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Fakultät für Lebenswissen-
schaften

integrative
zoology

Soft-body morphology evolution in the Bryozoa

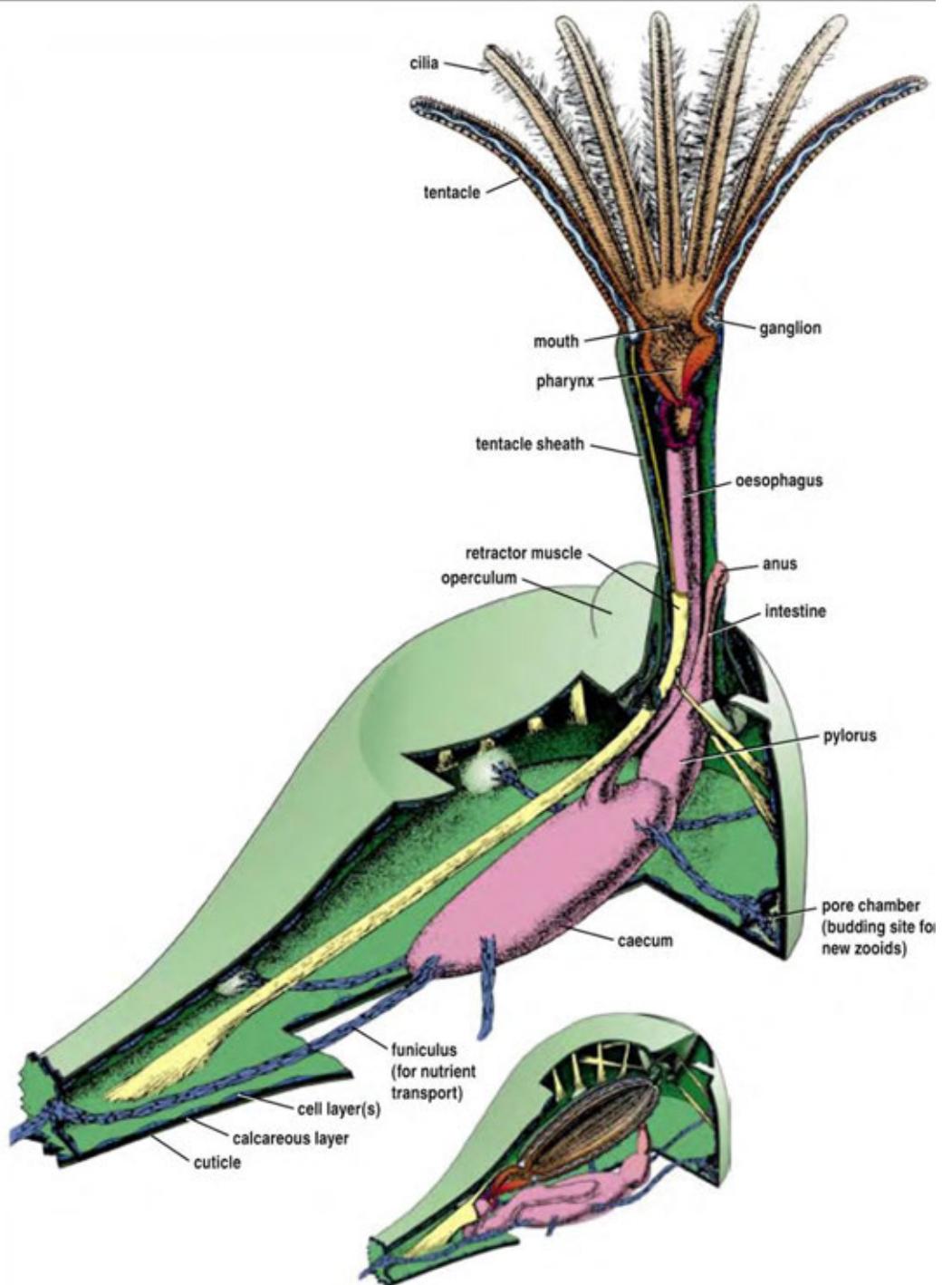
Thomas Schwaha

University of Vienna

Department of Integrative Zoology

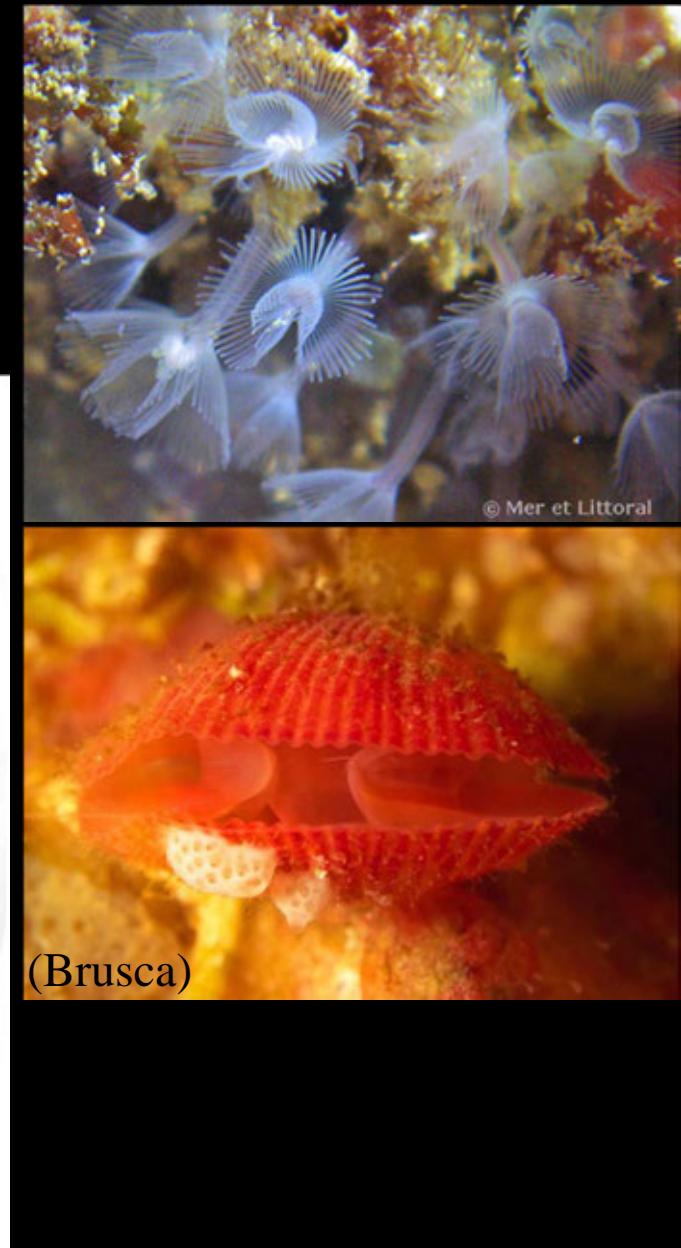
Bryozoa

