Koljeno: Mollusca - mekušci

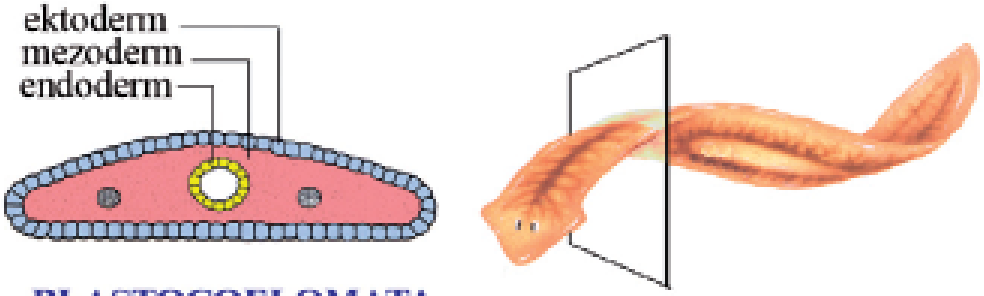
- **BILATERIA**
- **PROTOSTOMIA**
- **COELOMATA**

SCHIZOCOELNI NEKOLUTIĆAVI COELOMATA

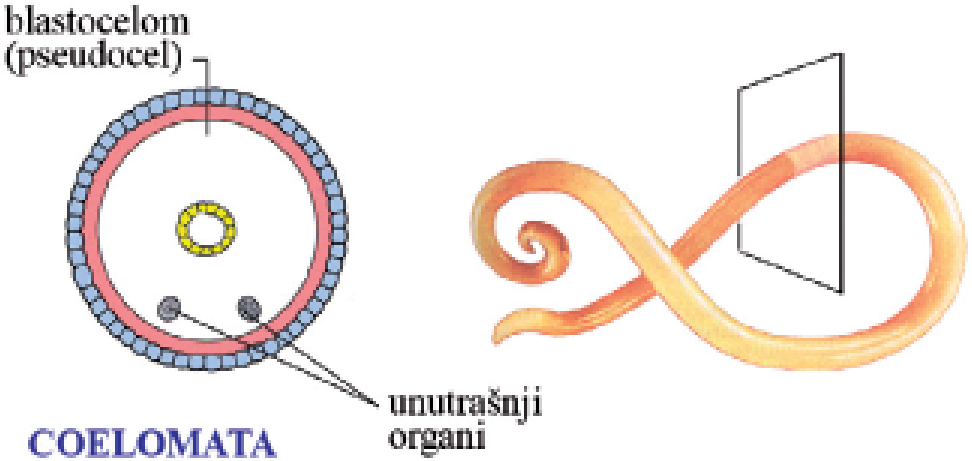
- najveći dio tijela ispunjava **blastocel** (primarna tjelesna šupljina); **coelom** (sekundarna tjelesna šupljina) je u području oko
  - srca (**perikard**) i
  - gonada (**gonocel**)

- razvili su se iz **acelomatskih predaka**

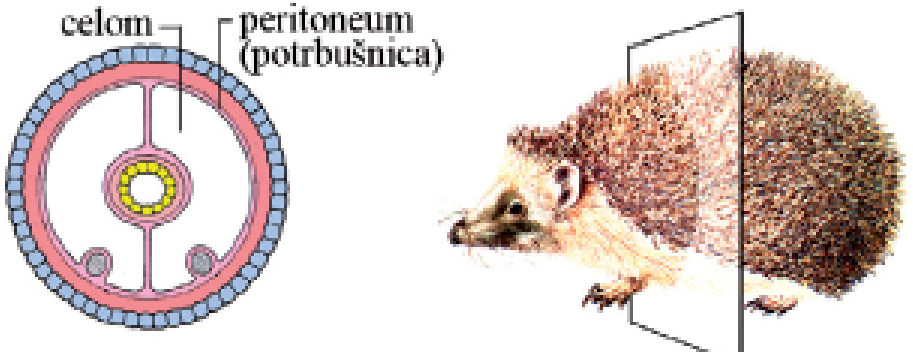
ACOELOMATA



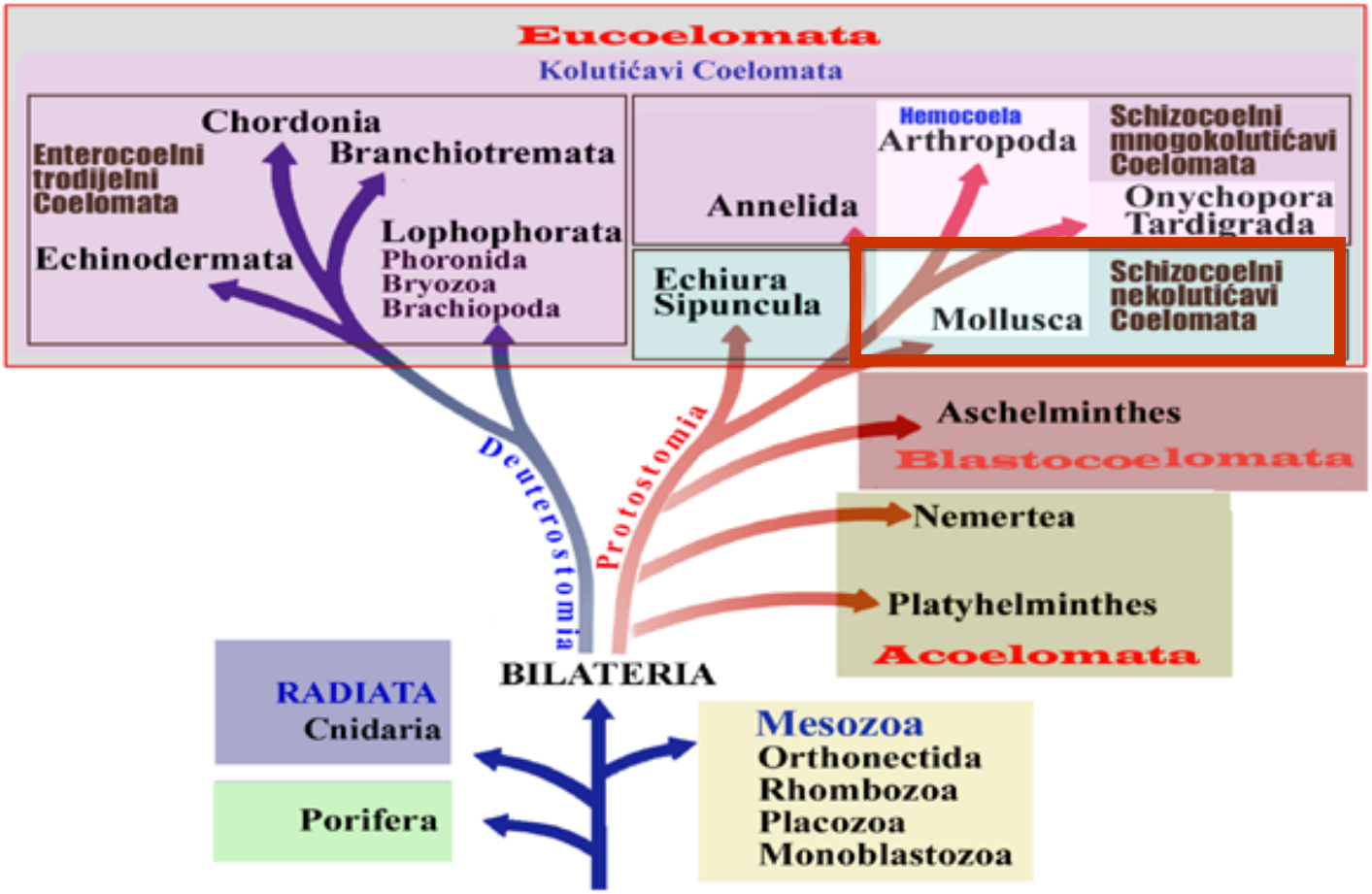
BLASTOCOELOMATA



COELOMATA

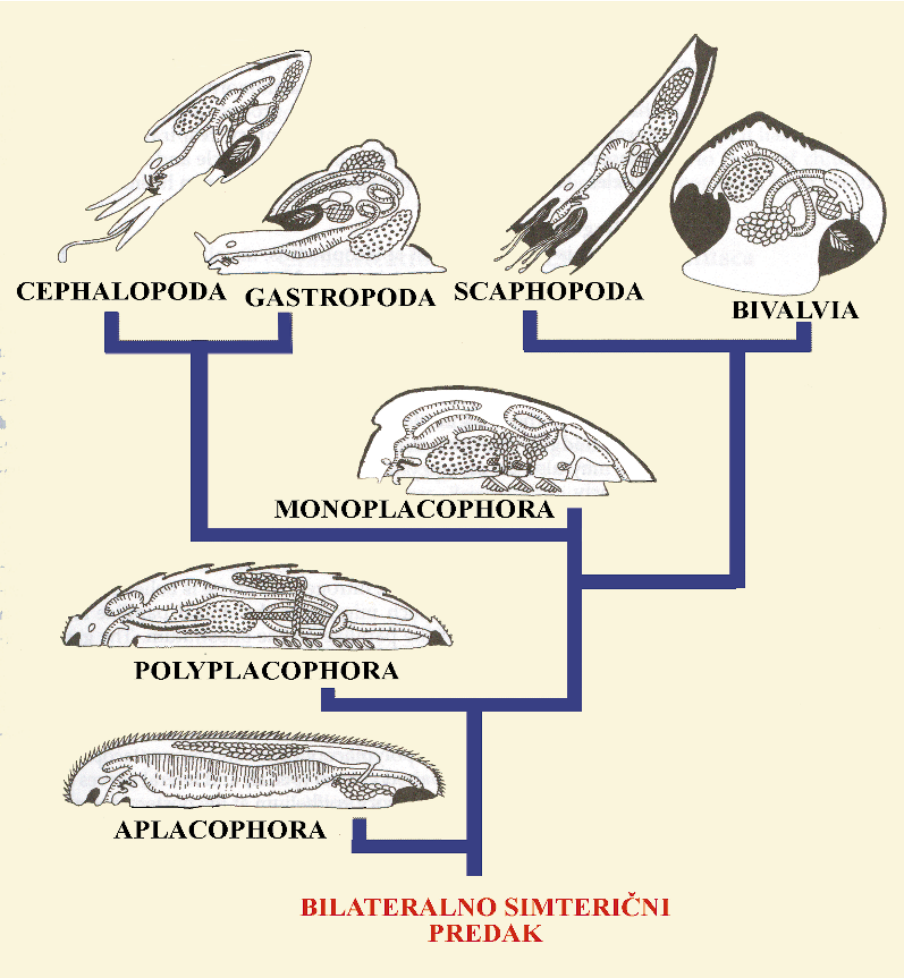


Položaj mekušaca (Mollusca) u rodoslovnom stablu



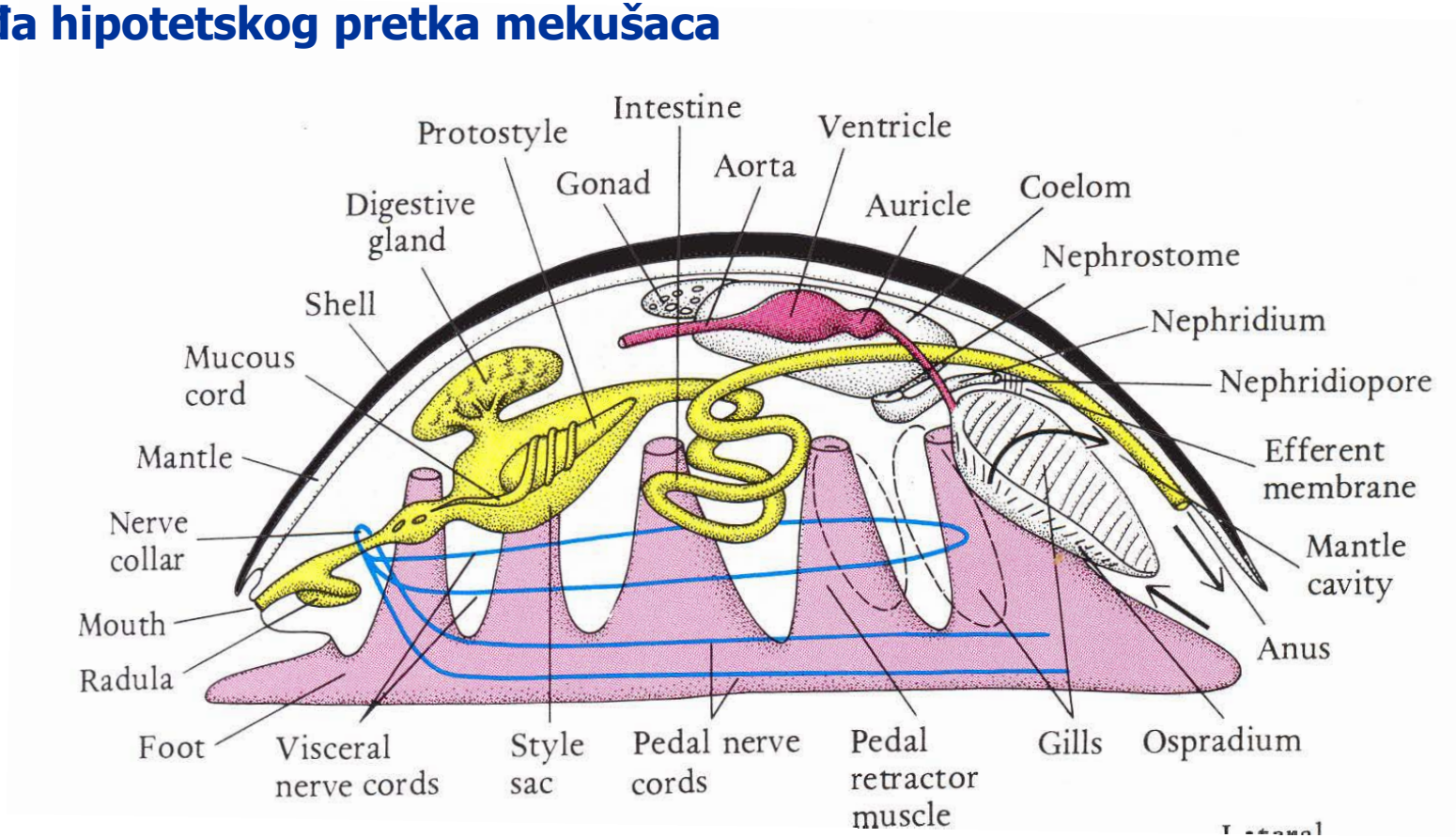
Koljeno: Mollusca – mekušci

(lat. *molis* – mekan, gibak, nježan)



