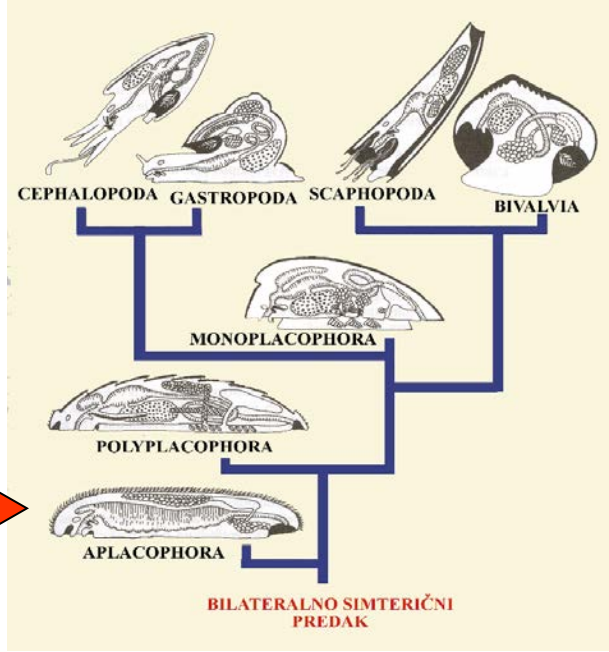
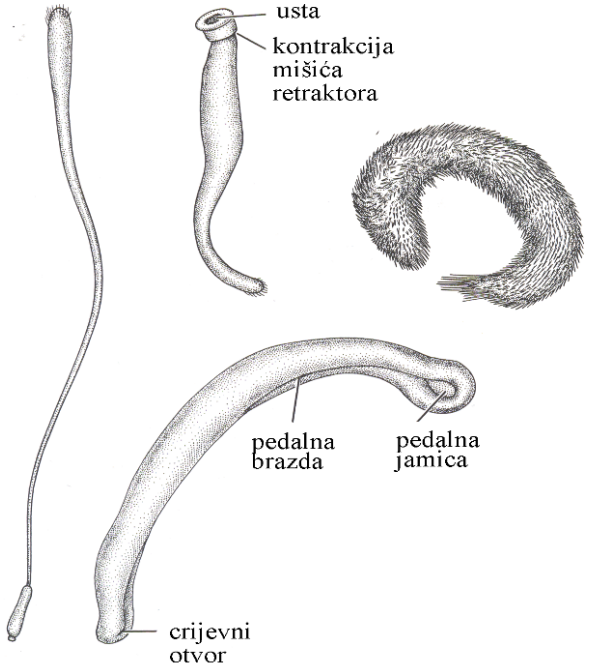
Aplacophora - bezljušturaši



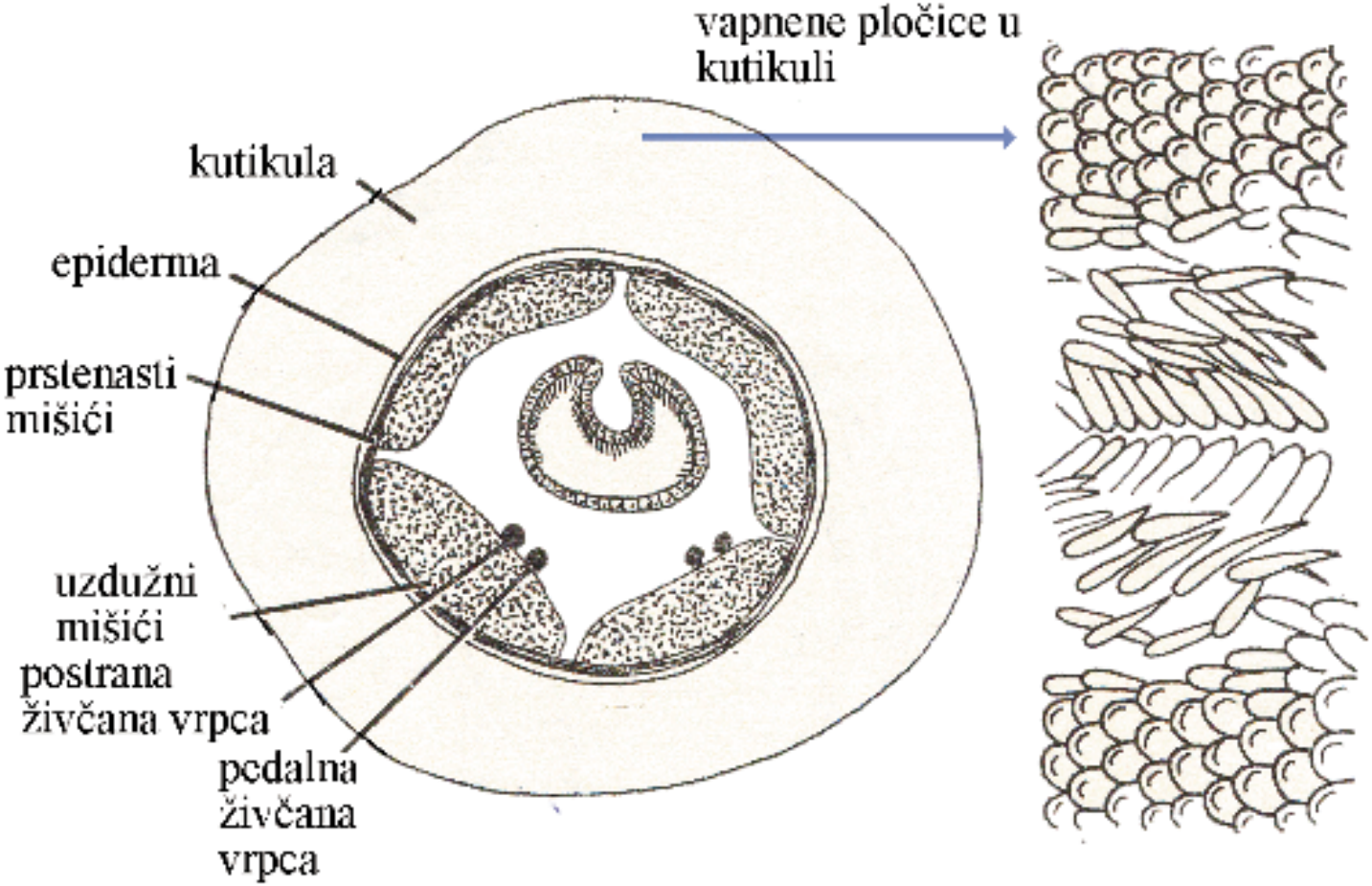


- crvolikog oblika, ukopavaju se u pijesak
- bez ljušture; epiderm luči kutikulu s vapnenačkim iglicama ili pločicama.
- glava i stopalo reducirani ili nedostaju
- plaštana šupljina rudimentarna, nemaju oči, statocist, kristalni držak u želucu, metanefridije
- isključivo morski, bentoski
- radula i oblik ktenidija ih povezuju s mekušcima
- oko 350 vrsta



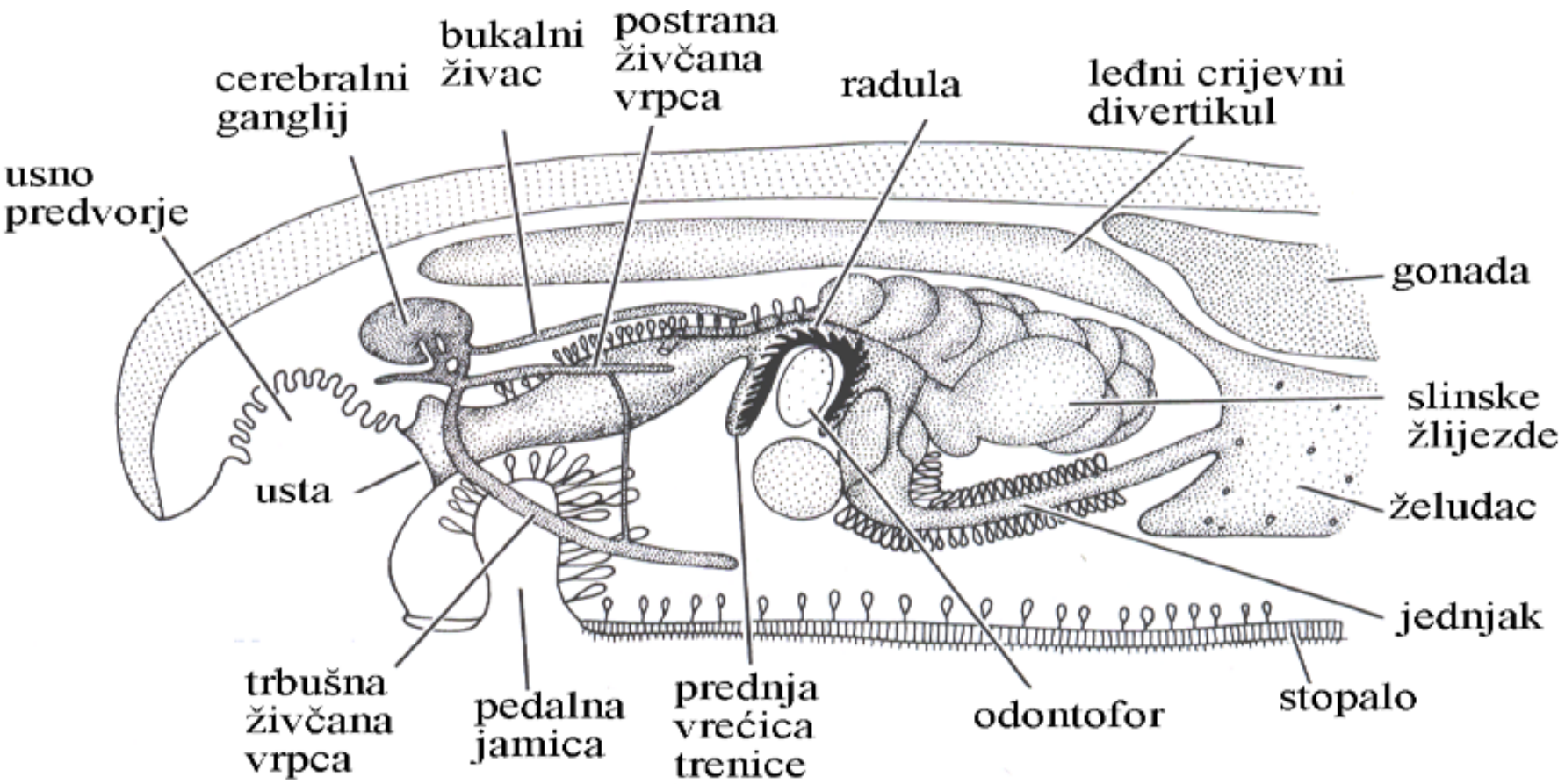
Aplacophora (bezljušturaši)

Unutrašnja građa

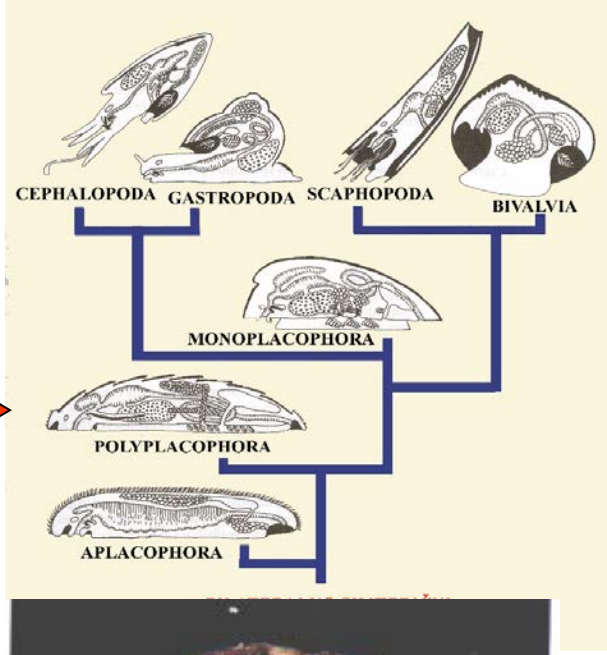


Aplacophora (bezljušturaši)

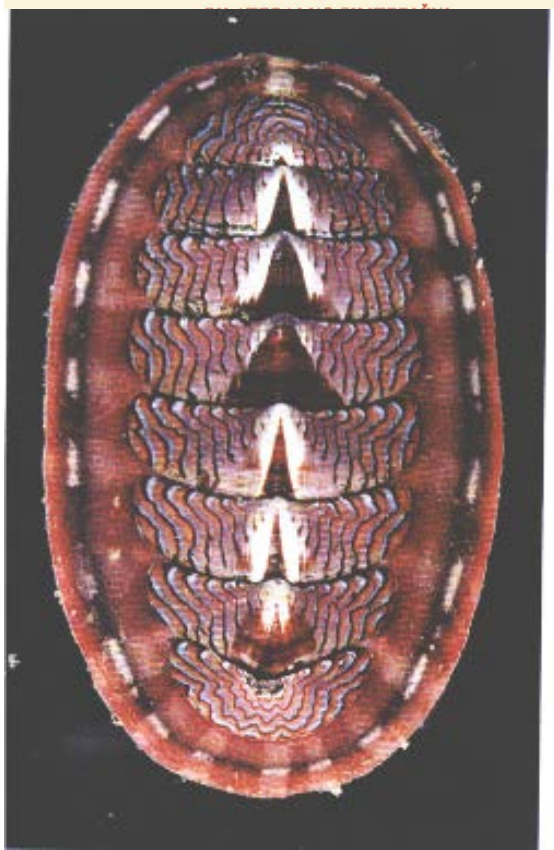
Unutrašnja građa



Polyplacophora - mnogoljušturaši

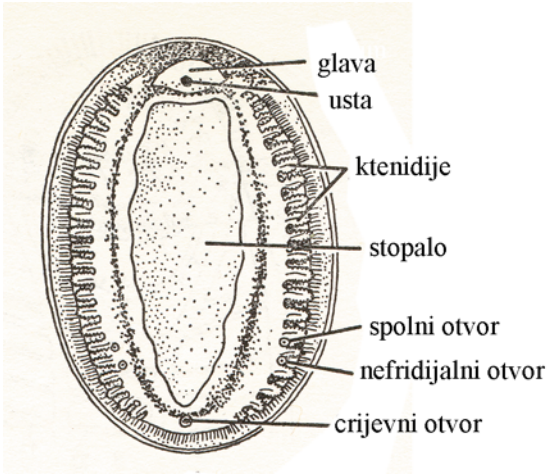


- ljuštura sastavljena od **8 vapnenačkih pločica** sa sitnim trnićima od vapnenca ili hitina:
  - 1 cefalička pločica
  - 6 medijanih pločica
  - 1 analna pločica
- ljuštura od četiri sloja:
  - periostrakum (konhiolin)
  - tegumentum (konhiolin + $CaCO_3$)
  - artikulamentum ($CaCO_3$)
  - hipostrakum ($CaCO_3$)