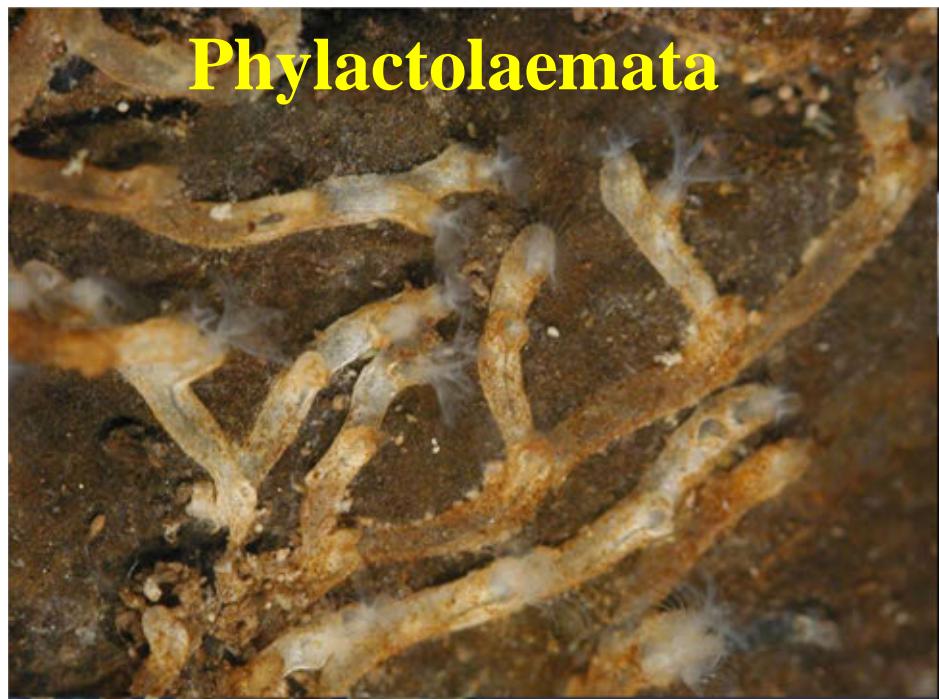
- Lophotrochozoan phylum
- 6.000 recent species
20.000 fossil
- mostly marine
- sessile filter feeders
- all colonial
- zooids (cystid + polypide)
- anus outside of lophophore



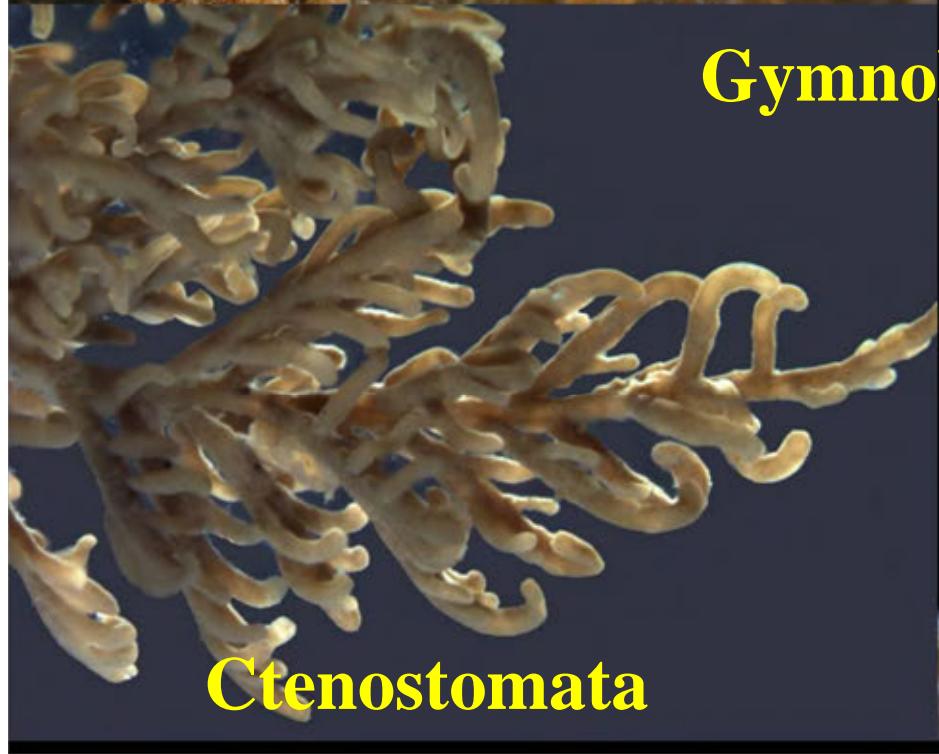
Phylogeny

- Position among Lophotrochozoa
 - Lophophorata concept
 - Sister-group Kamptozoa