- mekano i nekolutićavo tijelo
- izgrađuju vapnenačke **egzosklete**
- bilateralno simetrični (puževi sekundarno asimetrični)
- regije tijela: glava, **stopalo** i utrobna vreća obavijena **plaštom**
- tetraneuralan živčani sustav
- pojava i razvoj **celoma**
- dišu škrgama (ktenidijama) ili prokrvljenim plaštom
- spiralno brazdanje jajeta
- dugi nekoliko cm (od par mm - 18 m)
- oko 130.000 vrsta (35.000 fosilnih)

Građa hipotetskog pretka mekušaca



- regije tijela: glava, stopalo, utrobna vreća i vapnenačka ljuštura s plaštom



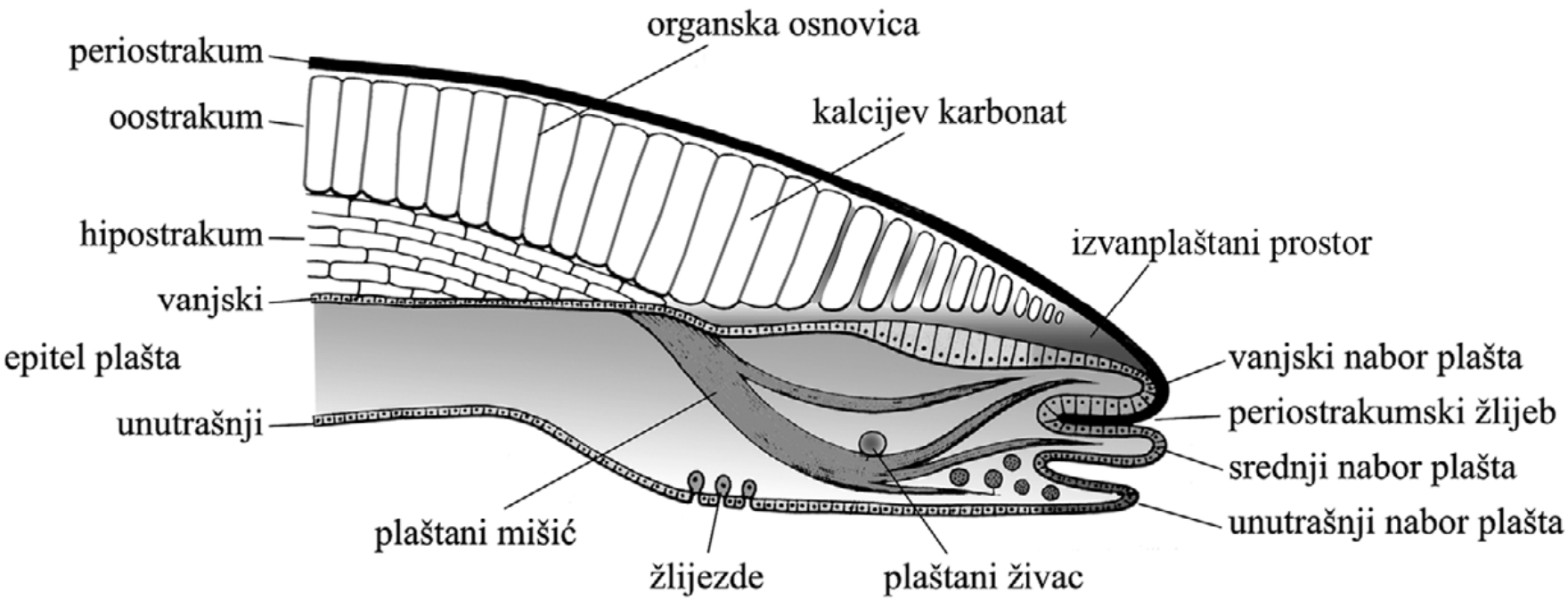
Građa ljušture i plašta



- **plašt (pallium)** prekriva utrobu i luči **vapnenačku ljušturu**

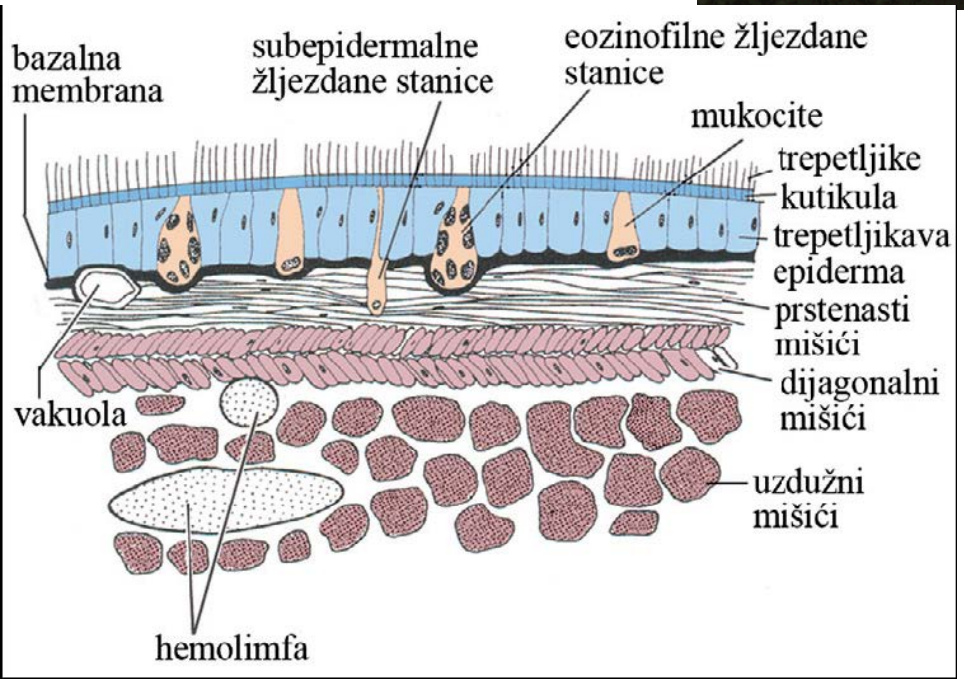
1. periostrakum- vanjski organski sloj (od konhiolina)
2. oostracum ili prizmatični sloj - $CaCO_3$ pomješan sa organskom tvari
3. sedefasti sloj - tanki listići $CaCO_3$ naizmjenično s organskom tvari

1. & 2. sloj luče stanice na vanjskom rubu plašta,
3. sloj luče stanice uzduž cijelog epitela plašta



Integumentna funkcija

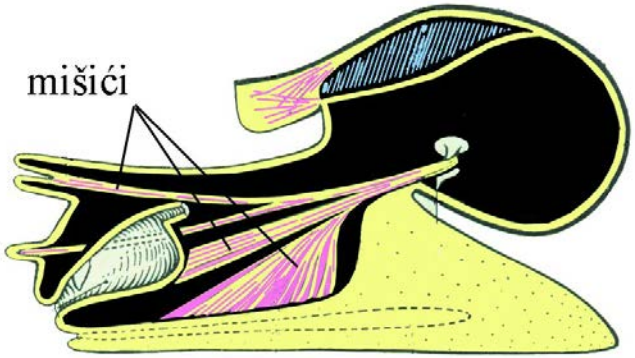




Mišićna funkcija

Prstenasti i uzdužni mišići

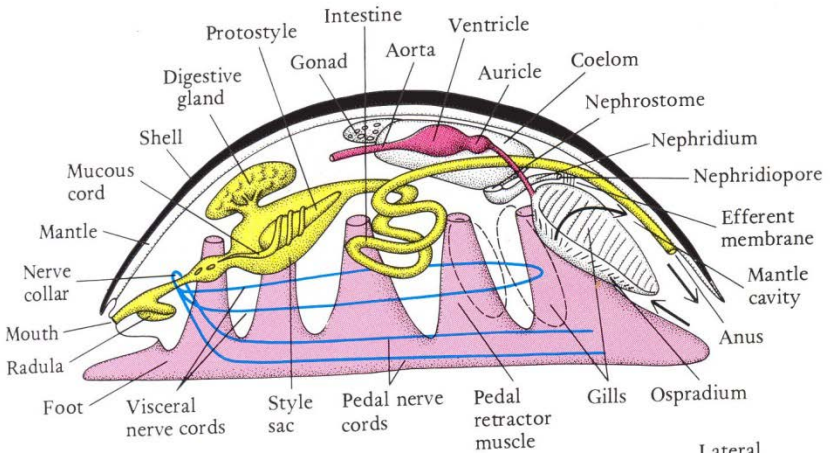
- mišići stopala (puževi i školjkaši)
- mišići plašta (lignja)
- mišići radule (puževi)
- mišići zatvarači (školjkaši)

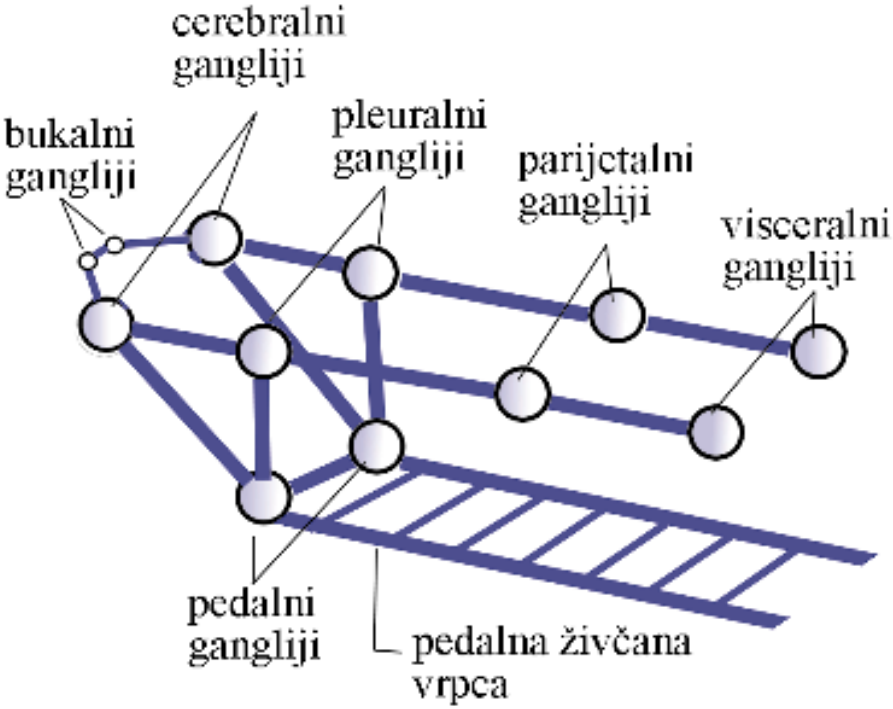


Živčani sustav

Tetraneuralan živčani sustav

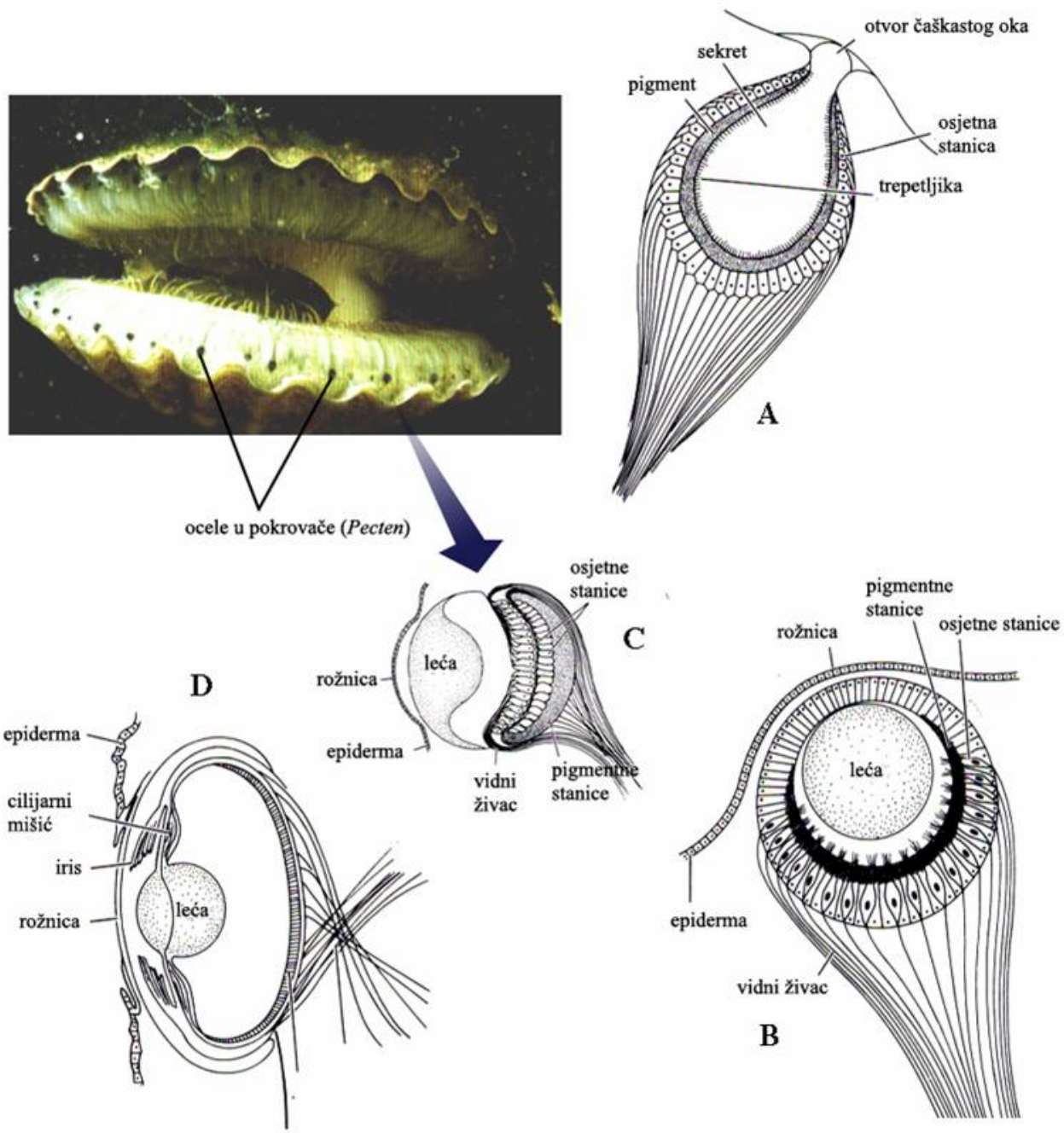
- 2 para **živčanih vrpci**
  - visceralne i
  - pedalne ž. v.
- 6 pari **ganglija:**
  - cerebralni,
  - bukalni,
  - pedalni,
  - pleuralni,
  - parijetalni i
  - visceralni gangliji