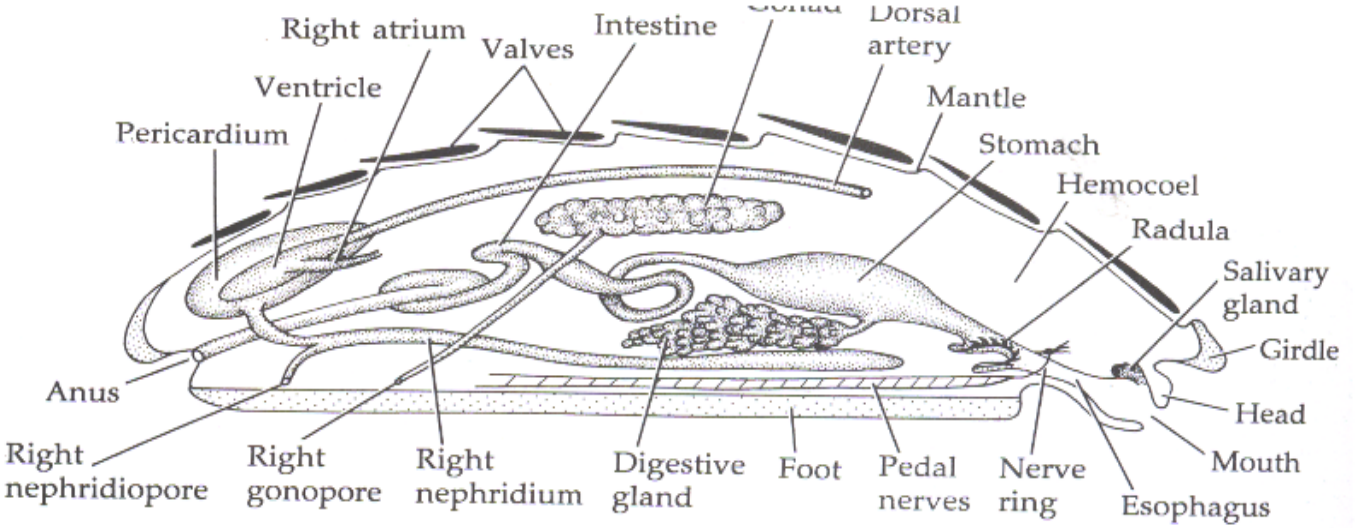


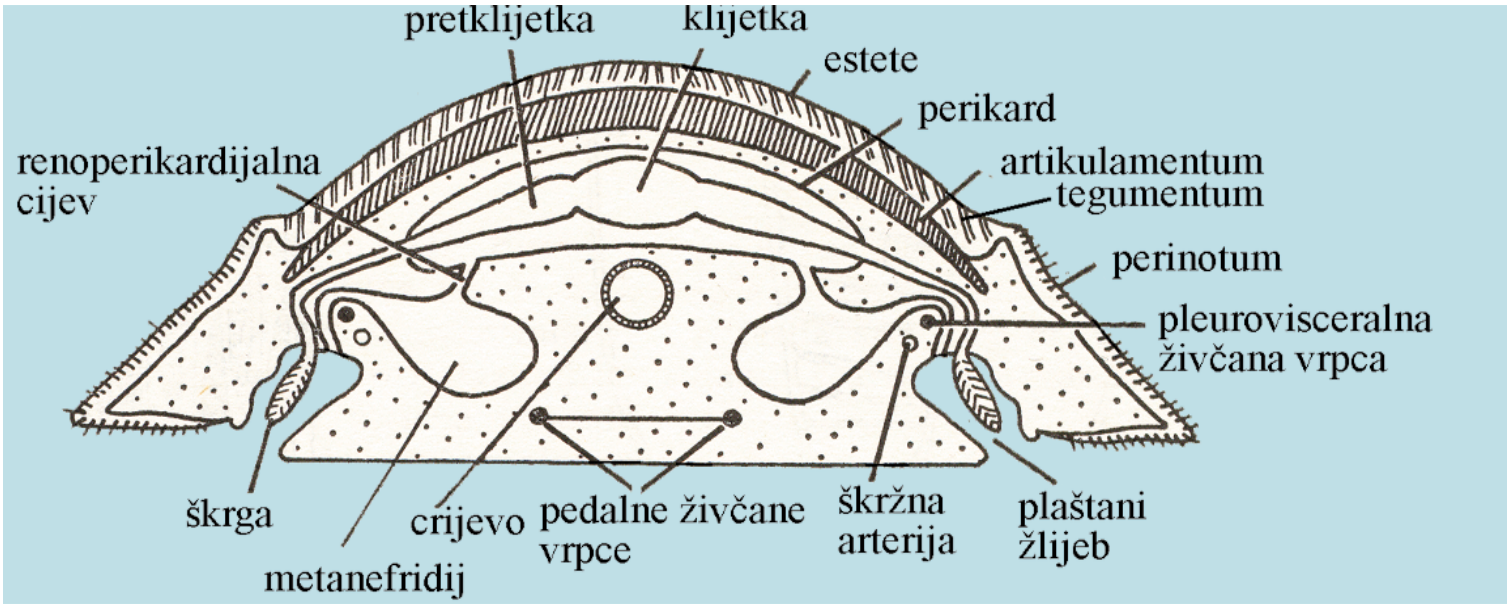
Polyplacophora (jednoljušturaši)

- stopalo okružuje plaštani žlijeb u koem se nalazi od 6 do 80 pari ktenidija;
- na prednjem dijelu je glava s usnim otvorom;
- na stražnjem dijelu je crijevni otvor



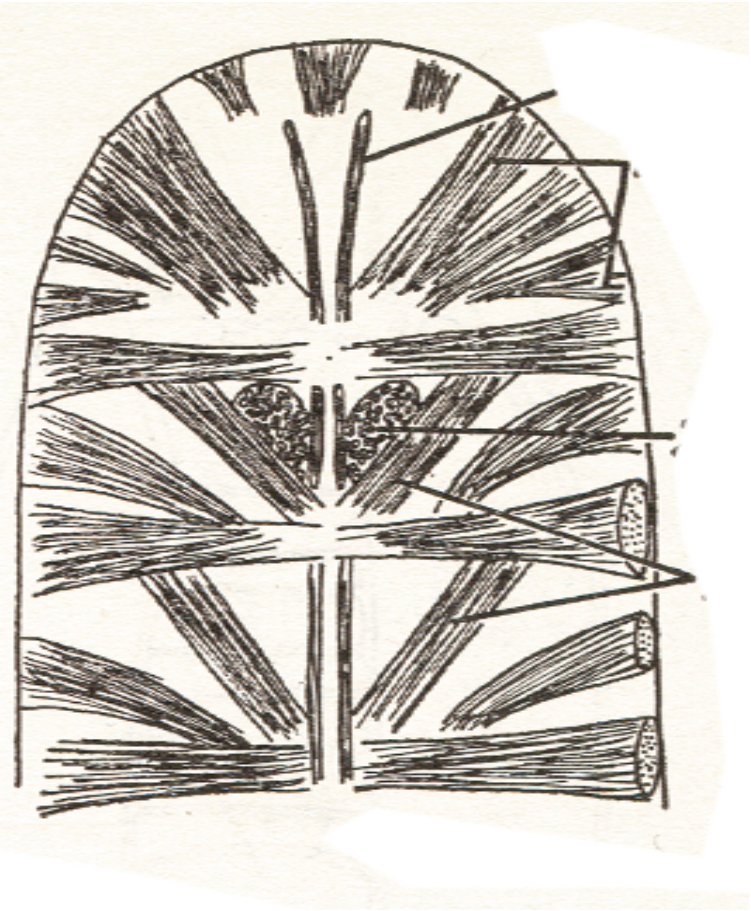
Polyplacophora (mnogoljušturaši)
Unutrašnja građa



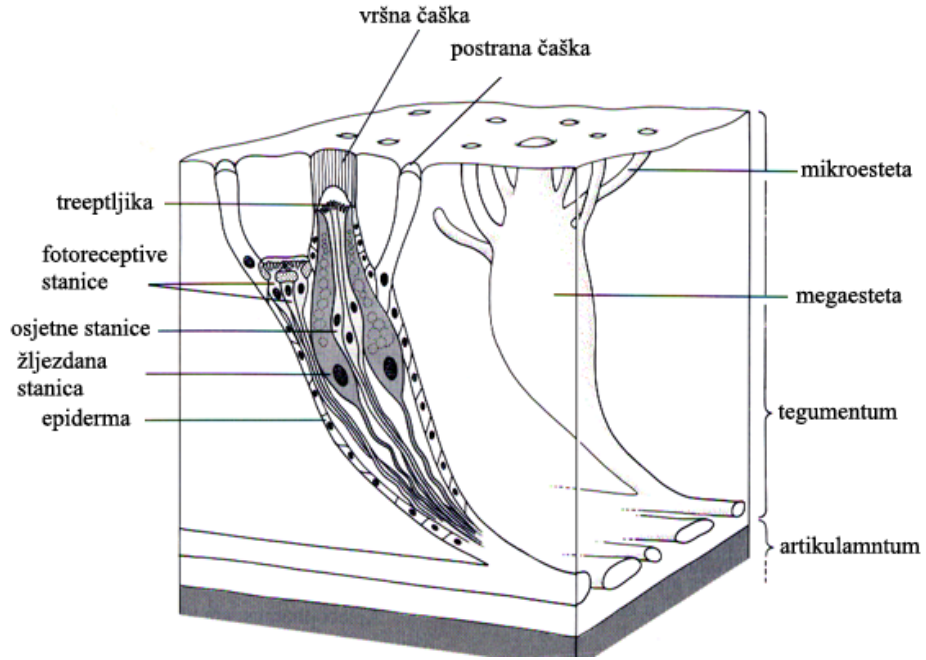


Polyplacophora
Unutrašnja građa i funkcije

Mišićni sustav



Položaj i građa estete



Polyplacophora (mnogoljušturaši)

- isključivo **morski**
- većinom na čvrstom dnu u području plime i oseke
- oko 800 vrsta
- najveća vrsta duga 40 cm

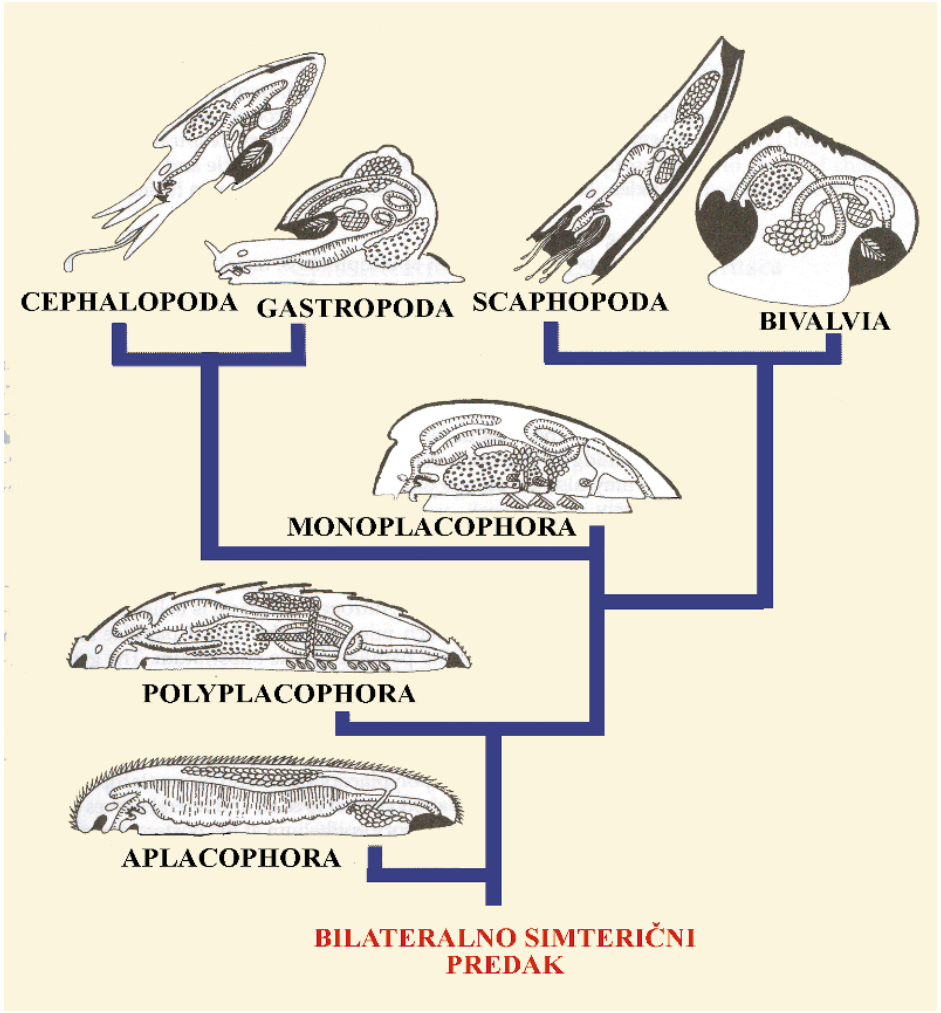




Chiton olivaceus

Nekolutićavi Coelomata

Mollusca (mekušci)



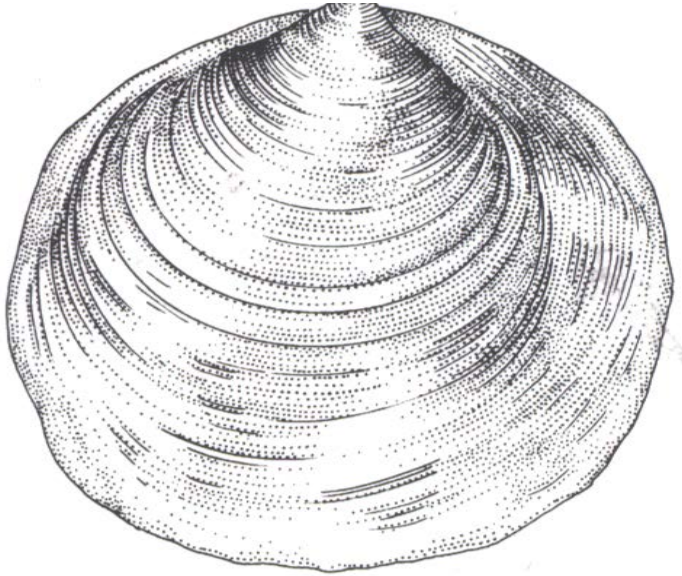
Monoplacophora - jednoljušturaši

- najbrojniji mekušci u kambriju, većina izumrla prije 400 milijuna g.
- prvi recentni oblik otkriven 1952. godine na ekspediciji danskog broda "Galathea" u Pacifiku (obale Kostarike) na 3.750 m dubine - *Neopilina galatheae* Lemche (liči na izumrli rod *Pilina*)
- do danas nađeno i opisano oko 25 vrsta; sve nađene u dubokim oceanskim jarcima



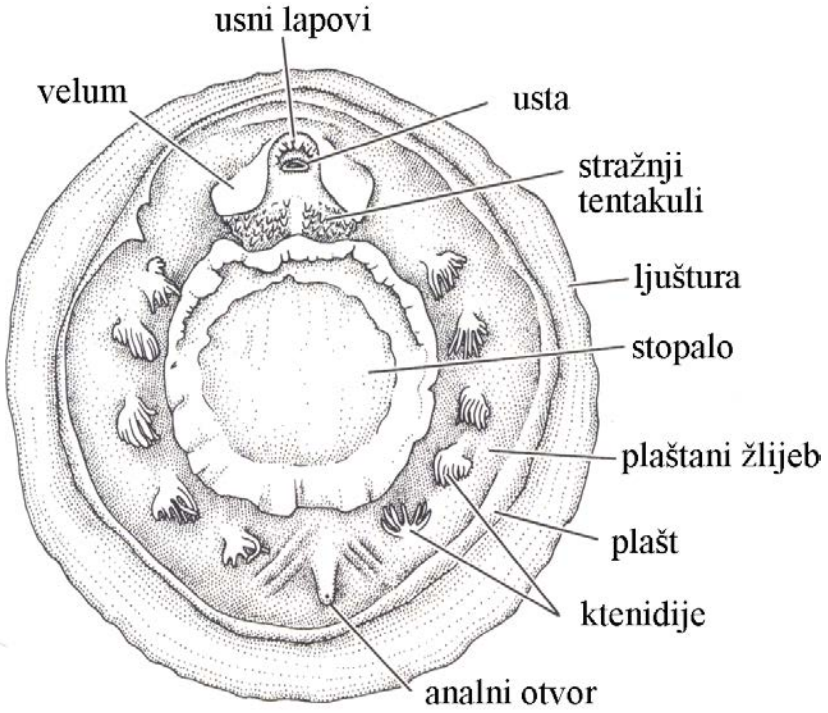


Monoplacophora (jednoljušturaši)