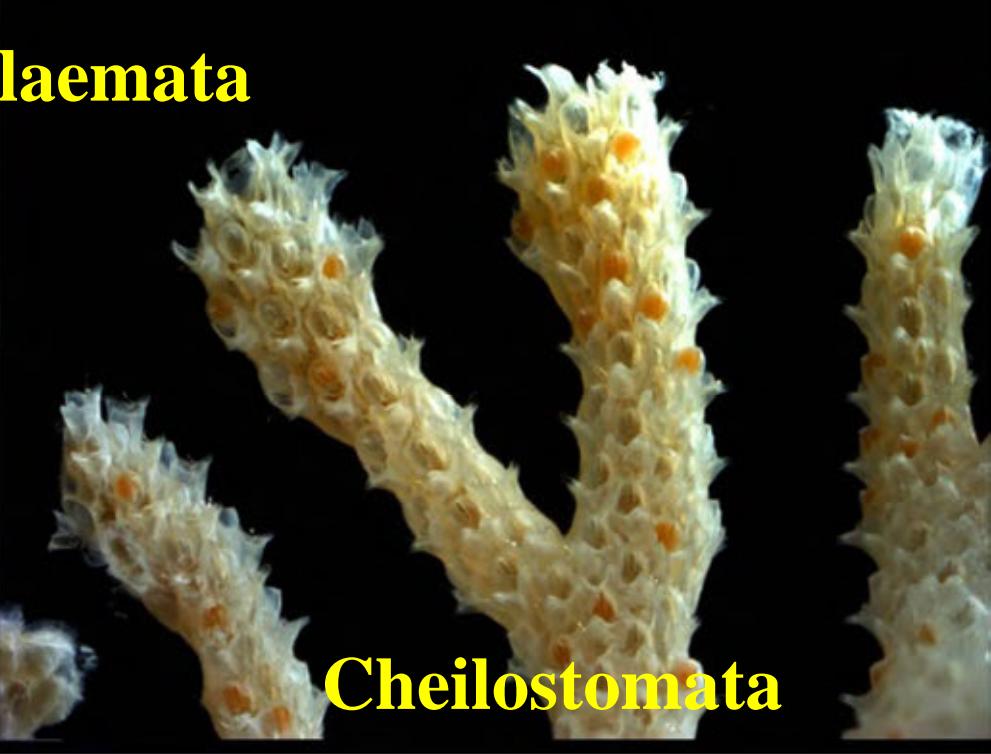
Phylactolaemata



Ctenostomata

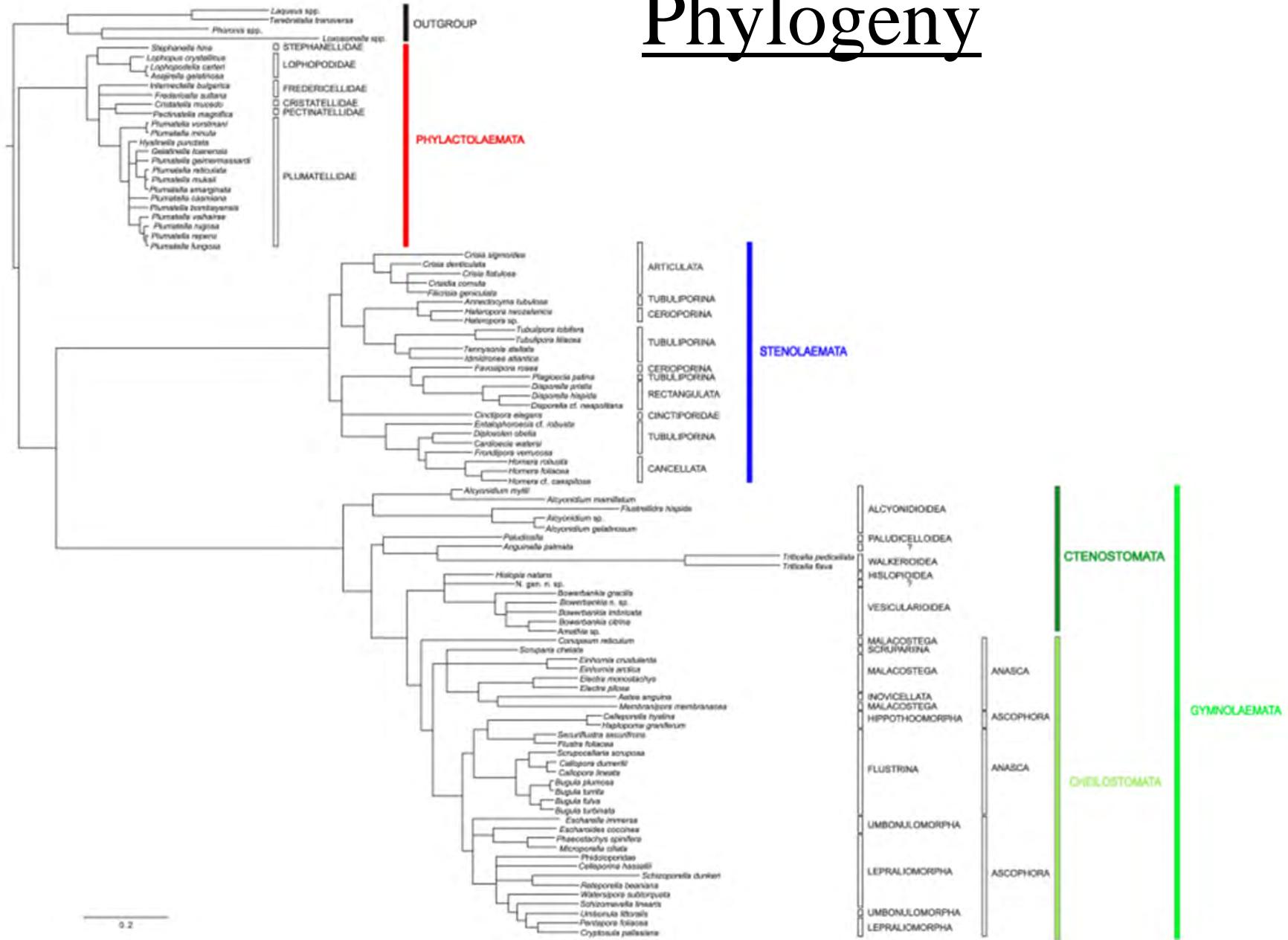


**Stenolaemata
(Cyclostomata)**



Cheilostomata

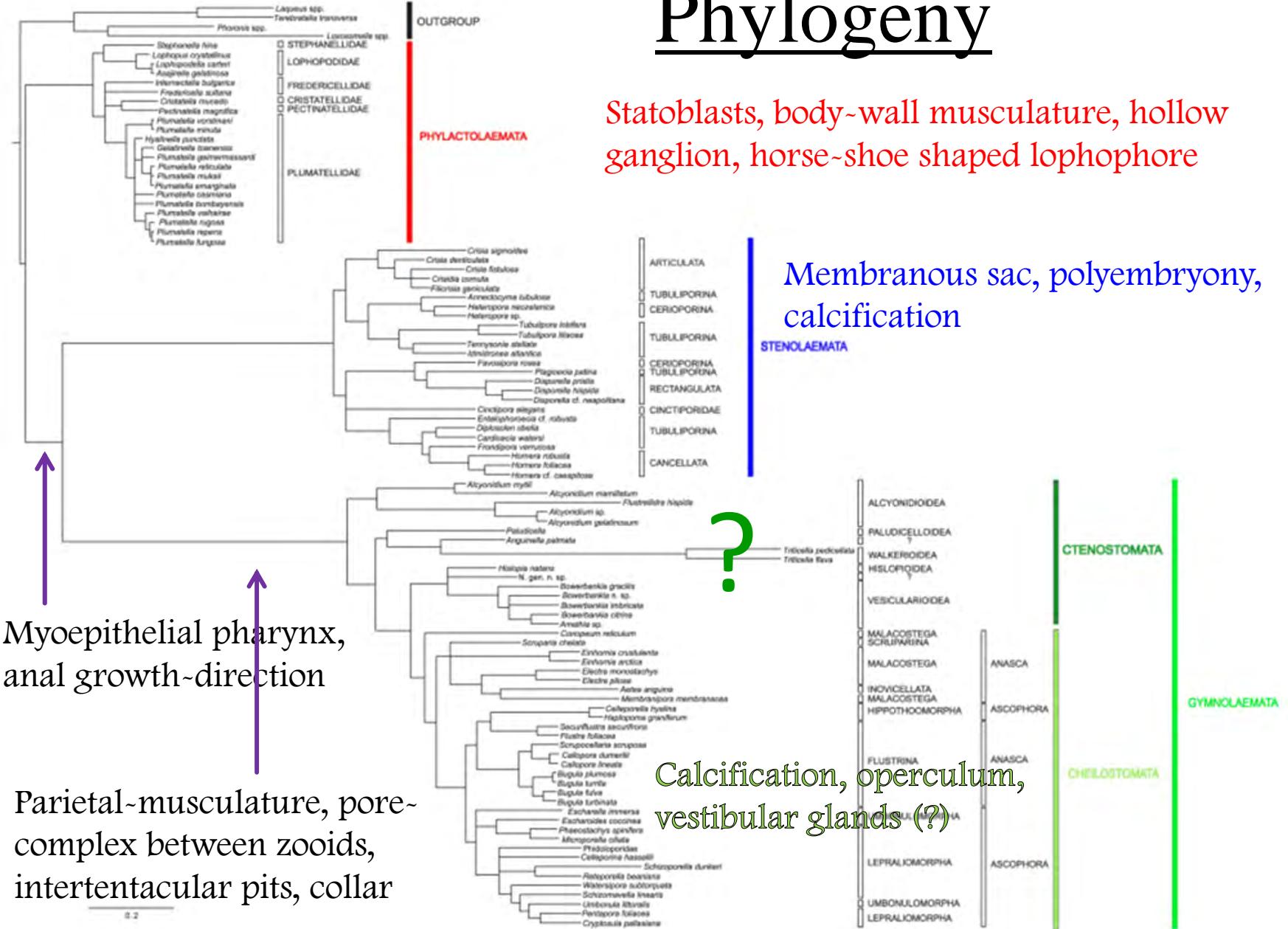