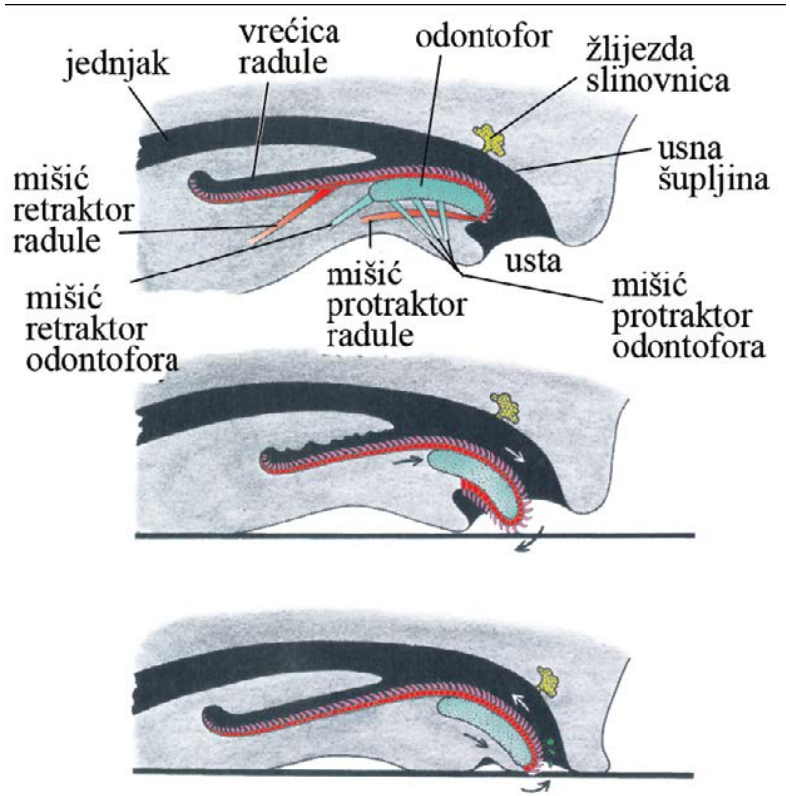
Osjetila

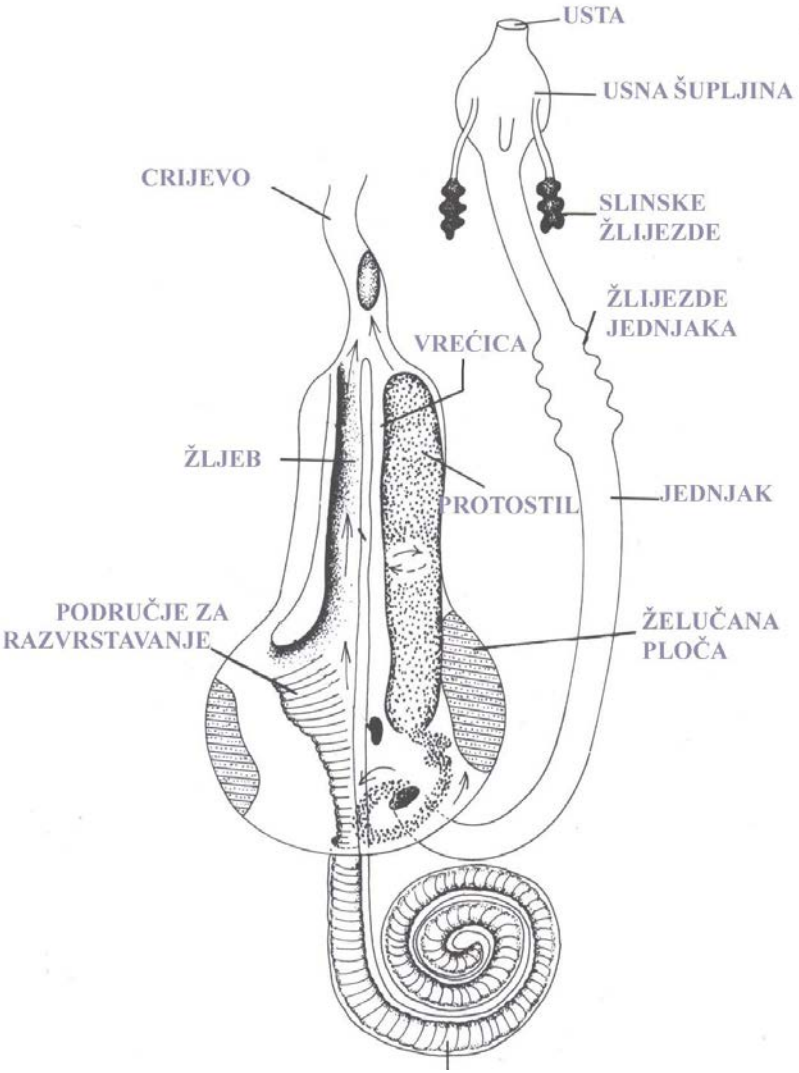
- oči
- statociste
- osfradiji



Probavni sustav

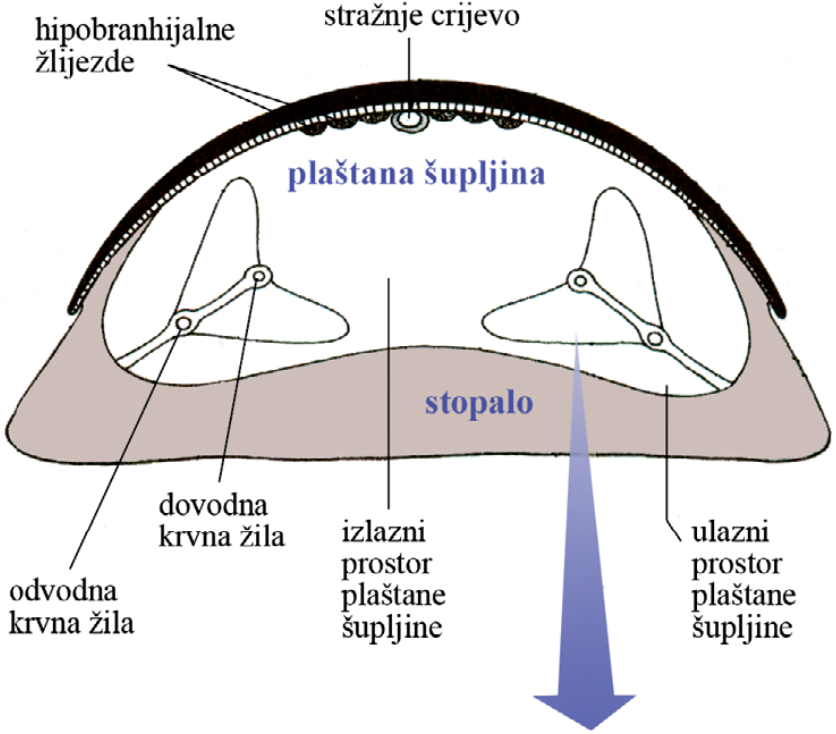
- **radula (trenica)** - nizovi hitinskih zubića na hitinskoj membrani
- **želudac** - trepetljikavo područje i **kristalni držak**
- **probavna žlijezda** za ekstra- i intracelularnu probavu

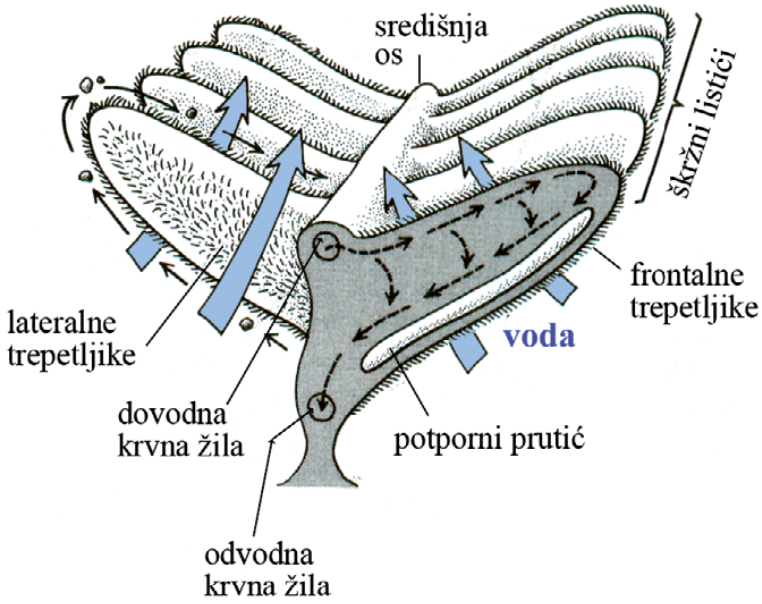




Dišni sustav

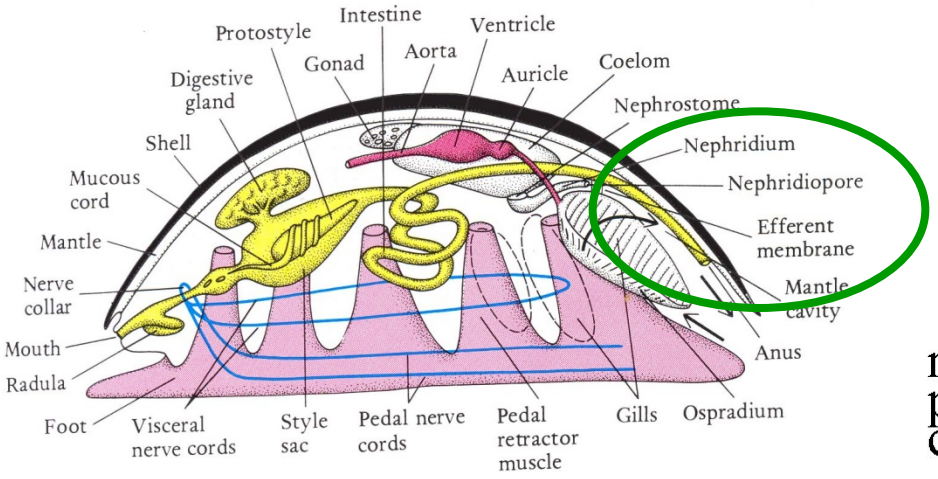
- **škrge (ktenidije) –** produljena i plosnata središnja os kroz koju prolaze **dovodna i odvodna krvna žila**; na osi su nizovi plosnatih trepetljikavih škržnih pločica