- **Vanjska građa**

jednodjelna ljuštura slična priljepku
(vel. 37 x 35 mm, visina 13 mm)





Monoplacophora (jednoljušturaši)

- **Unutrašnja građa**

Mišićna funkcija: **8 pari** retraktora;

Živčani sustav: tetraneuralan, nemaju oči

Plašt: okružuje stopalo;

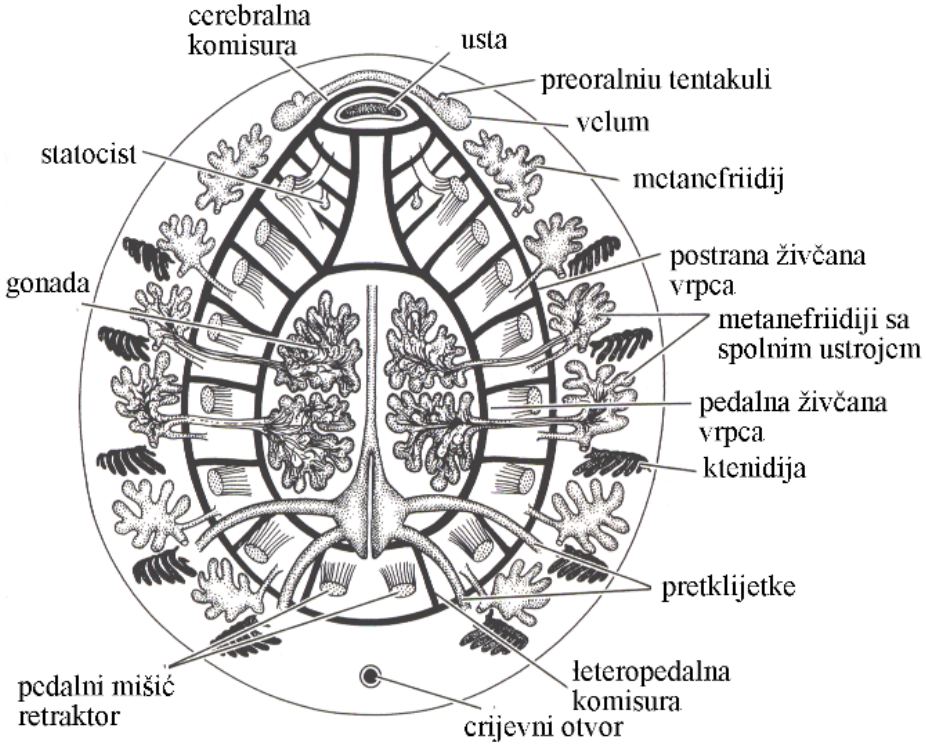
Disanje: **5 – 6 pari** ktenidija;

Spolni sustav: **2 para** gonada;

Izlučivanje i osmoregulacija: **6 pari** metanefridija;

Optjecanje: **2 para** pretklijetki; **1 par** klijetki, parni perikardijalni celom

Probavni sustav: u ustima radula, u želucu kristalni držak

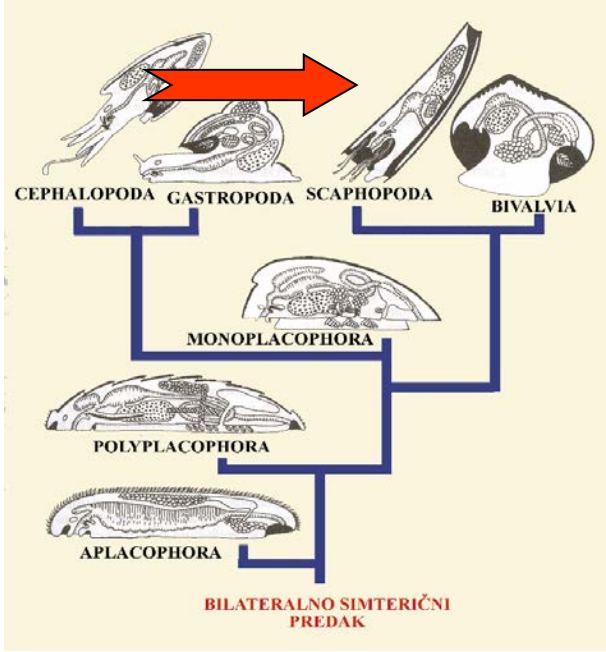




⇨ **polimerizacija** (umnoženi organi koji se ponavljaju uzduž tijela)
- nema uređenosti i stalnosti broja umnoženih dijelova (svaka struktura se javlja u drugom broju) - nije metamerizacija!

⇒ smatrano da su "missing link" prema kolutićavcima

Scaphopoda (koponošci)





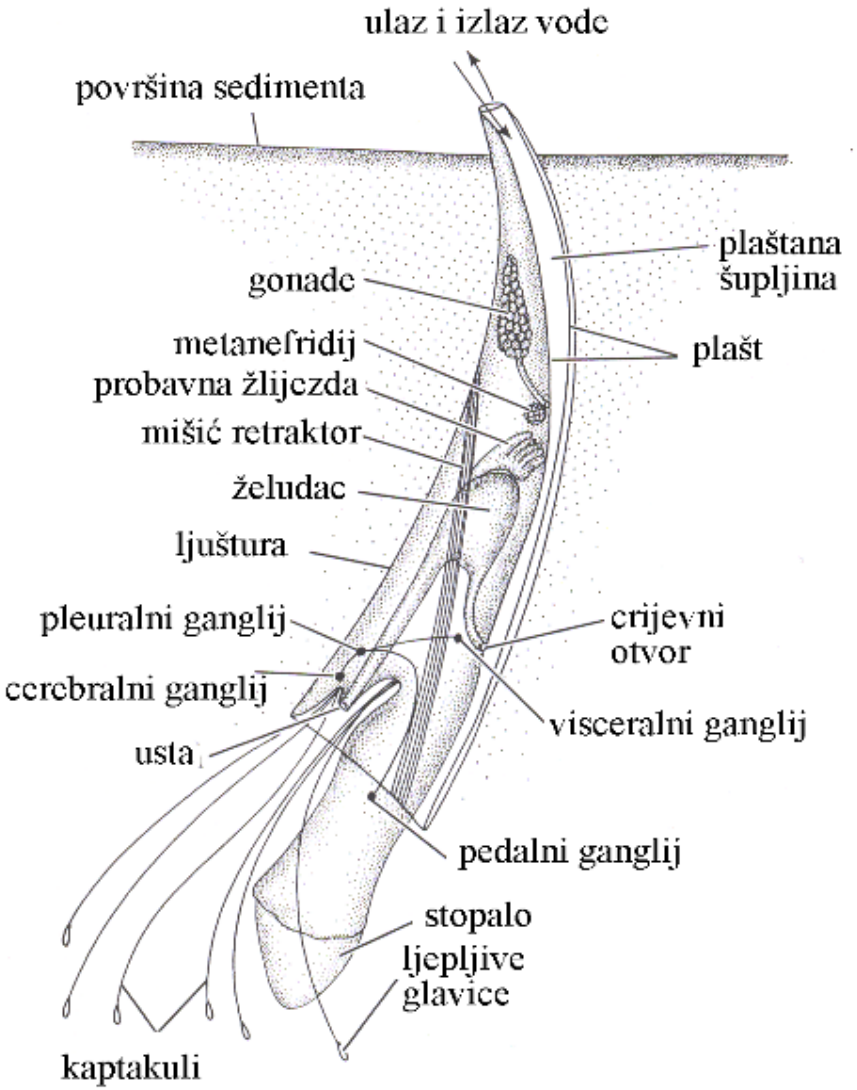
Vanjski izgled:

- bilaterlno simterični mekušci;
- kućica građena poput tuljca; izvedena od 2 ljušture koje se tijekom ličinačkog stadija na ventralnoj strani stope
- marinski oblici žive u sedimentu;
- poznato ih je oko 500 vrsta

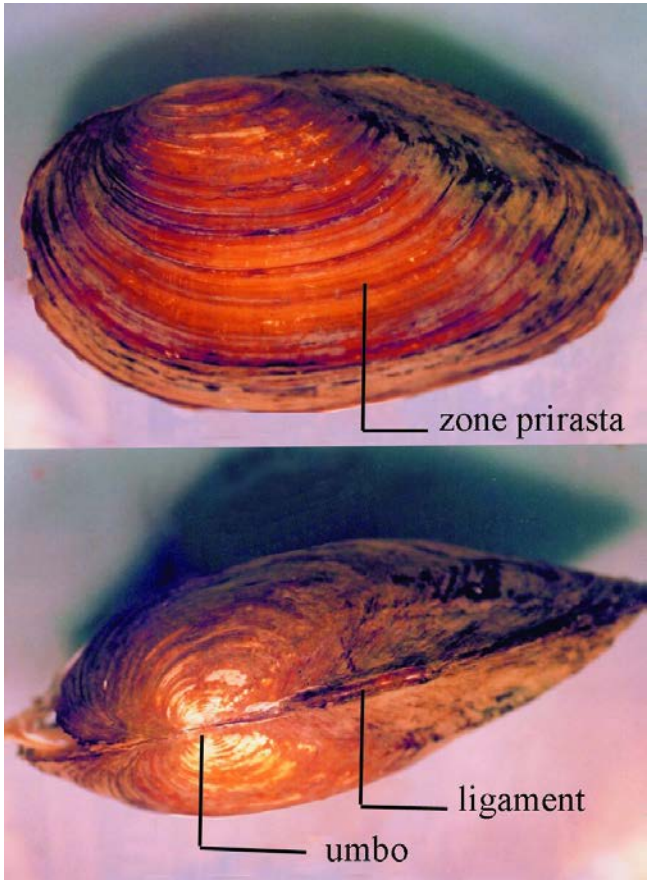
Scaphopoda (koponošci)

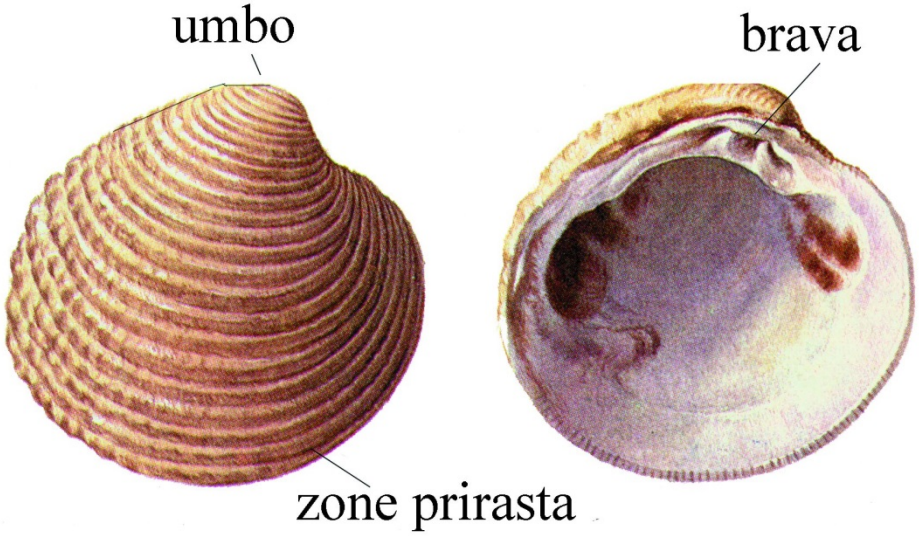
Unutrašnja građa i funkcije

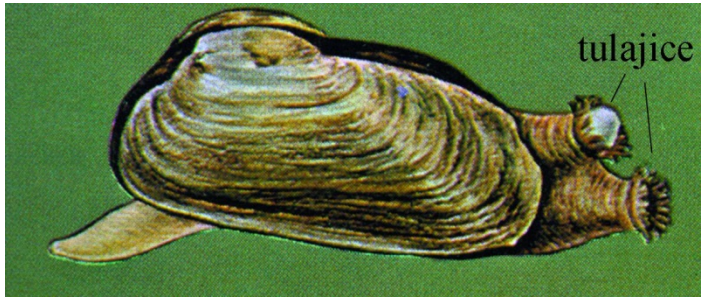
- plašt je srastao na trbušnoj strani čineći cijev;
- iznad cjevastog stopala je usni čunj s kaptakulima;
- živčevlje ima tetraneuralni raspored;
- probavnio sustav; usta s radulom – jednjak – želudac -crijevni otvor;
- škrge nemaju već dišu plaštem;
- nemaju srce, krv struju zatonima;
- razdvojena spola;



