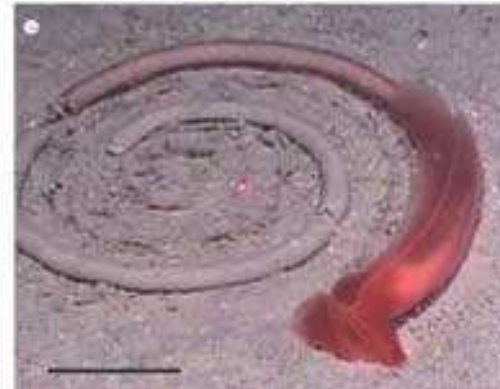
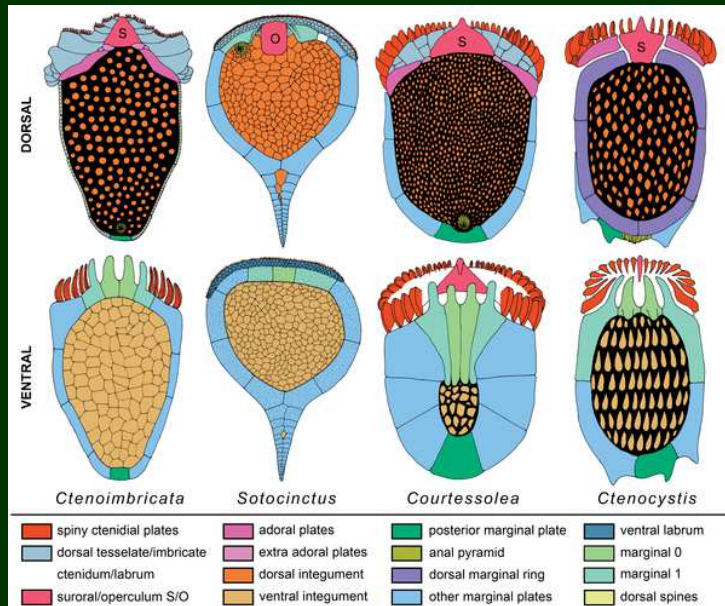
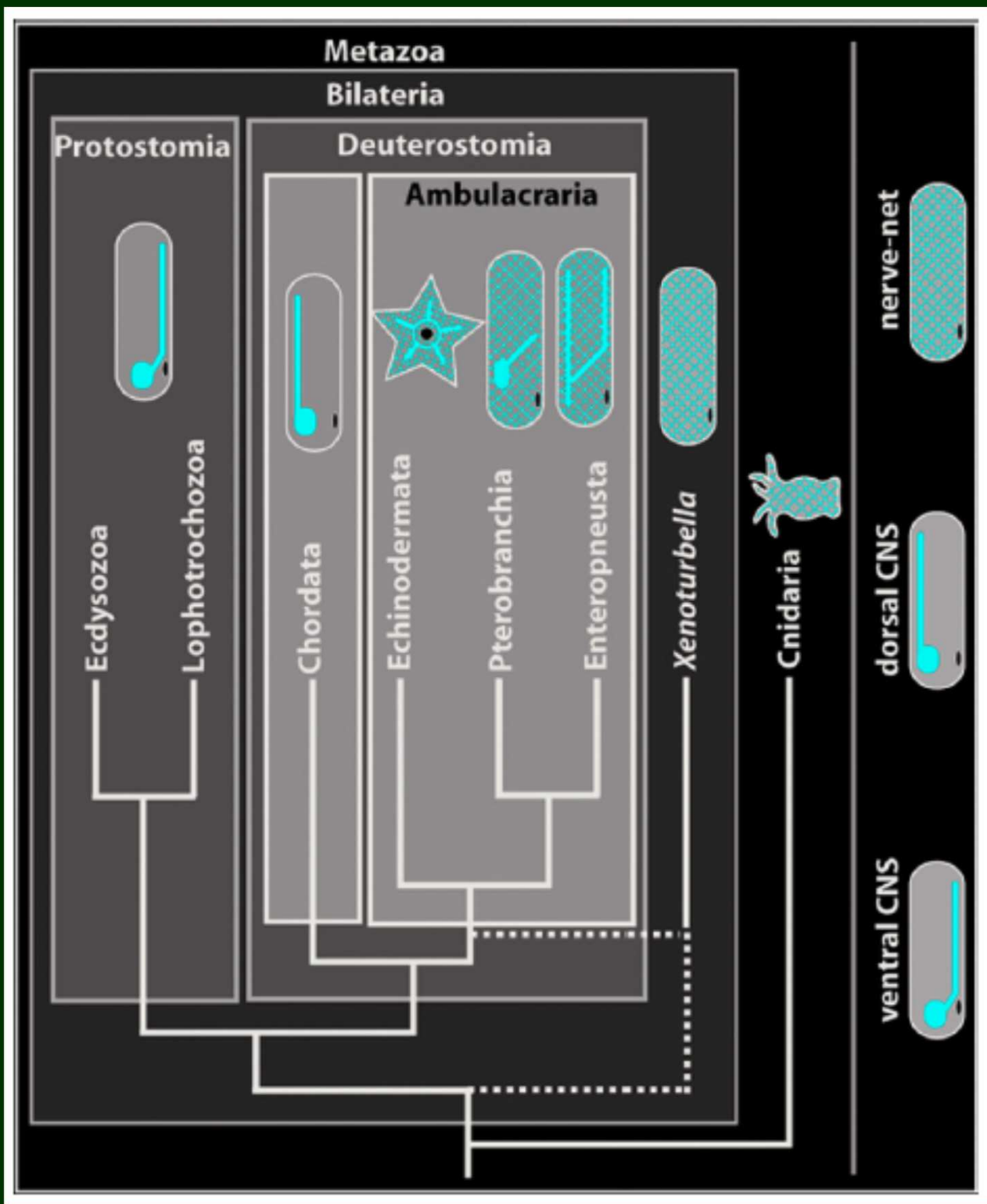


Deuterostomia



Deuterostomia

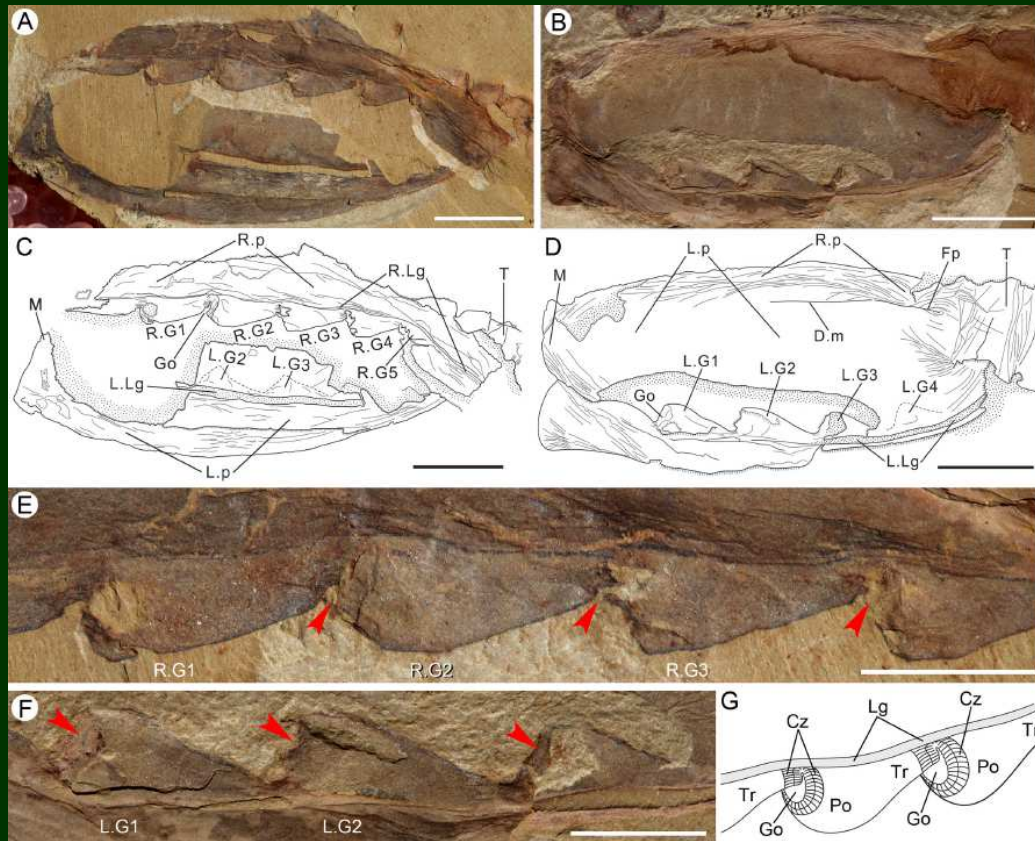
- odvozený typ embryonálního vývoje (rýhování, vznik střeva, vznik célomu, druhotný ústní otvor)
- x druhoústost strunatců a ambulakrarií je úplně jiná (u ambulakrarií larvální adaptace, u strunatců důsledek dorsoventrální inverze)
- původně síťovitá nervová soustava
- → všechny složitější orgány vznikly u nezávisle u prvoústých, strunatců a ambulakrarií?



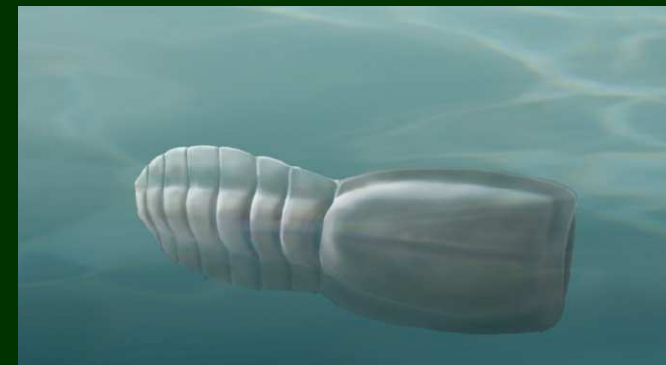
Deuterostomia a evoluce metazoí

- molekulární stromy → krátká větev oddělující předka deuterostomií od předka bilaterií (velmi odvození jsou až strunatci) + výjimečně dokonce parafyletická Deuterostomia + nejasné postavení xenacoelomorf (bazální Bilateria nebo Deuterostomia?) + široká distribuce „druhoústosti“ na bázi protostomií (Chaetognatha, Ecdysozoa)
- → předek bilaterií ~ Xenacoelomorpha ~ Ambulacraria

Vetulicolia



bazální
Deuterostomia,
nebo sesterská
skupina pláštěnců



Deuterostomia

Fylogeneze a systematika

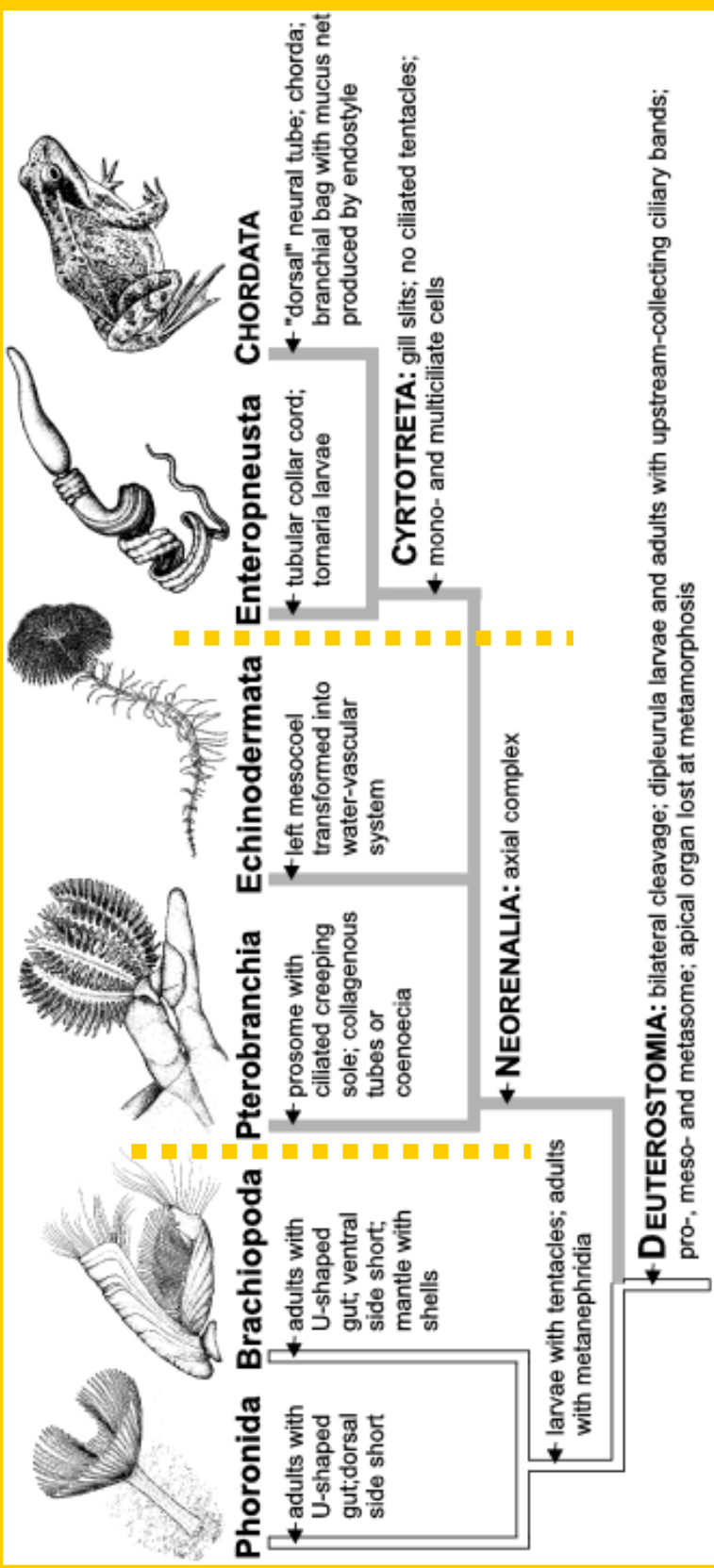
- 1. Ambulacraria
 - 1.1. Echinodermata
 - 1.2. Hemichordata
- 2. Chordata
 - 2.1. Cephalochordata
 - 2.2. Crustozoa (= Olfactores)
 - 2.2.1. Urochordata (= Tunicata)
 - 2.2.2. Craniata (= Vertebrata)
- + Xenacoelomorpha???