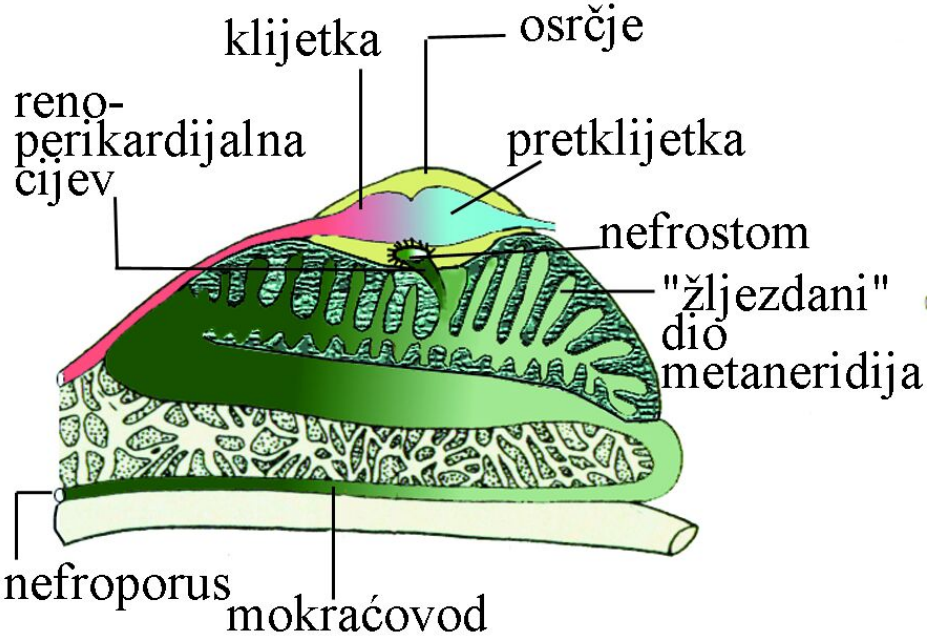




Ekskretorni sustav

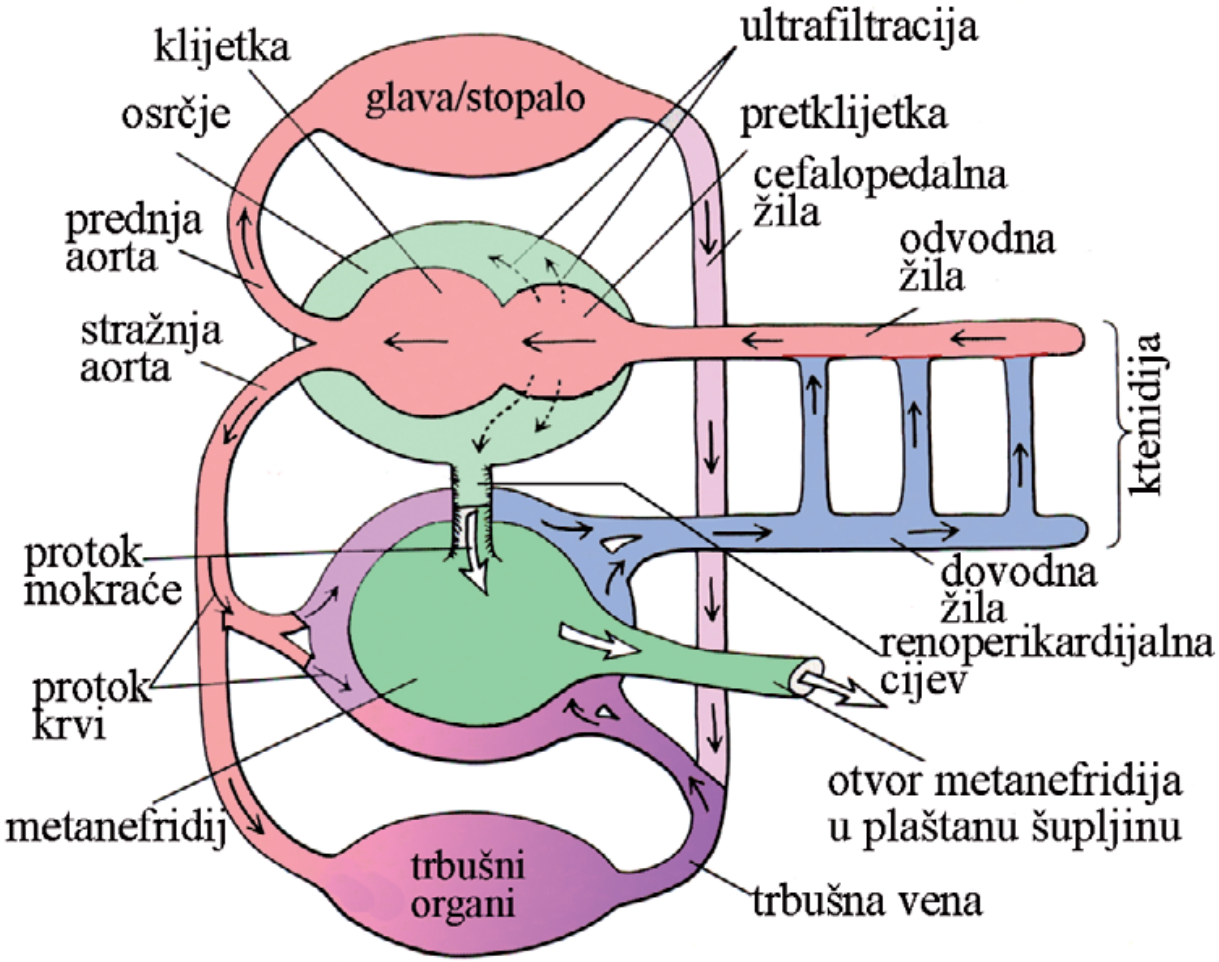
- **metanefridiji:** **nefrostom – žljezdano područje – nefridiopor**





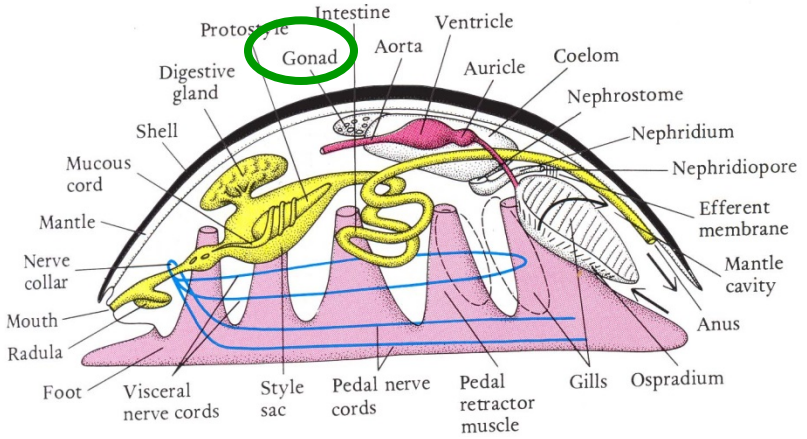
Optjecajni sustav

- **otvoren optjecajni sustav** (izuzev Cephalopoda)
- **srce**

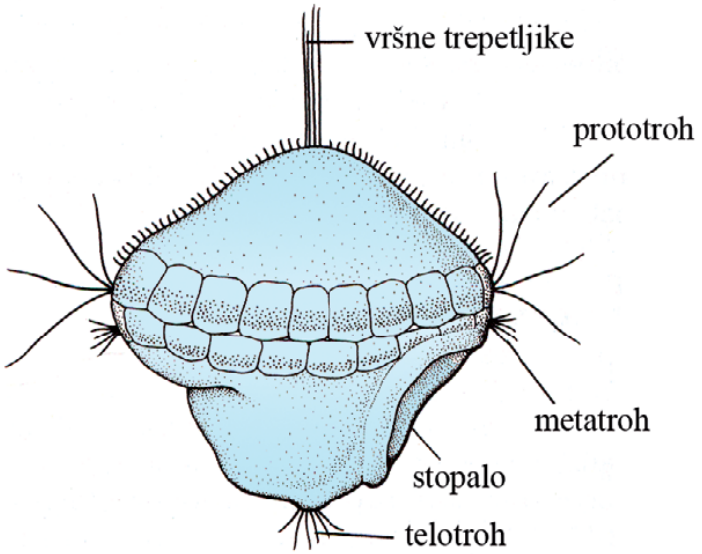


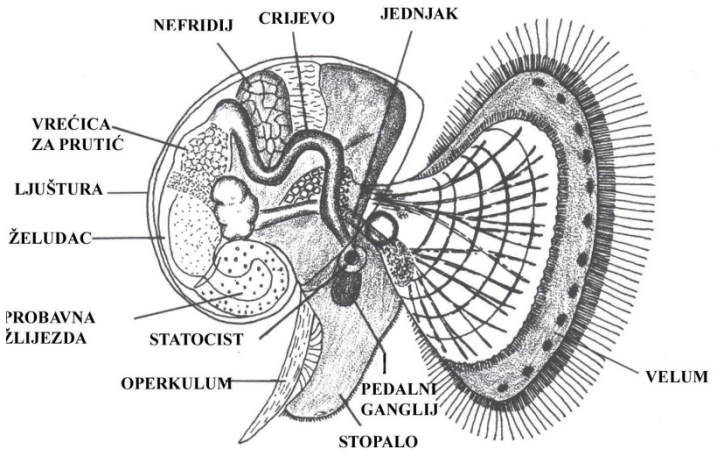
- pretežno jednospolci
- većinom unutarnja oplodnja
- spiralno brazdanje
- schizocelni postanak celoma

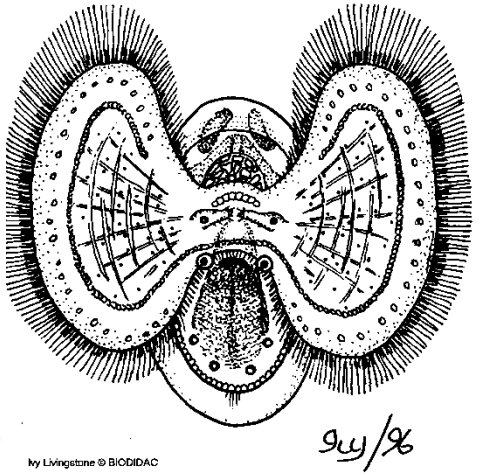
♂ ♀



- prvi stadij ličinke je trohofora, a drugi **veliger** – u planktonu



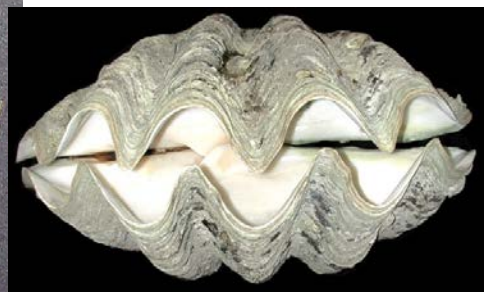


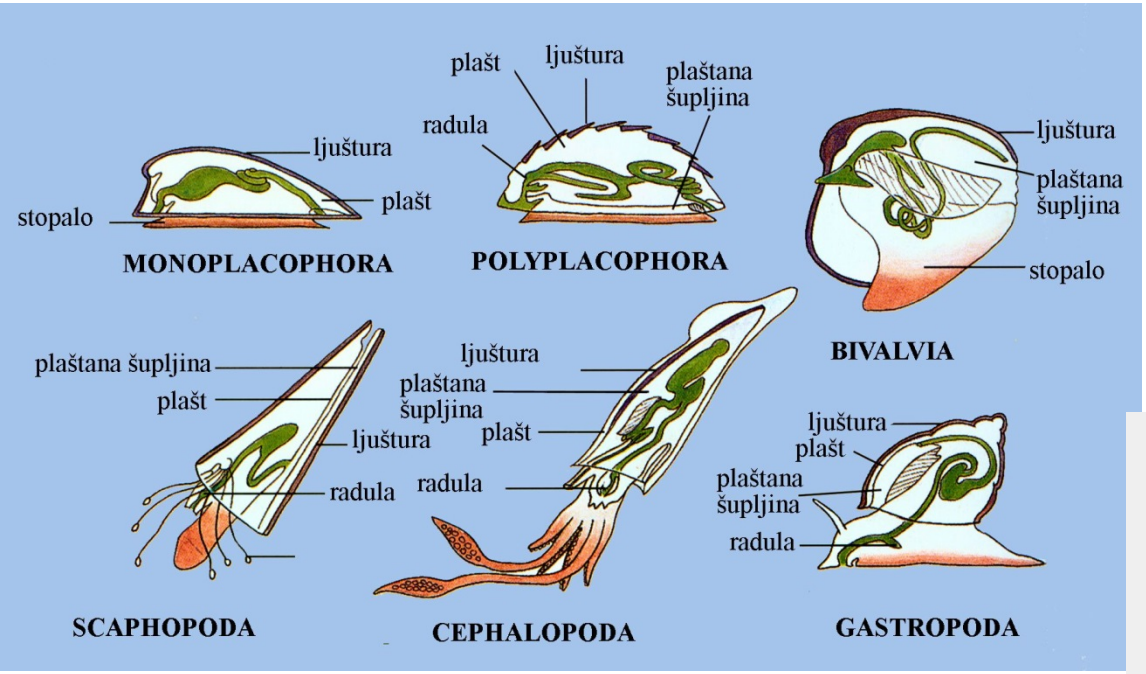


Raspodjela mekušaca







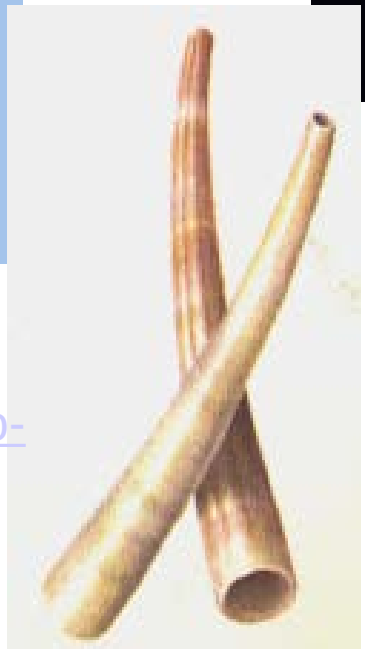


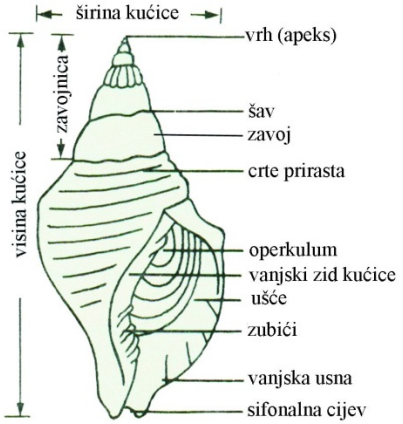


APLACOPHORA



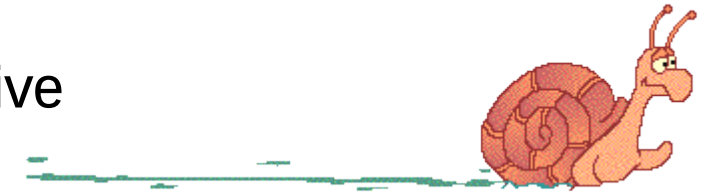
https://www.youtube.com/watch?v=s5iio-gKlAU





