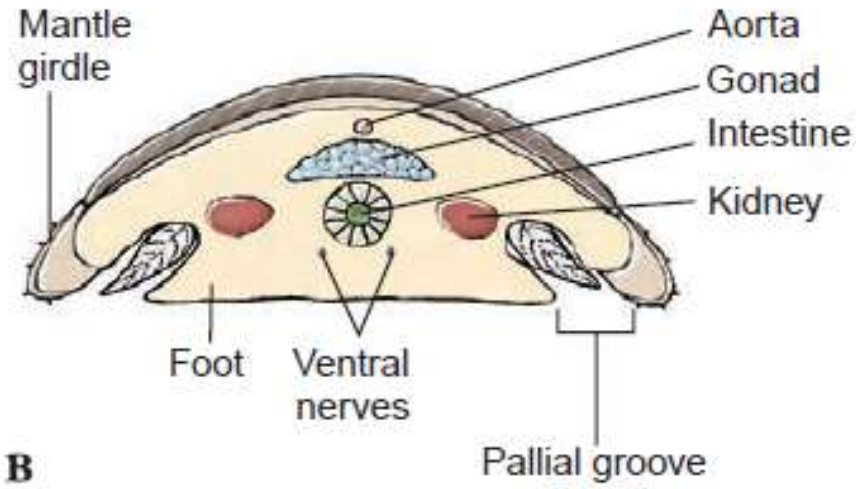


Figure 16.10
Anatomy of a chiton (class Polyplacophora). **A**, Longitudinal section. **B**, Transverse section. **C**, External ventral view.




Chiton – Dorsal Surface


Chiton – Ventral Surface


Mantle girdle
Aorta
Gonad
Intestine
Kidney
Foot
Ventral nerves
Pallial groove with gills
B