Razred: Bivalvia - školjkaši





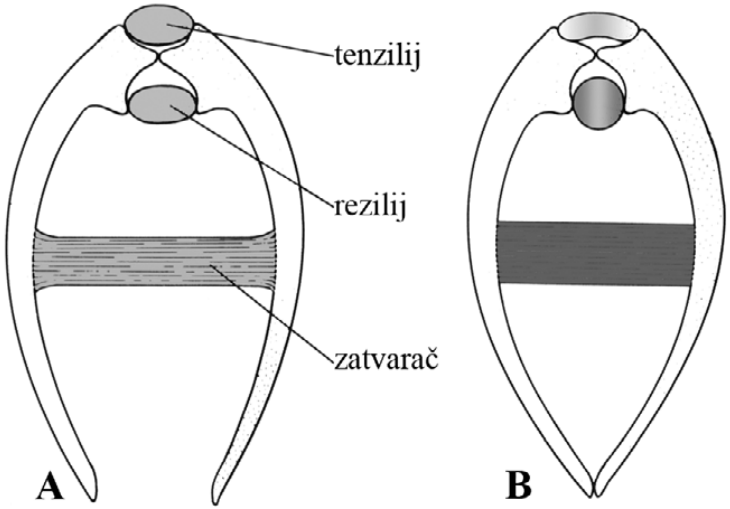


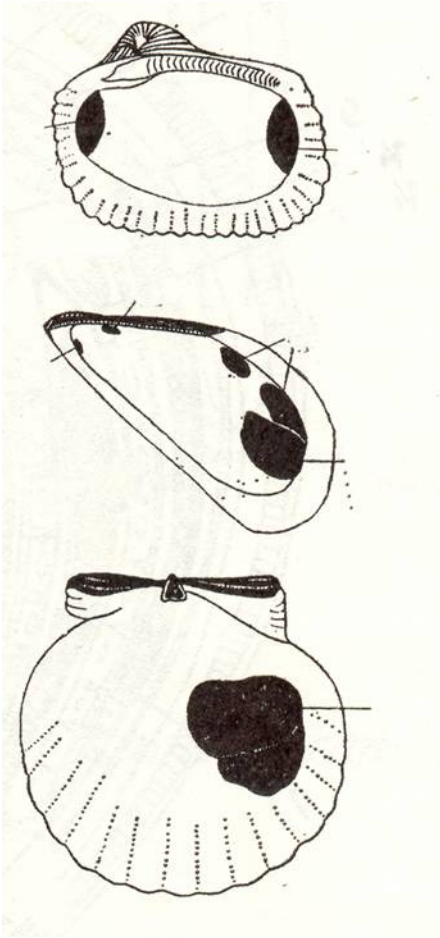


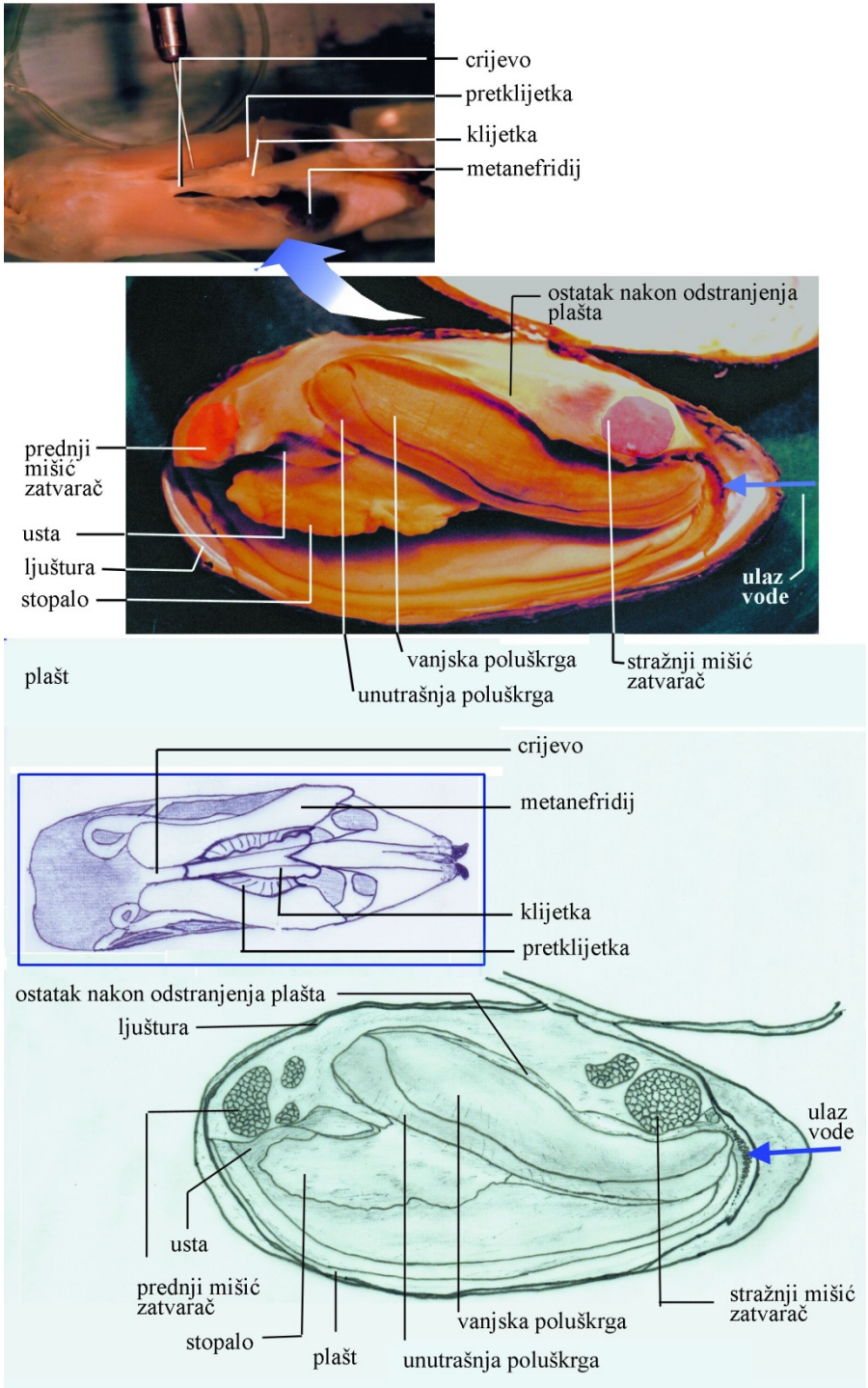
Simetrične ljušture



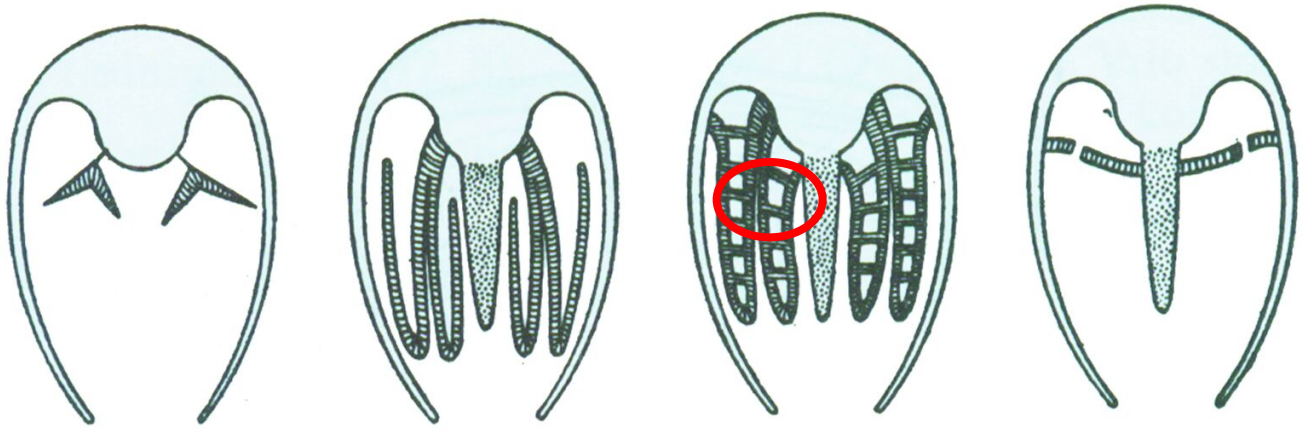
Asimetrične ljušture

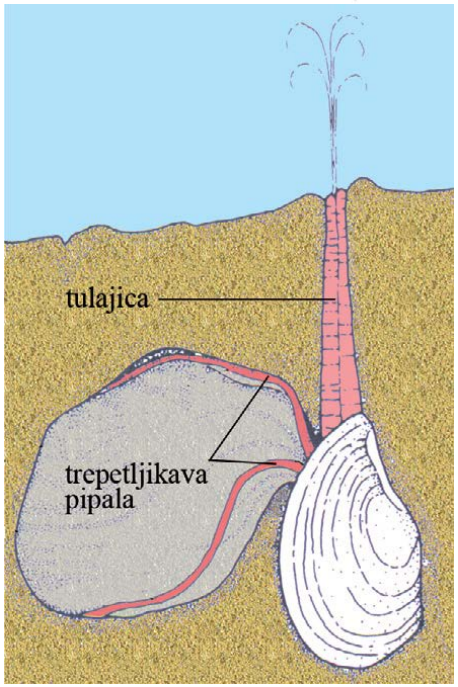


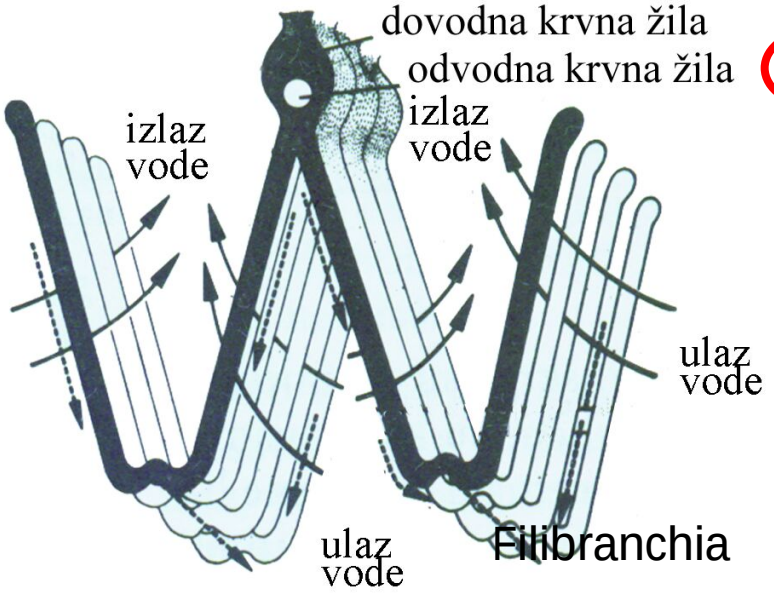



crijevo
pretklijetka
klijetka
metanefridij
ostatak nakon odstranjenja plašta
prednji mišić zatvarač
usta
ljuštura
stopalo
ulaz vode
plašt
vanjska poluškrga
unutrašnja poluškrga
stražnji mišić zatvarač
crijevo
metanefridij
klijetka
pretklijetka
ostatak nakon odstranjenja plašta
ljuštura
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prednji mišić zatvarač
stopalo
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vanjska poluškrga
unutrašnja poluškrga
stražnji mišić zatvarač