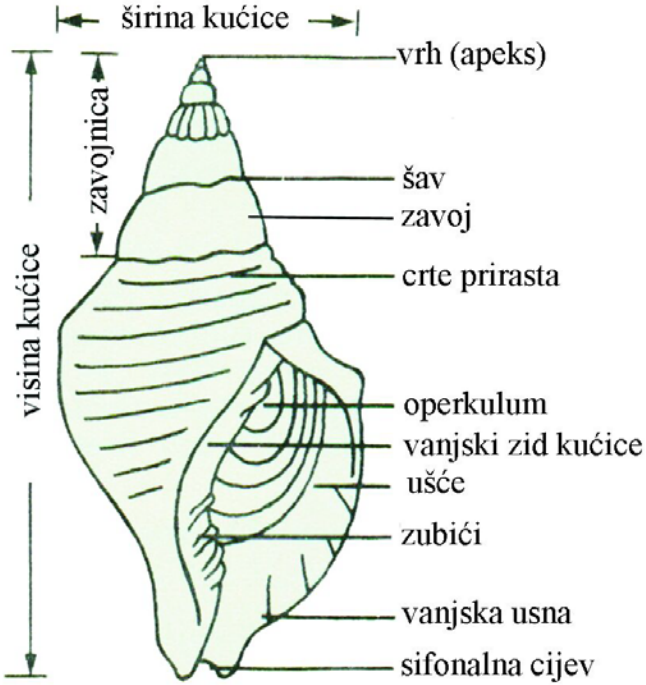
Razred: Gastropoda - puževi



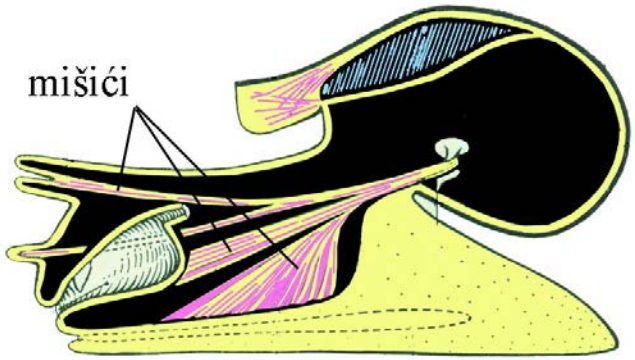


- najraznolikija skupina mekušaca; žive u različitim staništima – u moru, vodama na kopnu i na kopnu; različiti tipovi prehrane
- vjerojatno su se razvili iz Monoplacophora
- imaju 1, obično savinutu ljušturu ("kućica")
- imaju veliko stopalo kojim pužu po podlozi; većina se kreće valovitim stezanjem mišića
- bizarni proces tijekom razvoja: torzija (zakretanje stražnjeg dijela tijela)