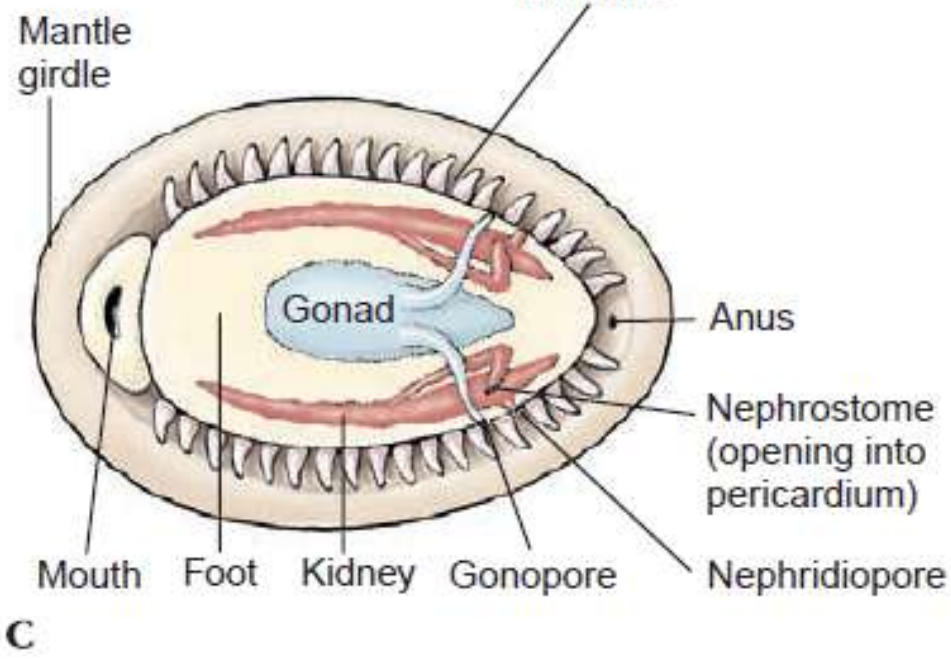
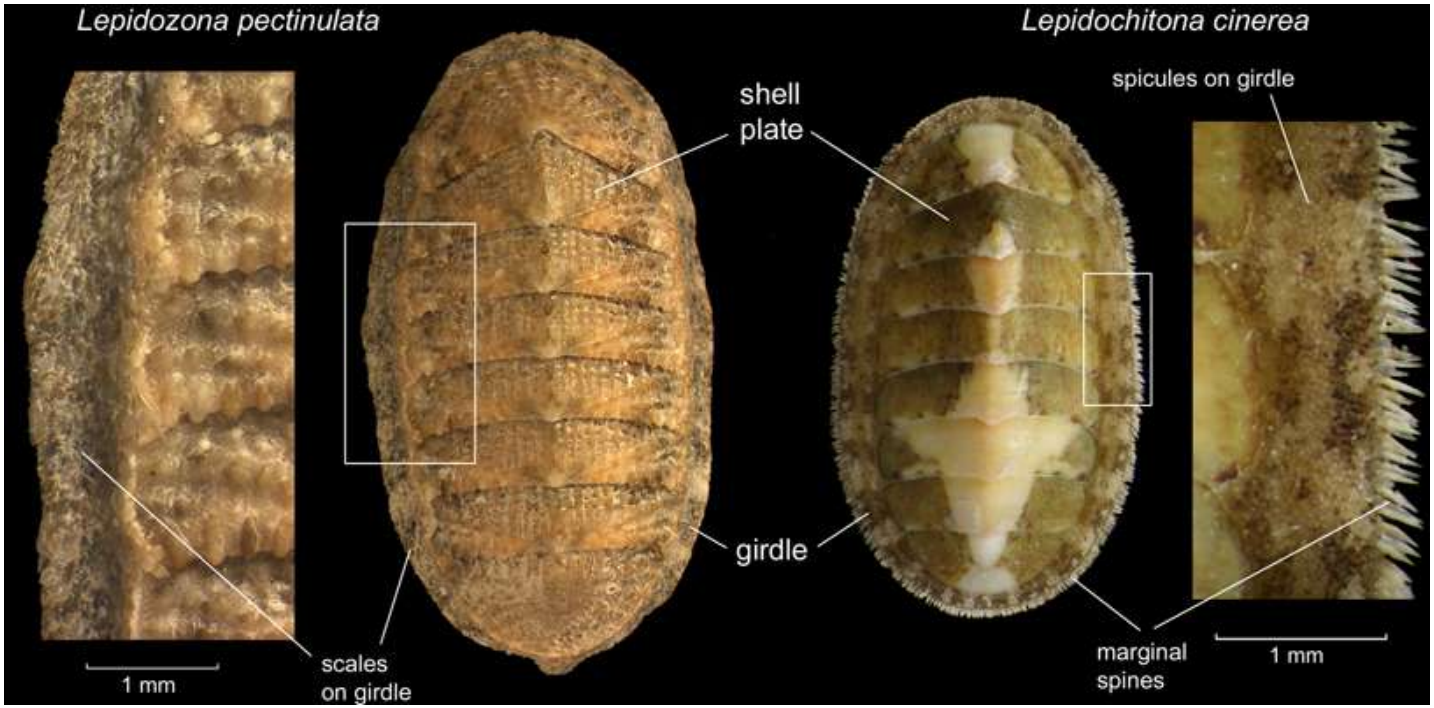