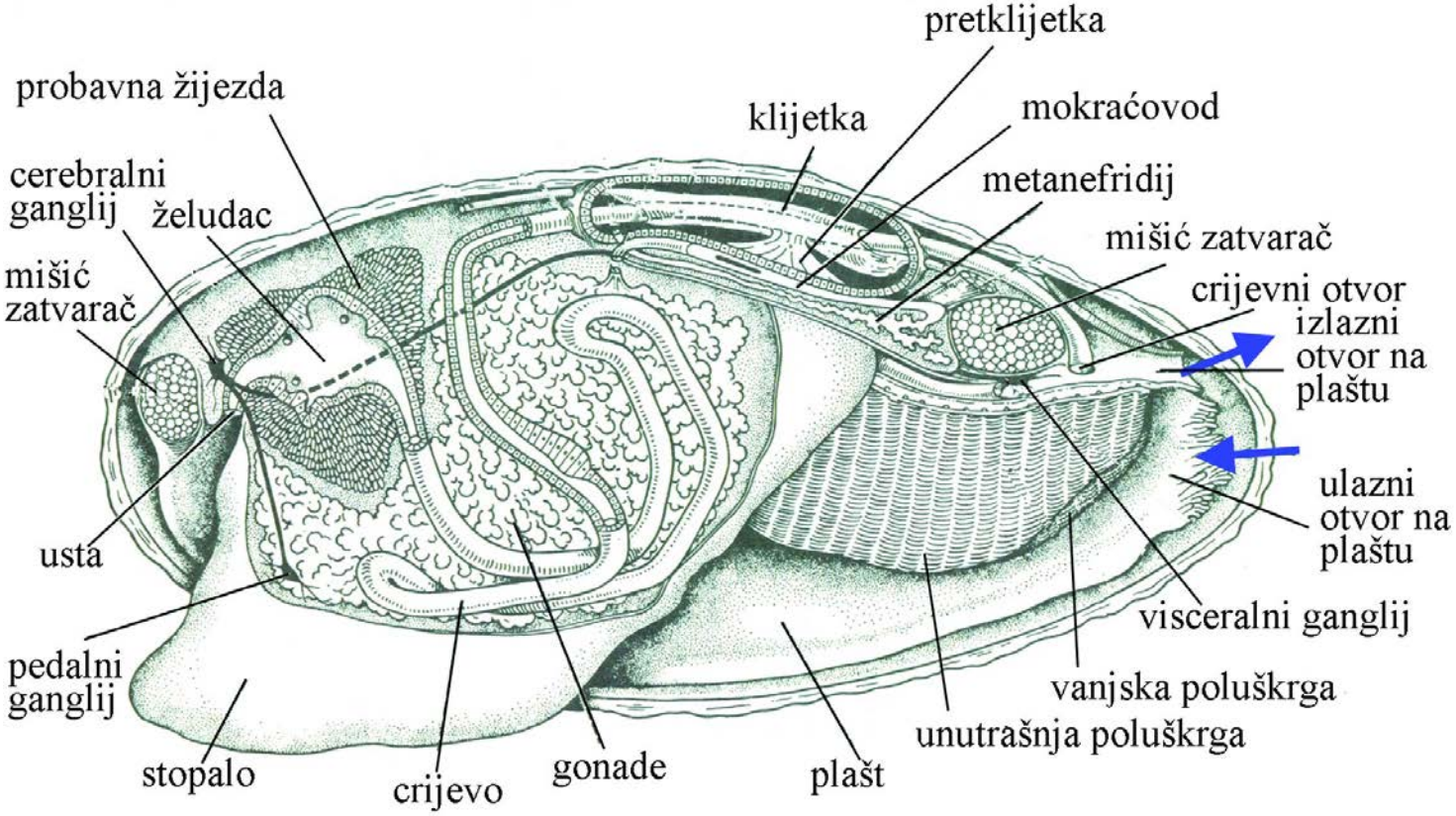
A



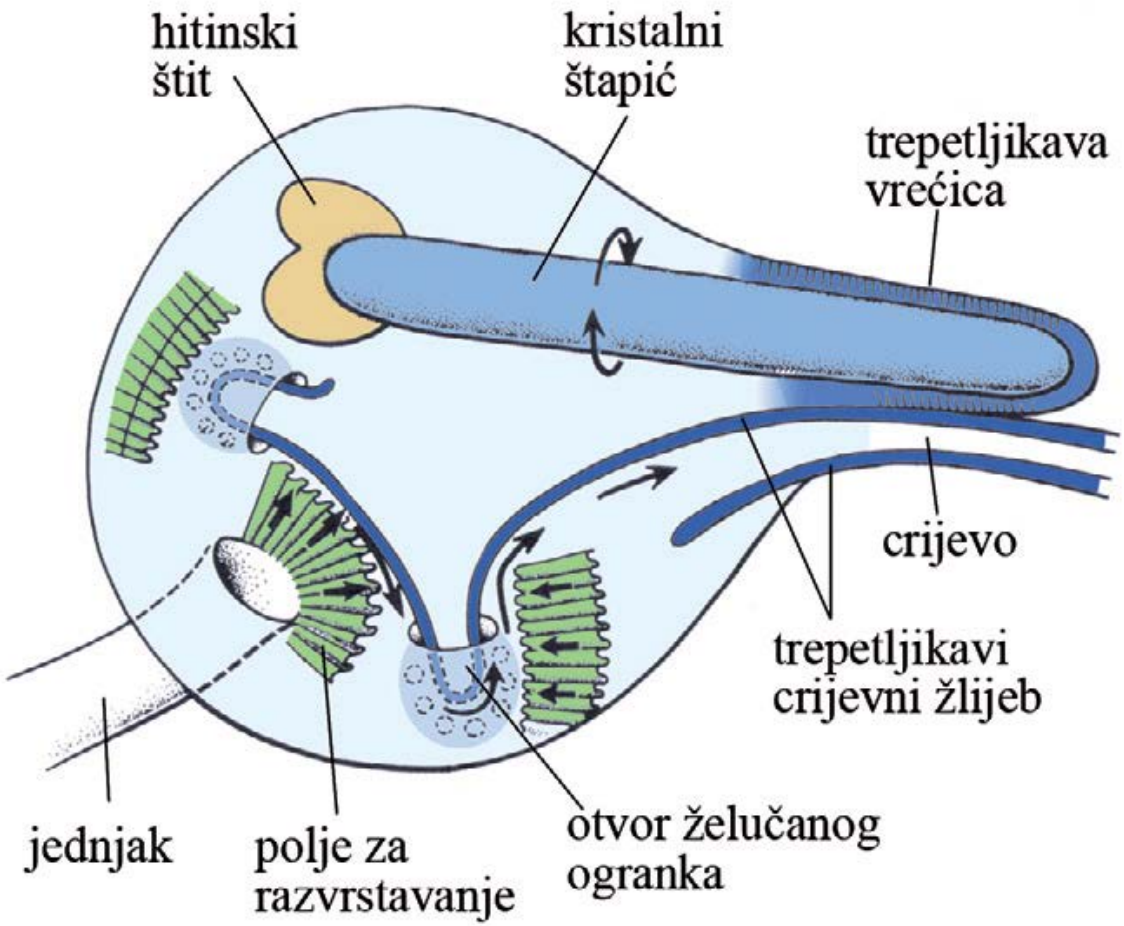




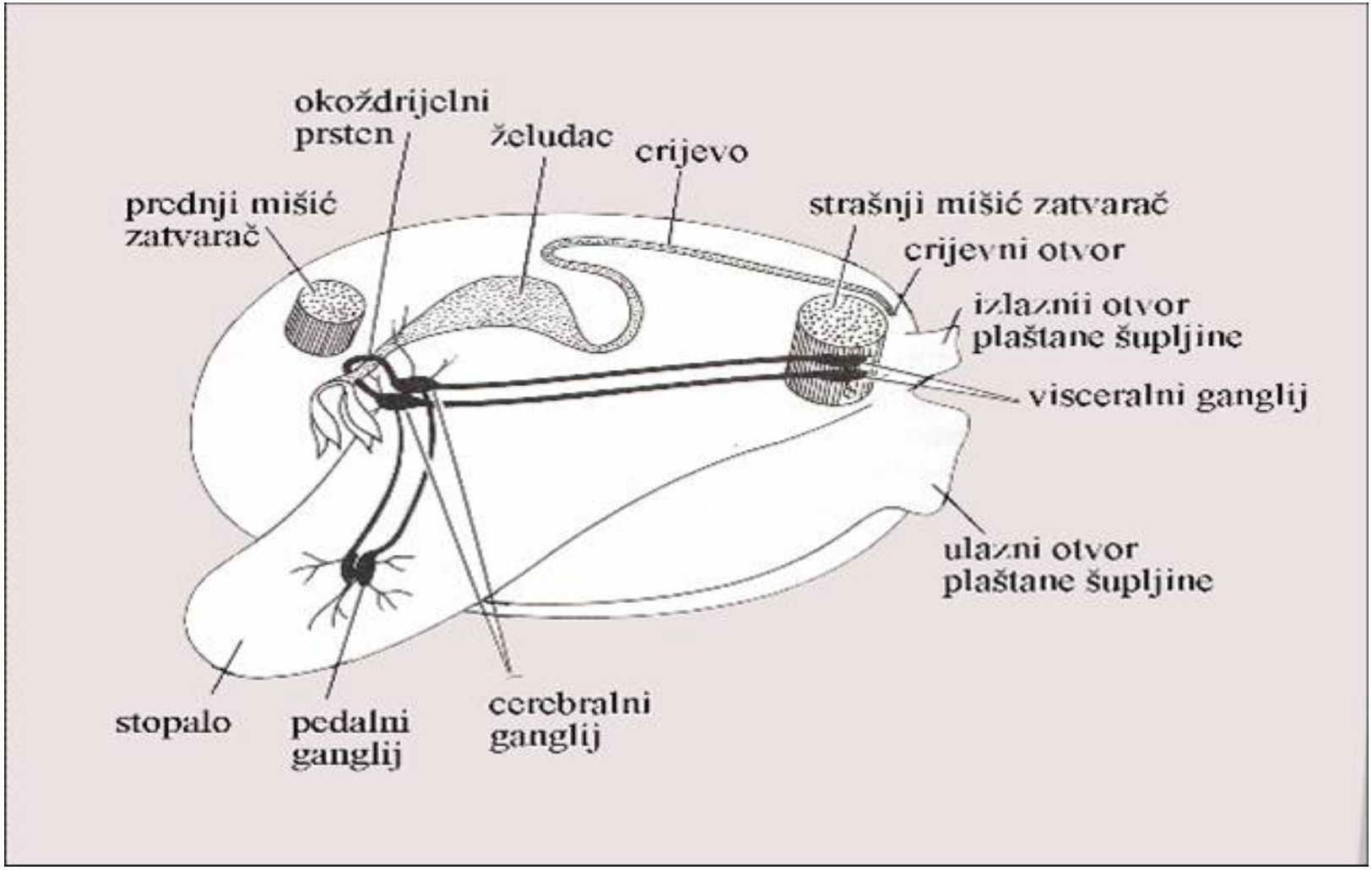
interlamelarne spojnice


pretklijetka
probavna žijezda
klijetka
mokraćovod
cerebralni ganglij
želudac
metanefridij
mišić zatvarač
mišić zatvarač
crijevni otvor
izlazni otvor na plaštu
ulazni otvor na plaštu
usta
visceralni ganglij
pedalni ganglij
vanjska poluškrga
unutrašnja poluškrga
stopalo
crijevo
gonade
plašt

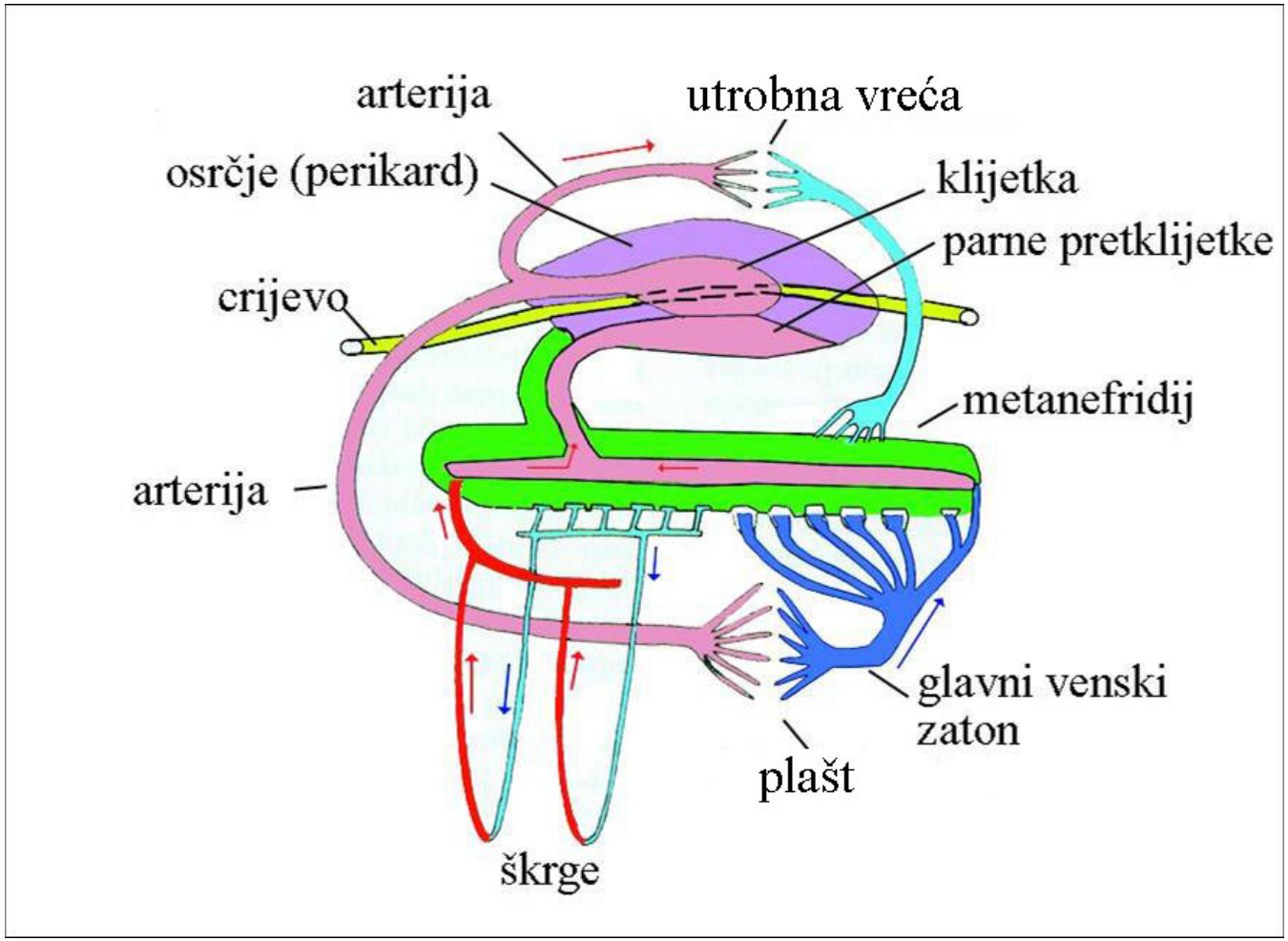
Građa želuca školjkaša

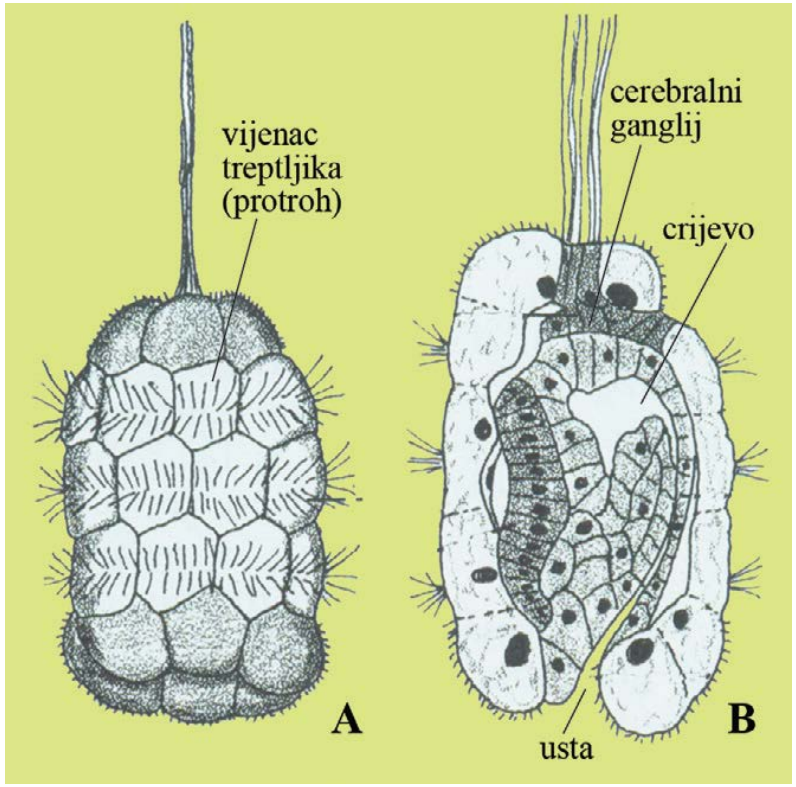


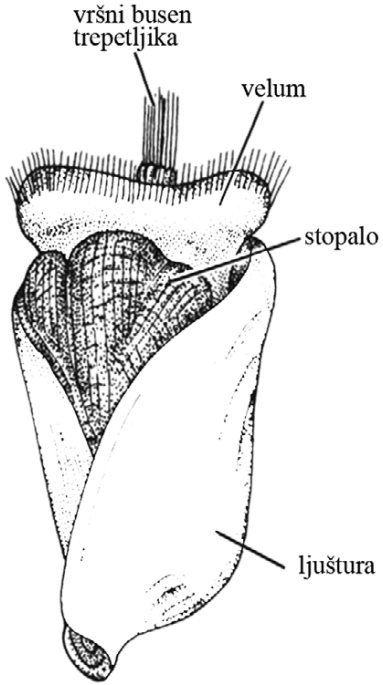
Živčani sustav školjkaša

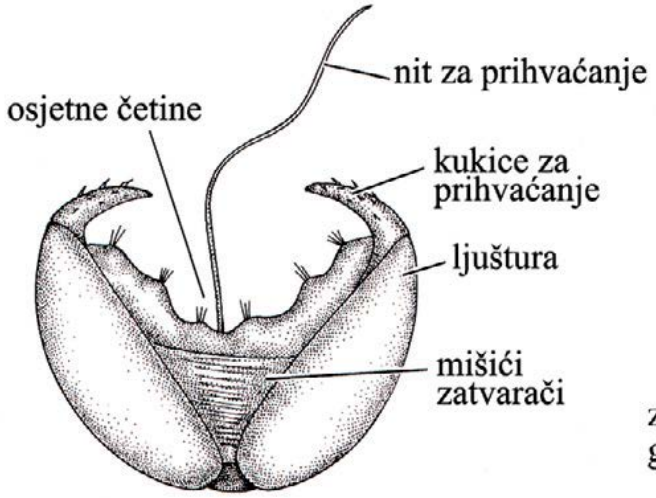


Optjecajni sustav školjkaša









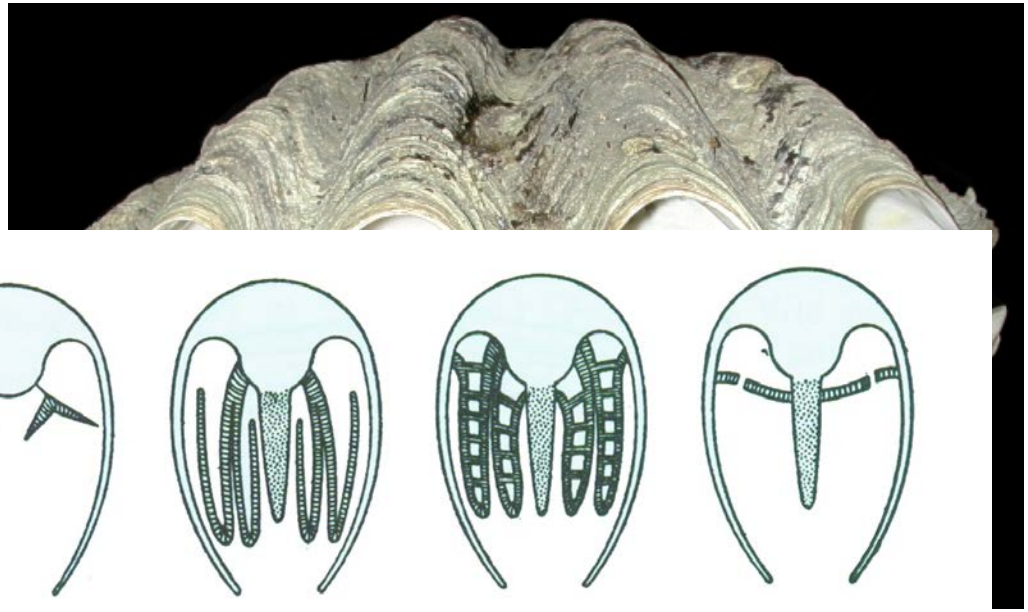


zatvorena ljuštura
glohidije

Rasprostranjenost i biološka raznolikost faune školjkaša

❖ najčešće su stanovnici **mora**, manje u vodama na kopnu, a nema kopnenih vrsta
❖ većinom **polusjedilački**, a neki su potpuno **sjedilački**.
❖ na svim vrstama dna, a neki buše hodnike u kamenu (prstac) i drvetu (brodotočac).
❖ veličina: od nekoliko mm do 1 m i mase od 250 kg (*Tridacna gigas*)
❖ oko 25 000 vrsta školjkaša, u Jadranskom moru oko 320 vrsta
❖ Raspodjela