Gastropoda (puževi)
Građa kućice



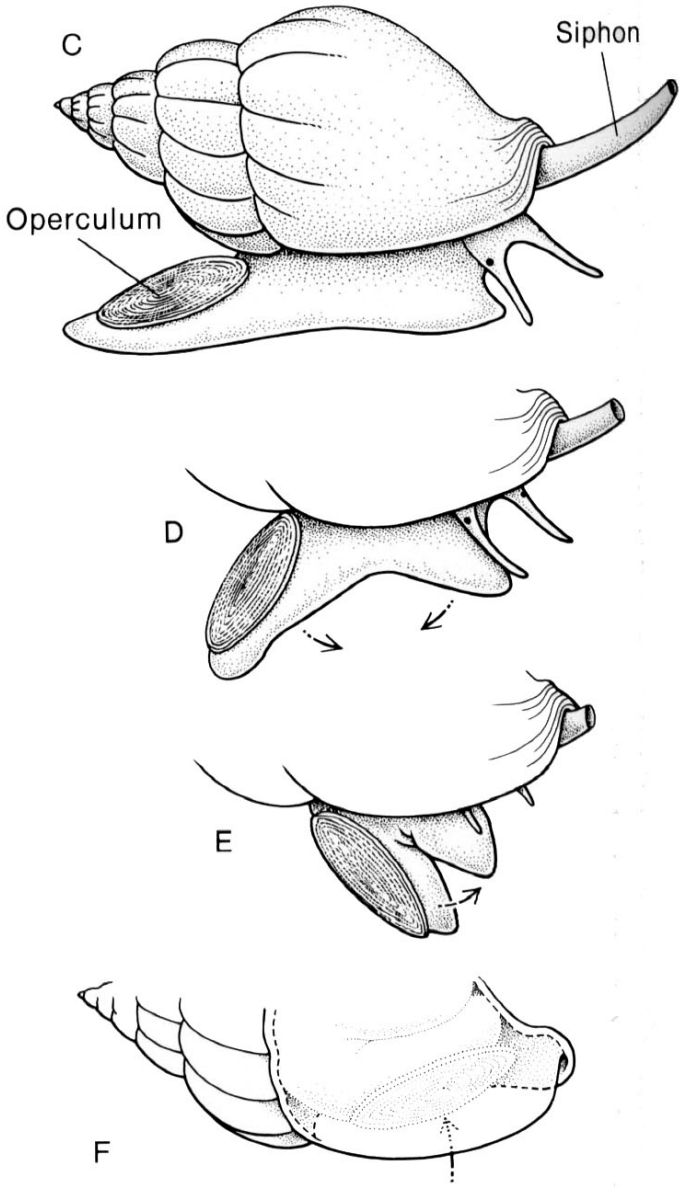




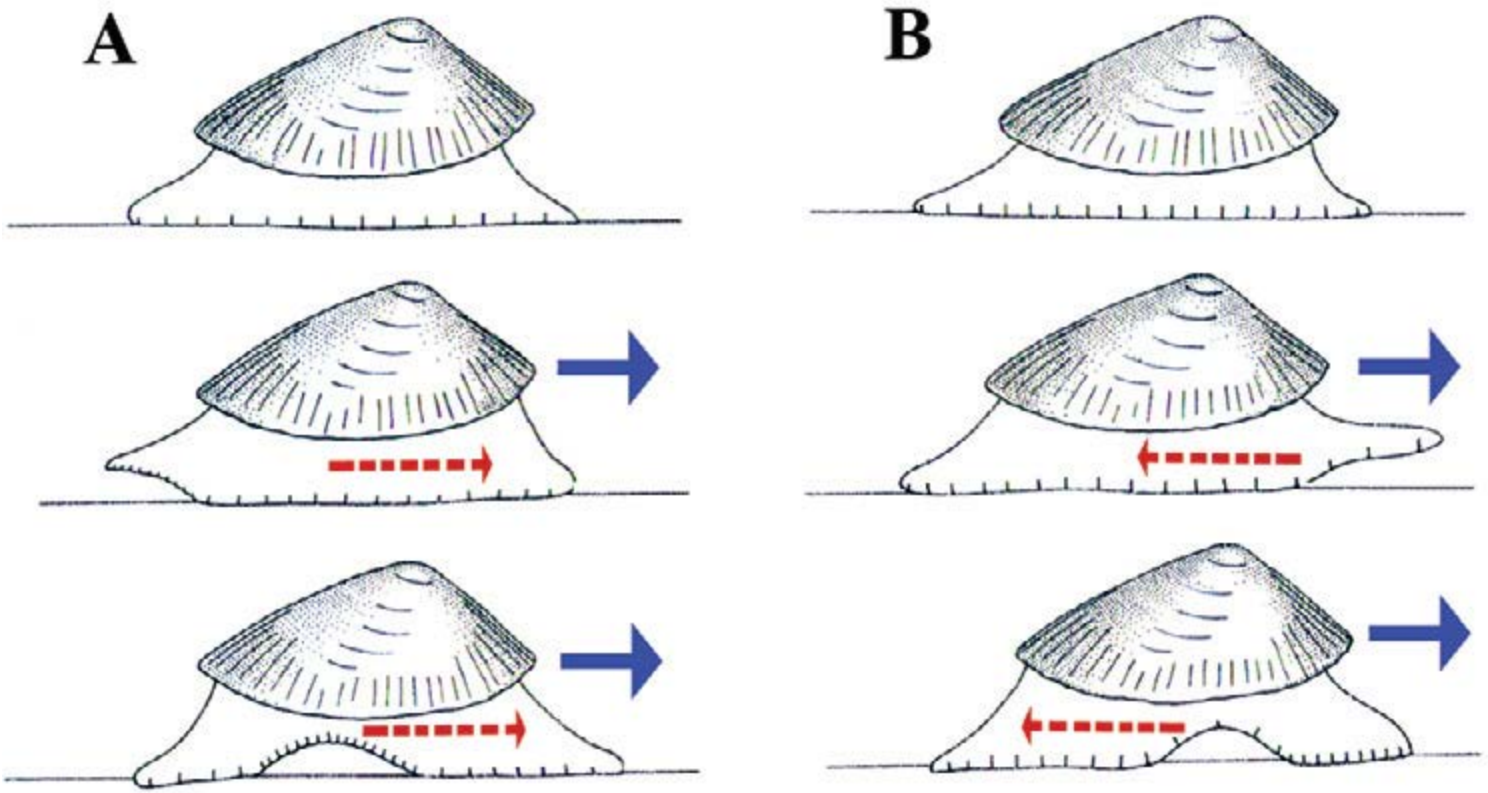




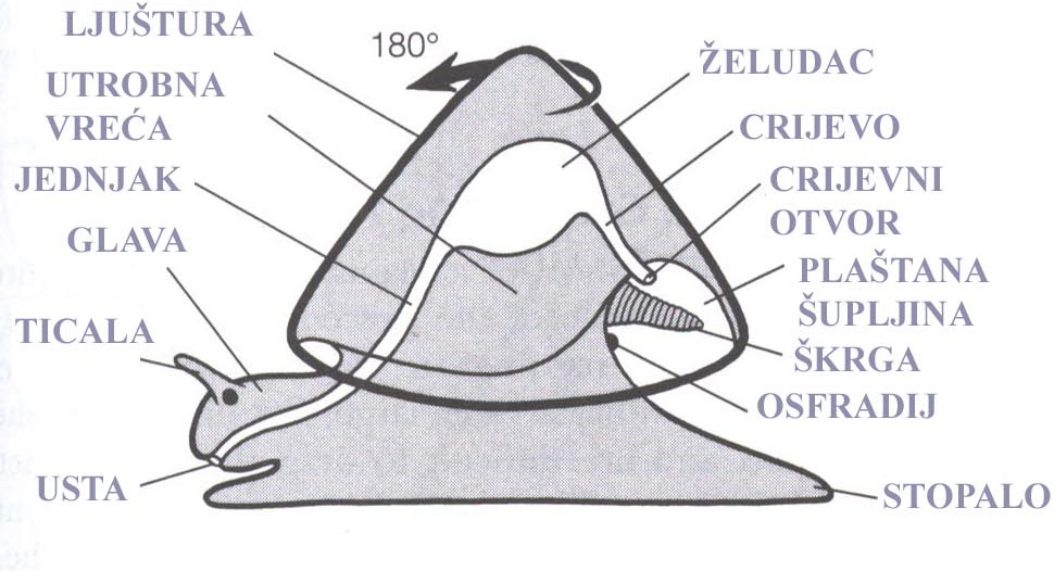
Operkulum

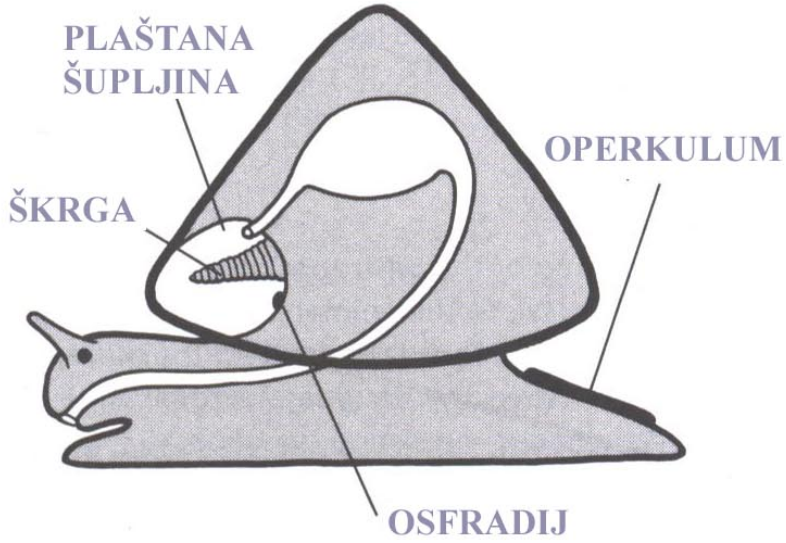


Pokretanje

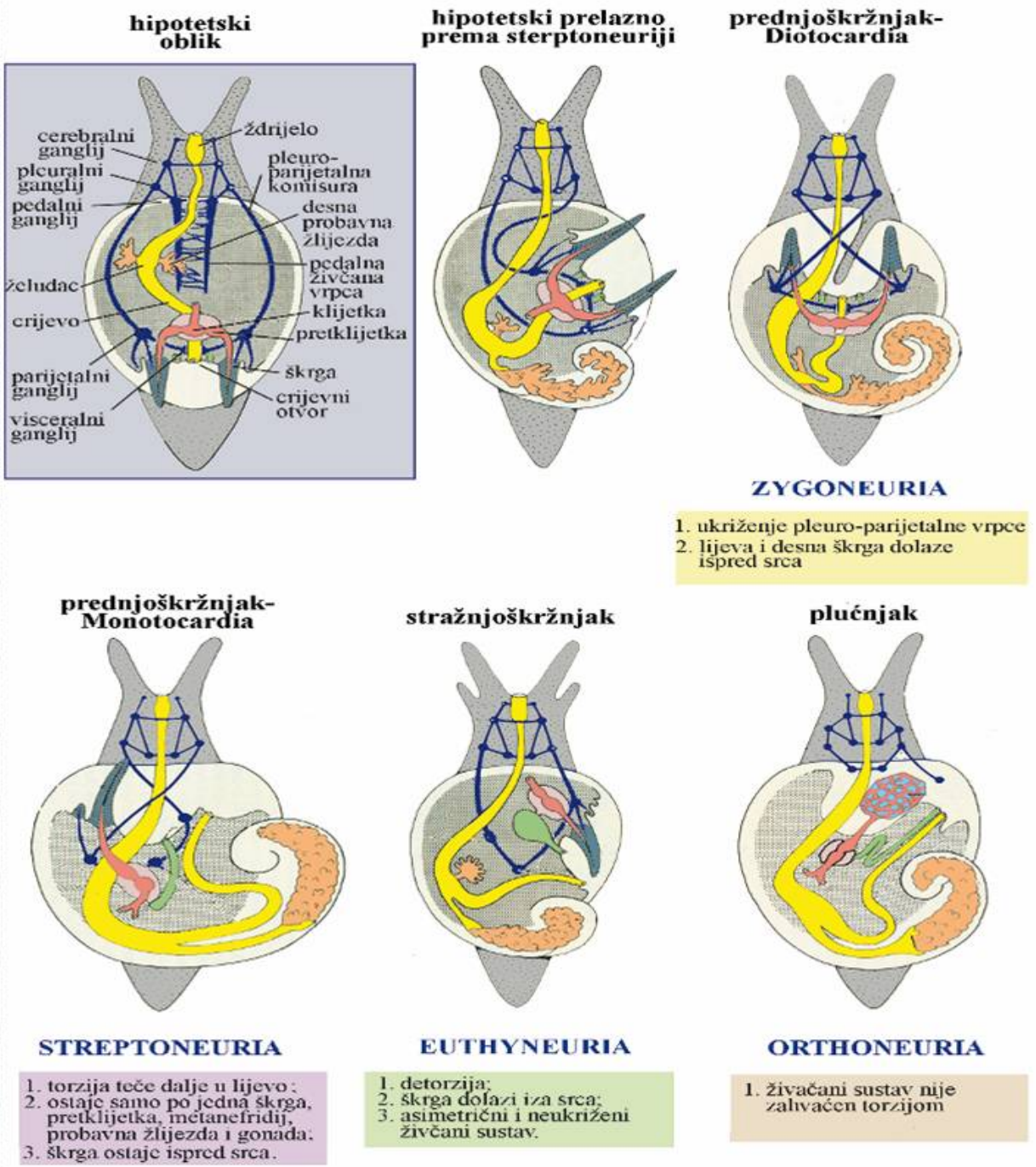


Torzija u puževa

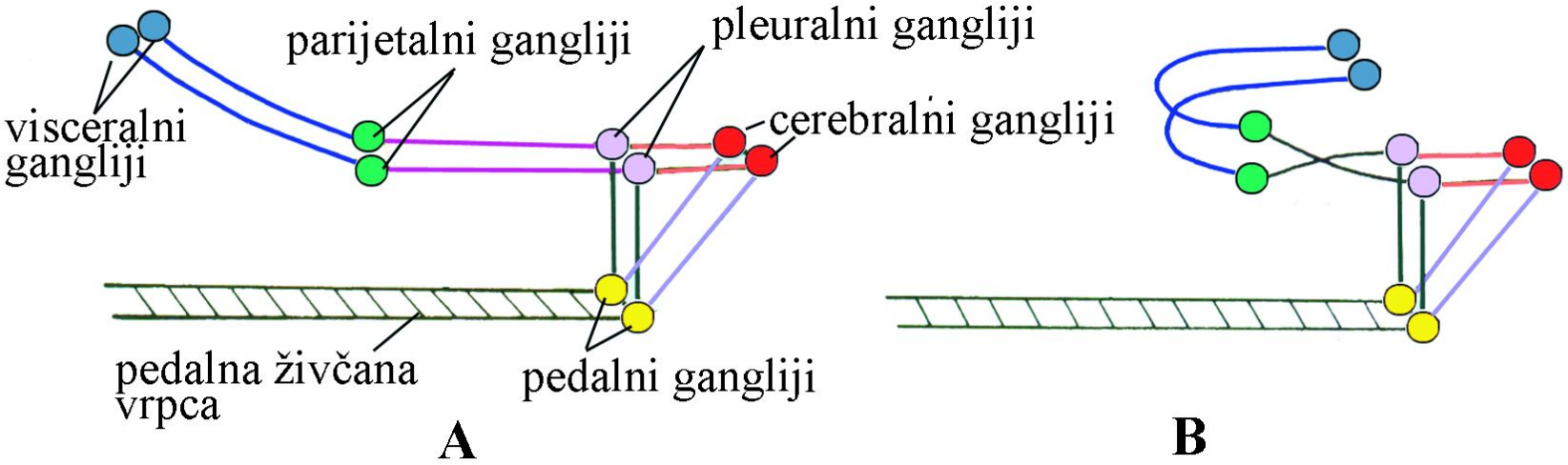




Torzija u puževa



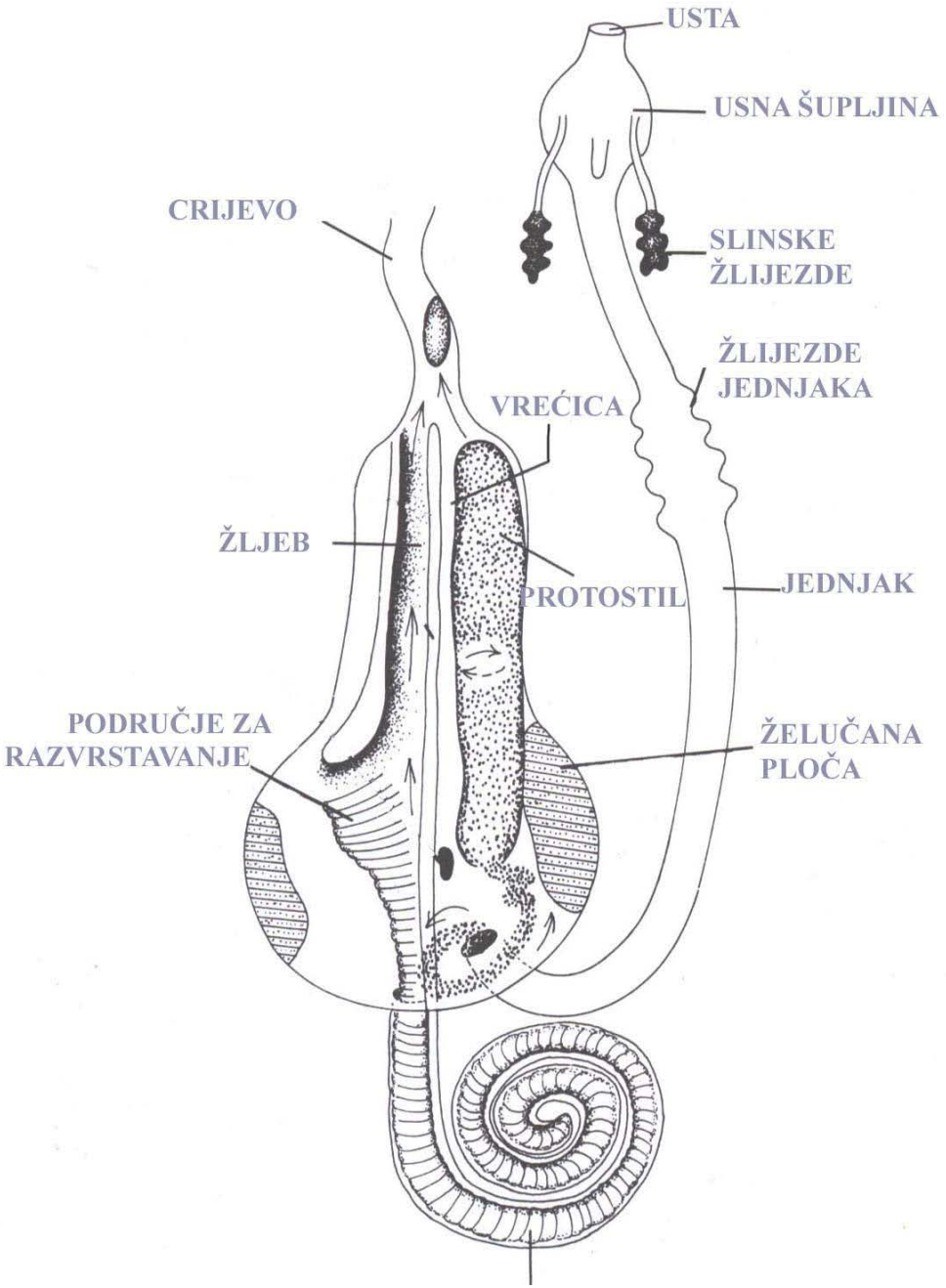
Posljedice torzije na položaj živčanog sustava kod puževa



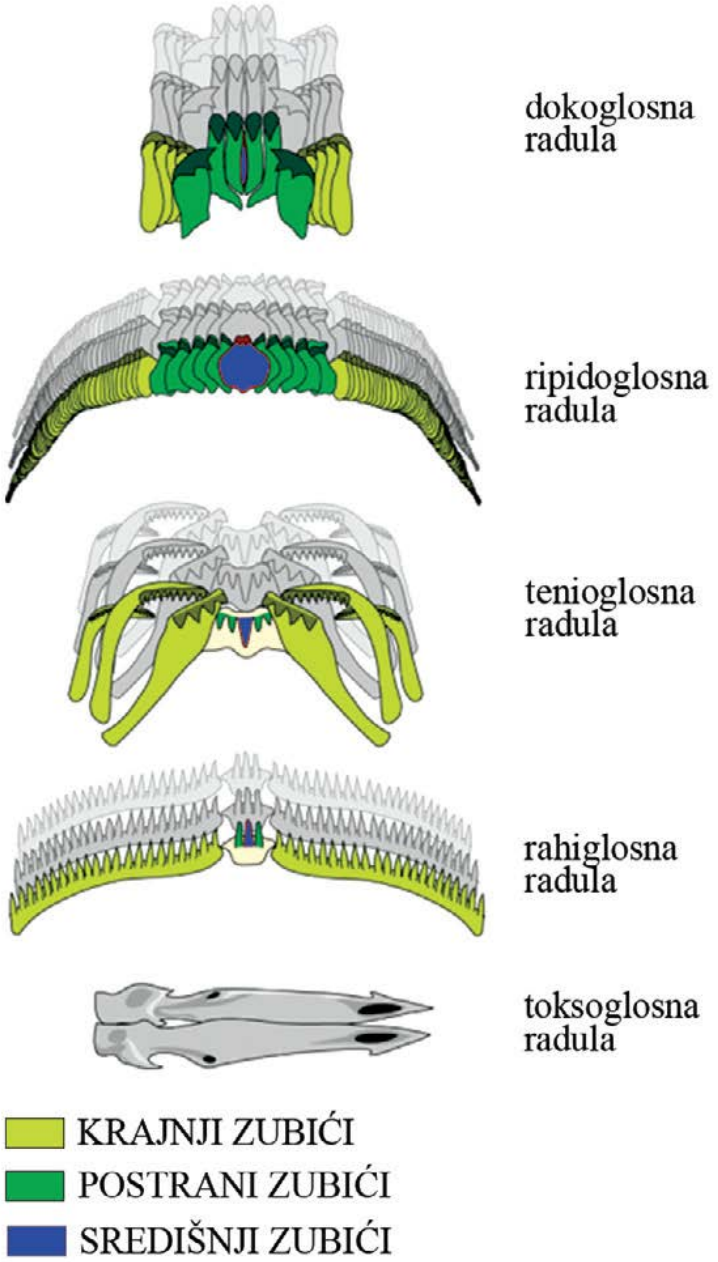


oči
ticala
penis
cerebralni ganglij
crijevo
crijevni otvor
srce
radula
jednjak
ljuštura
pedalni ganglij
dvospolna žlijezda
slinske žlijezde
probavna žlijezda
jajovod
želudac