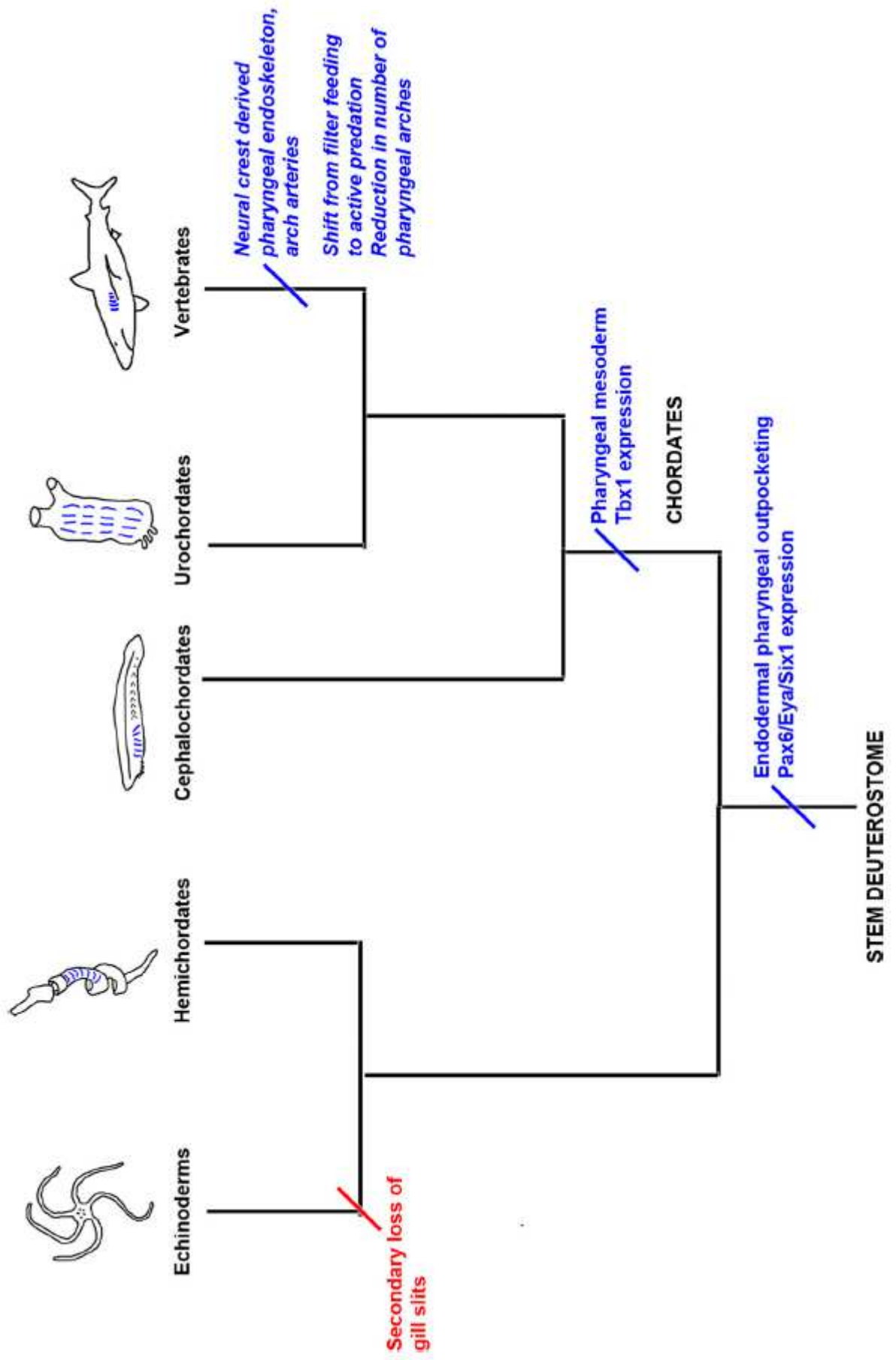


Hemichordata

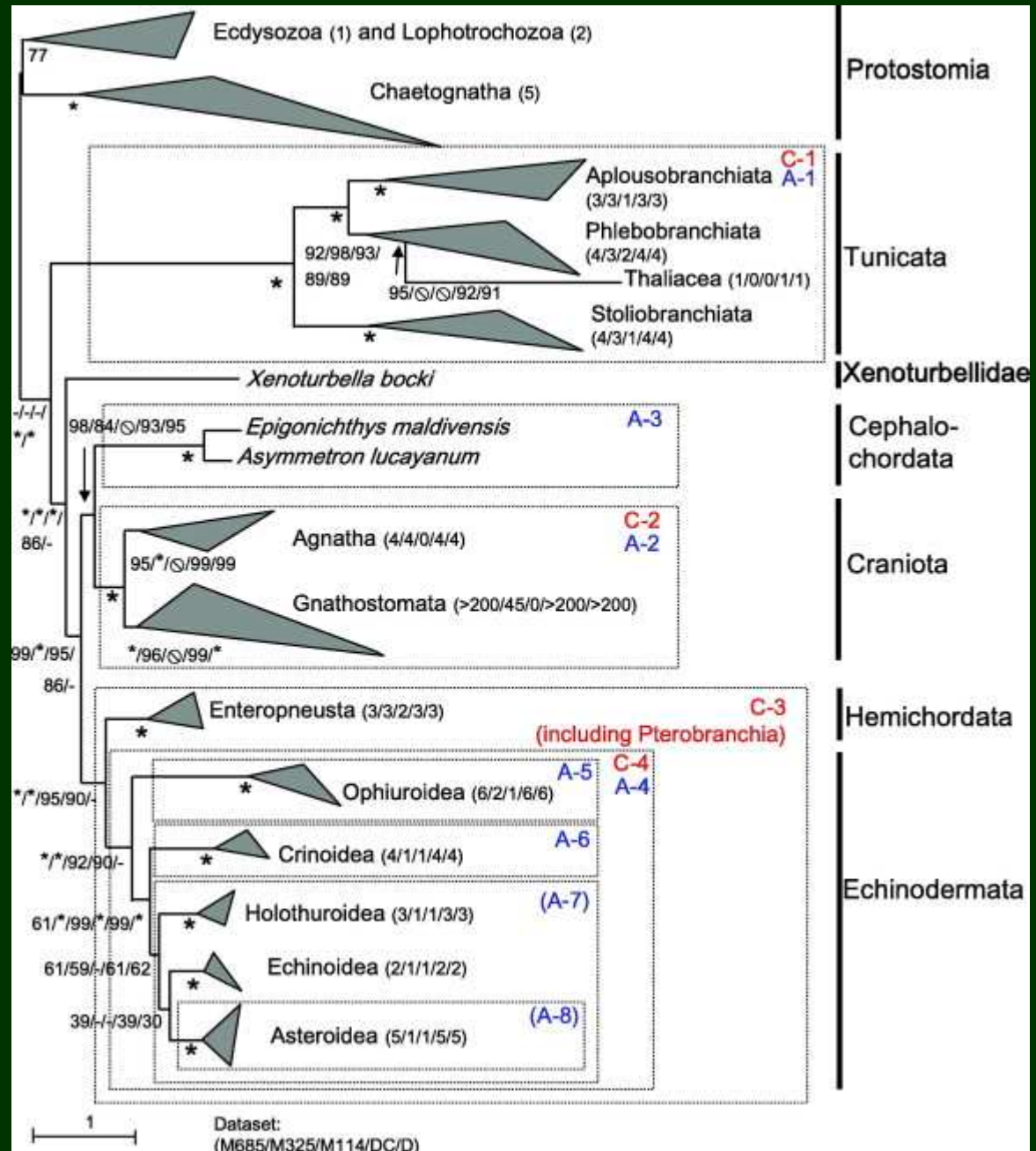


Cephalochordata

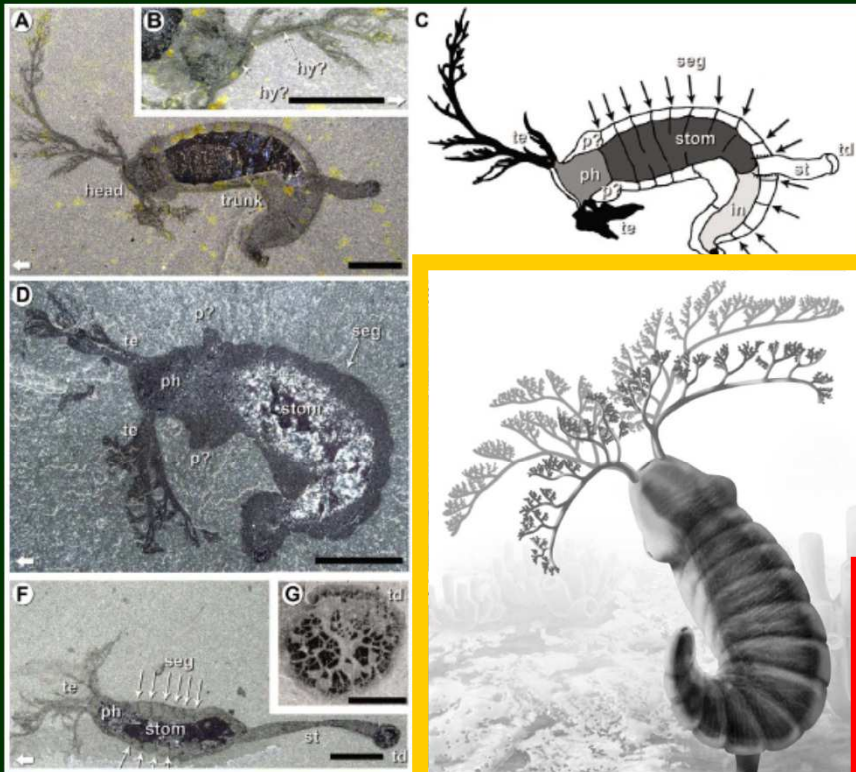




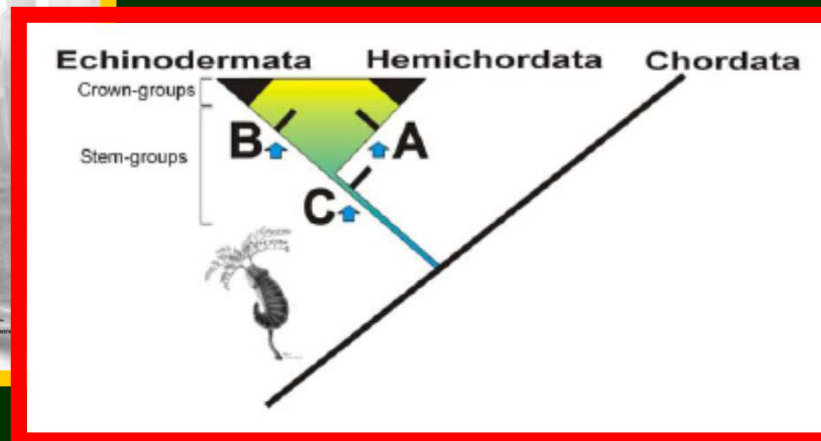
někdy
nemonofyletičtí
strunatci (zjevně
artefakt: pozice
pláštěnců)



Kambrijská Ambulacraria: Cambroernida

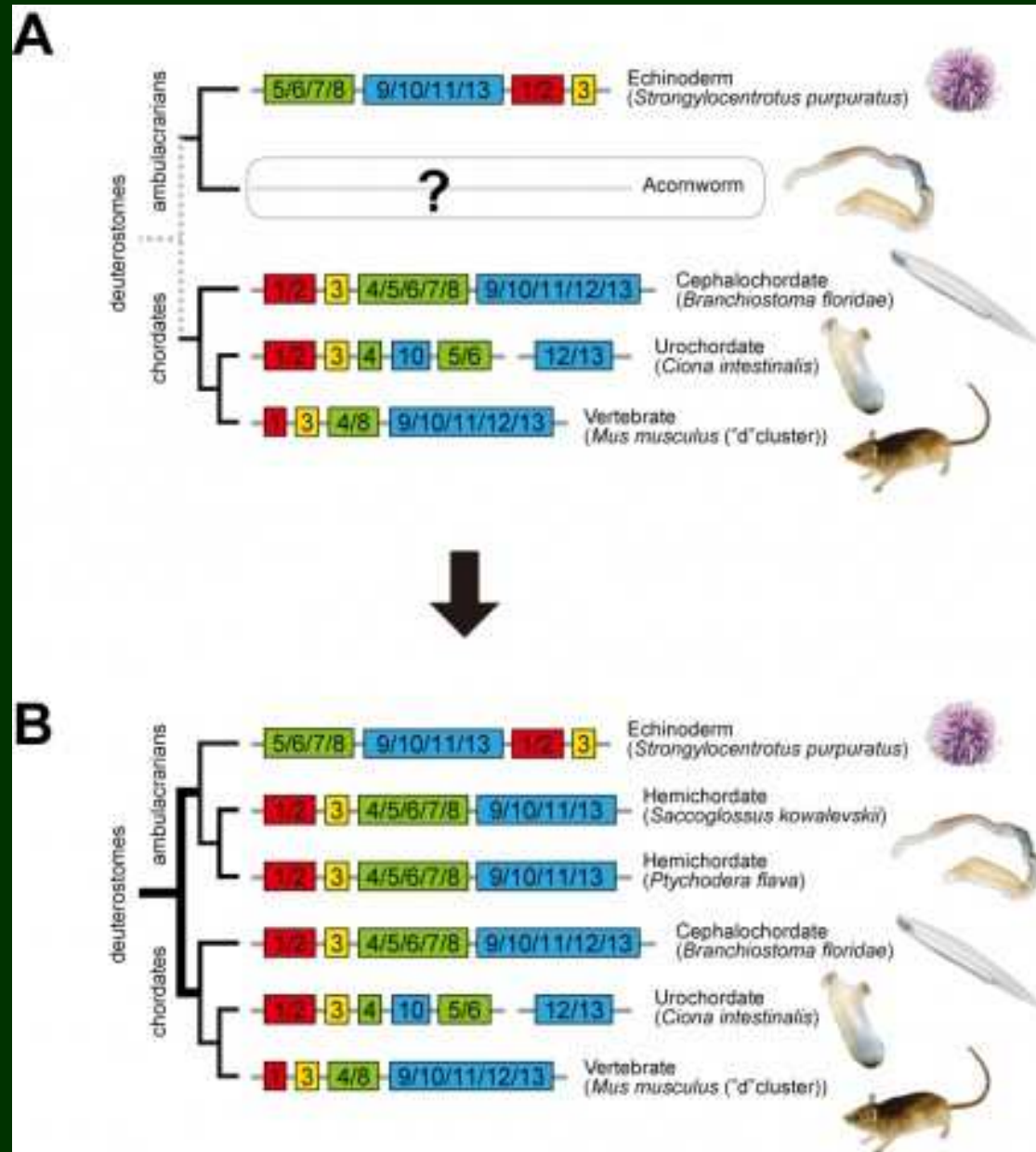


předek ambulakrarií:
bilaterálně symetrický
filtrátor s párovým
systémem vodních cév (L
+ R hydrocél), se
svalnatým postanálním
stvolem („ocasem“?)



Hox komplex

- u obou skupin ancestrálně stejný



Evolve Hox komplexu

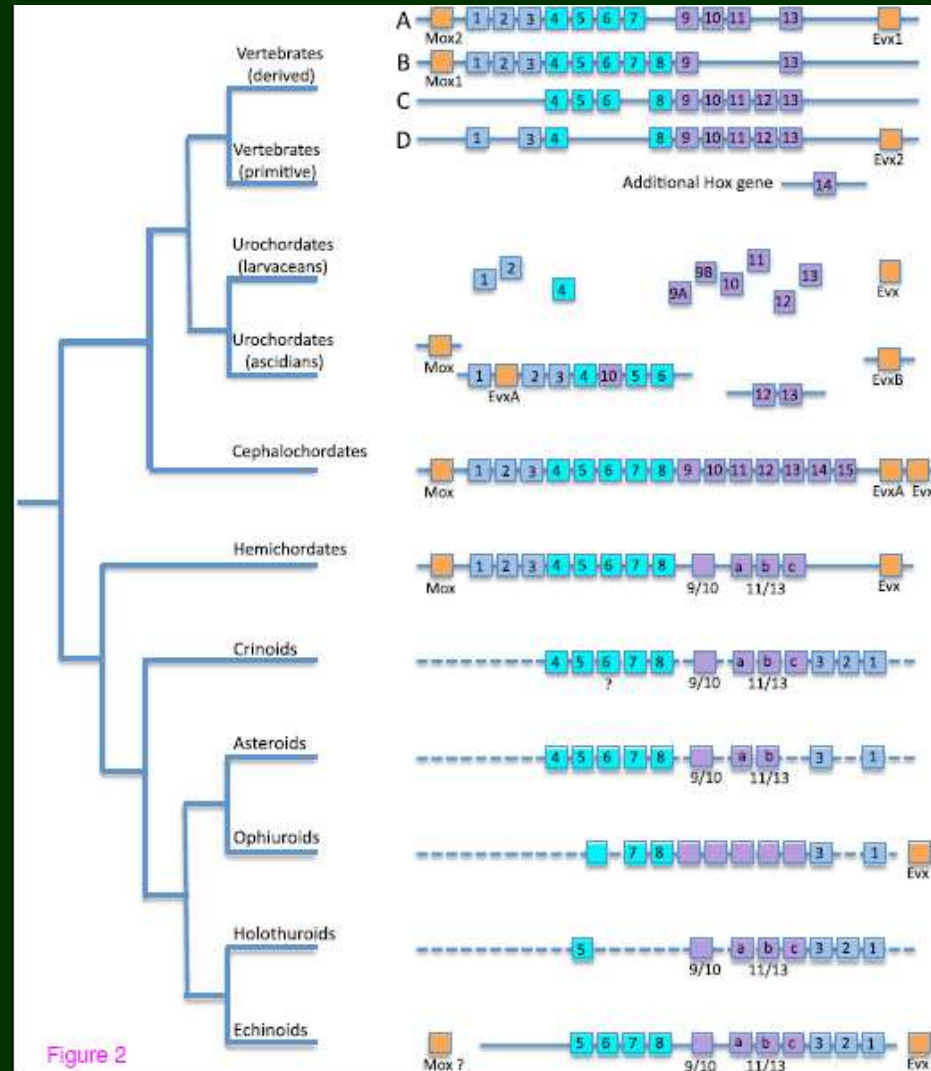


Figure 2

Hemichordata: vznik nervové soustavy (~ neurulace)

čistá histologie!

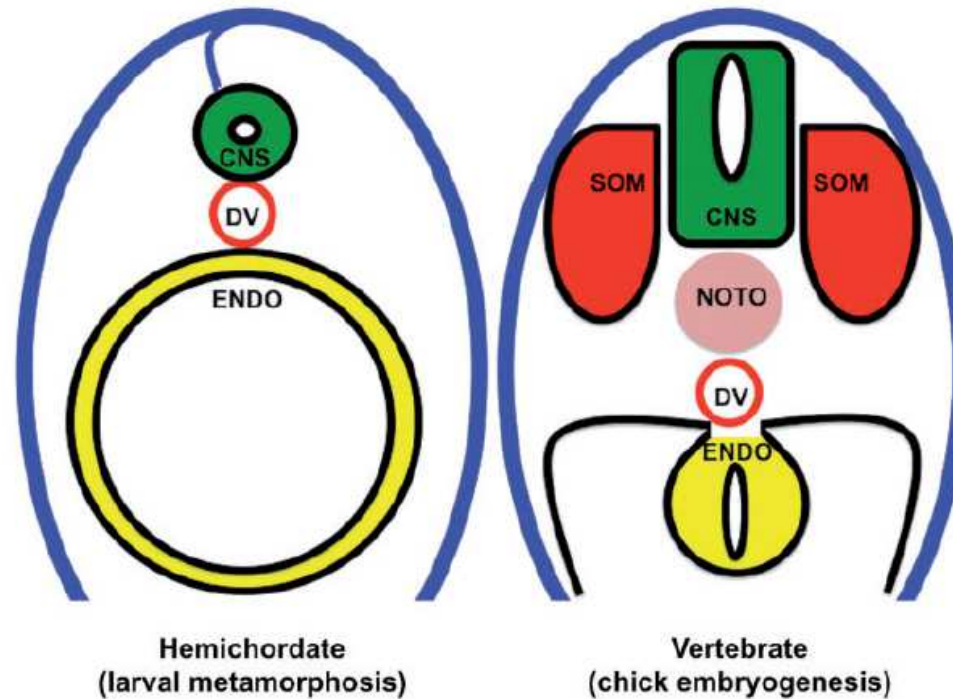
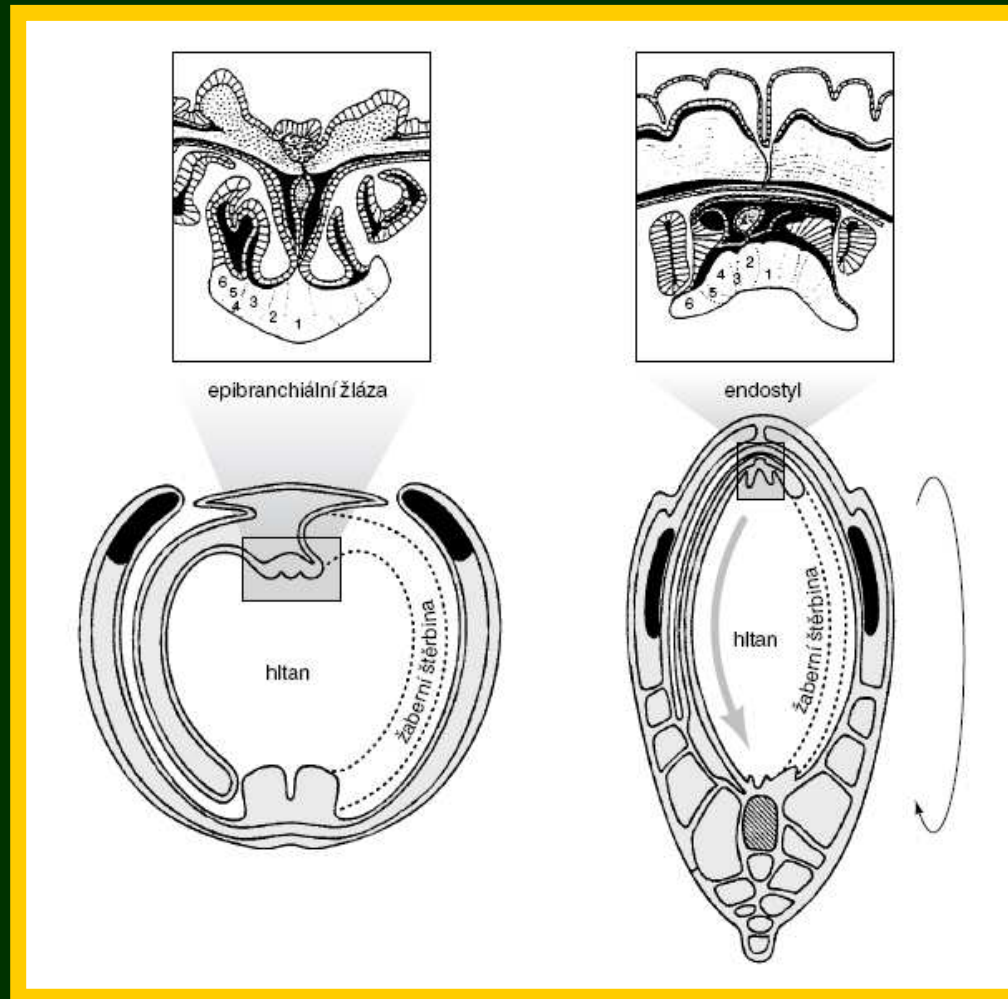