Protobranchia
Filibranchia
Eulamellibranchia
Septibranchia



Protobranchia
Nuculidae
Ledidae

❖ Najbrojnije vrstama su skupine **Filibranchia** i **Eulamellibranchia**

Filibranchia



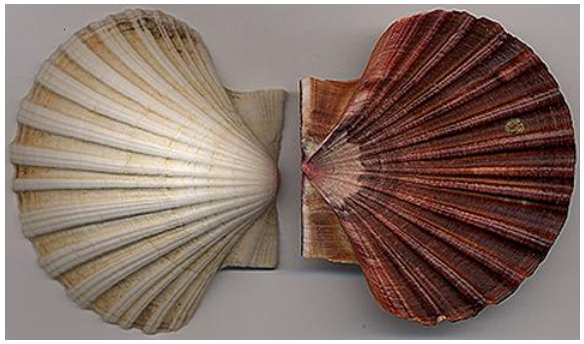
Arca noae - kunjka



Mytilus galloprovincialis - dagnja



Chlamys



Pecten jacobaeus



Pinna nobilis - periska



Pinctada - bisernica

https://www.youtube.com/watch?v=a1xIQvx0i60





Spondylus gaederopus - kopito





Ostrea edulis – ostriga, kamenica

Eulamellibranchia

Unio
Anodonta
Margaritana margaritifera

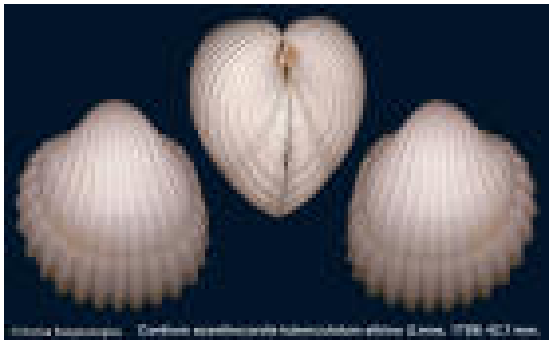




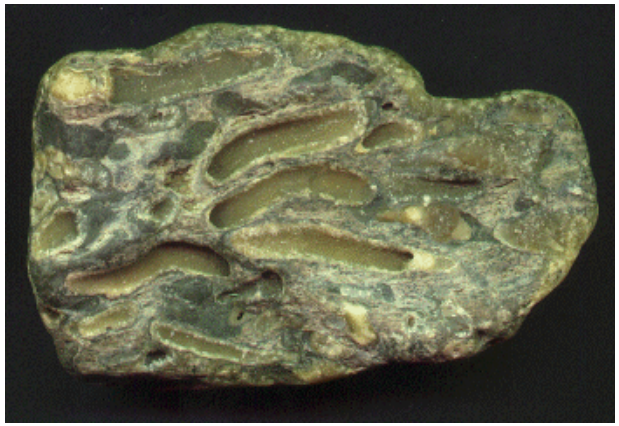
Tridacna gigas



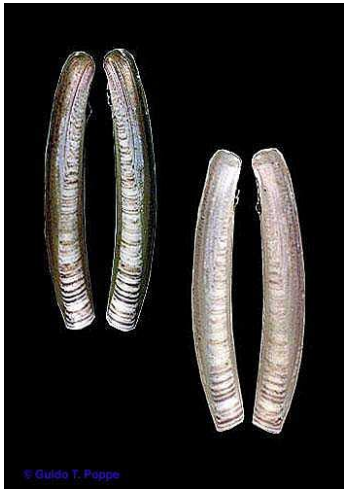
Venus



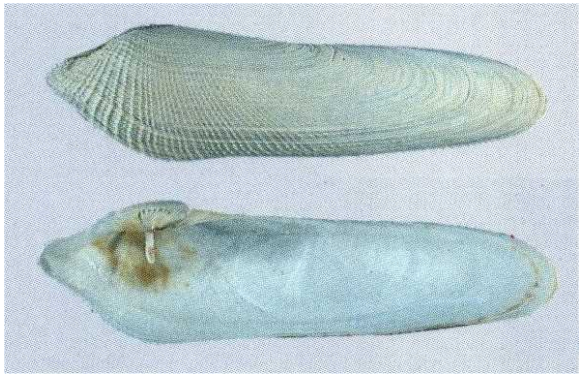
Cardium



Teredo - brodotočac

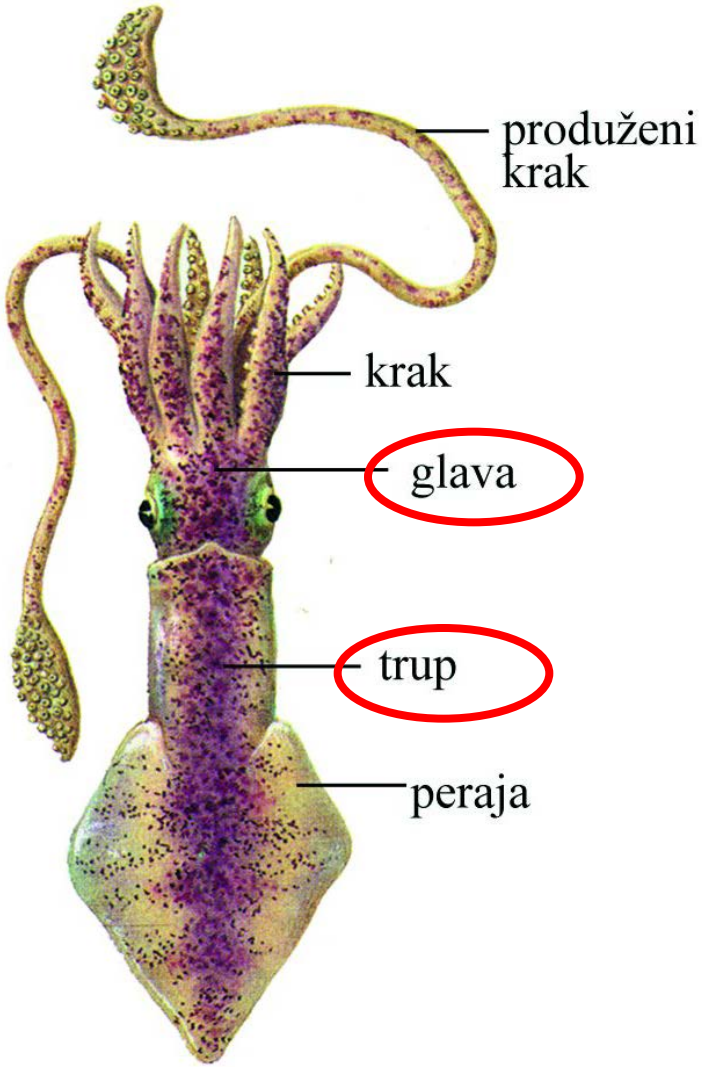


Ensis ensis - mač



Pholas dactylus - kamotočac

Razred Cephalopoda - glavonošci



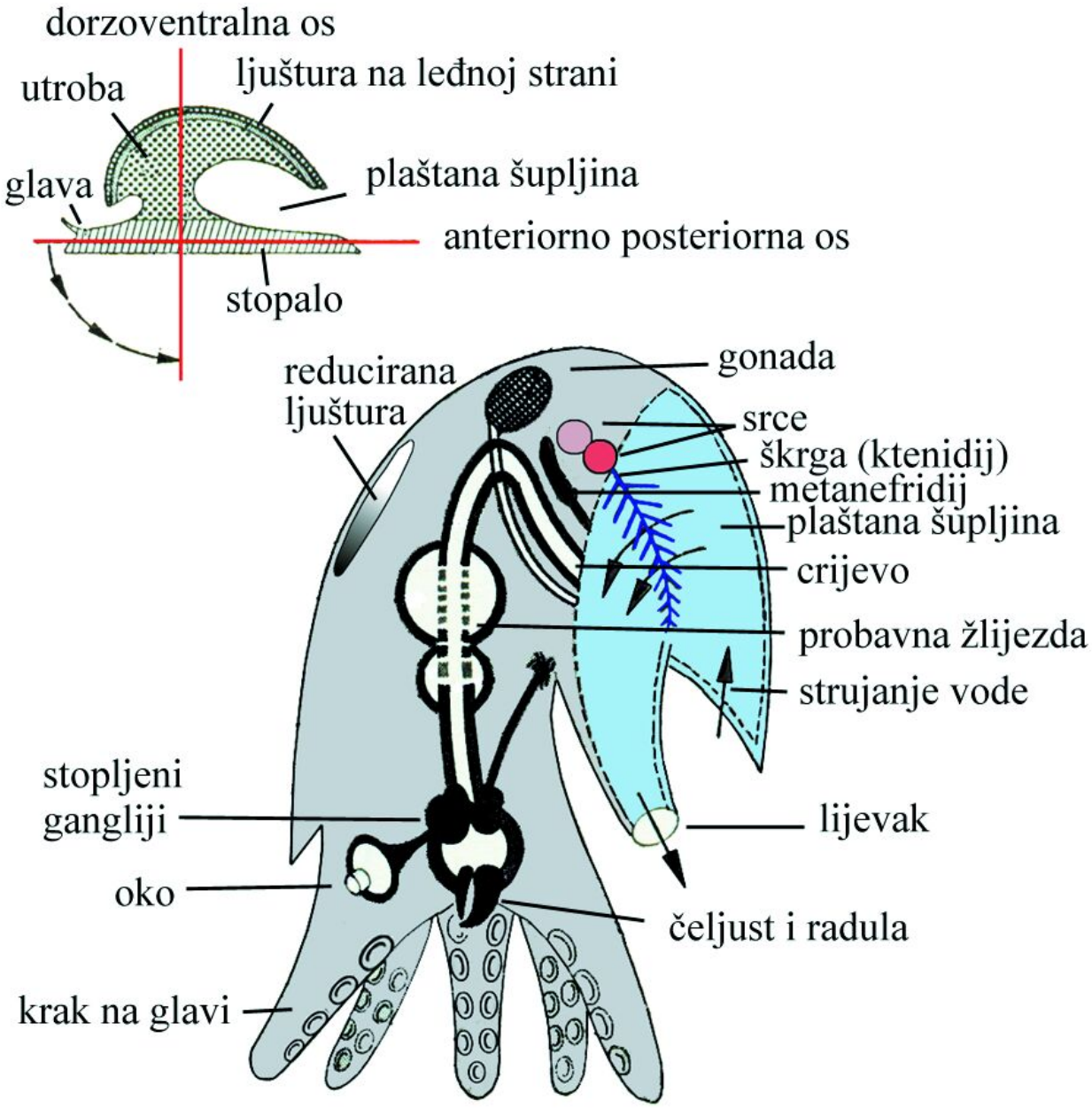
Opće značajke:

- najodvedeniji, najveći i najbrži beskralježnjaci
- građevni plan prilagođen pelagičkom načinu života
- ljuštura reducirana ili nedostaje
- vrlo sofisticirane oči i organi za ravnotežu (statocisti)
- 1 ili 2 para ktenidija; pravi zatvoreni optjecajni sustav
- plašt je mišićav a plaštana šupljina velika; propulzije izbacivanja vode postižu antagonističkim djelovanjem kružnih i radijalnih mišića plašta
- 3 skupine: Nautiloidea, Ammonoidea-izumrli, Coleoidea
- 730 vrsta, 10 000 izumrlih

Reorijentacija pretka mekušaca:
- anteriorno-posteriorna os pomaknuta u dorzoventrani pravac

stopalo preobraženo u
- krakove i lijevak (inervira ih pedalni ganglij)

kretanje

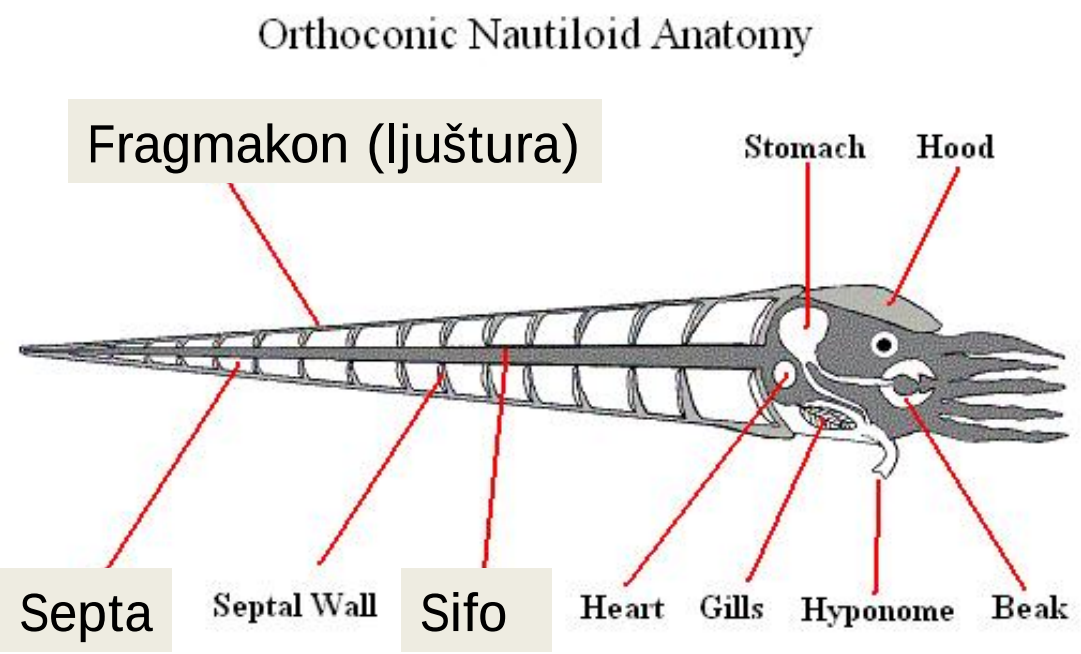


Građa ljušture



Prvi glavonošci (**Nautiloidea**) u kasnom kambriju, prije oko 515 milijuna g.

Bila su to sitne životinje dužine nekoliko mm s **vanjskom ljušturom** (nakon samo 50 milijuna godina razvili su se gigantski oblici dugi 11 m)







460 million year old Ordovician nautiloid Lituites from Hupei, China. Some laminations are still visible on the shaft.

Evolucija ljušture

kod recentnih vrsta različiti stupnjevi redukcije

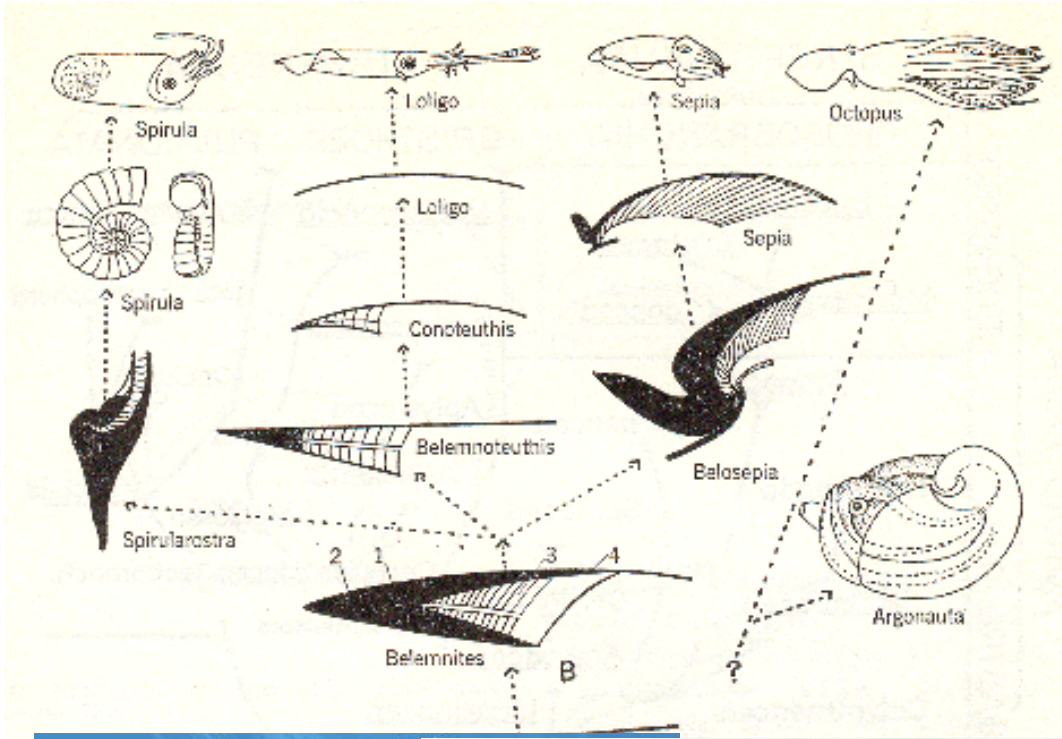


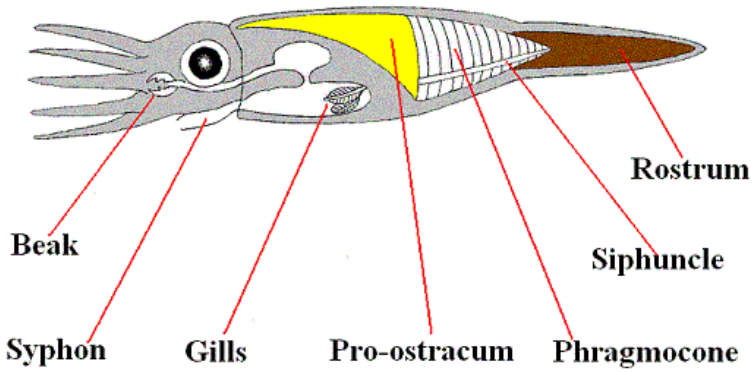
Belemnites (vladali mezozojskim oceanima):

rostrum

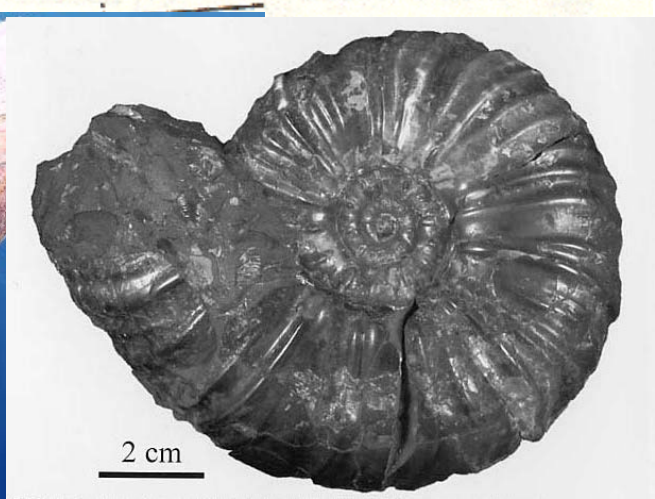
fragmakon (septalno pregrađeni dio kroz koji prolazi *sifo*)

proostrakum (produžetak fragmakona u obliku tankog lista s leđne strane)