Phylogeny



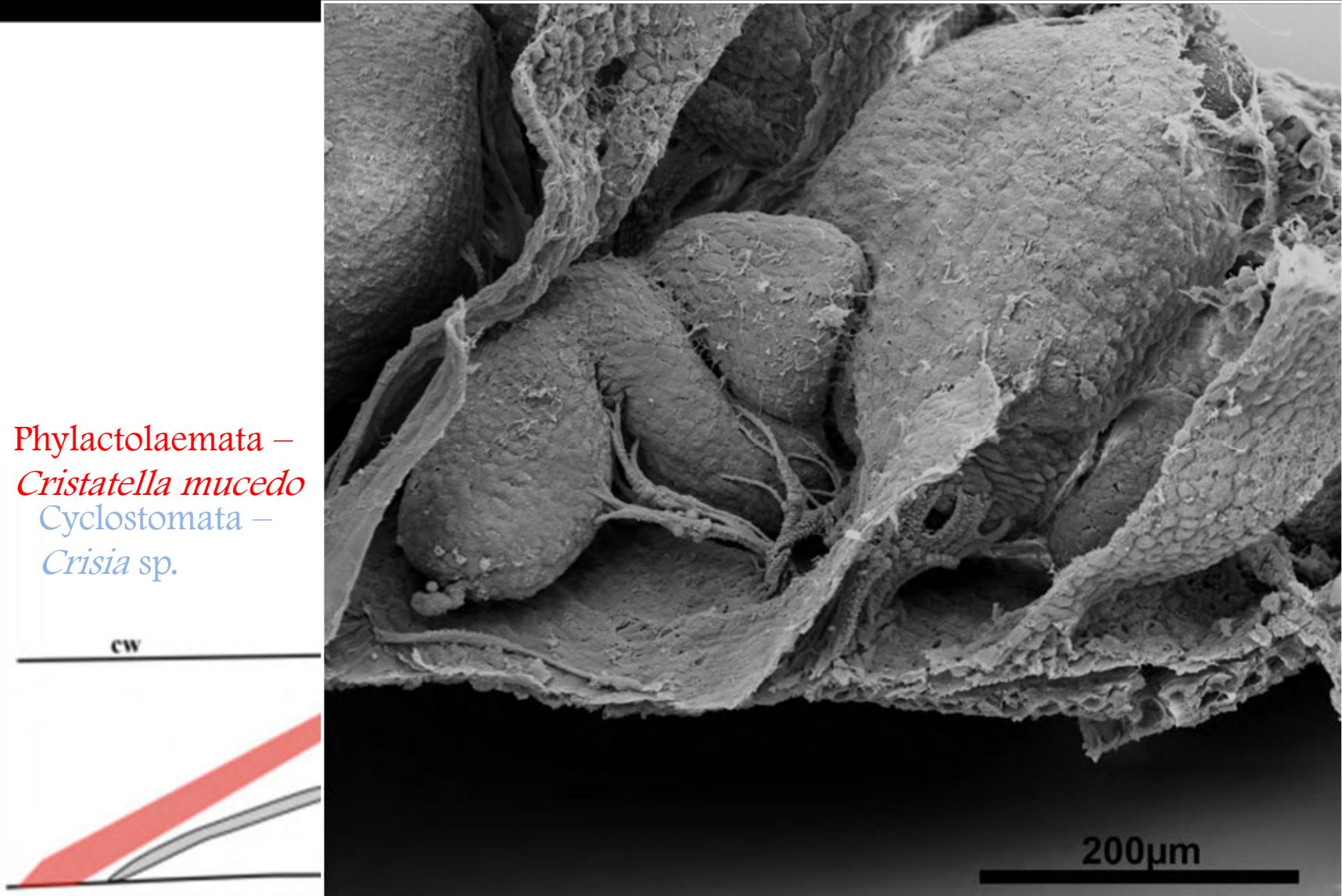
Waeschenbach et al. 2012

Phylogeny

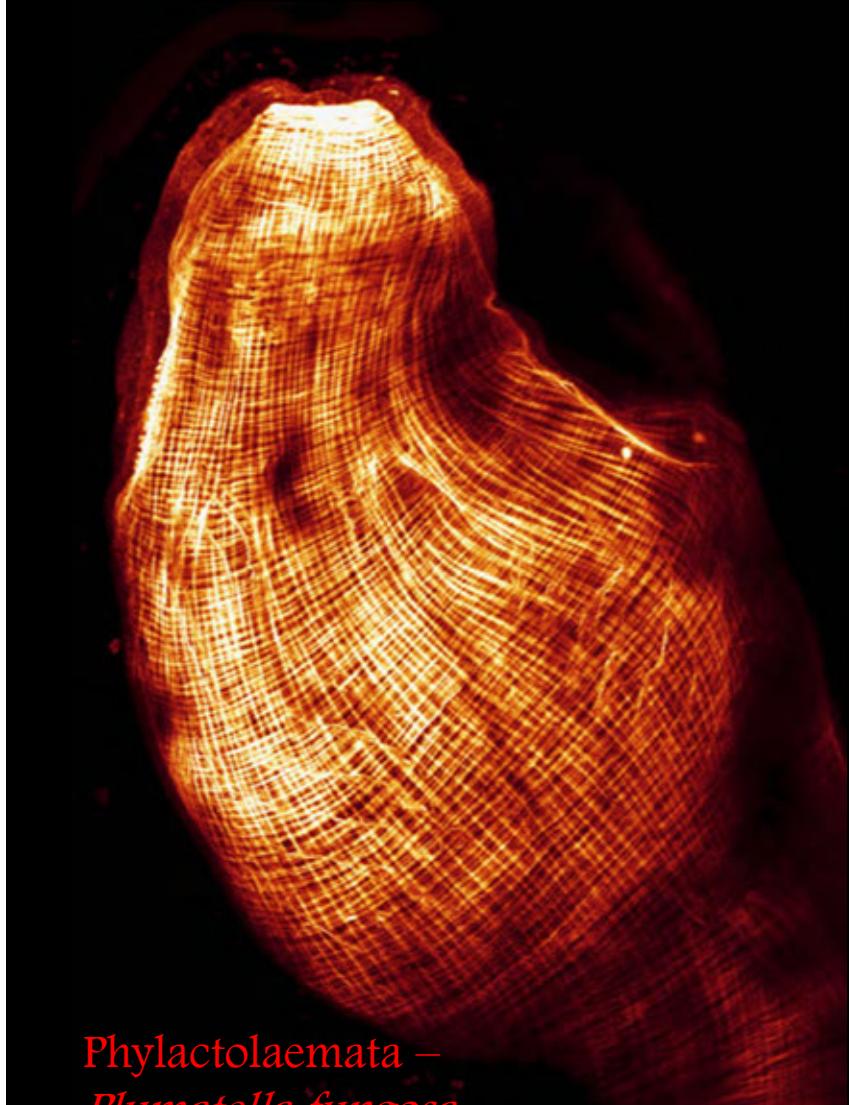
Statoblasts, body-wall musculature, hollow ganglion, horse~shoe shaped lophophore