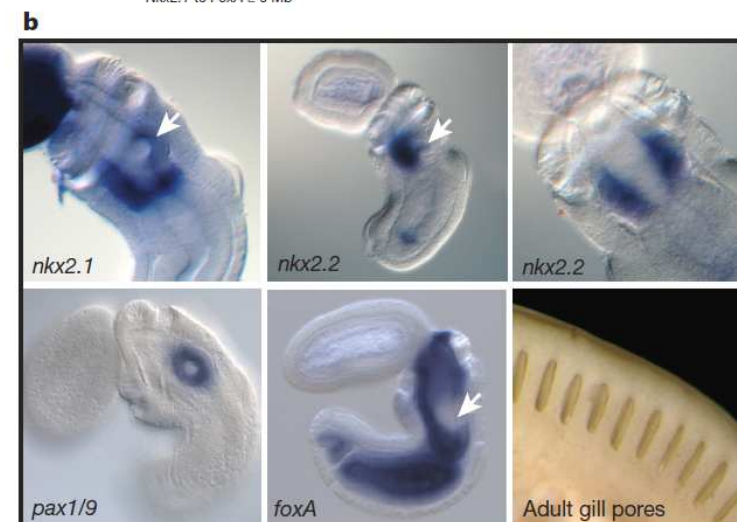
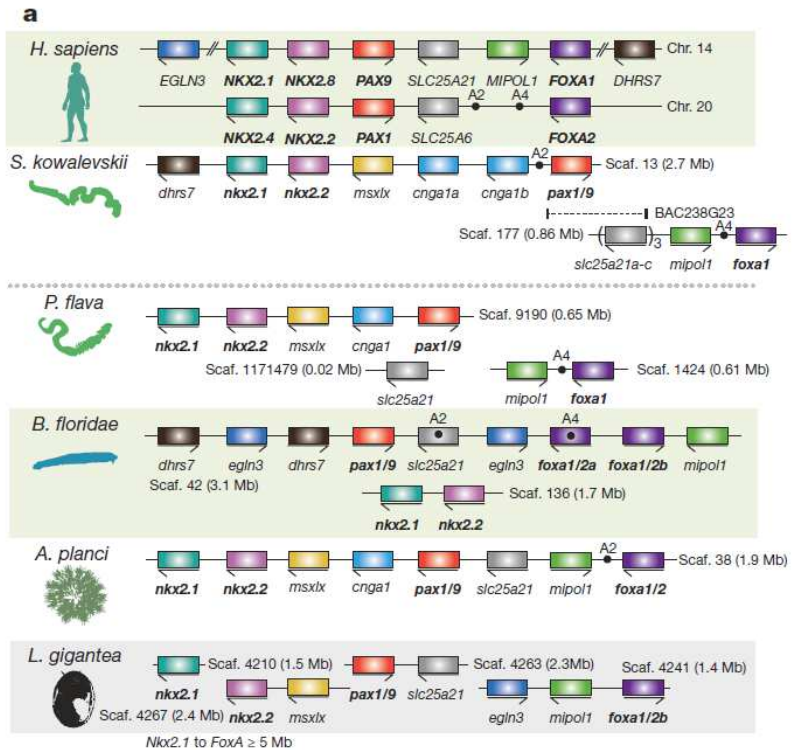
Fig. 4 Diagrams of cross sections of a hemichordate and a vertebrate. In both pictures dorsal is to the top and ventral is to the bottom. In the diagram on the left, the metamorphosing hemichordate neural tube (green) develops above the dorsal vessel (red). The endoderm (yellow) is directly ventral to the dorsal vessel. In the illustration of the developing chick embryo on the right, the vertebrate neural tube (green) develops above the notochord (pink). Somites (red) surround the neural tube and notochord. The dorsal vessel (red) is ventral to the notochord and dorsal to the endoderm (yellow). Blue represents nonneural ectoderm in both images.

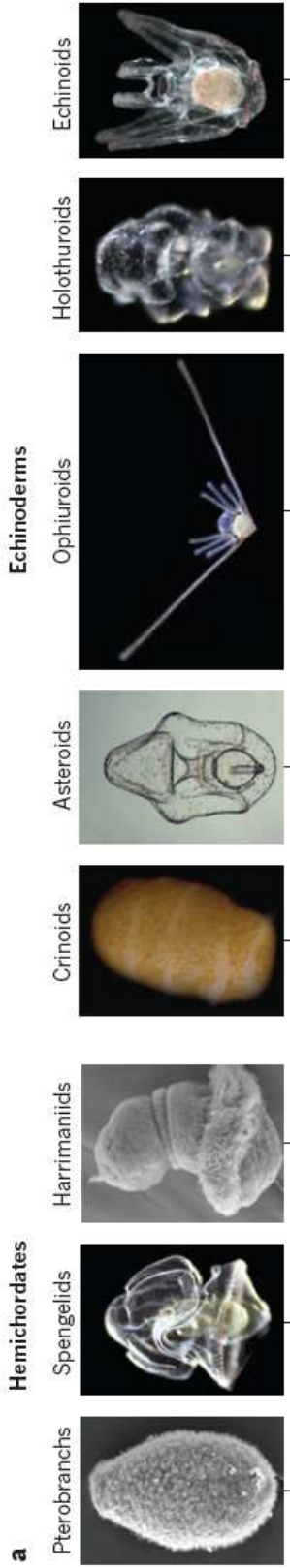


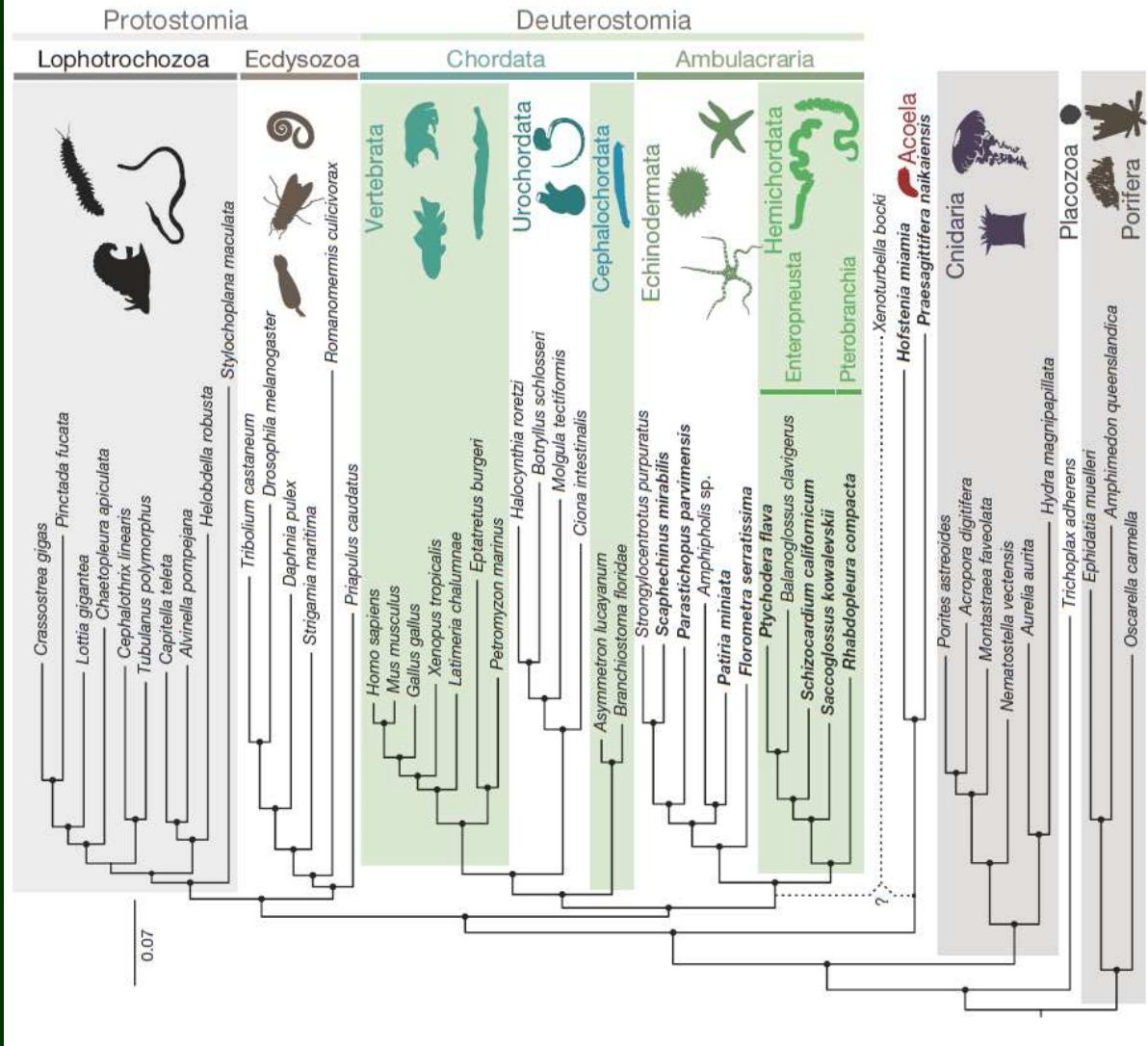
- tři fáze evoluce hltanu:
- 1. **Deuterostomia:** filtrační štěrbiný bez slizového aparátu a bez endostylu
- 2. **Chordata:** DV inverze, slizový filtr, endostyl, produkce jodovaných hormonů
- 3. **Craniata:** dýchací štěrbiný, endostyl → štítná žláza, svalový pohon

Pharyngeal gene cluster

- unikátní pro Deuterostomia
- *Lottia* (měkkýš) má geny oděšené

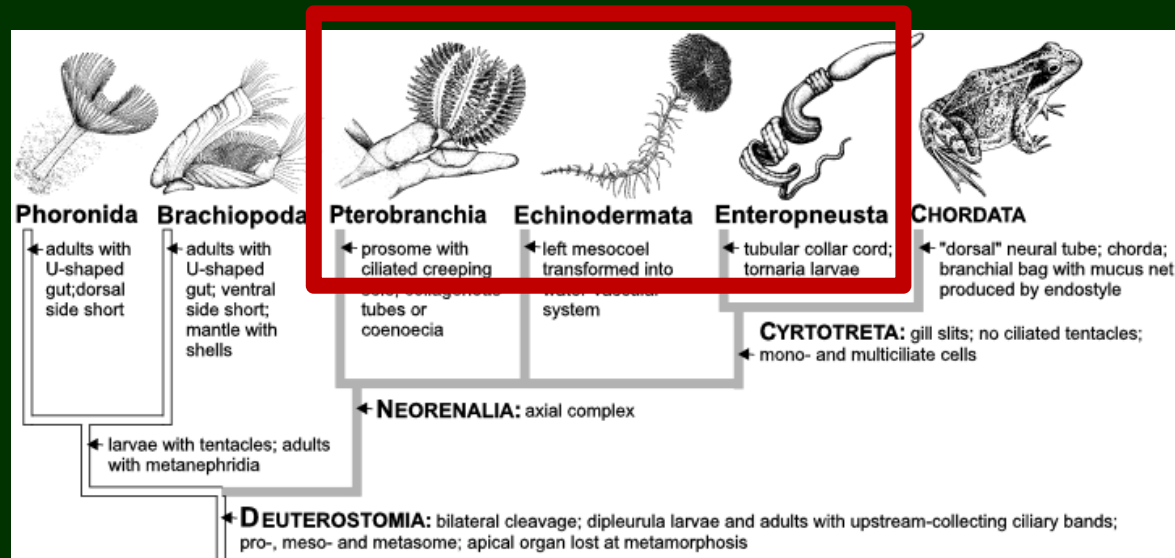






Shrnutí

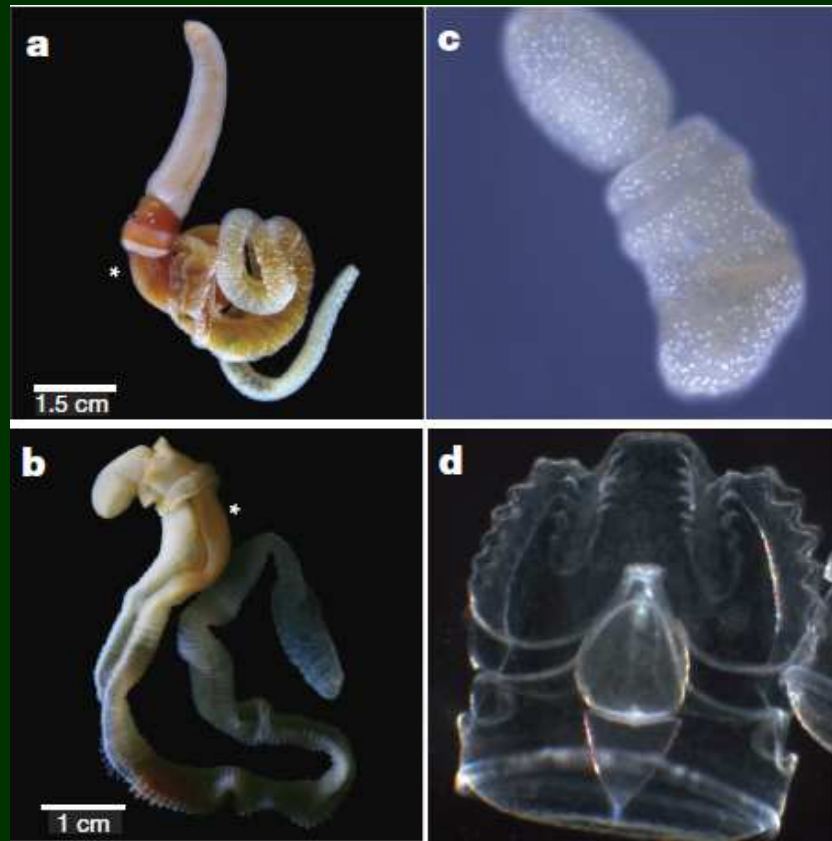
- bazální zástupci Hemichordata a Cephalochordata velmi podobní
- x nejsou si příbuzní
- → předka deuterostomií lze rekonstruovat do značných detailů
- (pokud se tam ovšem nemotají Xenacoelomorpha...)



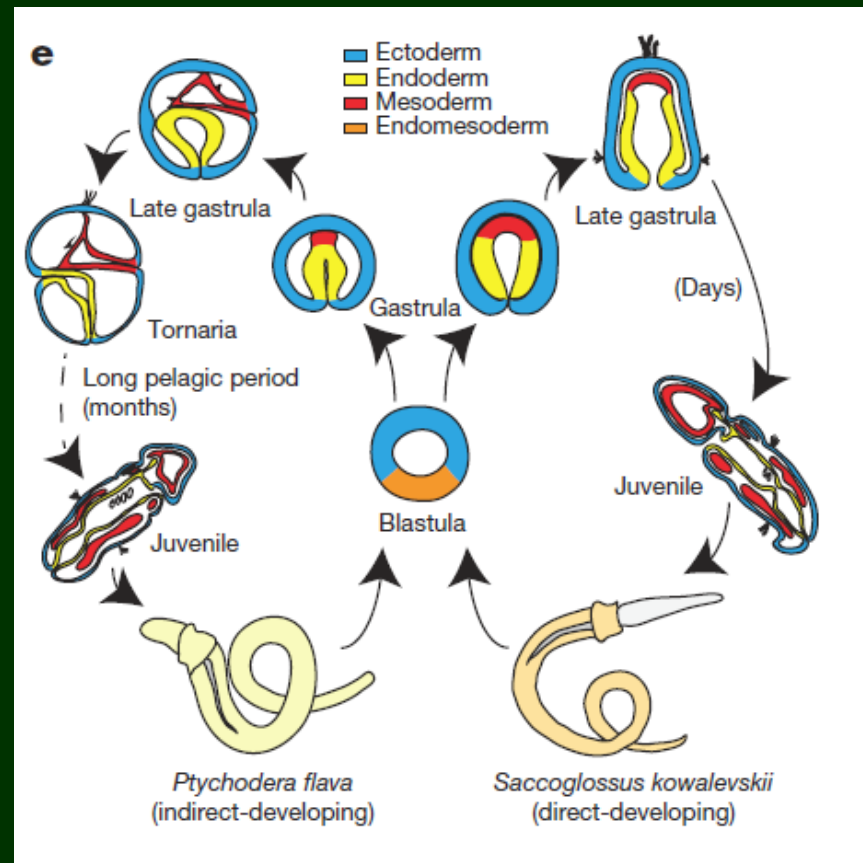
Hemichordata



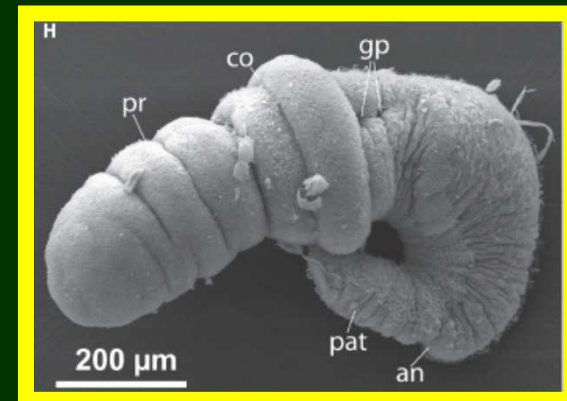
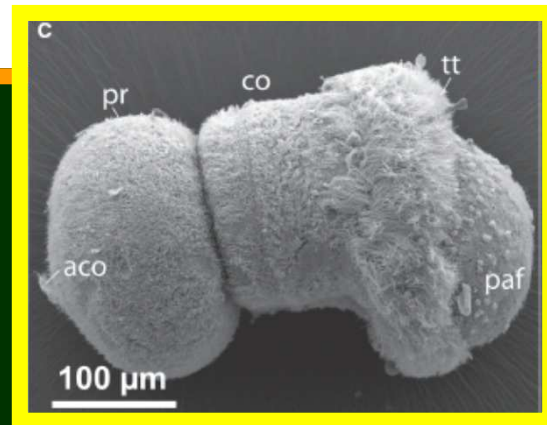
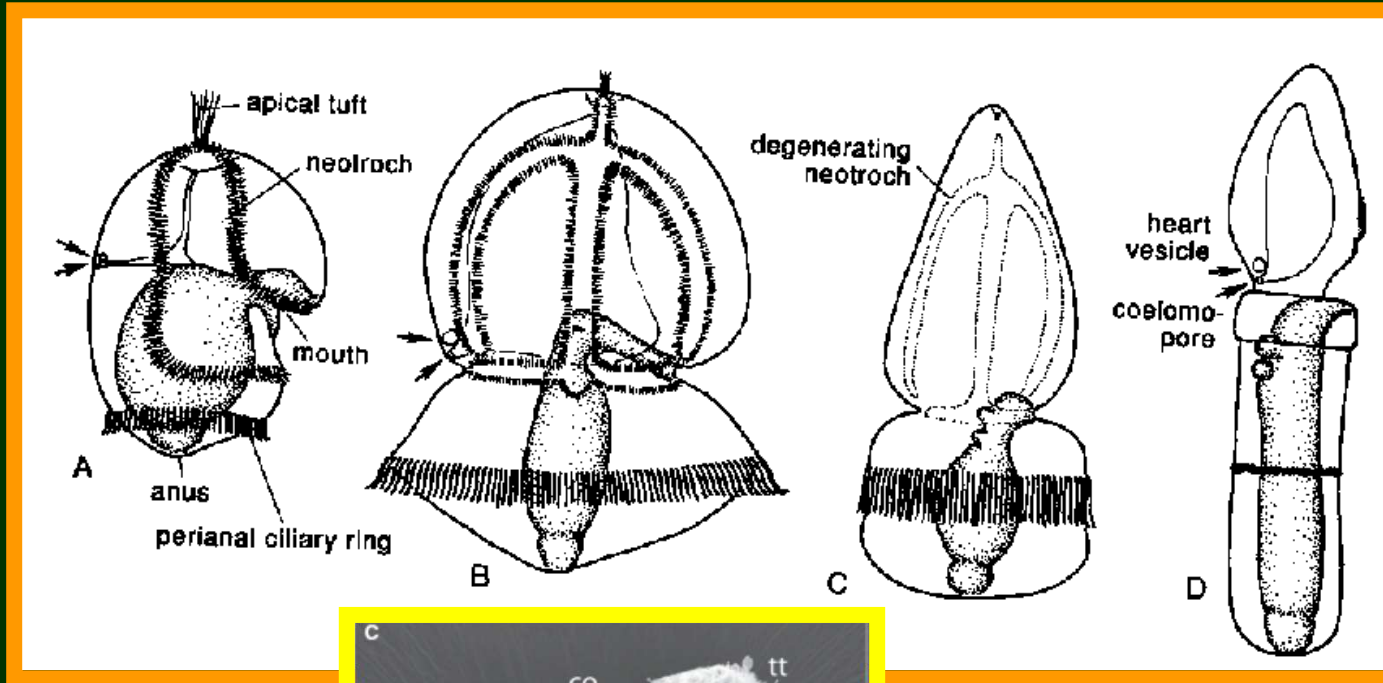
Hemichordata