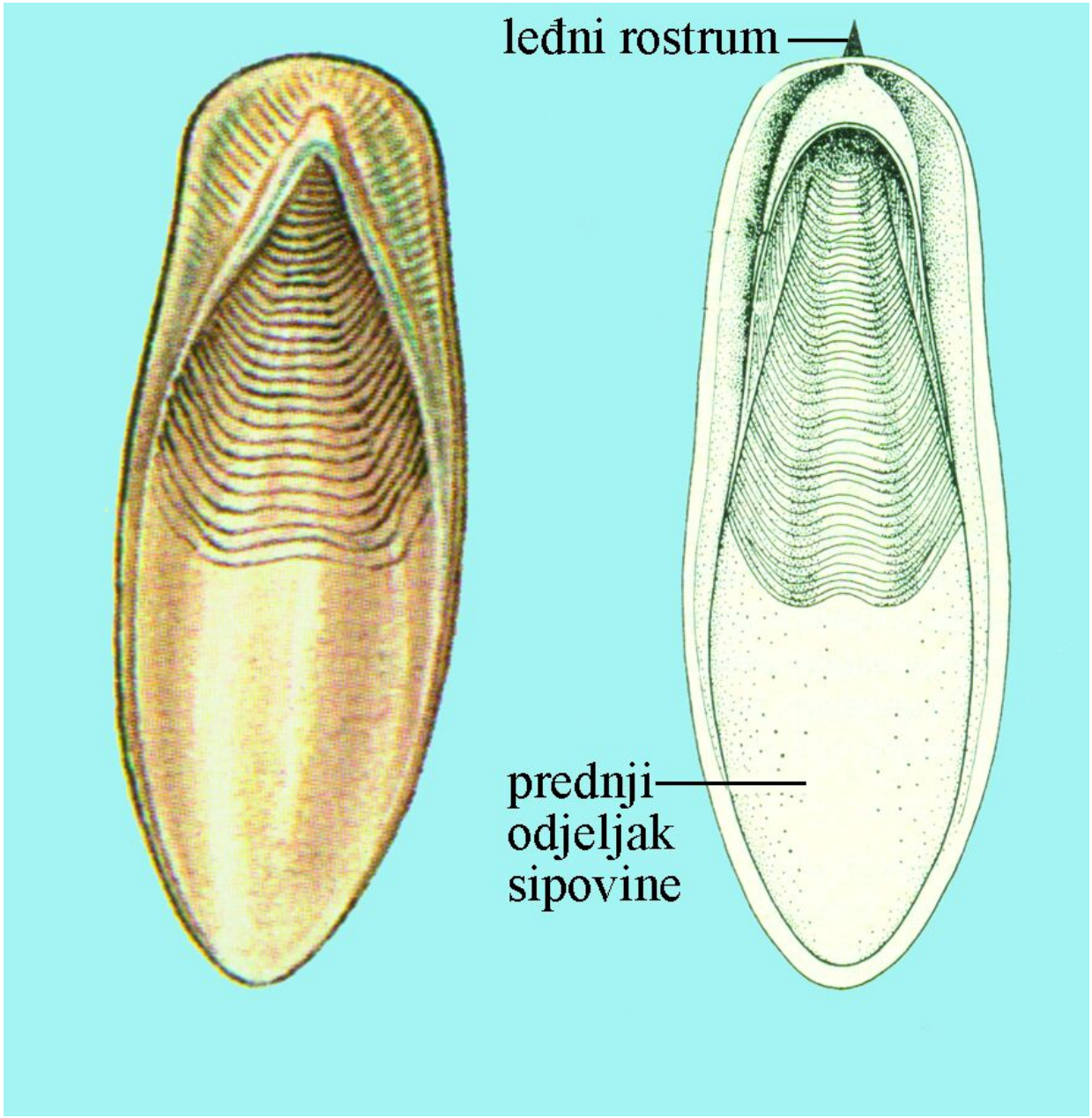


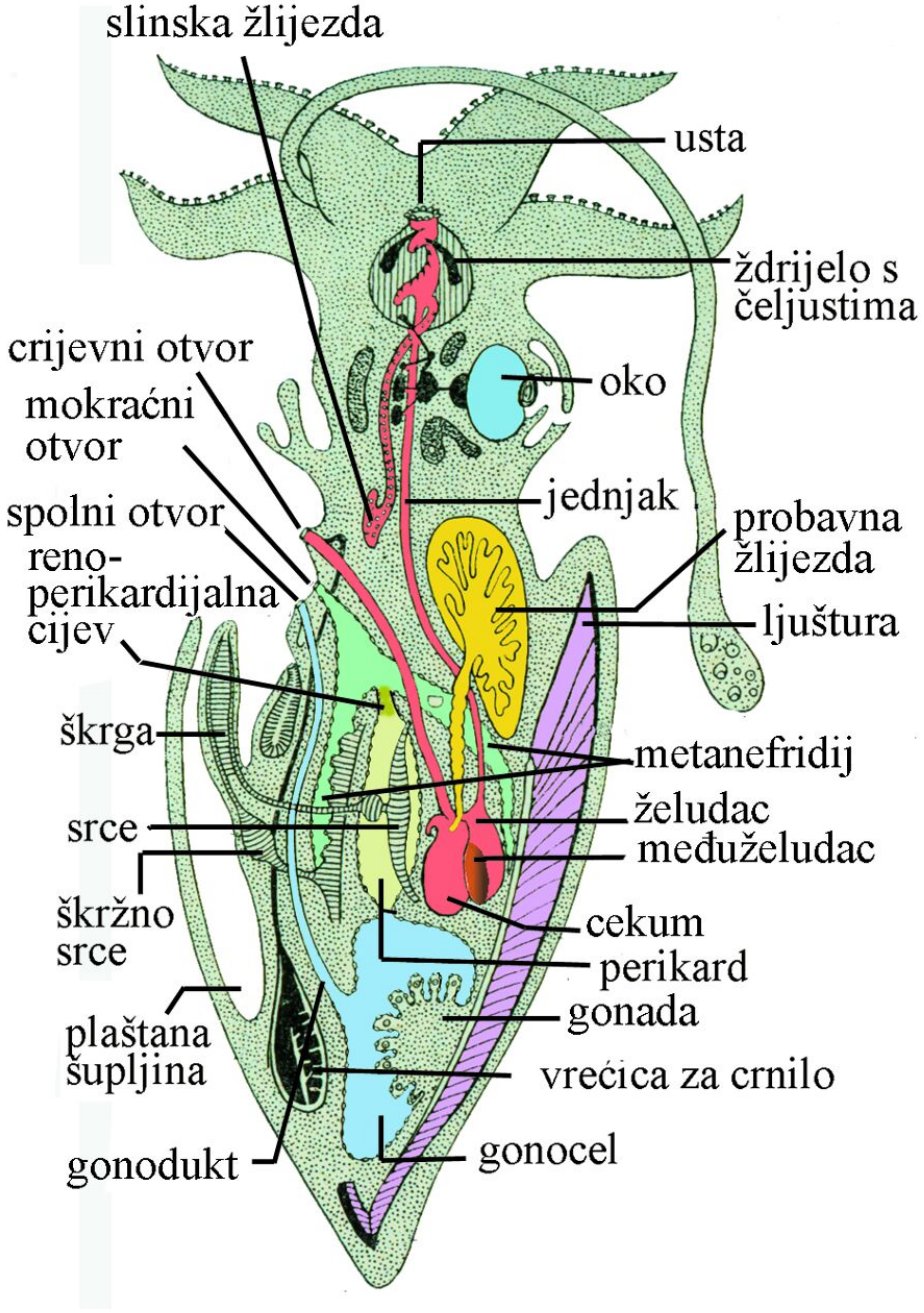


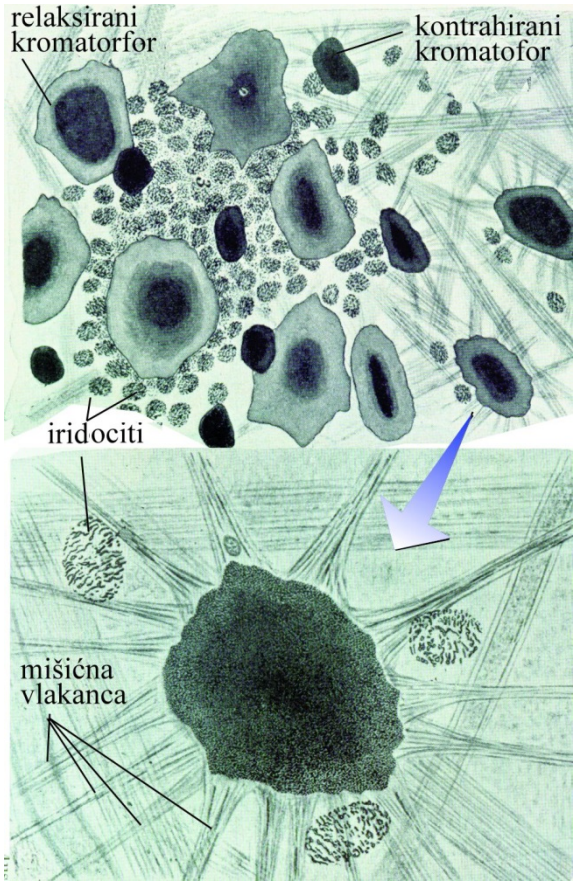


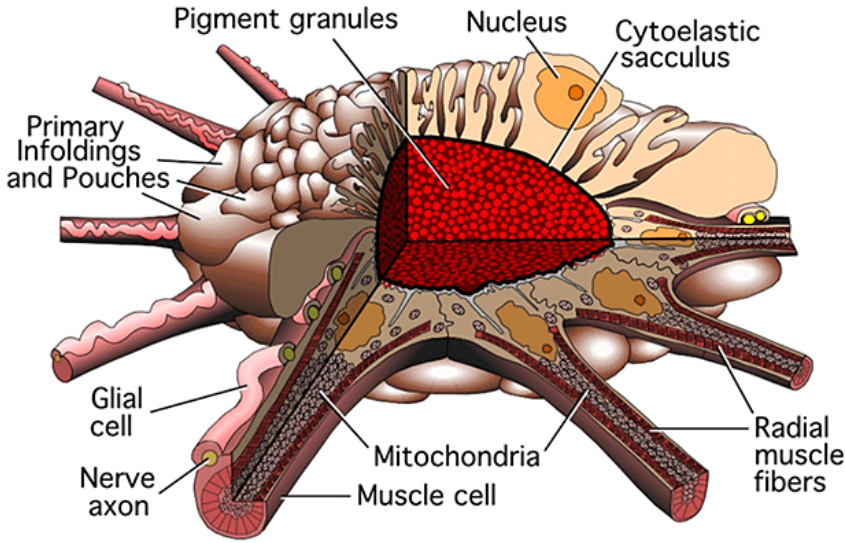


- razvojem cijevi za odvodnju vode iz plaštane šupljine poboljšano strujanje vode preko škrga i mogućnost kontrole smjera ispuštanja vode iz pl. š.; zatvaranjem komorica ljušture i ispumpavanjem vode mogu kontrolirati plutanje $\Rightarrow$ prve velike životinje s ljušturom koje su se mogle vertikalno kretati i živjeti u otvorenoj vodi


leđni rostrum
prednji
odjeljak
sipovine


slinska žlijezda
usta
ždrijelo s čeljustima
crijevni otvor
mokraćni otvor
oko
spolni otvor
jednjak
probavna žlijezda
reno-perikardijalna cijev
ljuštura
škrga
metanefridij
srce
želudac
međuželudac
škržno srce
cekum
perikard
plaštana šupljina
gonada
vrećica za crnilo
gonodukt
gonocel