Muscles ~ Retraction



Muscles ~ Protraction



Phylactolaemata –
Plumatella fungosa

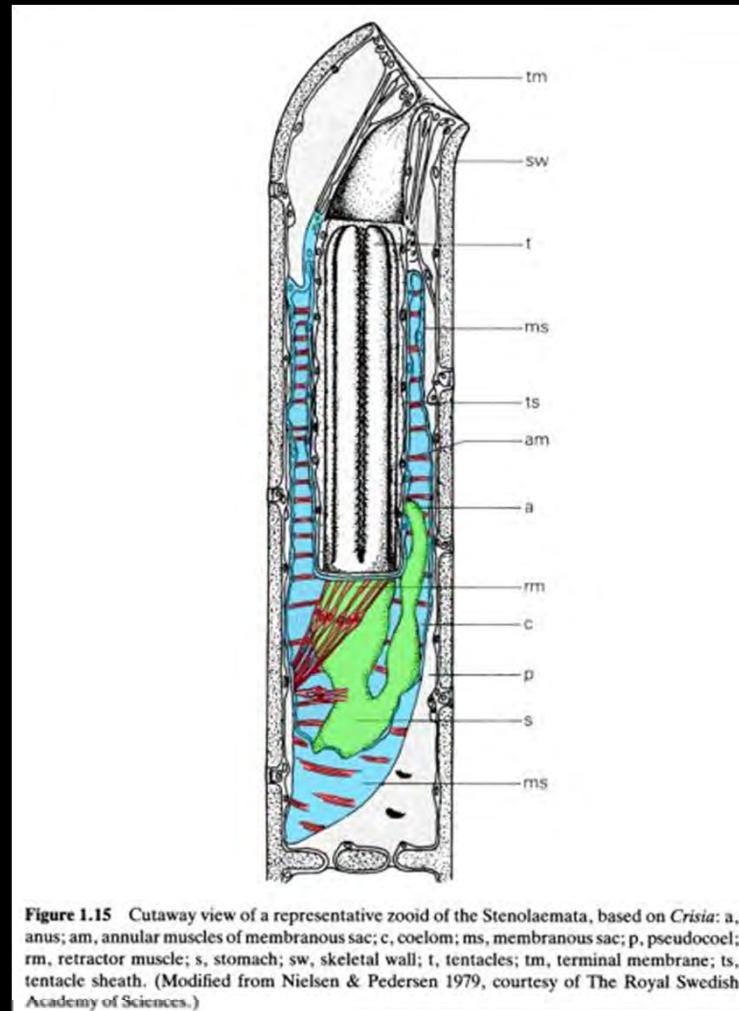
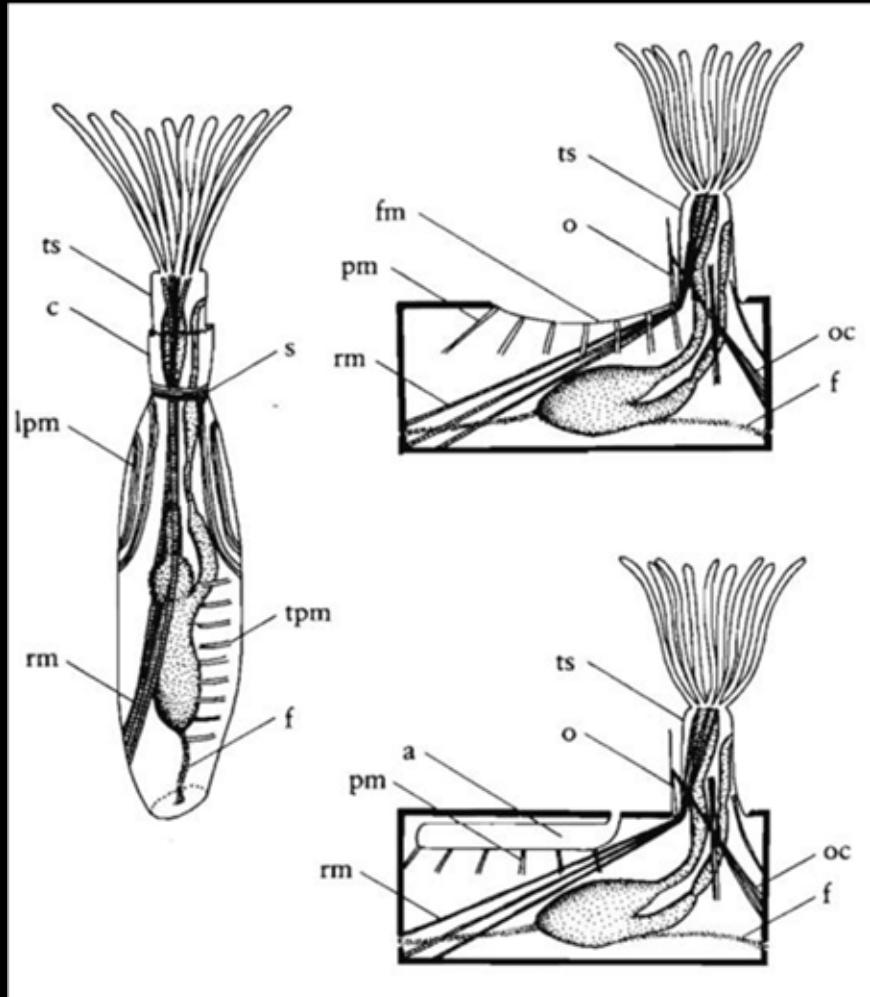


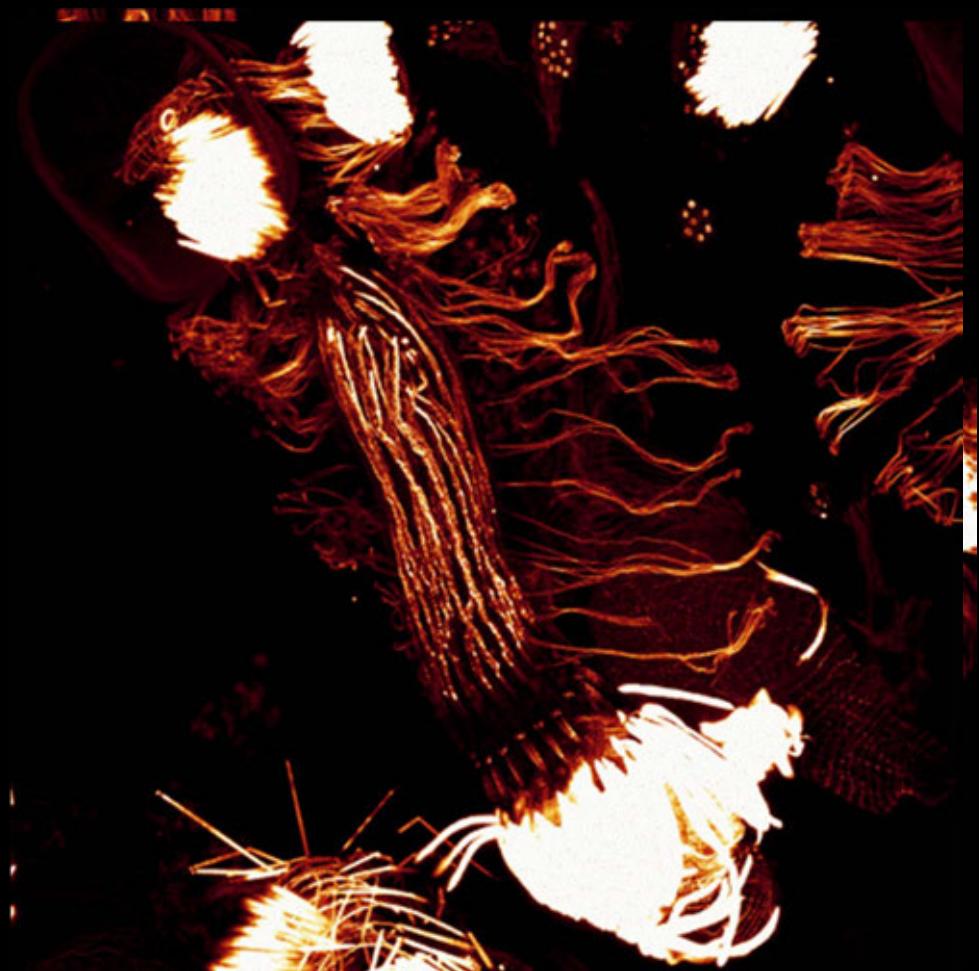
Figure 1.15 Cutaway view of a representative zoid of the Stenolaemata, based on *Crisia*: a, anus; am, annular muscles of membranous sac; c, coelom; ms, membranous sac; p, pseudocoel; rm, retractor muscle; s, stomach; sw, skeletal wall; t, tentacles; tm, terminal membrane; ts, tentacle sheath. (Modified from Nielsen & Pedersen 1979, courtesy of The Royal Swedish Academy of Sciences.)