Probavni sustav



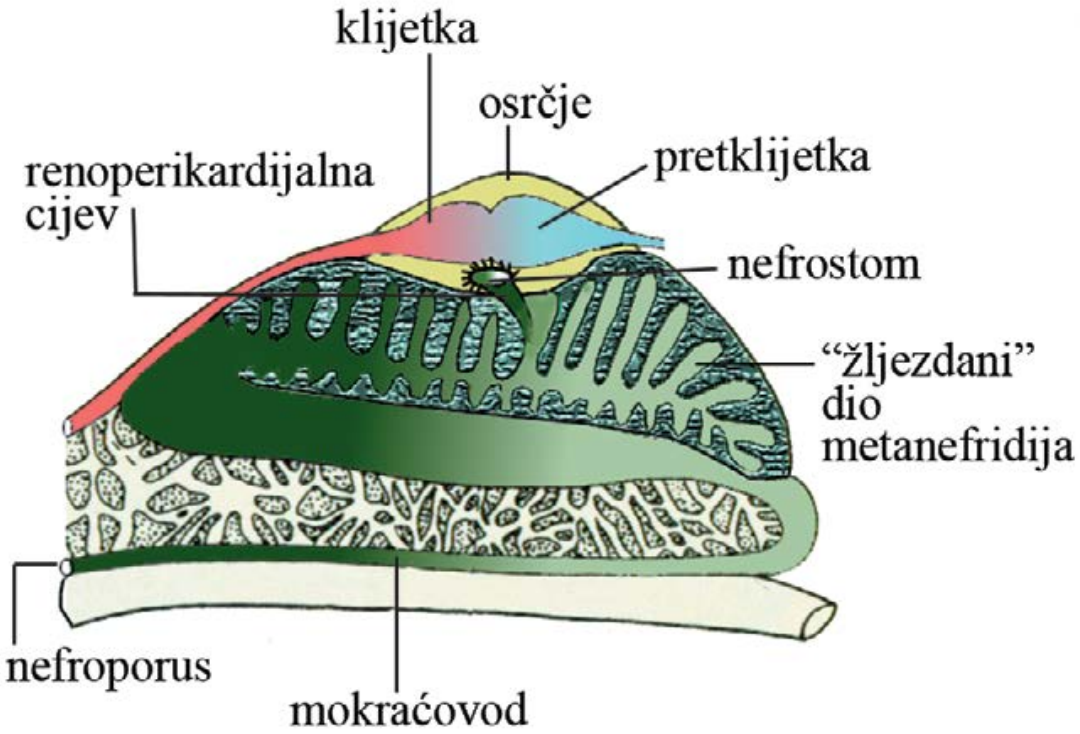
Radula



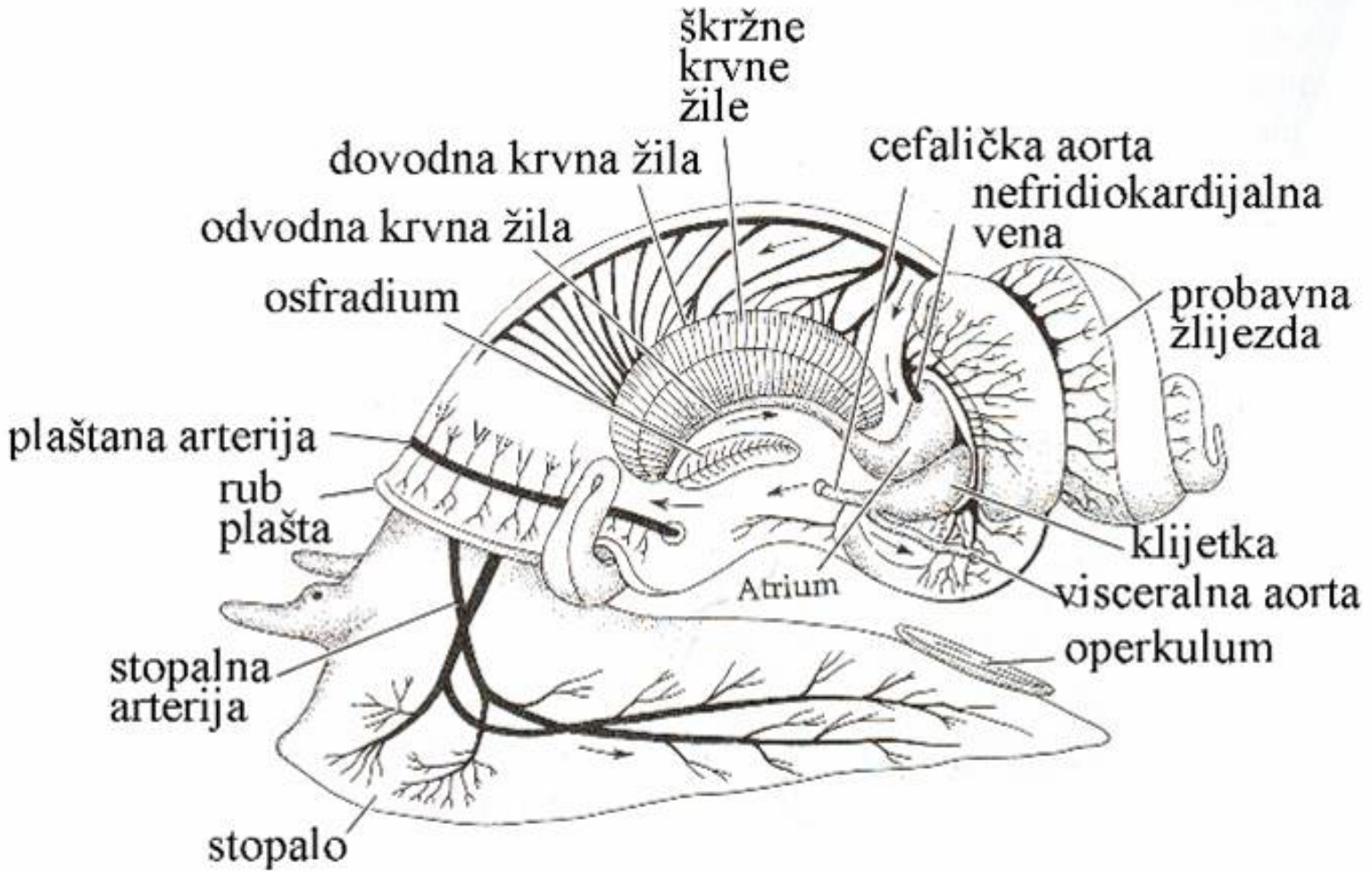
https://www.youtube.com/watch?v=7fUMtwfTqa0

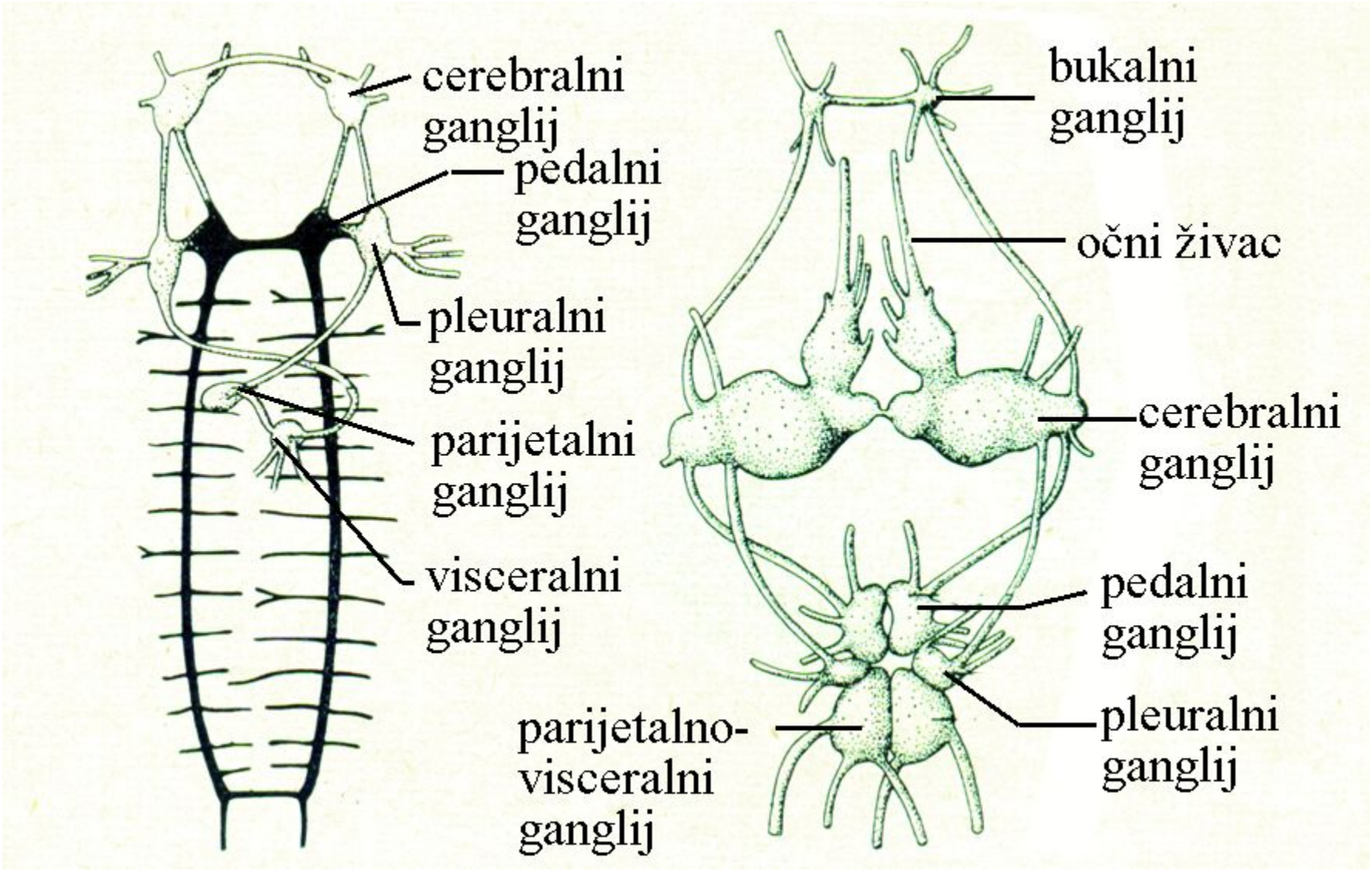
Ekskrecija

- vodeni – amoniotelični
- kopneni – urikotelični
  - neki prilagođeni na velik gubitak vode (*Helix* i do 50%, *Limax* i do 80%*)*
  - u vlažnim staništima ili aktivni noću



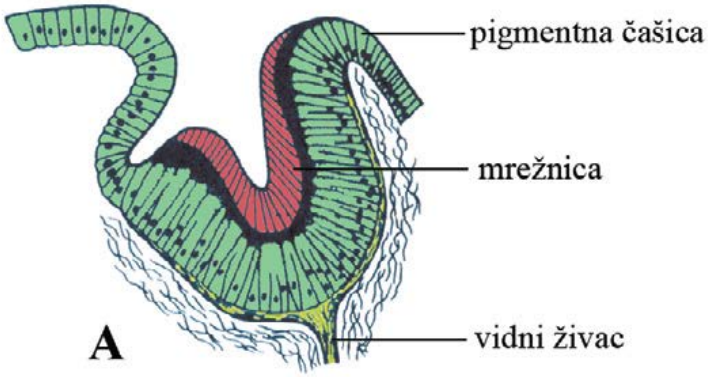
Optjecajni sustav

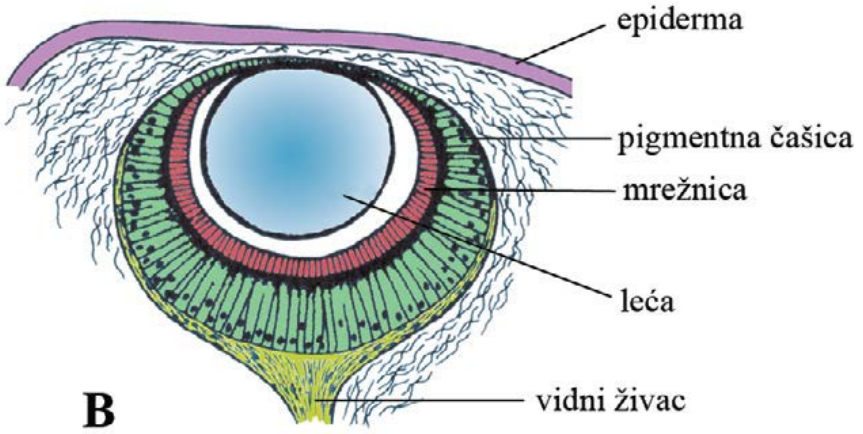


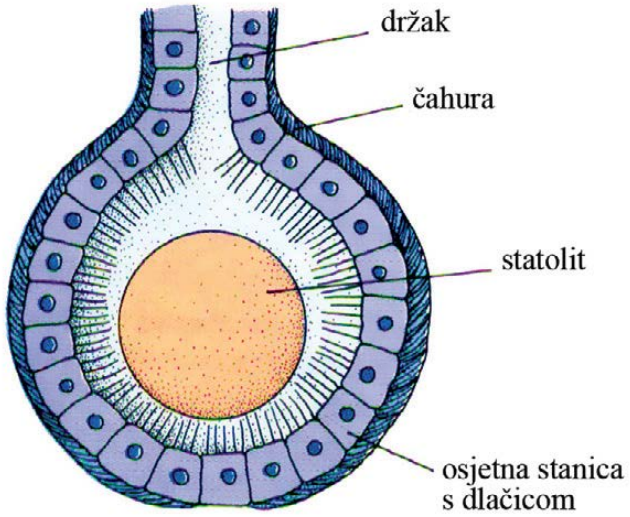

cerebralni ganglij
pedalni ganglij
pleuralni ganglij
parijetalni ganglij
visceralni ganglij
bukalni ganglij
očni živac
cerebralni ganglij
pedalni ganglij
pleuralni ganglij
parijetalno-visceralni ganglij