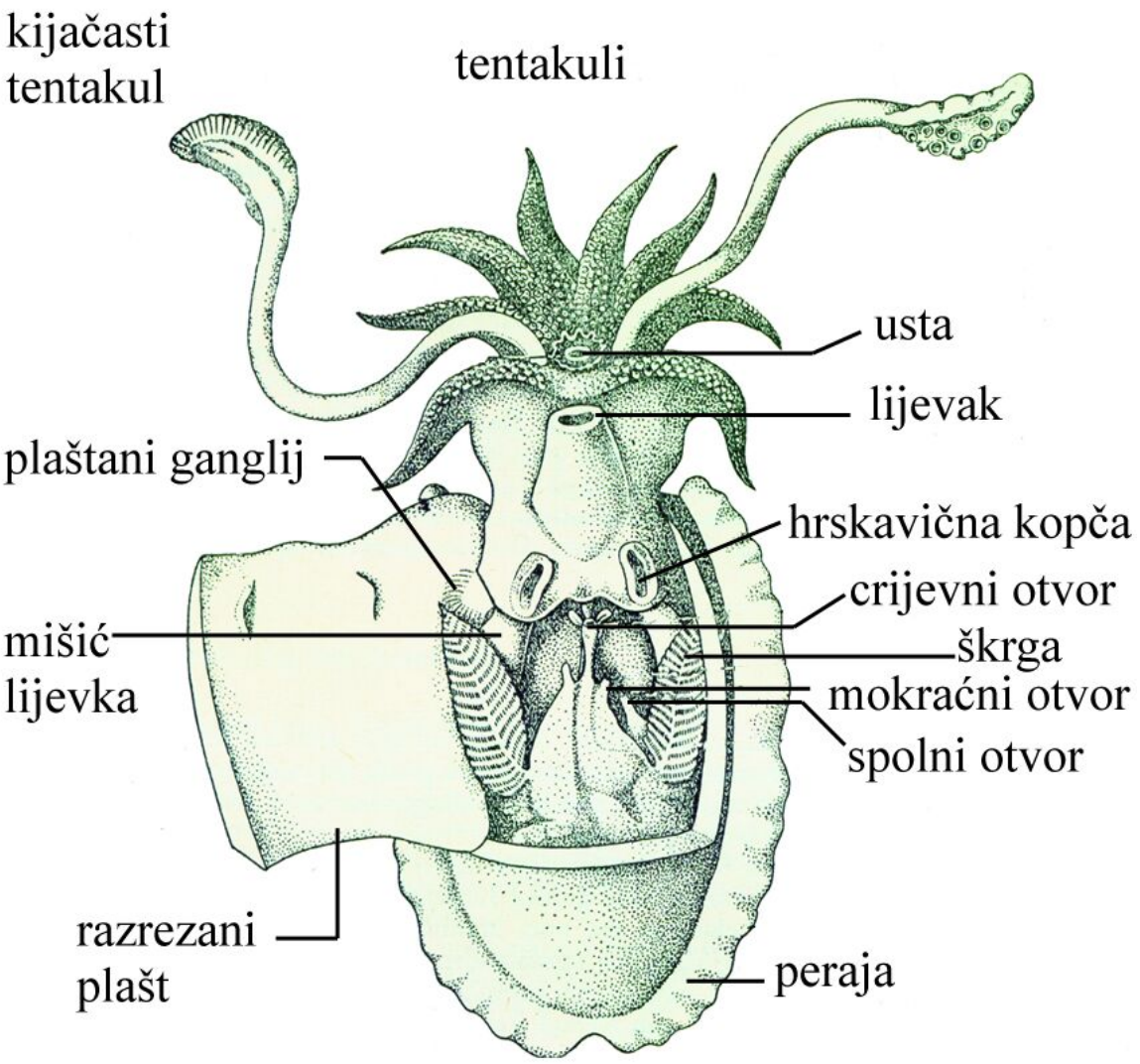




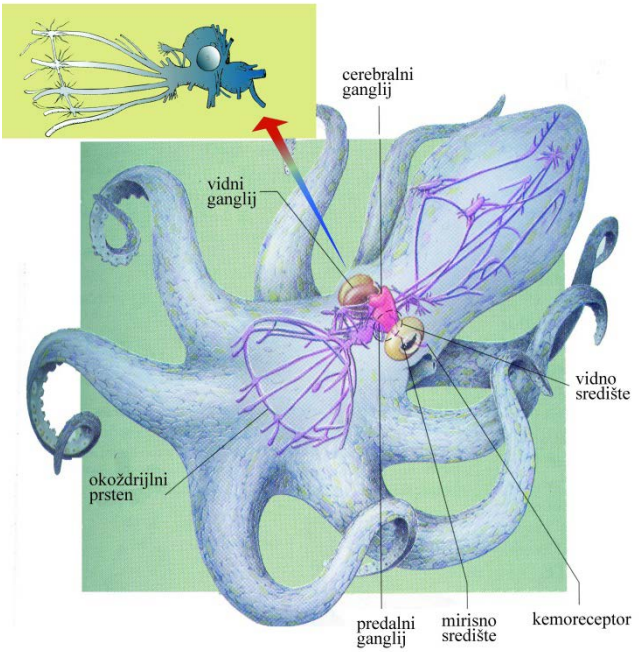
Kromatoforni organi

- sastavljeni od 1 kromatoforne stanice, brojnih mišića, živaca, glija i ovojnih stanica
- kontrakcijom mišića pigment se razvuče na oko 50x veću površinu
- promjena boje tijela pod kontrolom živčavnog sustava
  ⇨ brze promjene

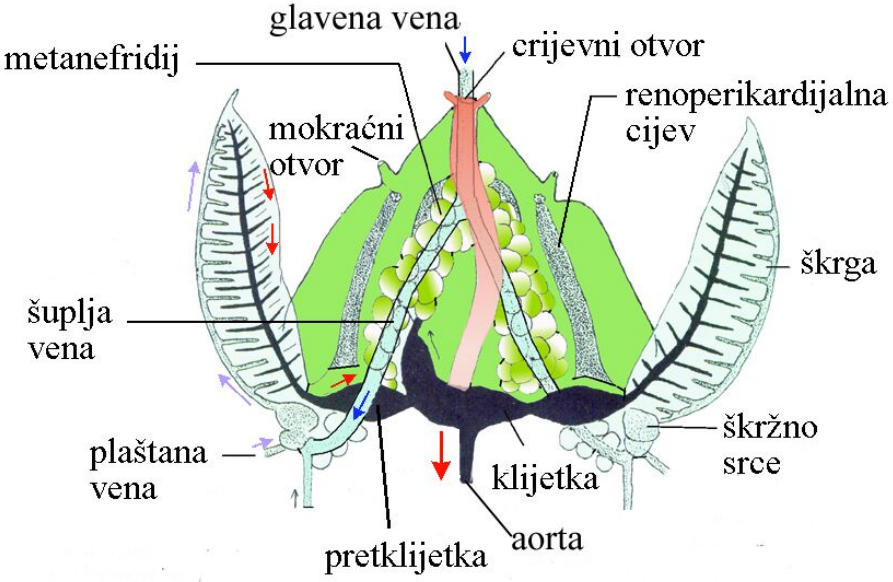
Organi plaštane šupljine



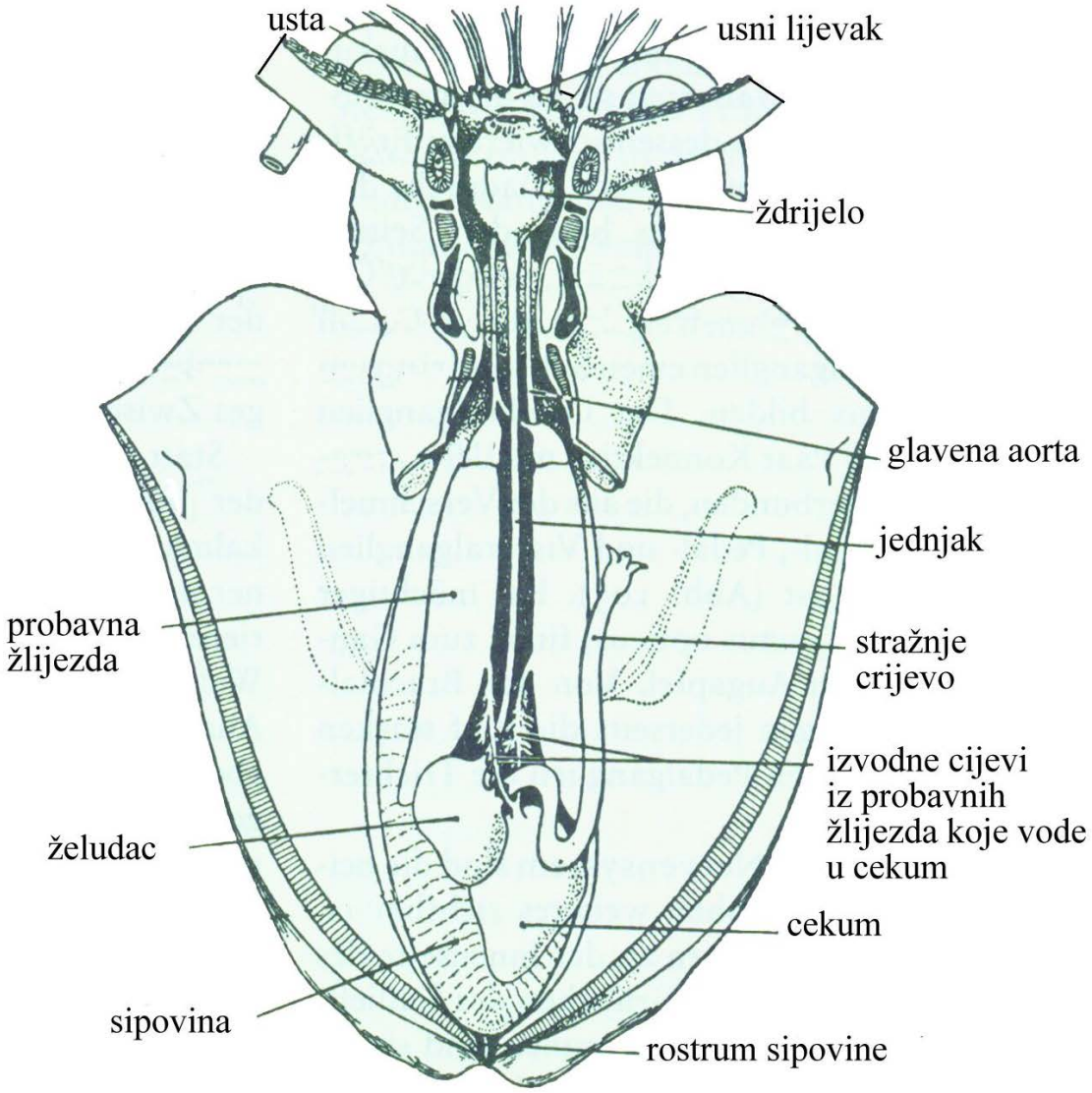
- endoskelet od **hrskavice** (čahura za mozak, oči i org. za ravnotežu)
- **koncentracija živčane** mase u glavi



- zatvoreni **krvotok**



Probavni sustav





- diskoidalno brazdanje jajeta

- isključivo morski; recentnih 730 vrsta (29 u Jadranu), fosilnih oko 10000

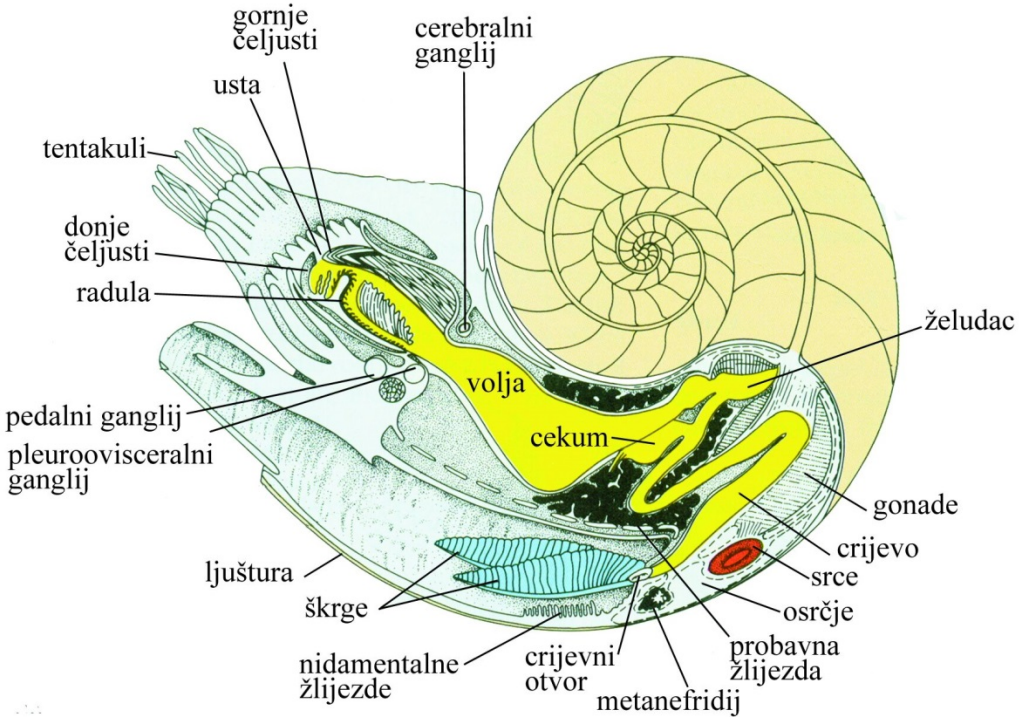
1. Tetrabranchiata (Ectocochlia) – četvoroškržnjaci
2. Dibranchiata (Endocochlia) - dvoškržnjaci



1. Tetrabranchiata (Ectocochlia) - četveroškržnjaci

- vanjska ljuštura spiralno savijena i podijeljena pregradama
- 4 škrge
- 4 nefridija
- oko 90 krakova
- *Nautilus pompilius* - indijska lađica





2. Dibranchiata (Endocochlia) – dvoškržnjaci

- **ljuštura rudimentarna, preraštena duplikaturom plašta→ unutar tijela;**
- **2 škrge;**
- **2 nefridija;**
- **10 ili 8 krakova**

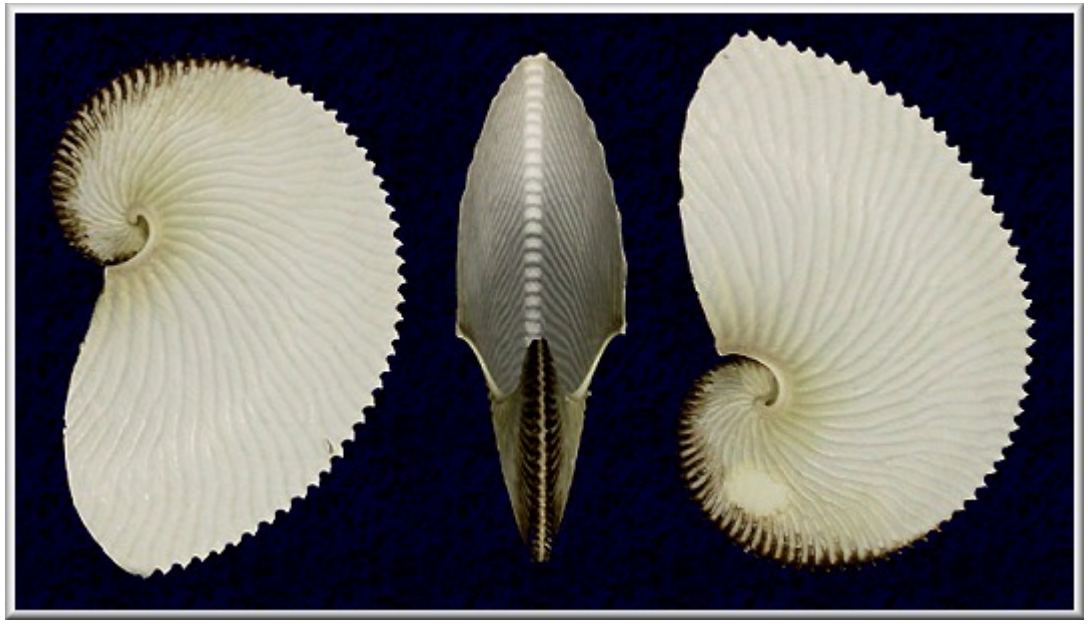
Red Octopoda - osmokračnjaci

Red Decapoda - deseterokračnjaci

Red Octopoda - osmokračnjaci



Octopus



Eledone

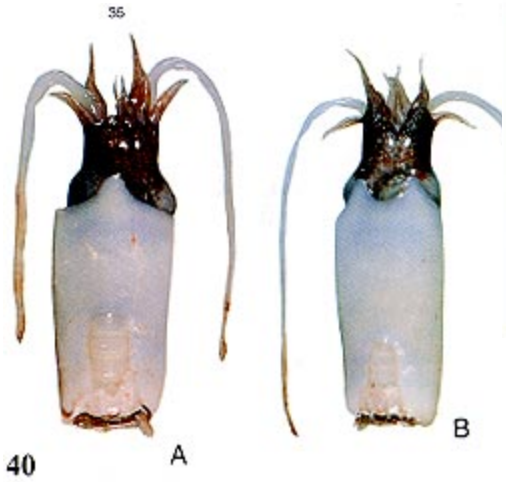
Argonauta

Red Decapoda - deseterokračnjaci





Loligo







Spirula





Sepia