Cyclostomata,
Crisia sp.

Muscles ~ Protraction

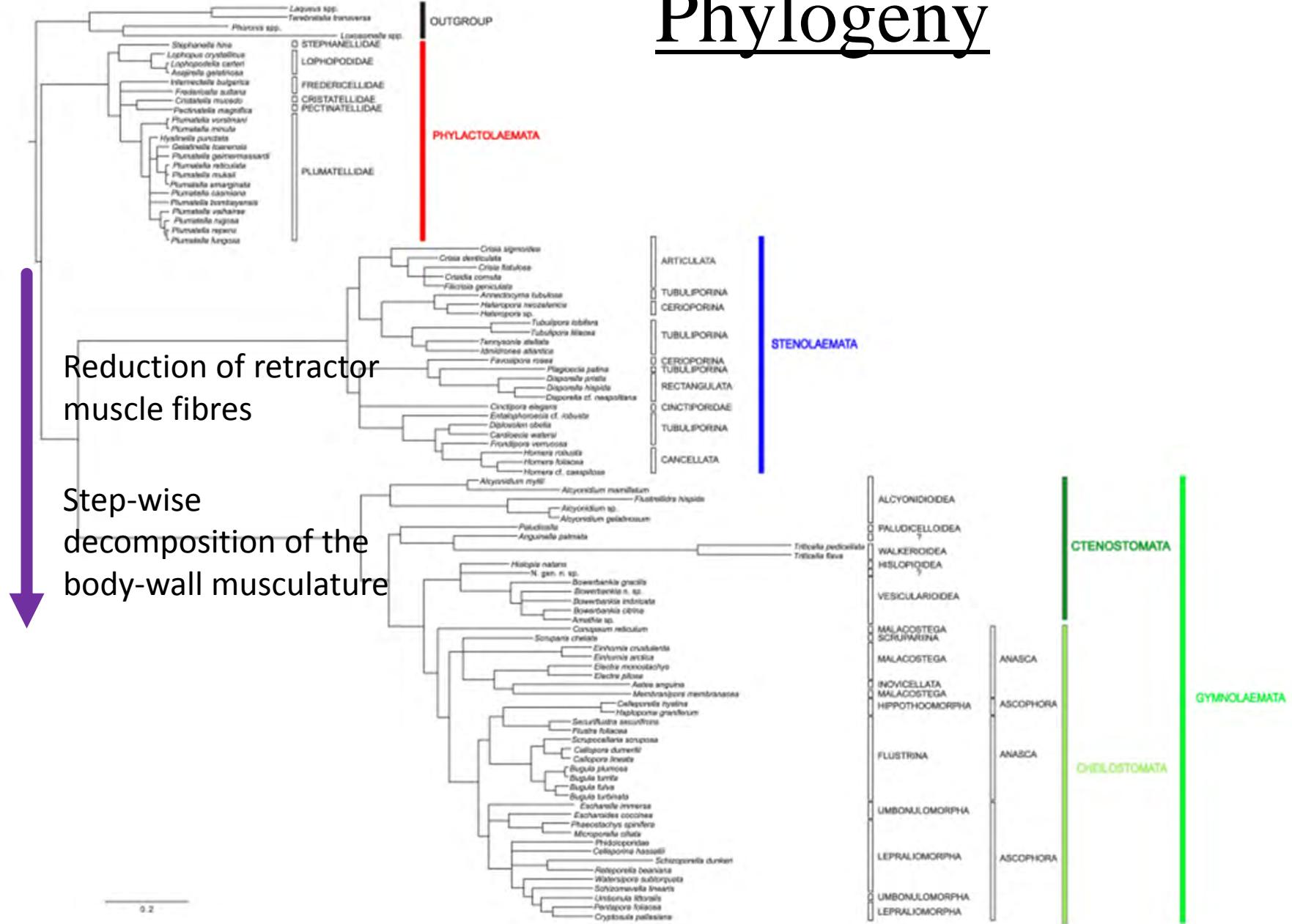


Taylor 1981



Bowerbankia pallissiana
Cteabiolontamata

Phylogeny

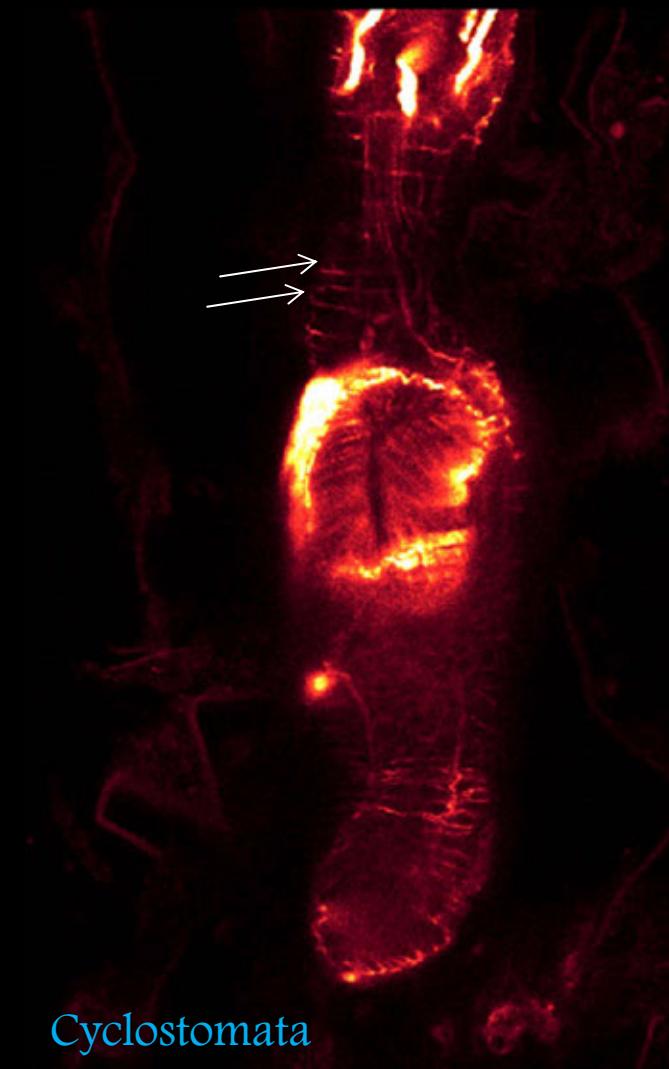


Waeschenbach et al. 2012

Muscles – Tentacle sheath

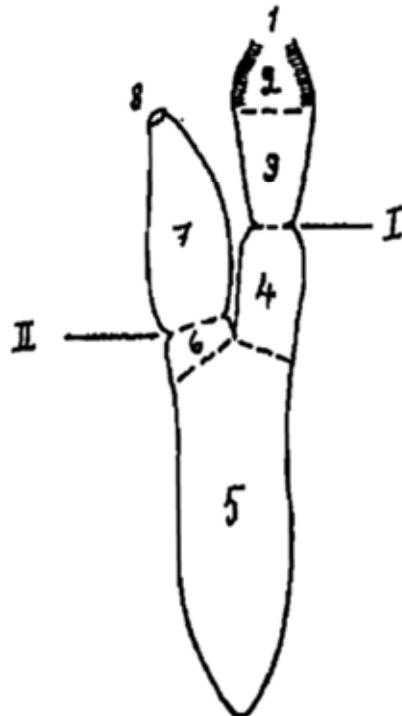


Phylactolaemata –
Phidomyces fusiformis

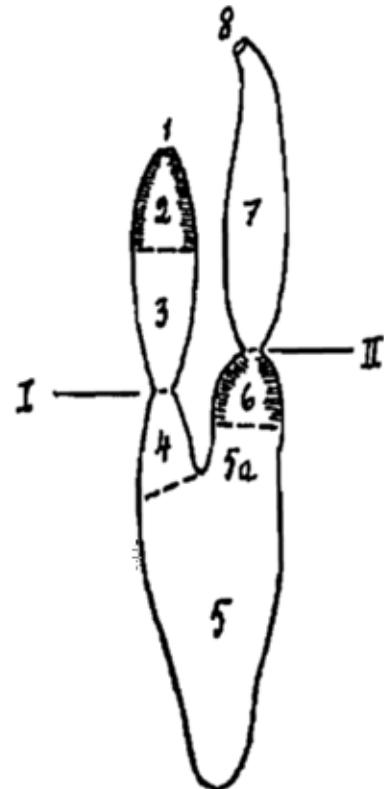


Cyclostomata
Crisia sp.