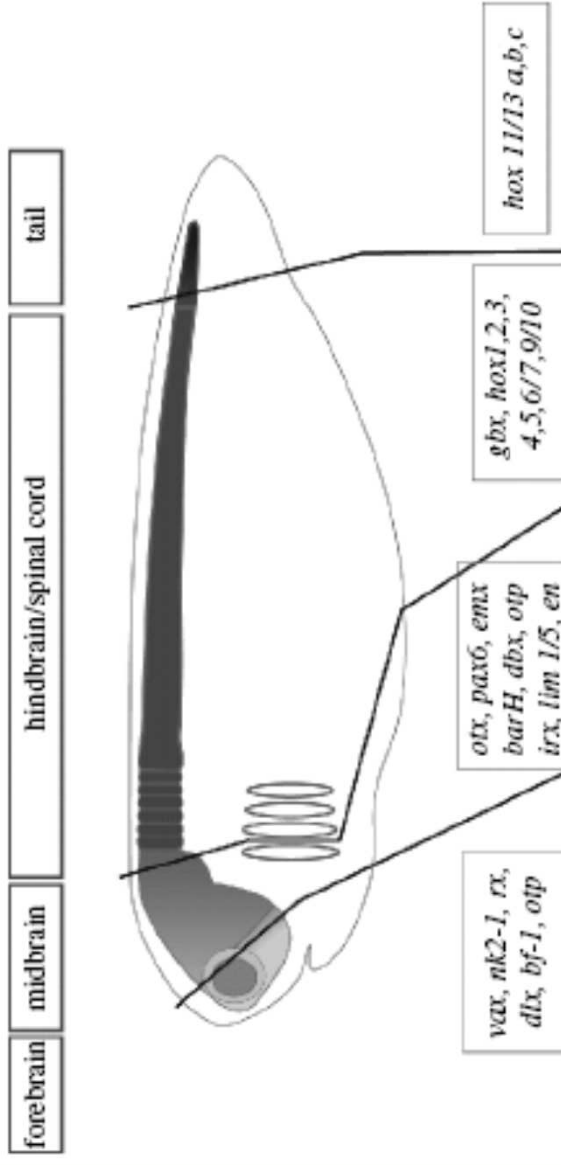
- přímý i nepřímý vývoj (tornarie)



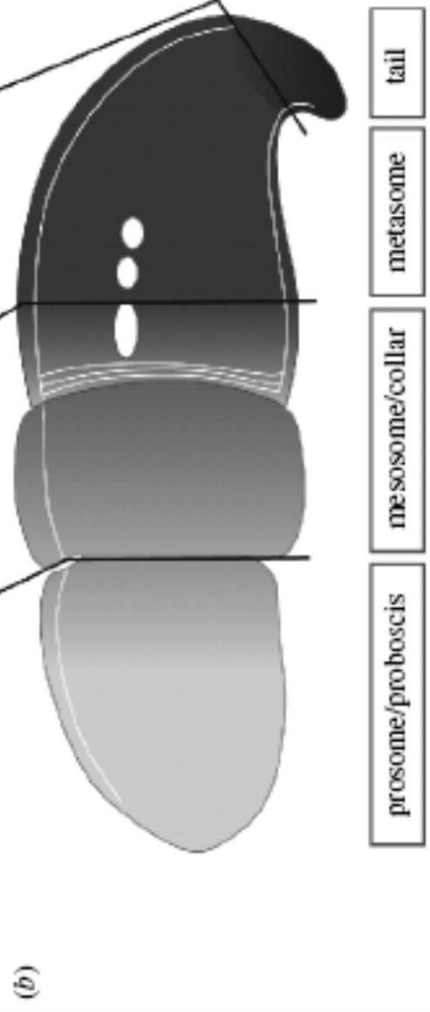
Hemichordata



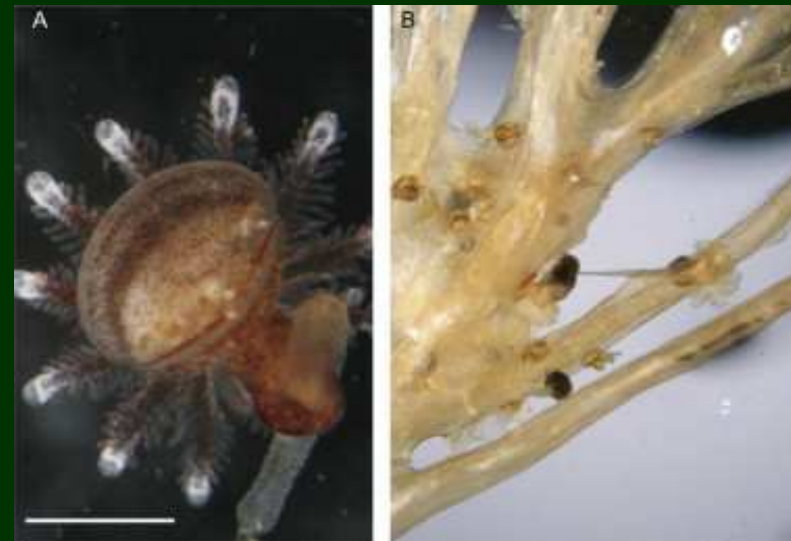
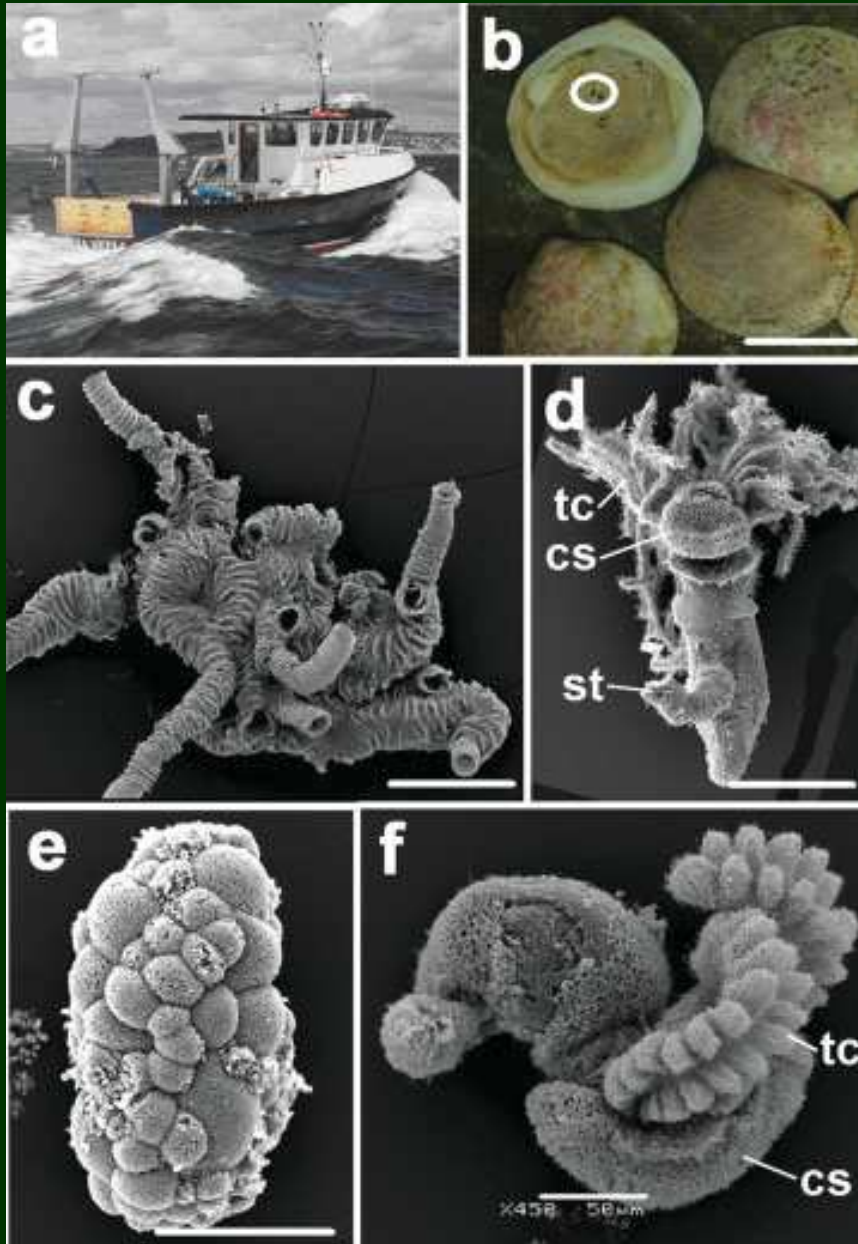
(a)



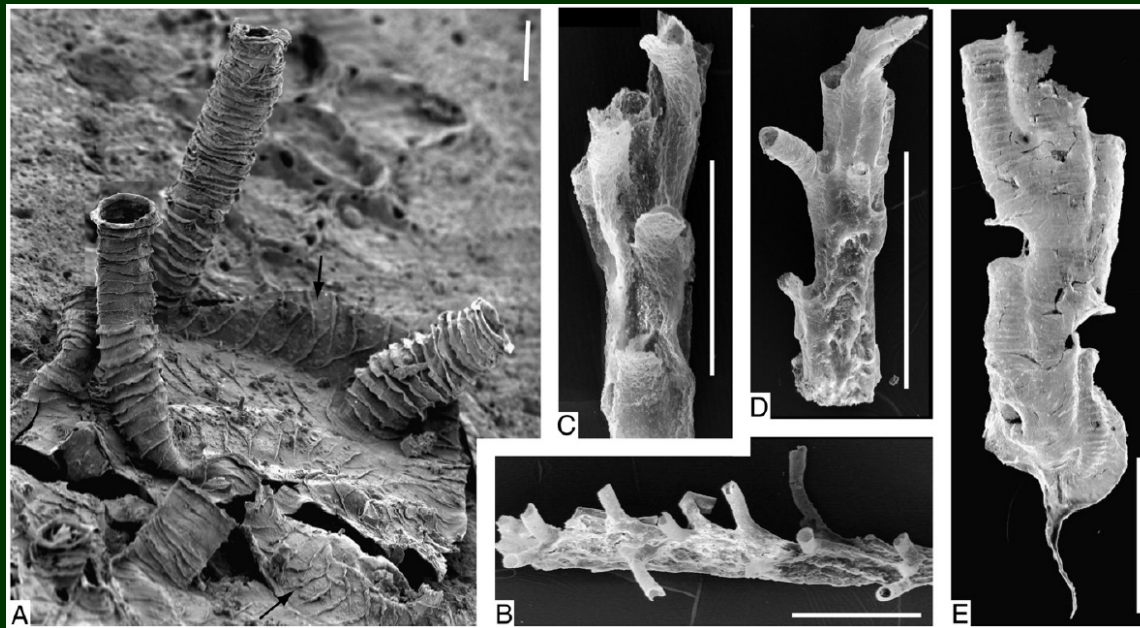
(b)



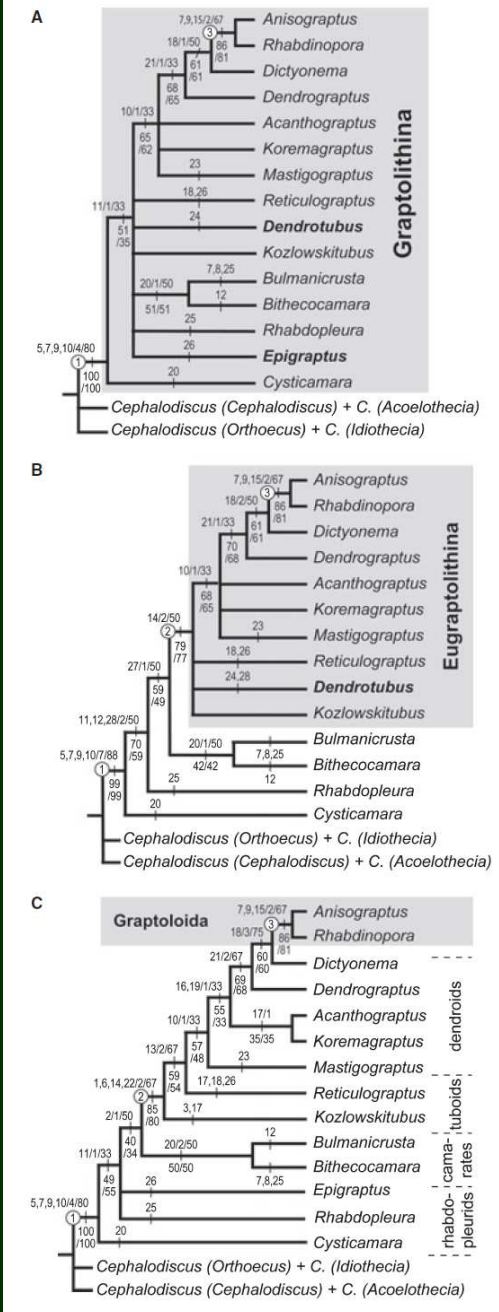
Pterobranchia



Rhabdopleura = recentní graptolit



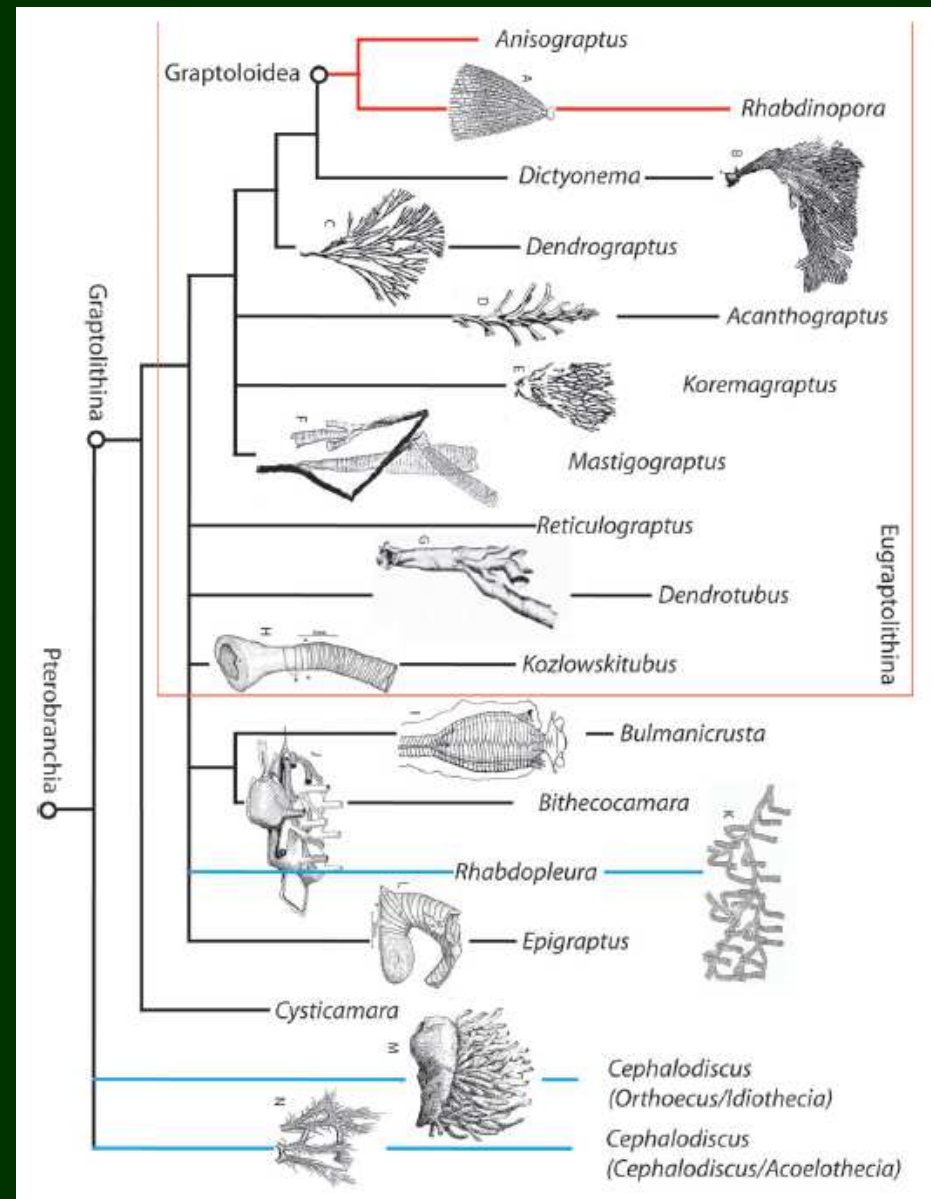
- Pterobranchia: Cephalodiscida (incl. *Atubaria*) + Graptolithina (incl. *Rhabdopleura*)



Pterobranchia

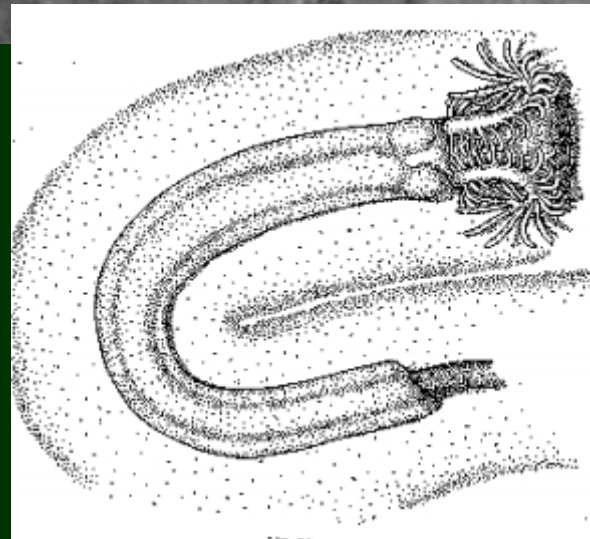


Cephalodiscus graptolitooides
(1993)