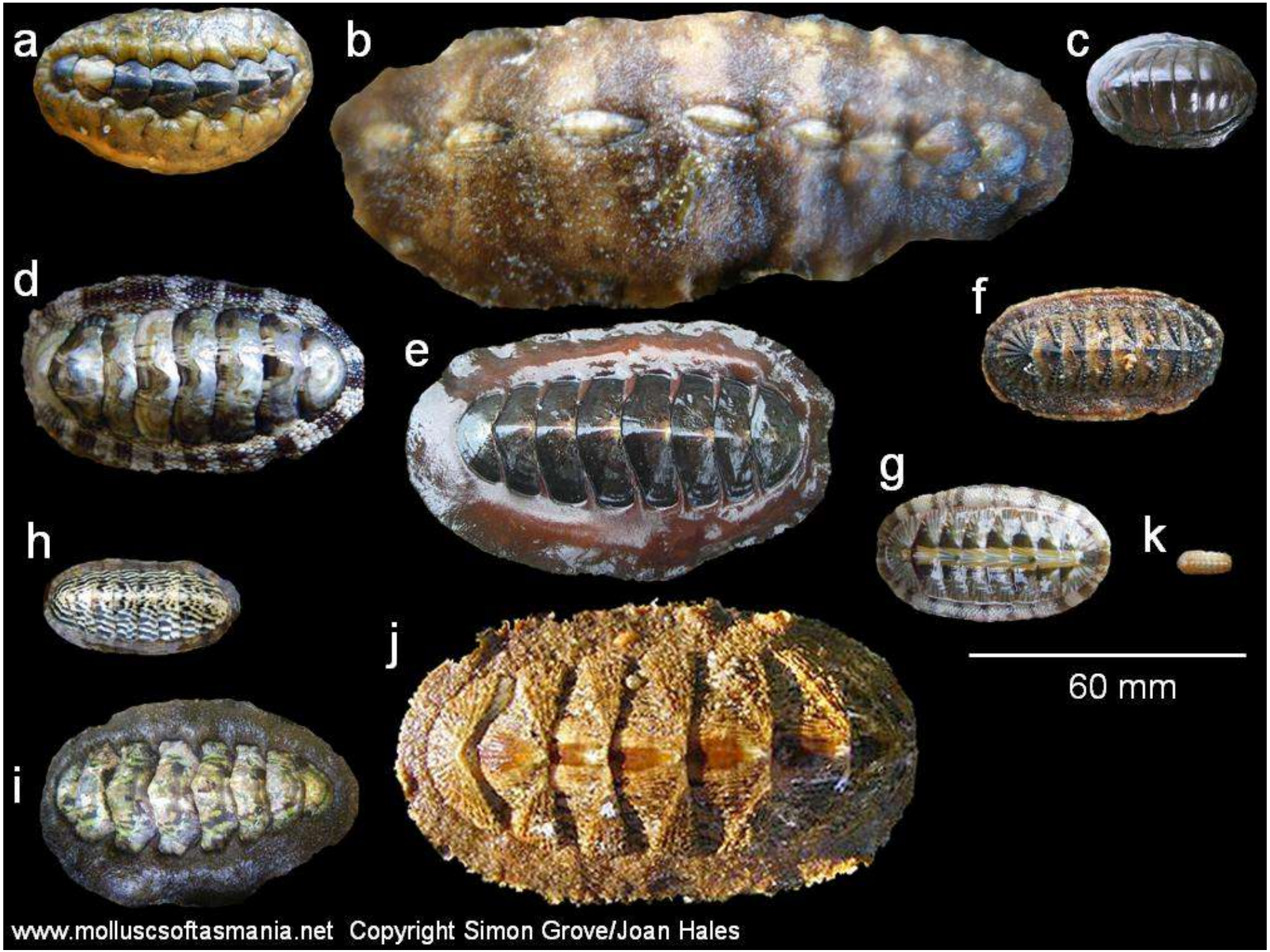