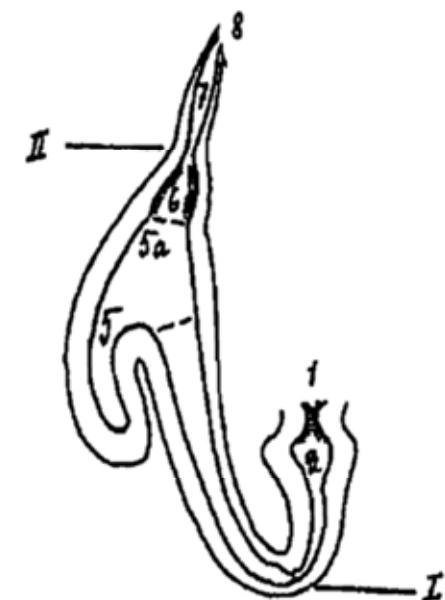
Digestive tract



Phylactolaemata



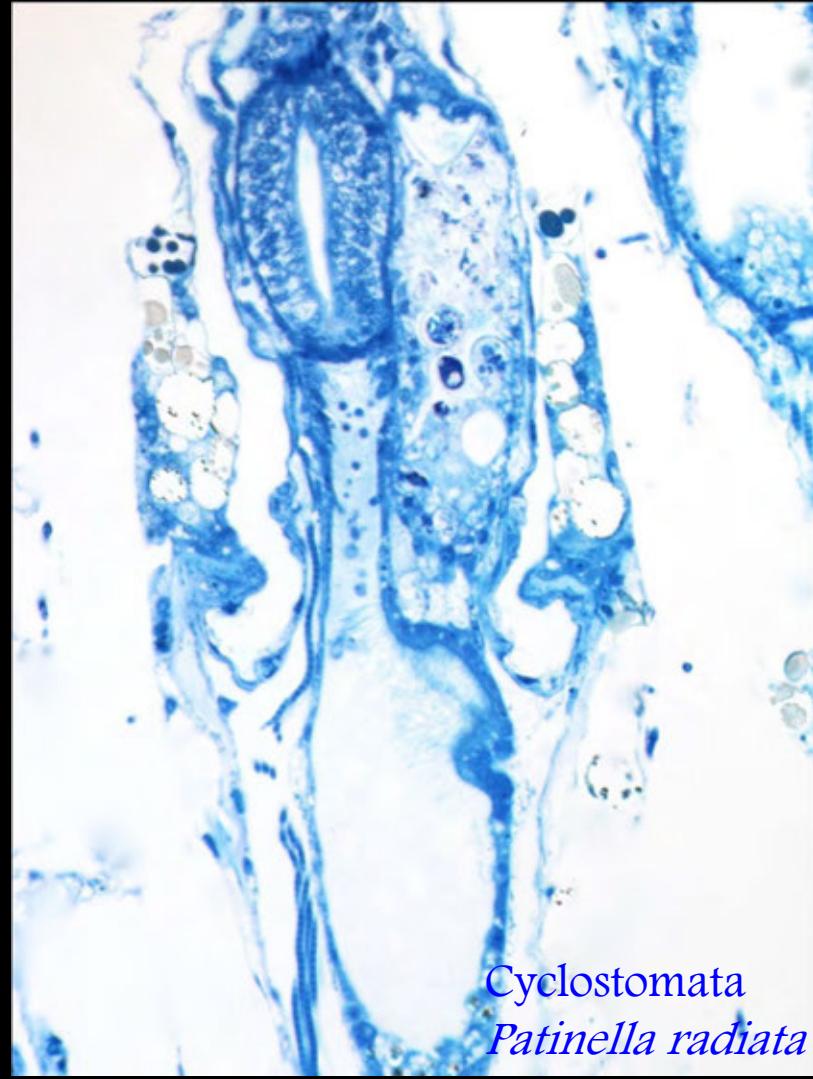
Cyclostomata



Gymnolaemata

After Silen 1944

Digestive tract



Digestive tract

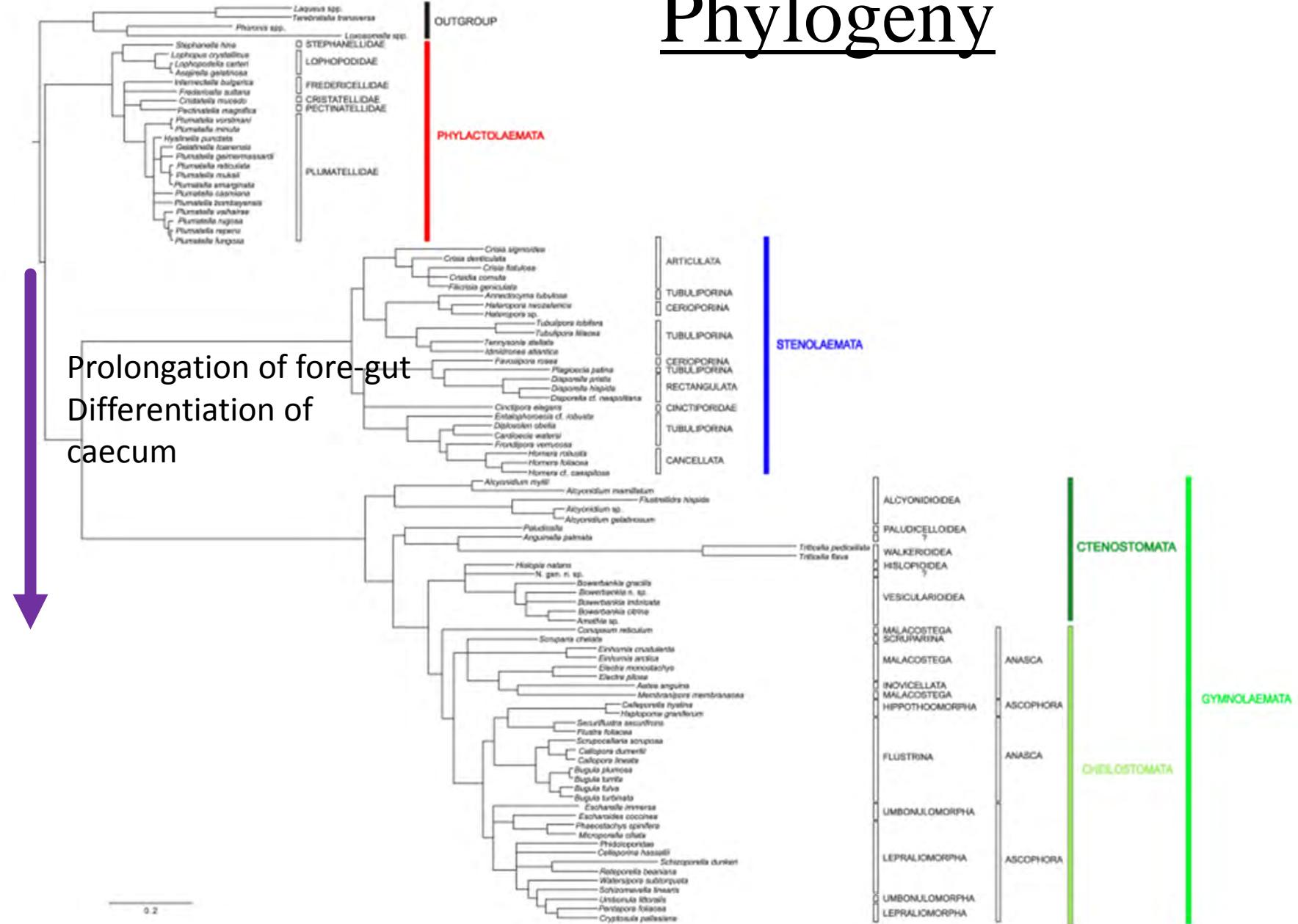