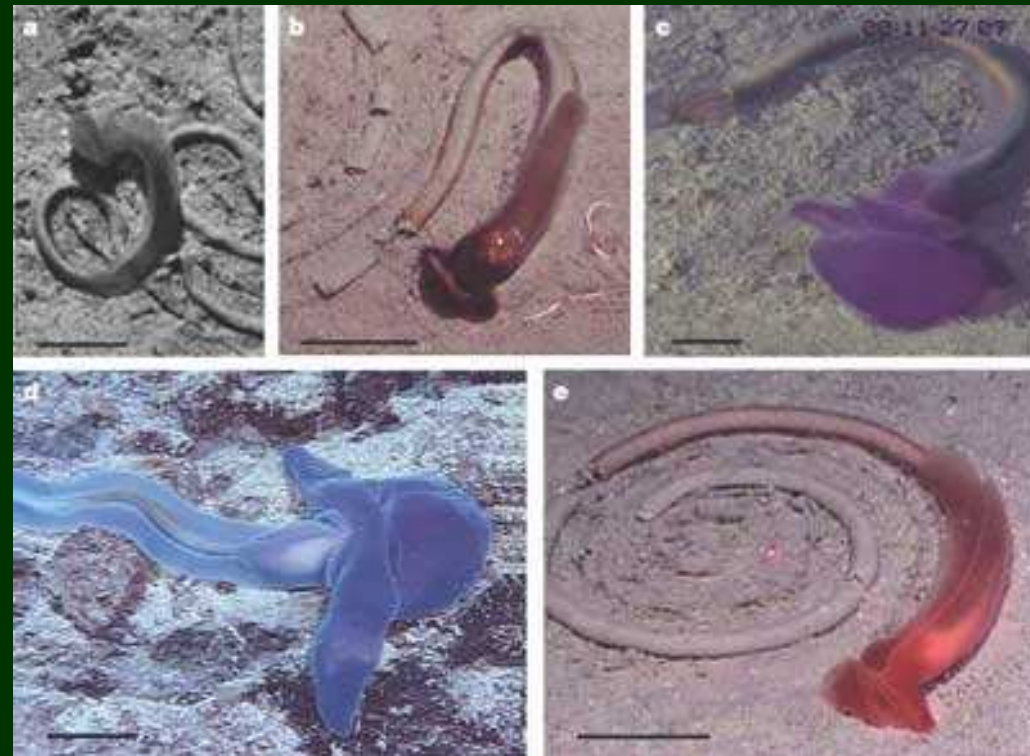
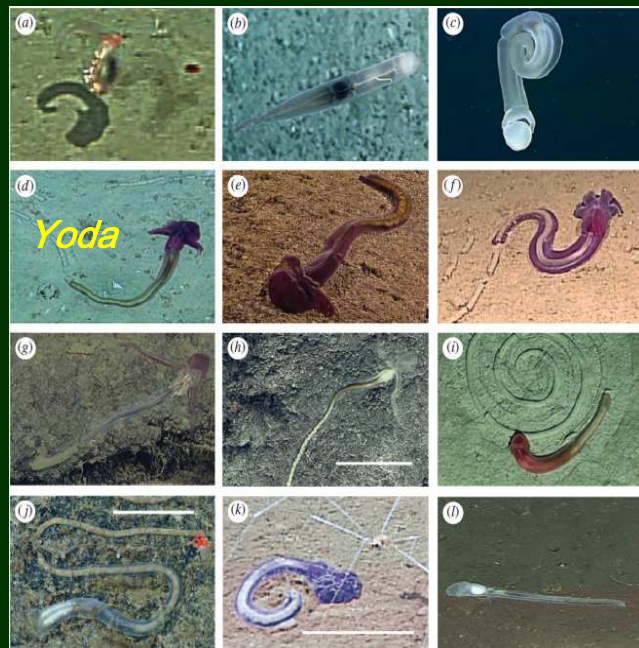
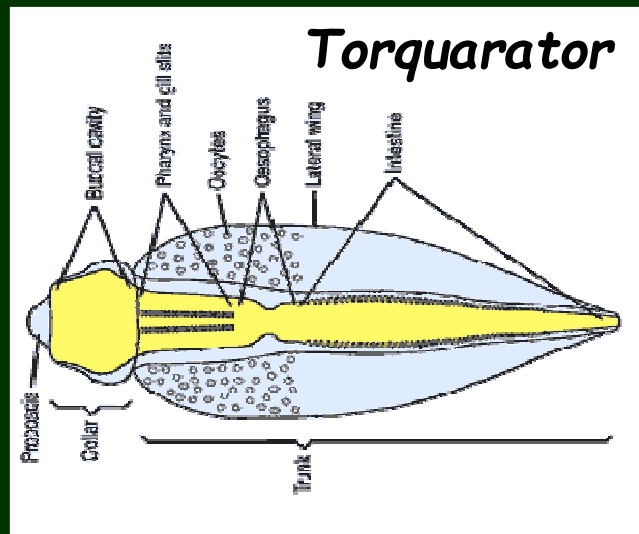


„Lophenteropneusta“

- „společný předek Enteropneusta a Pterobranchia“
- špatná interpretace hlubokomořských fotografií z roku 1979
- → Torquaratoridae



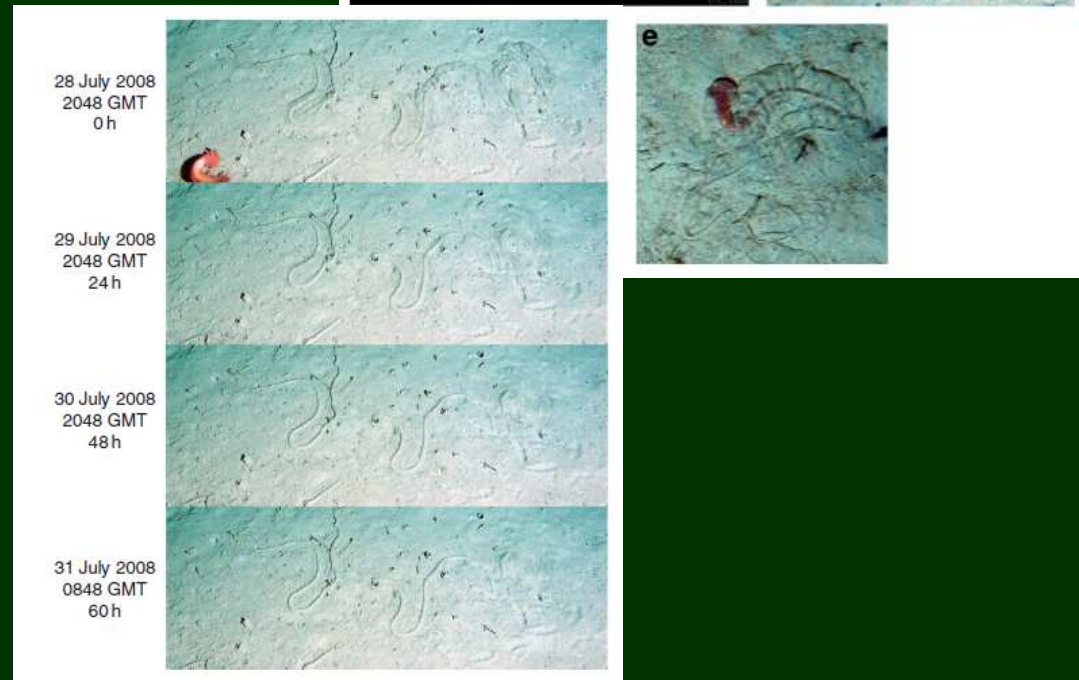
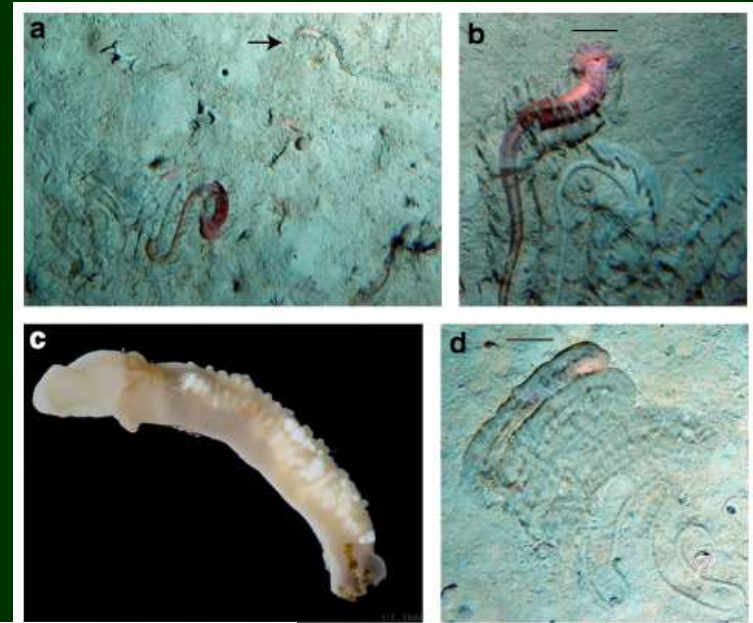
Enteropneusta



- velká a málo známá diverzita v hlubinách (Torquaratoridae, Saxipendiidae)

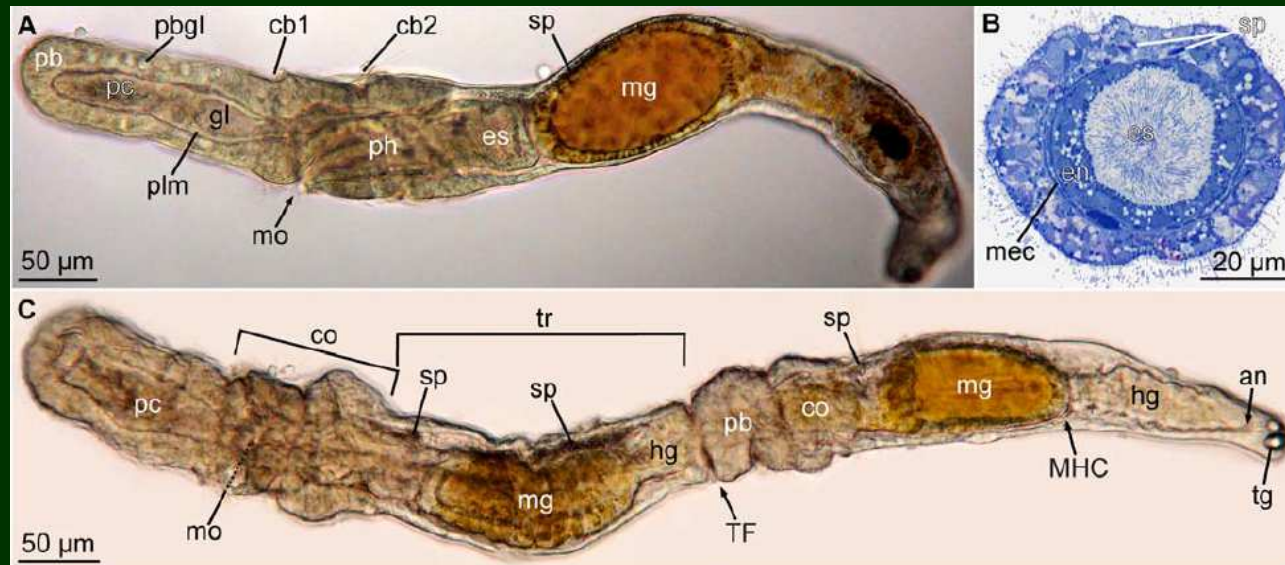
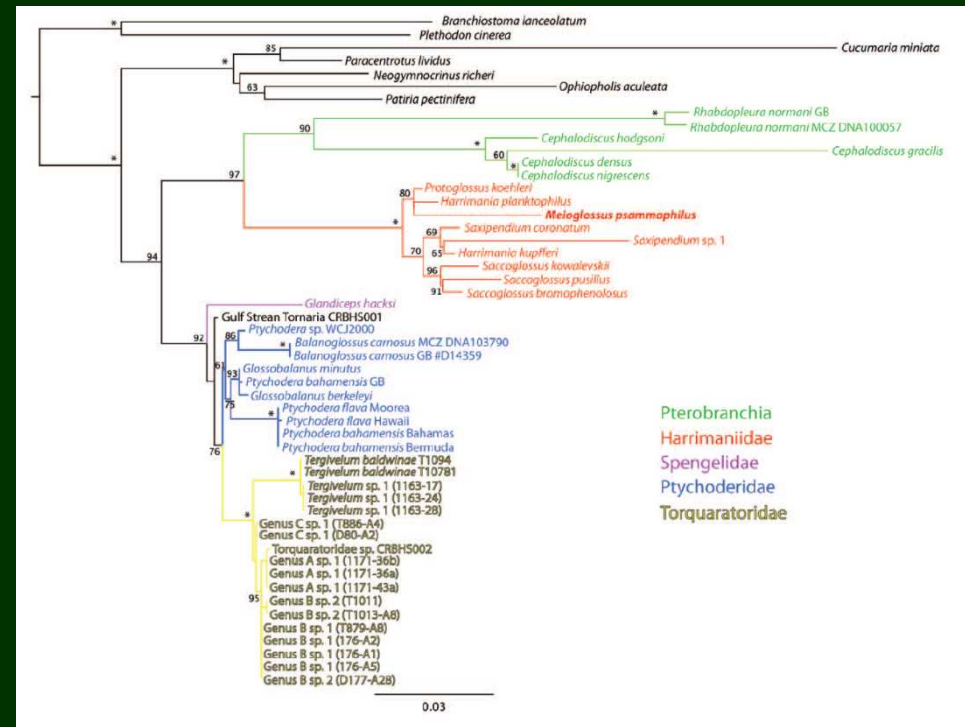
Torquaratoridae

- tubikolní Enteropneusta – odpovídají kambrijským fosiliím (tj. tubikolní žaludovci nemusejí být příbuzní pterobranchiím)
- největší vajíčka kromě hlavonožců a obratlovců → *Planctosphaera*?

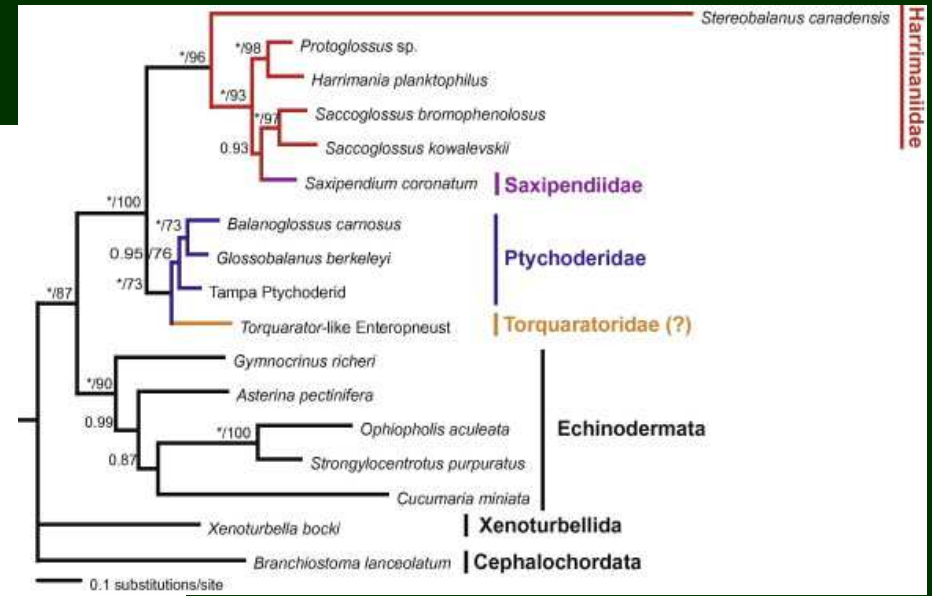
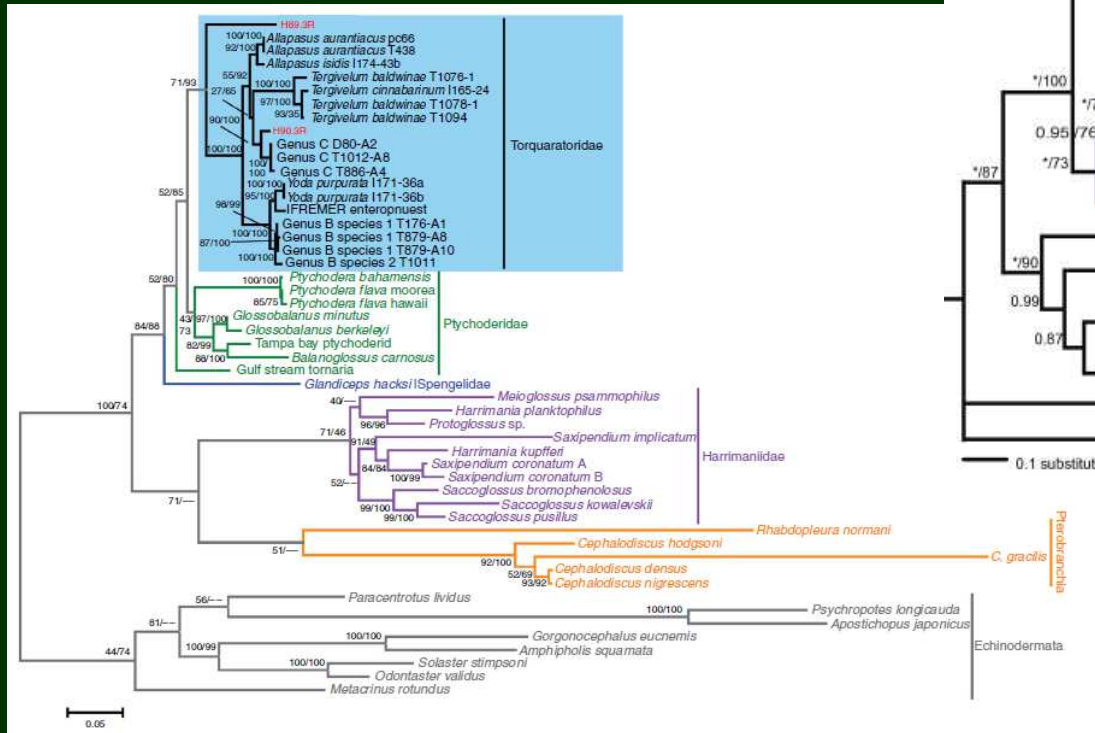