Mantle girdle
Gonad
Anus
Nephrostome (opening into pericardium)
Mouth
Foot
Kidney
Gonopore
Nephridiopore
C

Figure 16.11
Mossy chiton, *Mopalia muscosa*. The upper surface of the mantle, or "girdle," is covered with hairs and bristles, an adaptation for defense.




a
b
c
d
e
f
g
h
k
j
i
60 mm
www.molluscsoftasmania.net Copyright Simon Grove/Joan Hales

CLASS SCAPOPHODA

- **Tusk shells or tooth shells**
- Marine; benthic; sedentary
- Slender body covered with a mantle and a tubular shell open at both ends
- Foot protrudes through larger end of shell – used to burrow into mud or sand
- Small end of shell exposed
- Gills absent, gaseous exchange via mantel
- Long tentacles extend from the head region
  - Captacula- feeding
- Dioecious; trochophore larvae (ancestral)

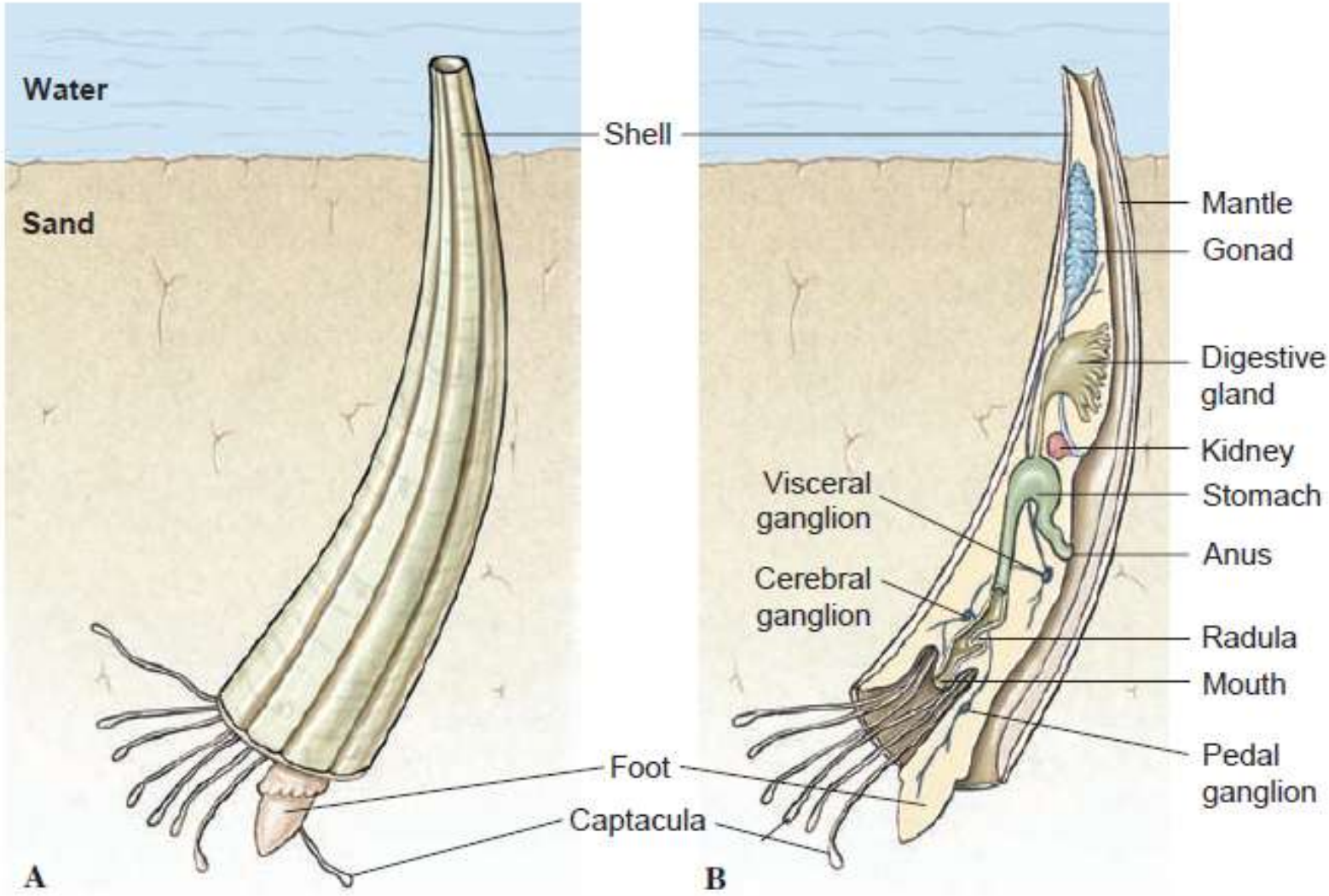


Figure 16.12

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.*


Dentalium congoensis
Senegal, Dakar
NMR 43064. Actual size 15 mm


Dentalium elephantinum
Taiwan, Penghu, Taiwan Strait
NMR 50995. Actual size 85 mm

CLASS SOLENOGASTRES

- Wormlike
- Shelless with scales or spicules
- 250 Marine species
- Reduced head, No radula, No gills
- No nephridia
- Monoecious
- Bottom dwelling without burrows
- Feed on cnidarians