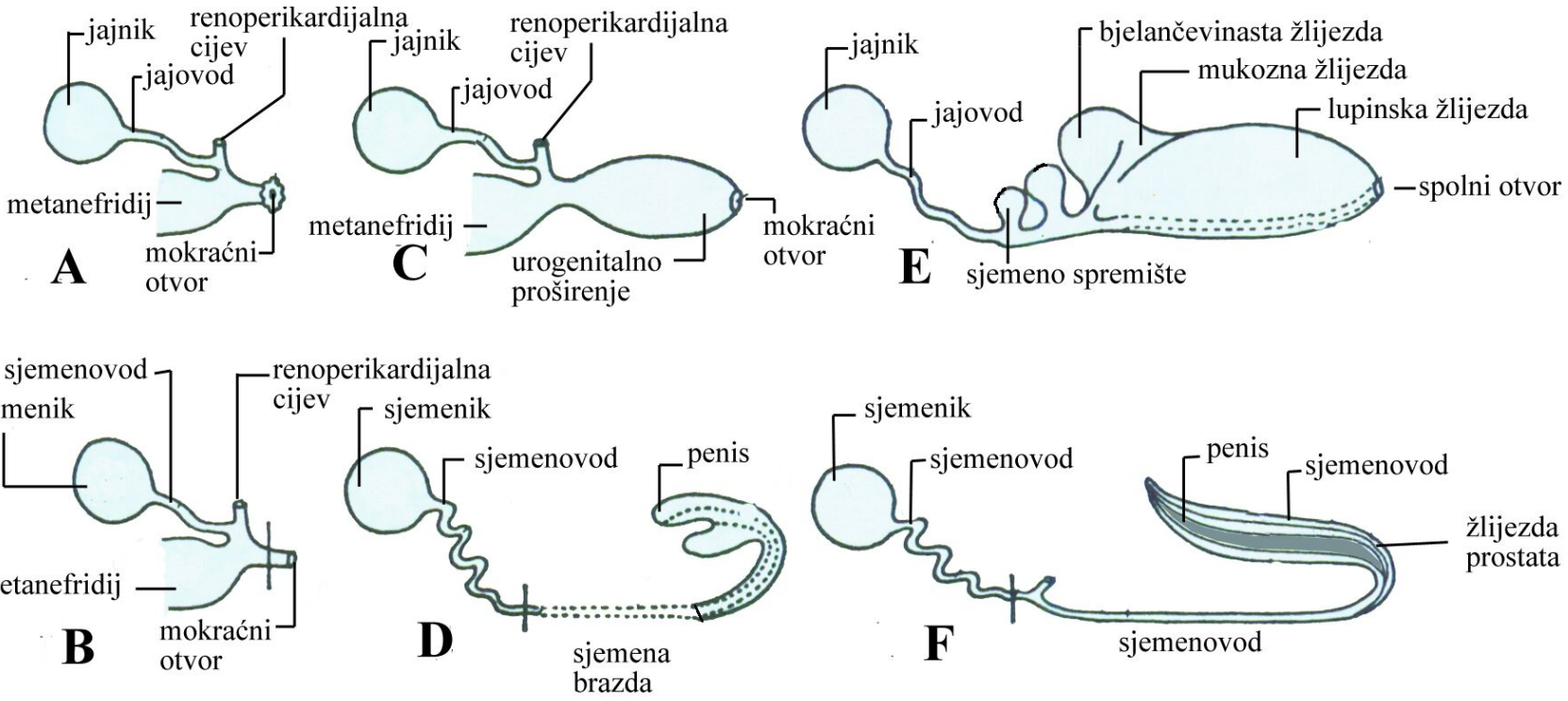
Osjetila

- oči
- ticala
- osfradiji
- statociste

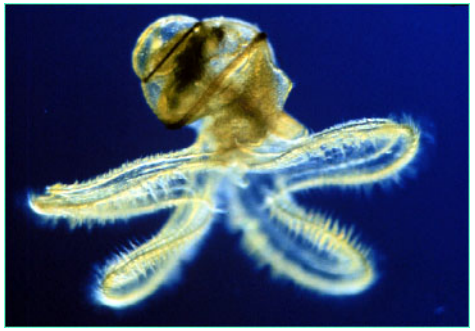







jajnik
renoperikardijalna cijev
jajovod
metanefridij
mokraćni otvor
A
jajnik
renoperikardijalna cijev
jajovod
metanefridij
urogenitalno proširenje
mokraćni otvor
C
jajnik
bjelančevinasta žlijezda
mukozna žlijezda
lupinska žlijezda
jajovod
spolni otvor
sjemeno spremište
E
sjemenovod
sjemenik
renoperikardijalna cijev
metanefridij
mokraćni otvor
B
sjemenik
sjemenovod
penis
sjemena brazda
D
sjemenik
sjemenovod
penis
sjemenovod
žlijezda prostata
sjemenovod
F





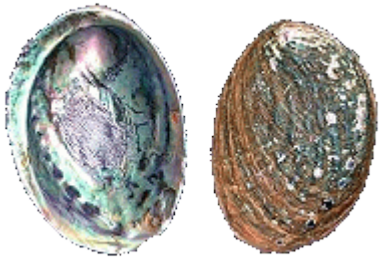
Rasprostranjenost i biološka raznolikost faune puževa

- najbrojnija skupina mekušaca (**?** 40 000–100 000 vrsta, vjerojatno ≈ 70 000)
- najvećim dijelom žive u moru, manji broj vrsta na kopnu, a najmanji u slatkim vodama

1. **Prosobranchia**
   - **Archeogastropoda (Diotocardia)**
   - **Mesogastropoda (Monotocardia)**
   - **Neogastropoda (Monotocardia)**
2. **Opistobranchia**
   - **Tectibranchia**
   - **Sacoglossa**
   - **Nudibranchia**
3. **Pulmonata**
   - **Basimmatophora**
   - **Stylommatophora**

1. **Prosobranchia** - **prednjoškržnjaci** žive u moru, a manjim dijelom i u slatkim vodama

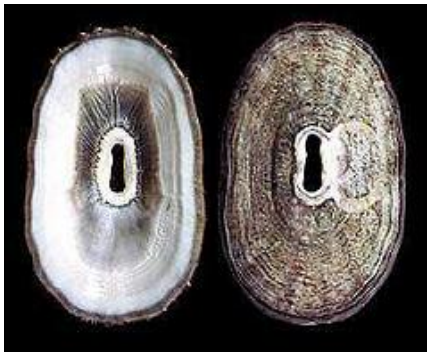
1. Red Archaeogastropoda – obično 2 škrge (2 pretklijetke), 2 nefridija



Haliotis **-** puzlatka



Patella - priljepak



Fissurella **-** rasporka



Calliostoma **-** zvrk

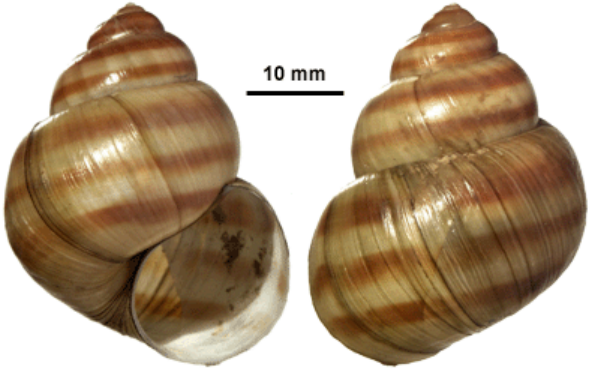


Theodoxus fluviatilis



Astraea rugosa - turban

2. Red Mesogastrtopoda –1 škrga (1 pretklijetka), 1 nefridij, 1 osfradij



Viviparus viviparus - živorodni ogrc



Vermetus



Cerithium - vretenjača



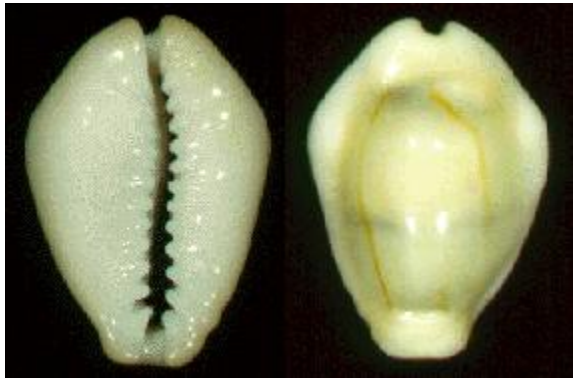
Janthina – ljubičasti splavar



Aporrhais pes-pelecani – pelikanovo stopalo



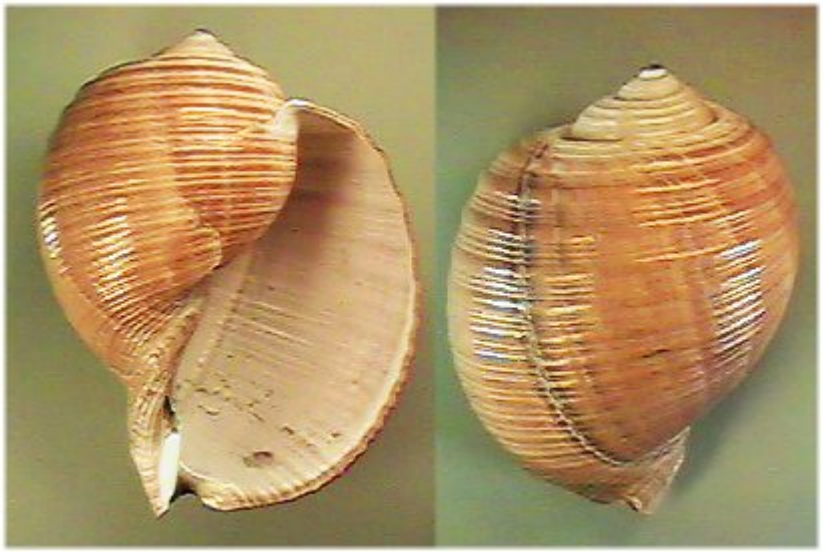
Cypraea lurida
– žabica, kravica



Cypraea moneta



Natica millepunctata



Dolium galea – velika bačvara

3. Red Neogastropoda



Murex brandaris – bodljavi volak
M. trunculus – kvrgavi volak



Columbella rustica



Conus ventricosus - stožac



2. Opisthobranchia - stražnjoškržnjaci

- isključivo stanovnici mora (na dnu ili u planktonu)
- plašt i kućica mogu biti reducirani
- na stopalu česti parapodiji
- plaštana šupljina s desne strane tijela

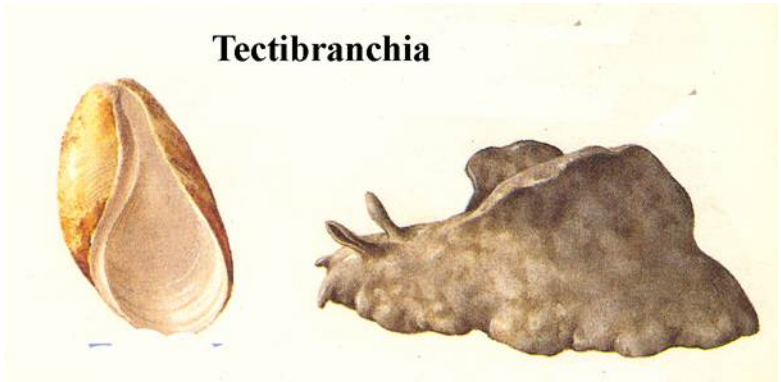




Aplysia – morski zekan







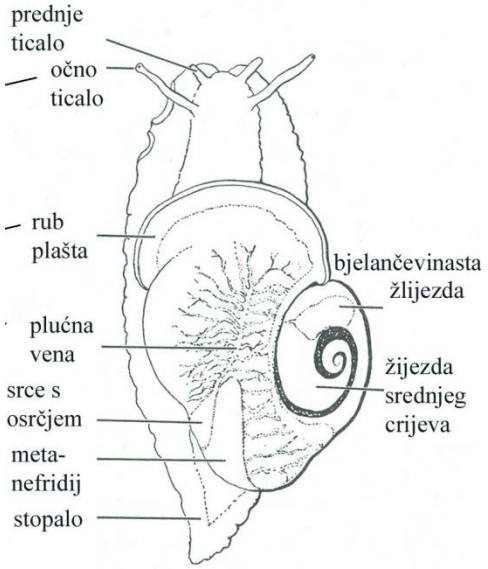


Tethys fimbria

3. Pulmonata - plućnjaci

- prilagođenii životu na kopnu
- detorzija ⇨ plaštana šupljina s desne strane
- prokrvljeni plašt; sekundarne škrge iz vanjskog ruba plašta

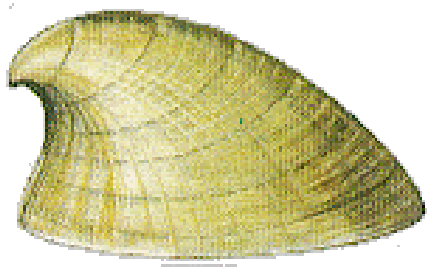
1. red Basommatophora
2. red Stylommatophora



1. **Red Basommatophora**
   jedan par ticala koja mogu uvlačiti
   na osnovici ticala su oči



Lymnaea stagnalis - obični barnjak



Ancylus fluviatilis

Por. Carychiidae



Weigand, 2013

Zospeum tholussum

- Troglobiont, kopnena vrsta
- opisan 2013.

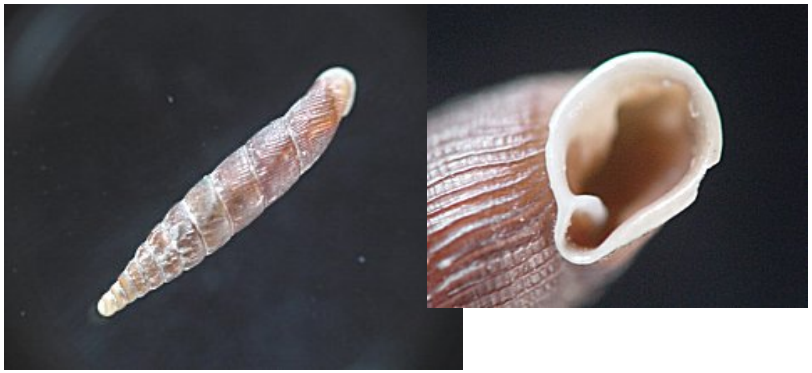
- 5 vrsta ovog roda strogo zaštićene

http://www.esf.edu/top10/10.htm



2. Red Stylommatophora

kopneni puževi s kućicom ili bez nje
dva para ticala
oči na vrhu 2. para ticala



Clausilia **-** zaklopnica



Arion rufus – šumski prpolj



Limax - balavac



Cepaea nemoralis – prugasti živičnjak