Meioglossus

- 18S
- první mikroskopický dospělec, podobný juvenilům, paratomie

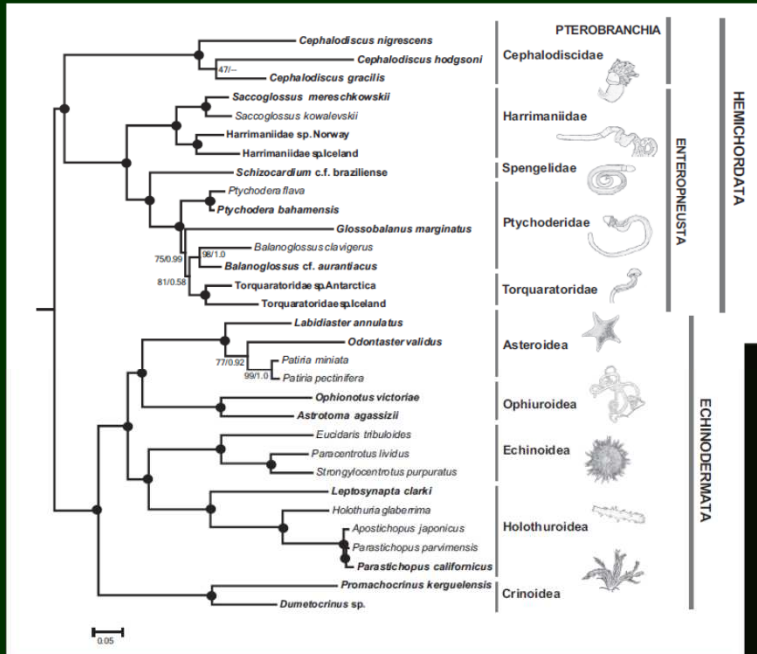


Fylogeneze polostrunatcũ

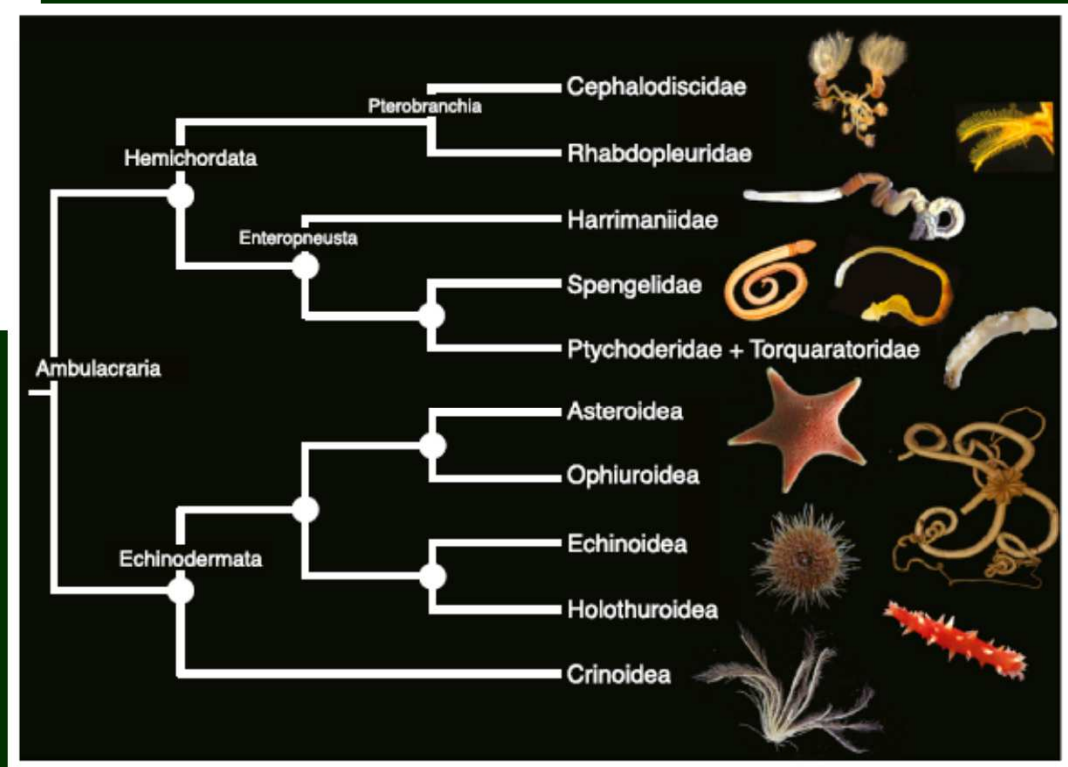


18S vs. 18S + 16S + *cytb*

Fylogeneze polostrunatců



- cca 300 genů
- *Rhabdopleura* nestabilní (málo dat)



Echinodermata

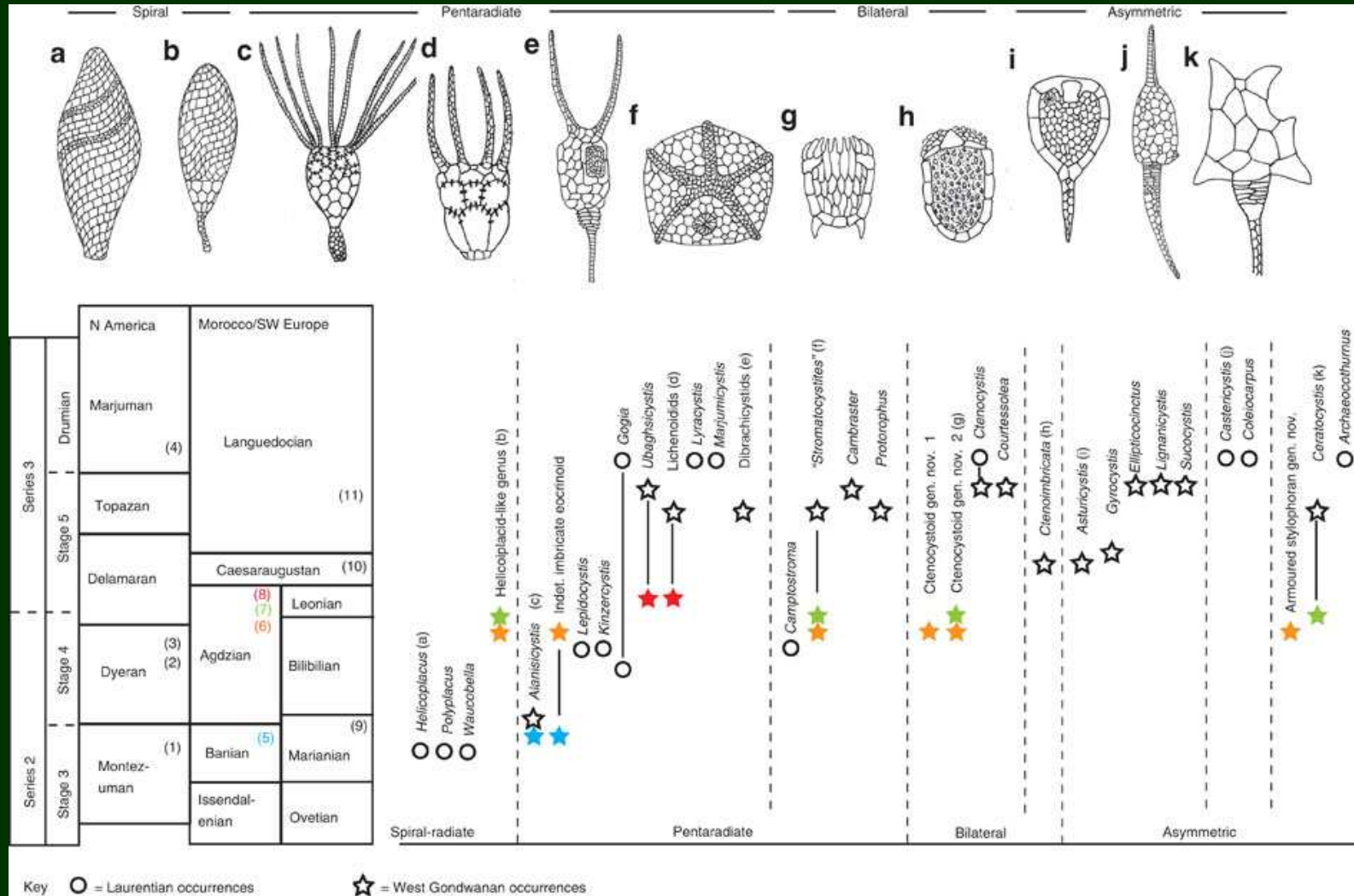


Xyloplax turnerae - male



PHOTO BY DANIEL JANIES

Fosilní ostnokožci



Larvy ostnokožců

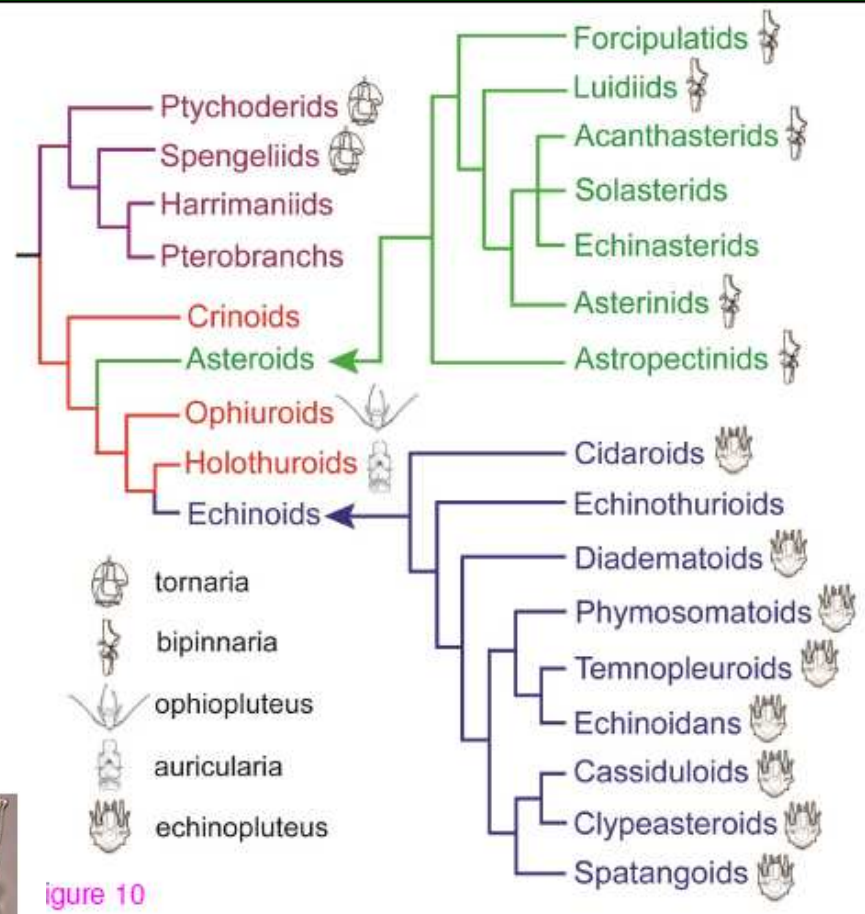
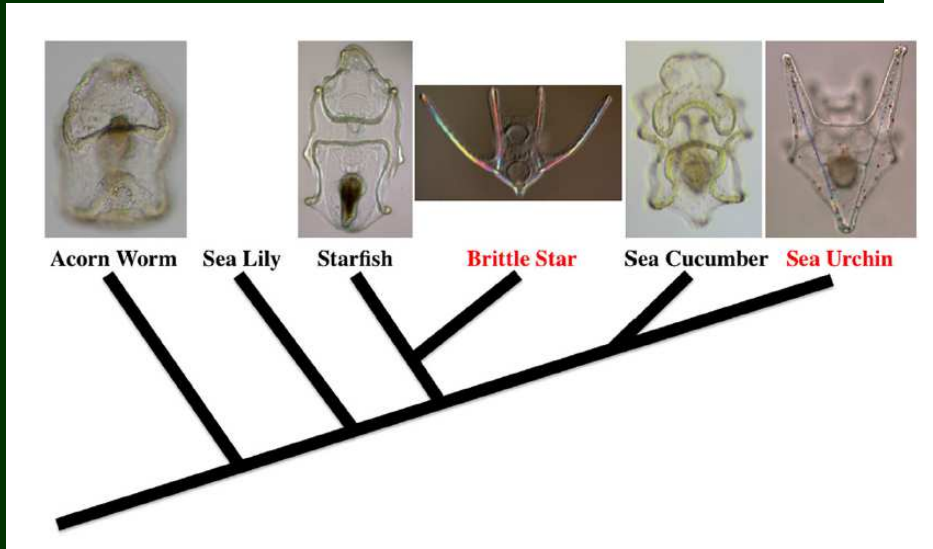
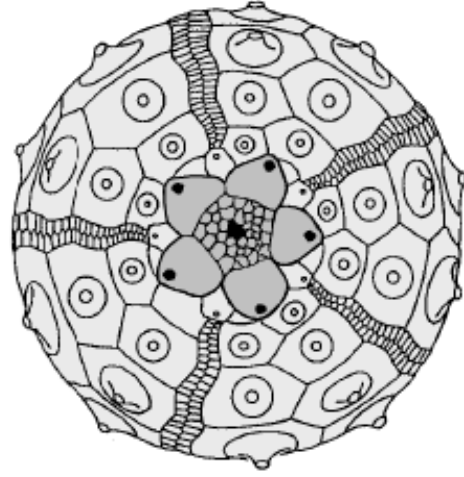
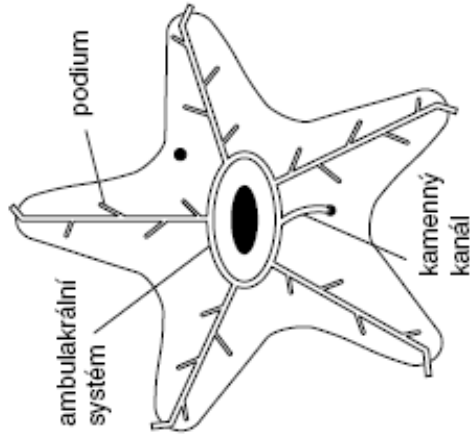


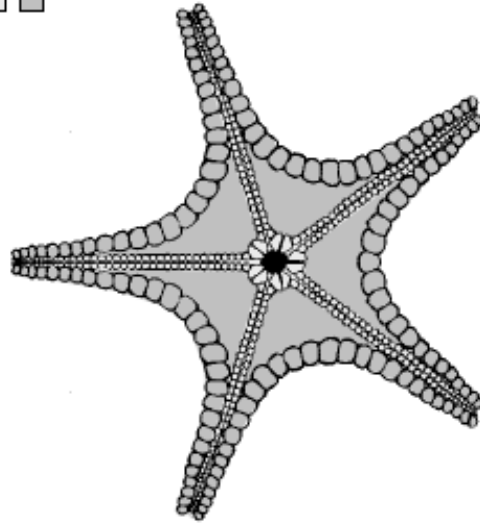
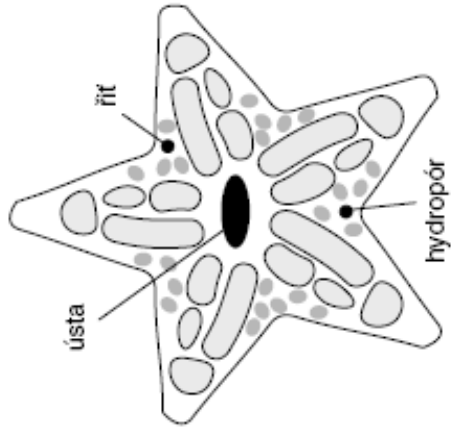
figure 10

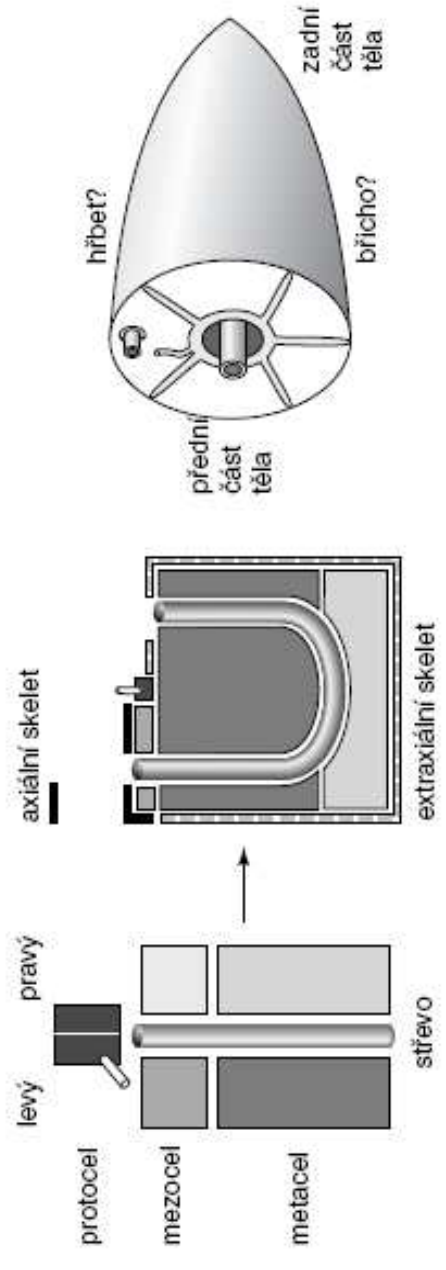
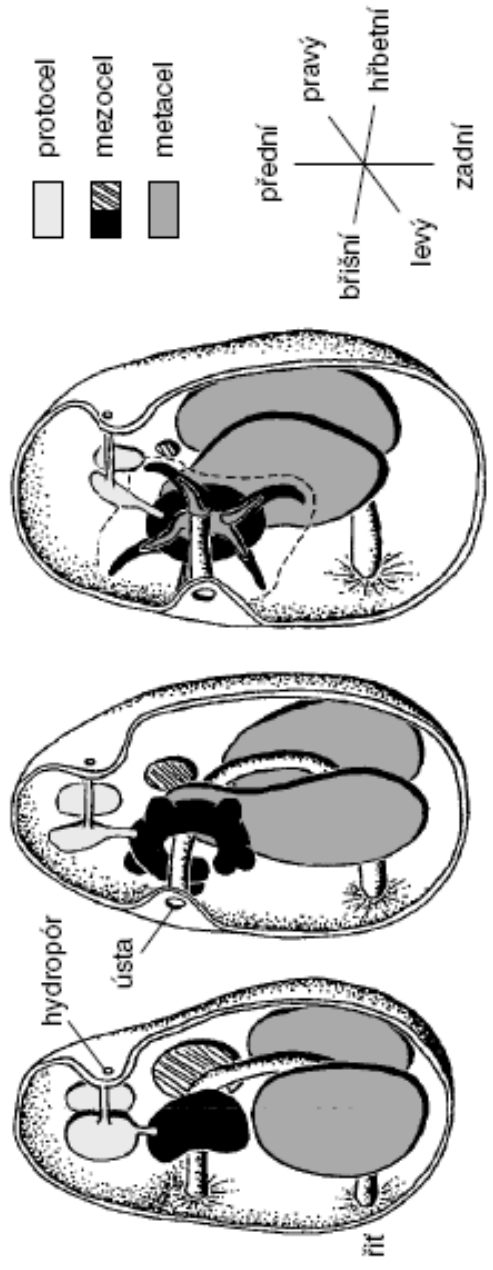