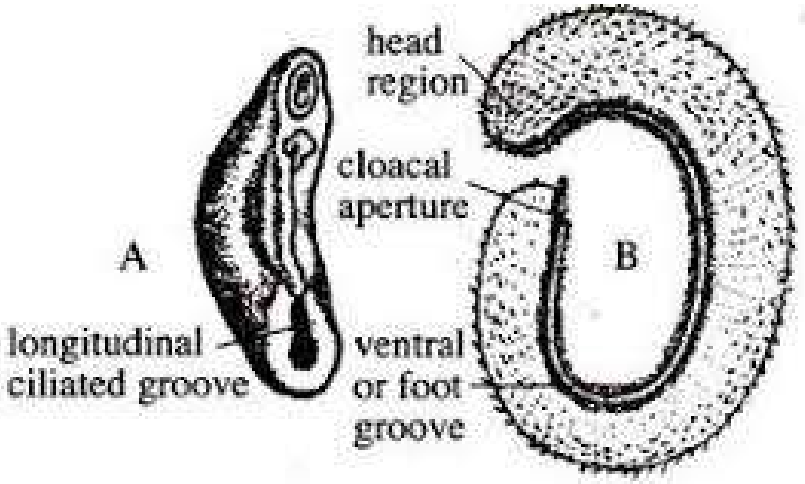
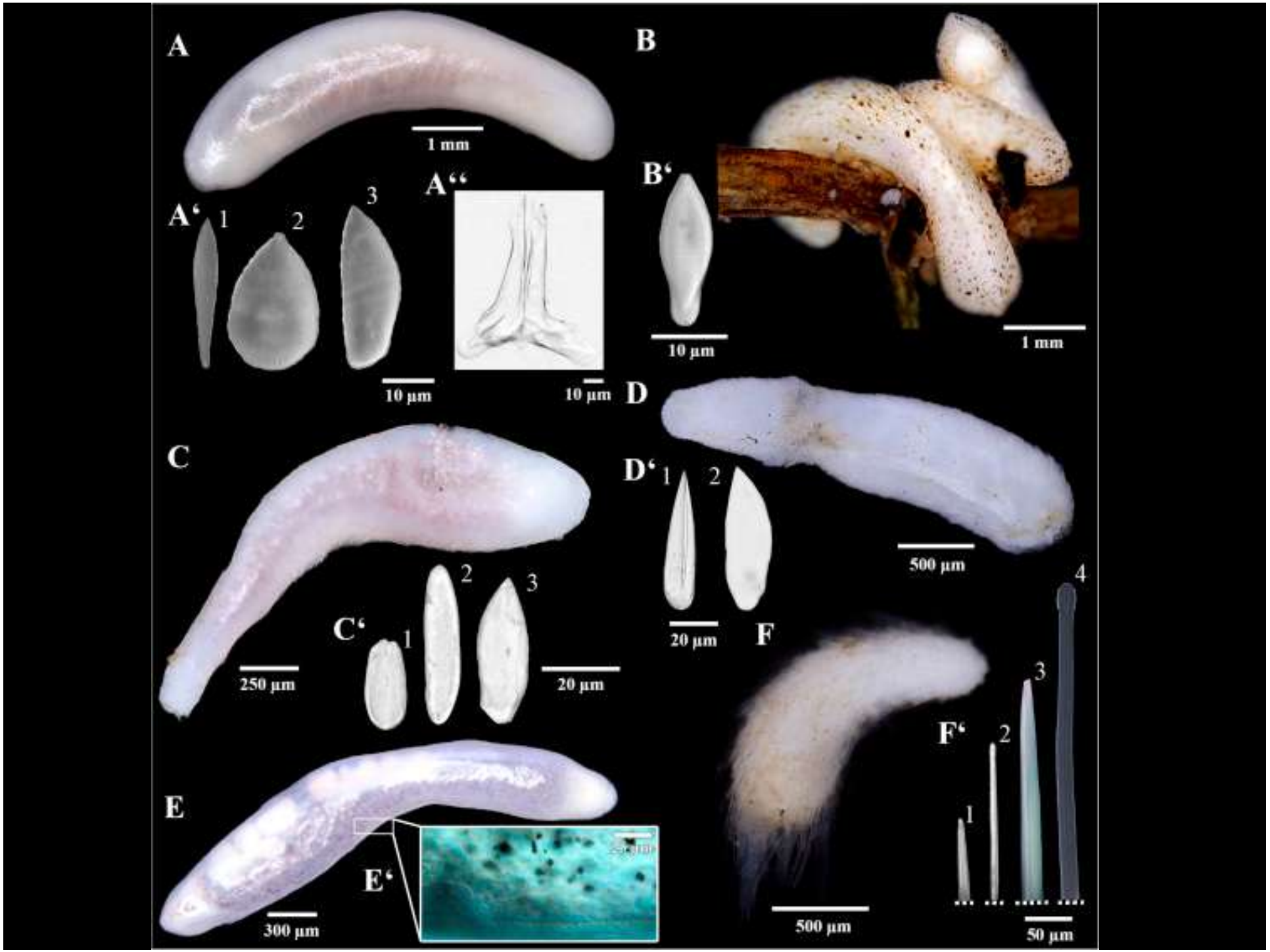


Fig. 1.72 : A. *Neomenia*, B. *Proneomenia*.


A
1 mm
A‘
1
2
3
10 µm
A‘‘
10 µm
B
B‘
10 µm
1 mm
C
250 µm
C‘
1
2
3
20 µm
D
D‘
1
2
20 µm
500 µm
F
F‘
1
2
3
4
50 µm
500 µm
E
E‘
300 µm

Class: Caudofoveata	Class: Solenogastres
Wormlike	Wormlike
Marine	Marine
Reduced head	Reduced head
Have no shell but covered with calcareous scales or spicules	Have no shell but covered with calcareous scales or spicules
Mostly burrowers	Mostly free-living on bottom sediments
Sexes are separate	Hermaphroditic (monoecious)
Radula present but may be reduced	Usually radula is absent
Gills present	Gills absent, secondary respiratory structures may be present

“ Didalam Raga yang Keras Ada Hati yang Lunak, Dont Judge A Book by Its Cover“

TUGAS

Peranan Moluska di Kehidupan Manusia