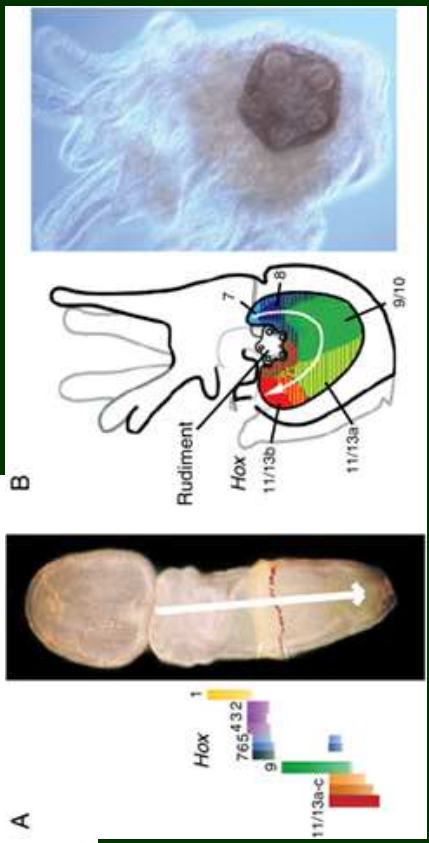
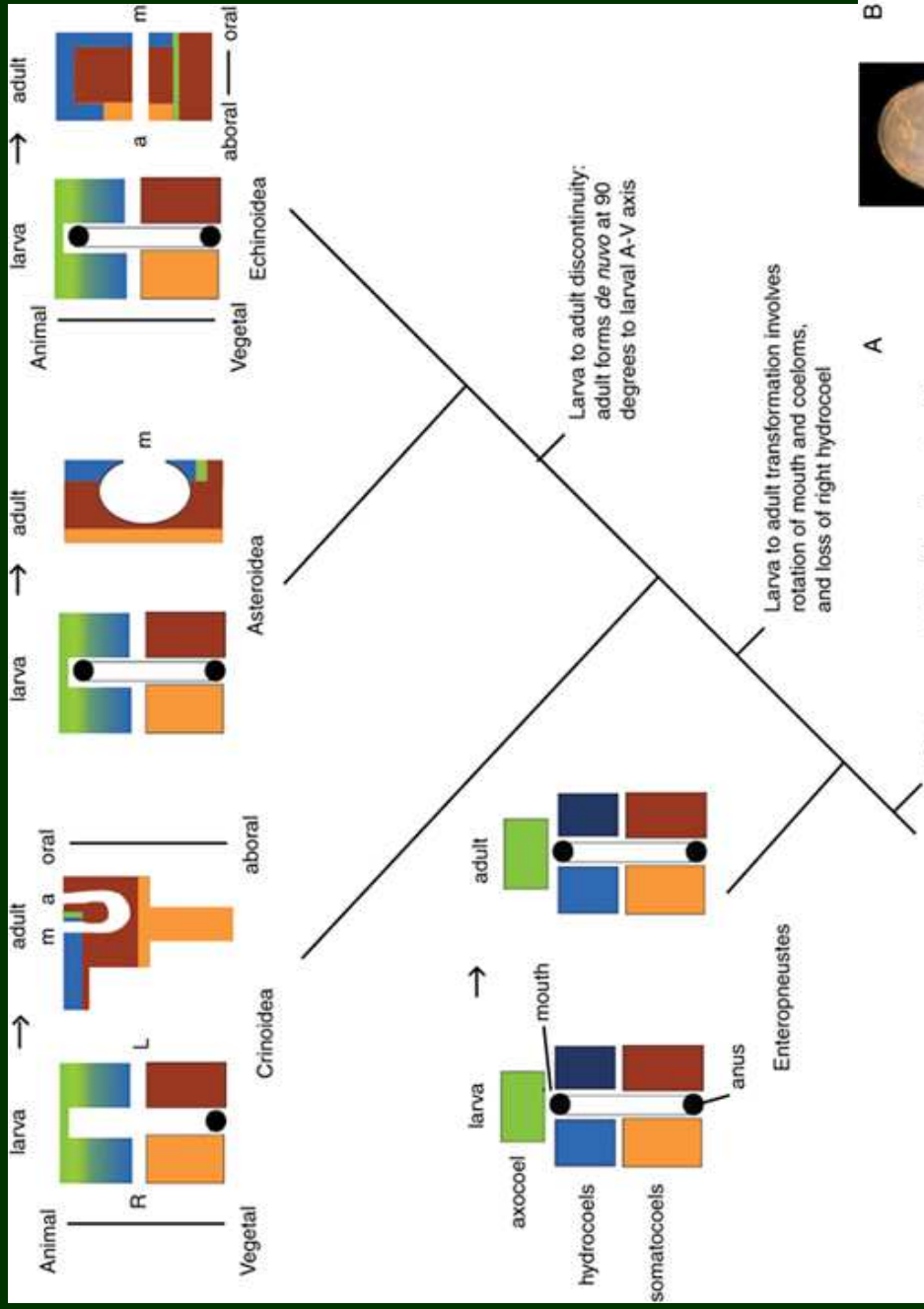


skelet

- axiální
- extraxiální





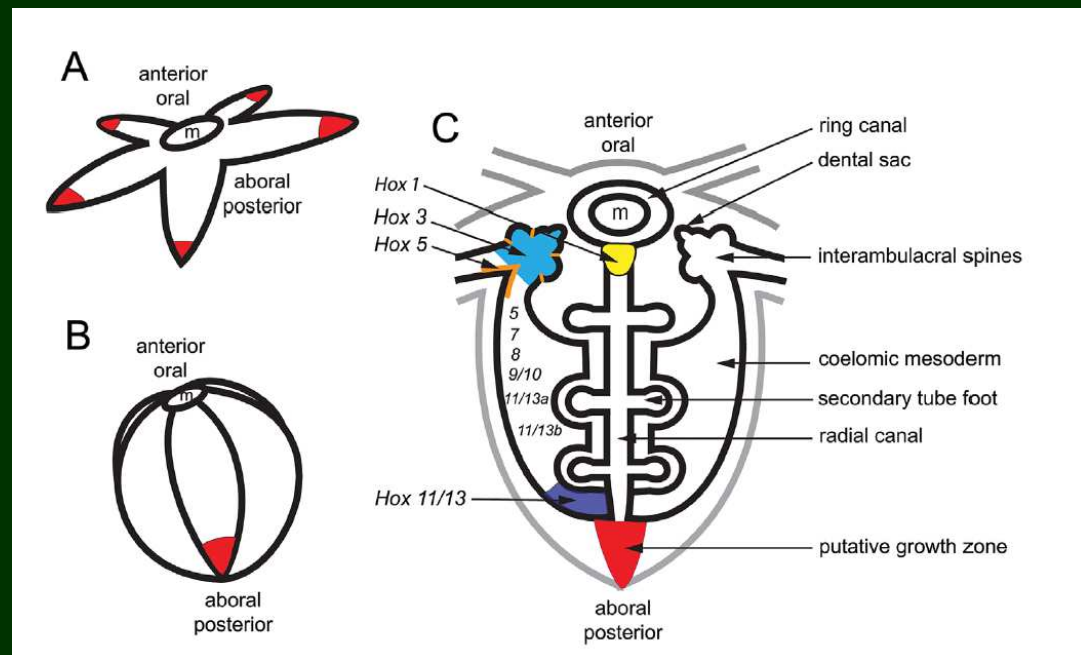
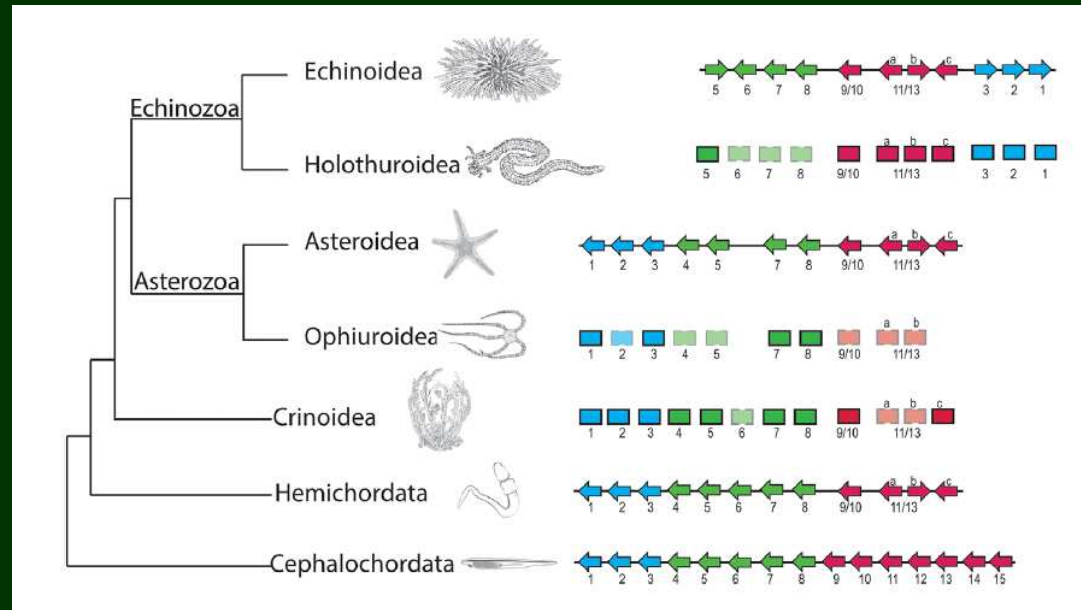


Body axes maintained from larva to adult

Larva to adult transformation involves rotation of mouth and coeloms, and loss of right hydrocoel

Tělní plán a Hox

- pentamerie *není* spojená s rozpadem Hox komplexu
- pentamerie ~ osová duplikace
- fosilní záznam: via trimerie?



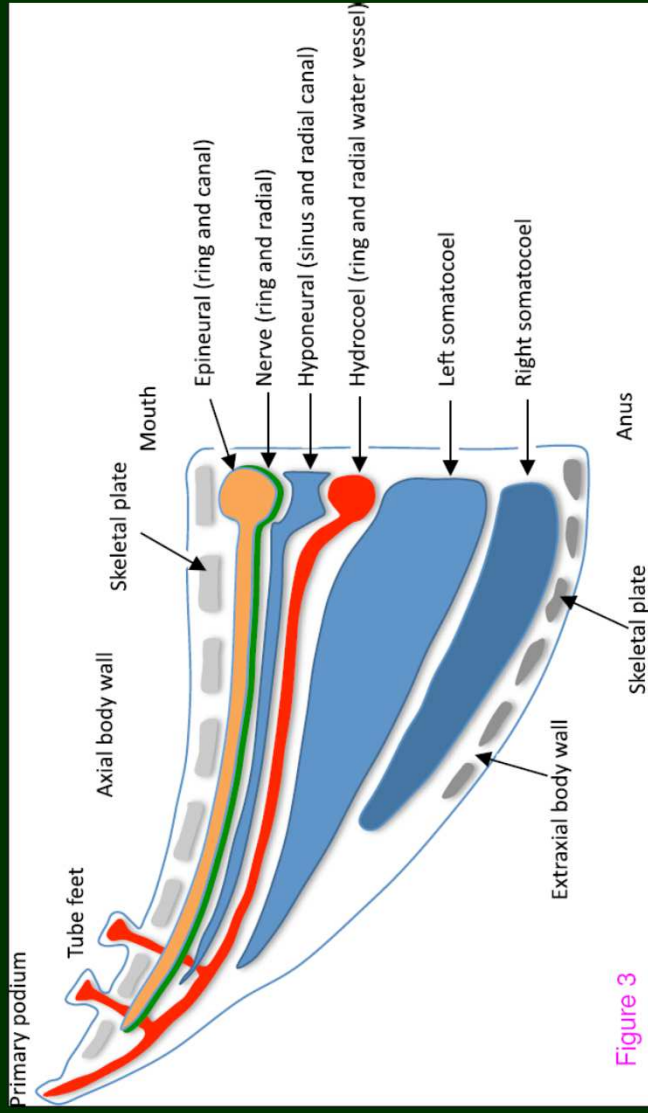


Figure 3

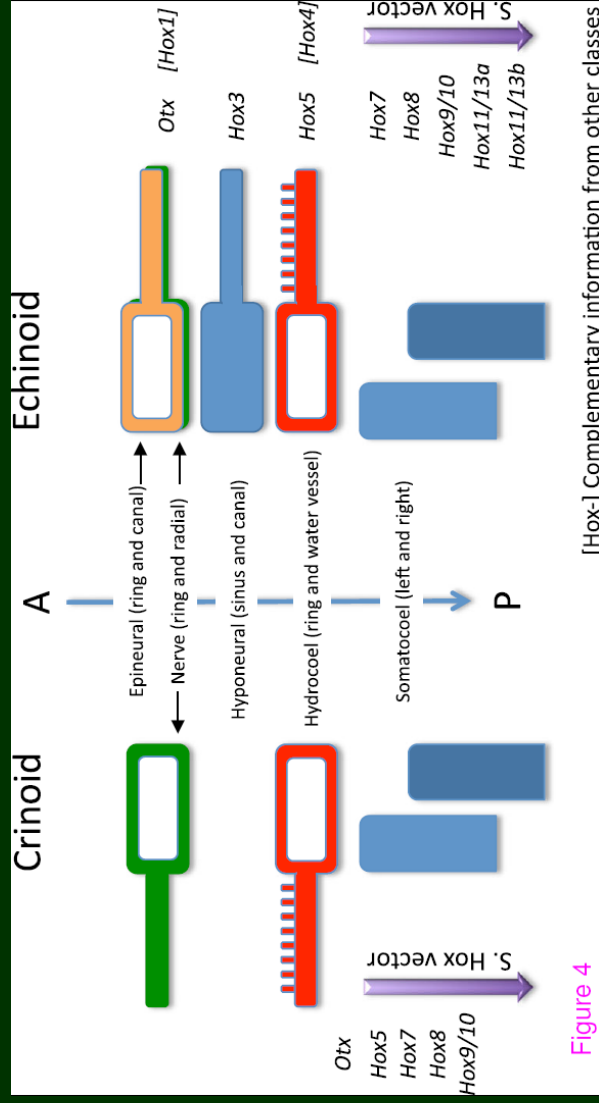
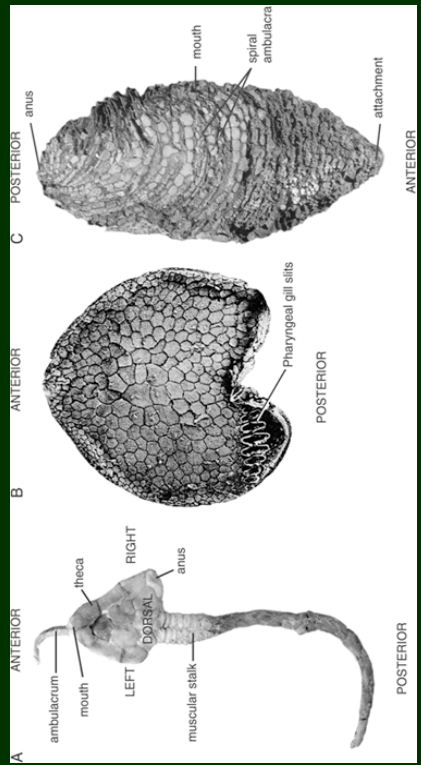
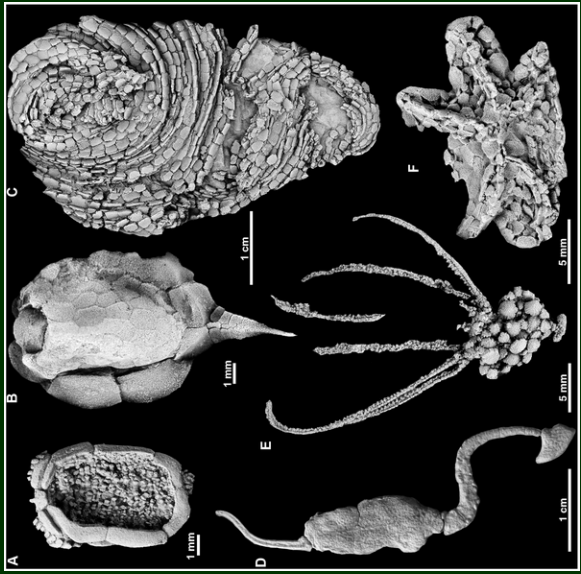
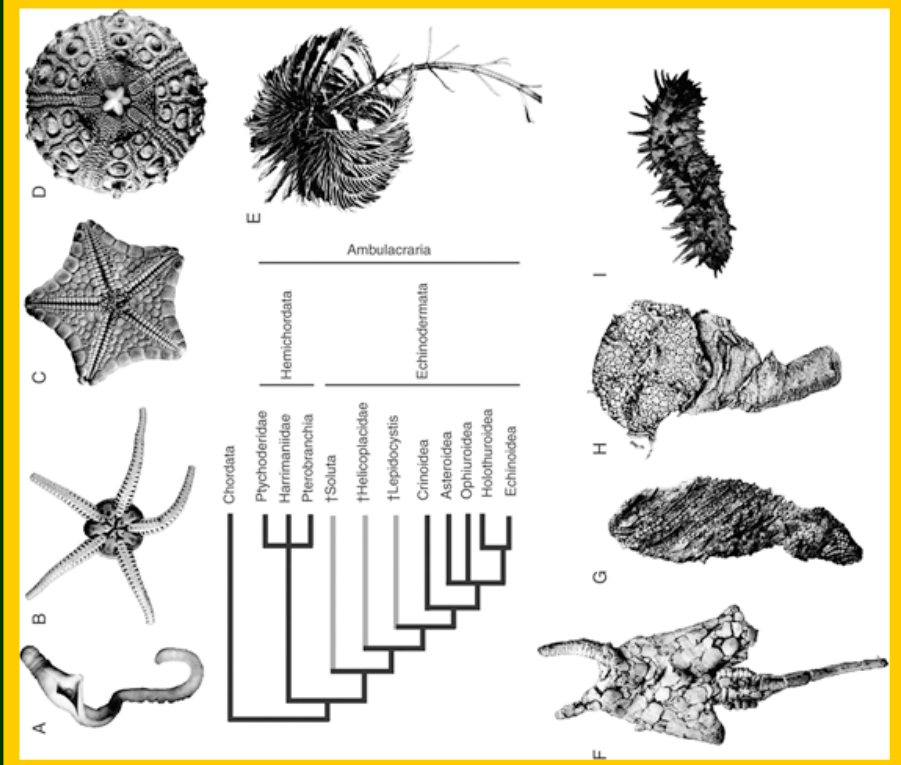
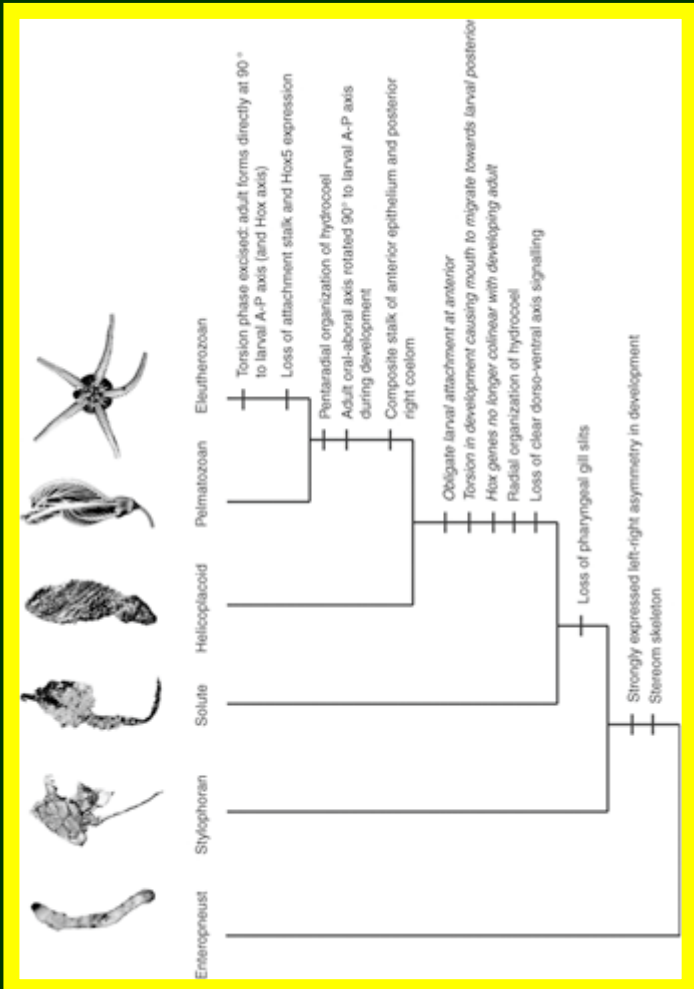
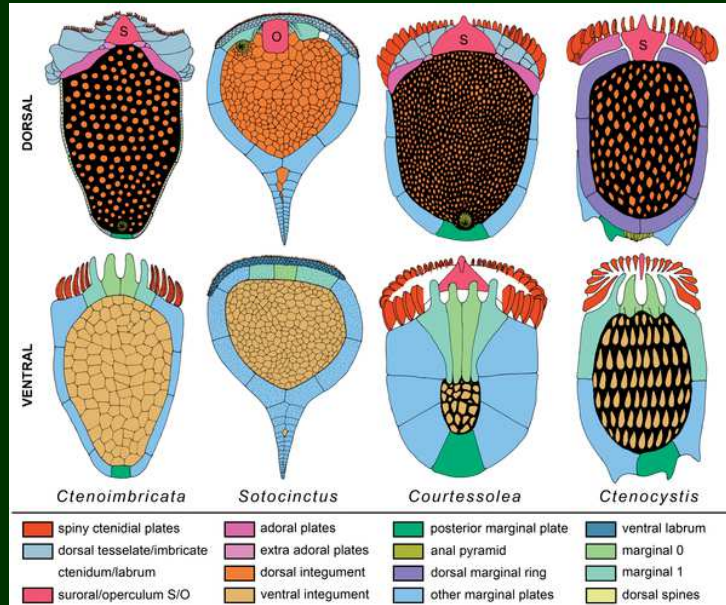


Figure 4

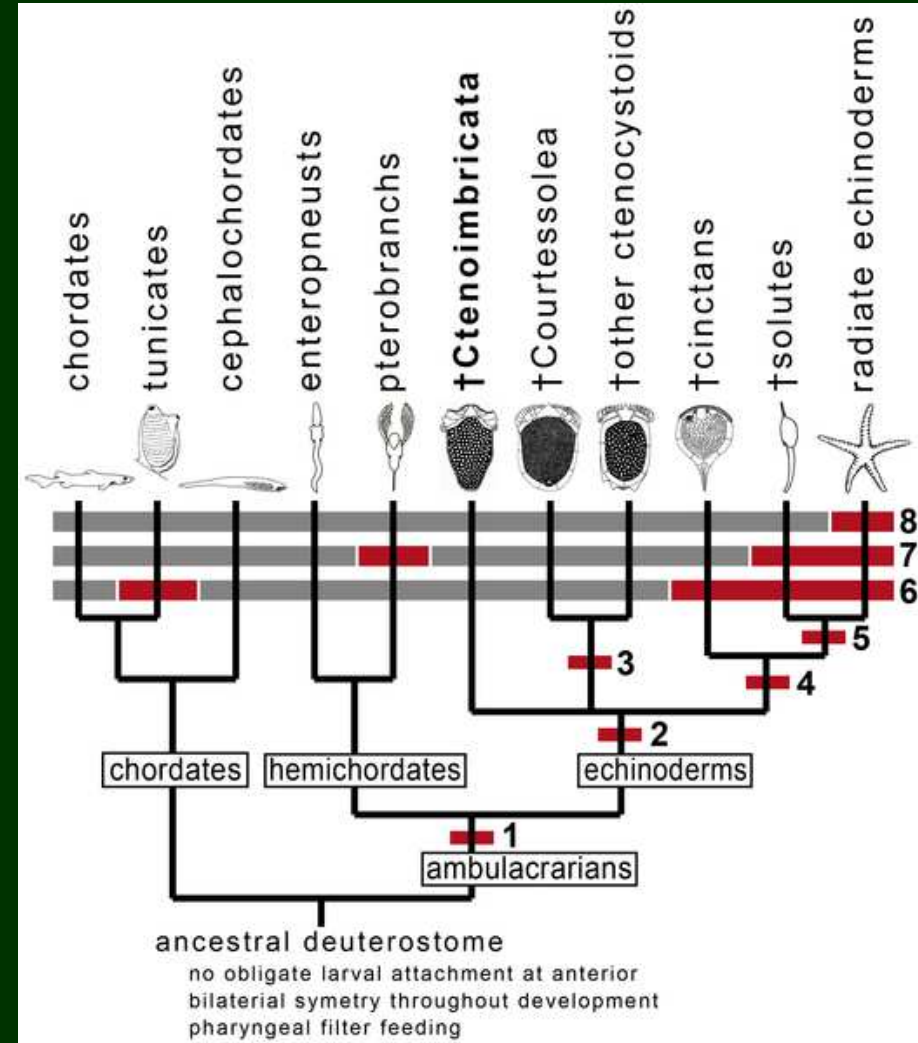
[Hox-] Complementary information from other classes



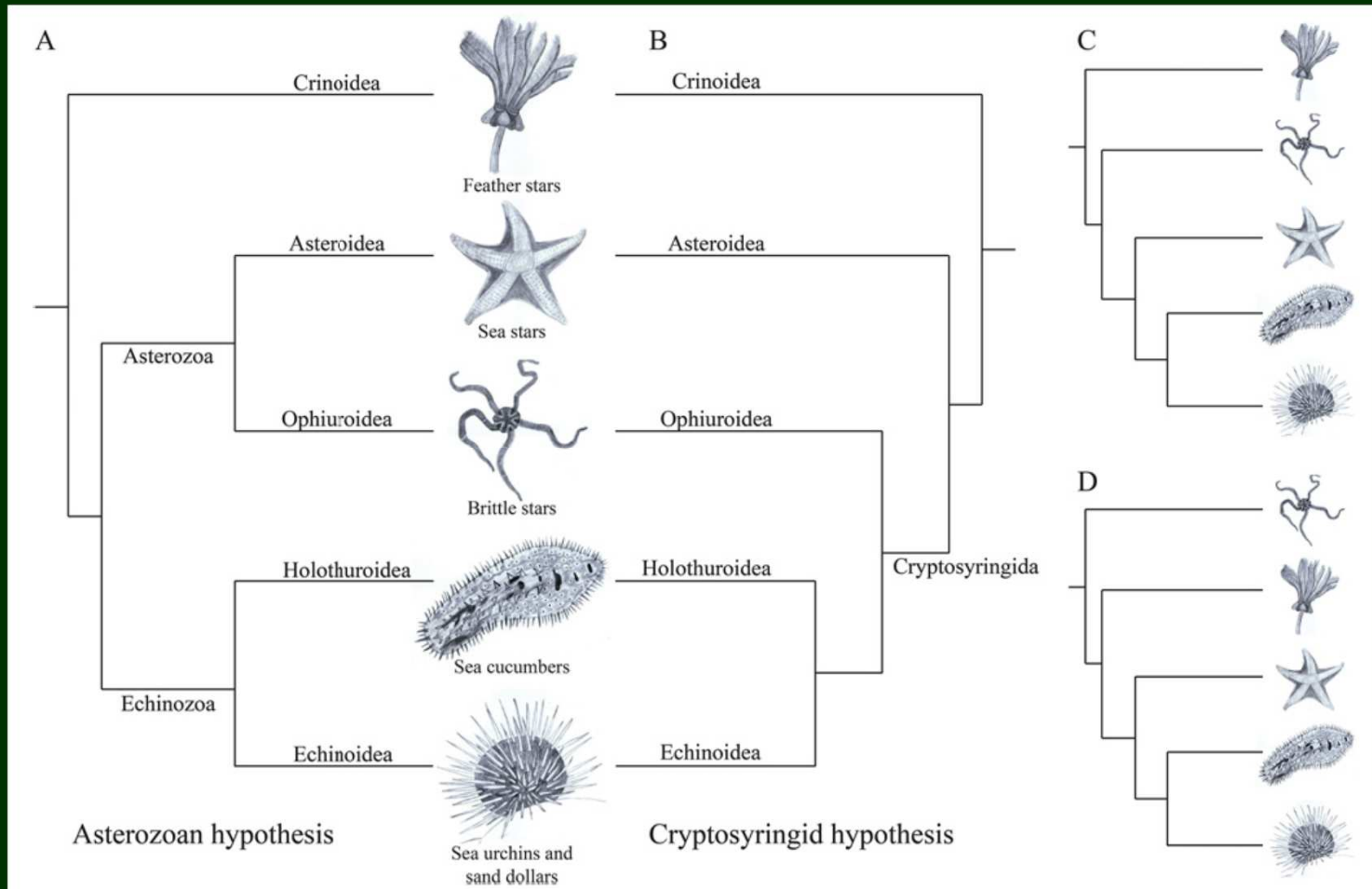
Fylogeneze ostnokožců



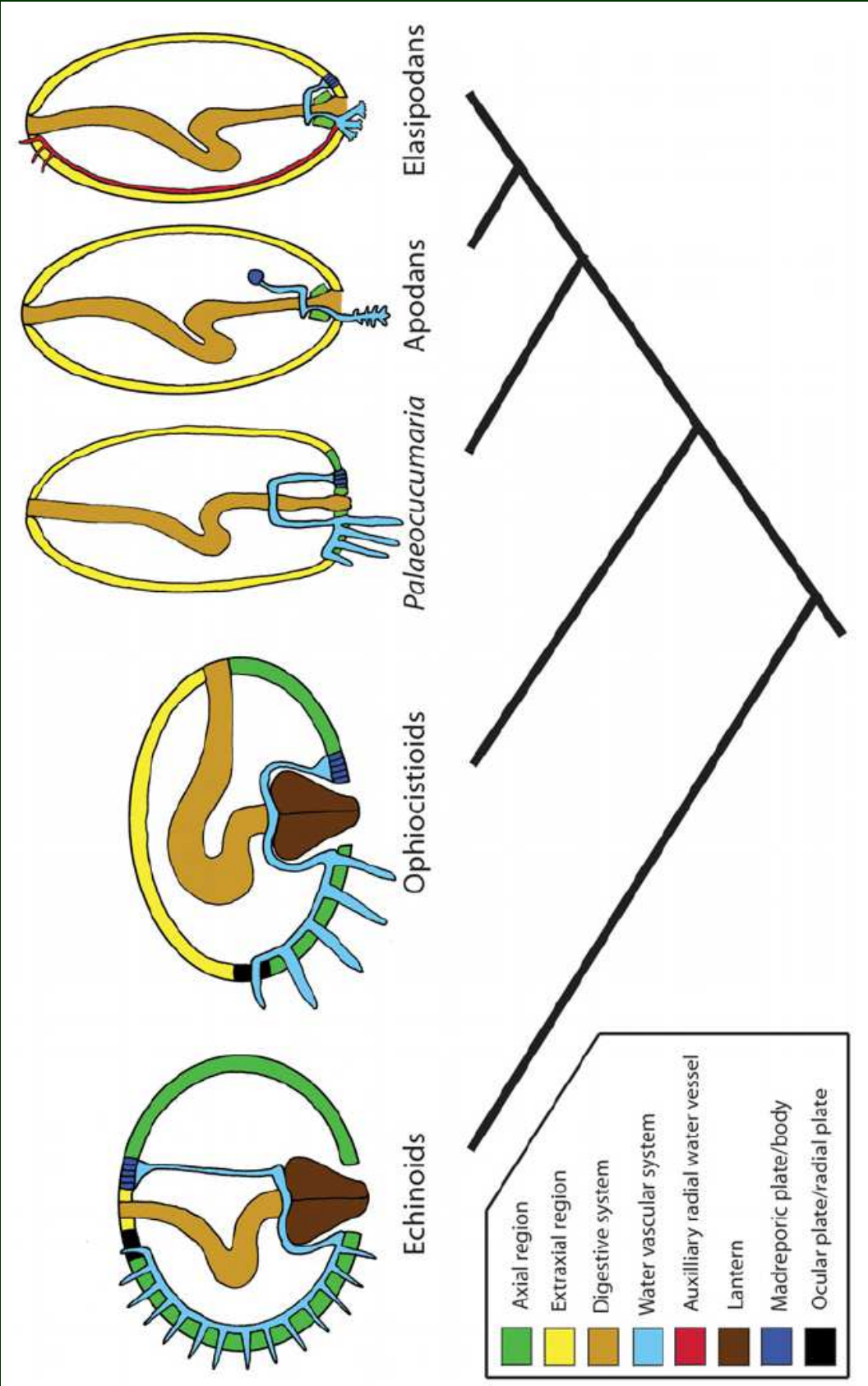
- 1, *Dipleurula*-type larva and tripartite organization of body coeloms;
- 2, Multiplated calcite skeleton with stereom microstructure;
- 3, Complete ctenidial ring;
- 4, Periproct non-terminal;
- 5, Water vascular system with single hydropore (asymmetric development of coeloms);
- 6, Adult body plan not bilateral (associated with larval attachment and torsion during metamorphosis in extant groups);
- 7, Tentacular feeding;
- 8, Radial organization of water vascular system



Fylogeneze ostnokožců

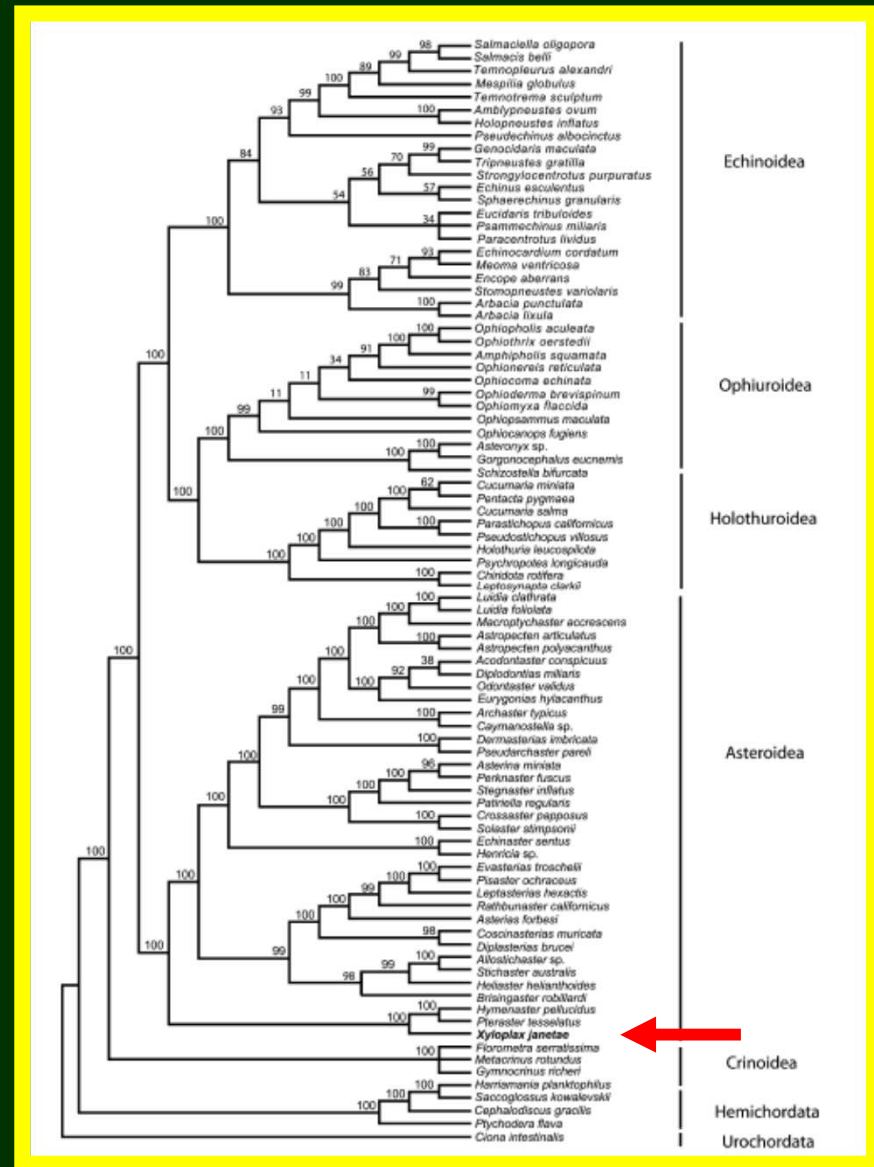
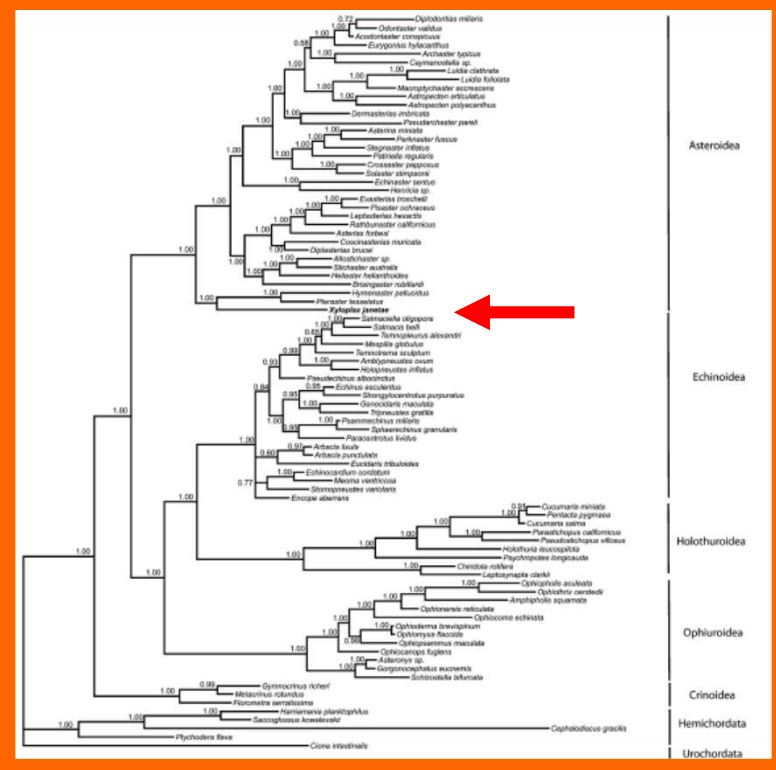


C a D –
pořadí
genů v
mtDNA



Fylogeneze ostnokožců

- 7 genů
- MP: mol + mor (POY)
- Bayes: mol + mor



Fylogenomika ostnokožců

- cca 4,600 genů
- Asterozoa: larvální skelet („pluteus“) vznikl nezávisle u hadic a ježovek (evo-devo: předek echinozoí ho *nemě!*)