Ctenostomata
Hislopia malayensis



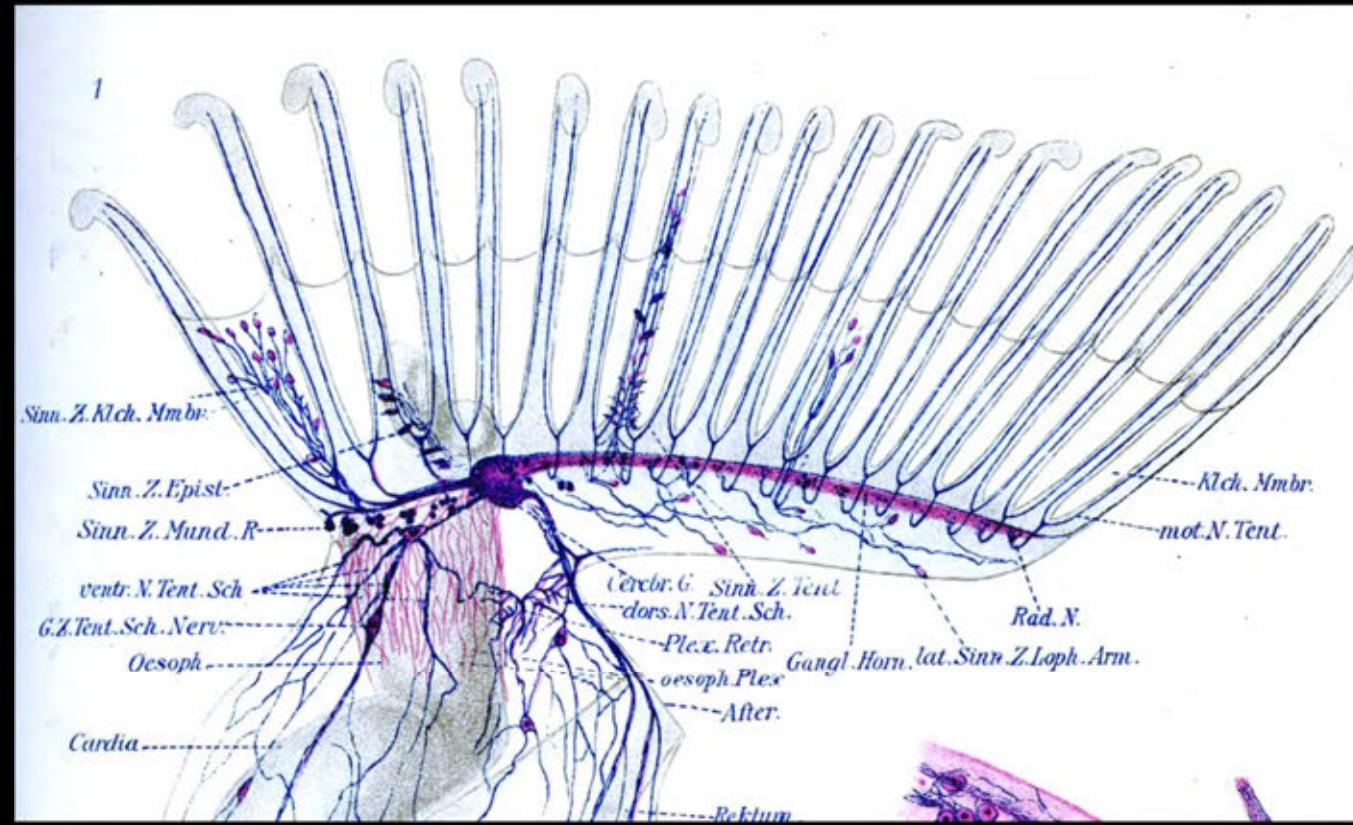
Cheilostomata
Electra pilosa

Phylogeny

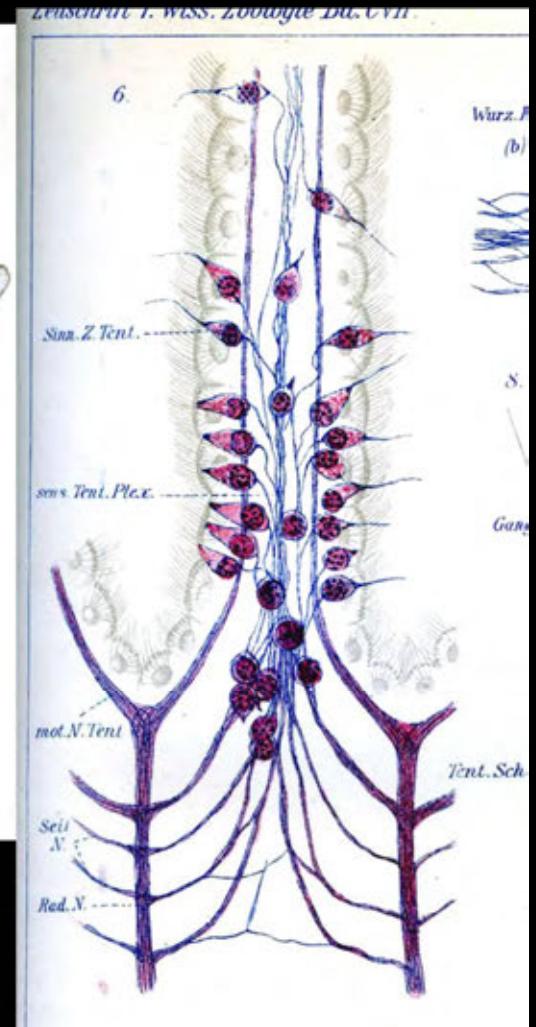


Waeschenbach et al. 2012

Nervous system



Phylactolaemata
Gewerzhagen
1913
Cristatella mucedo

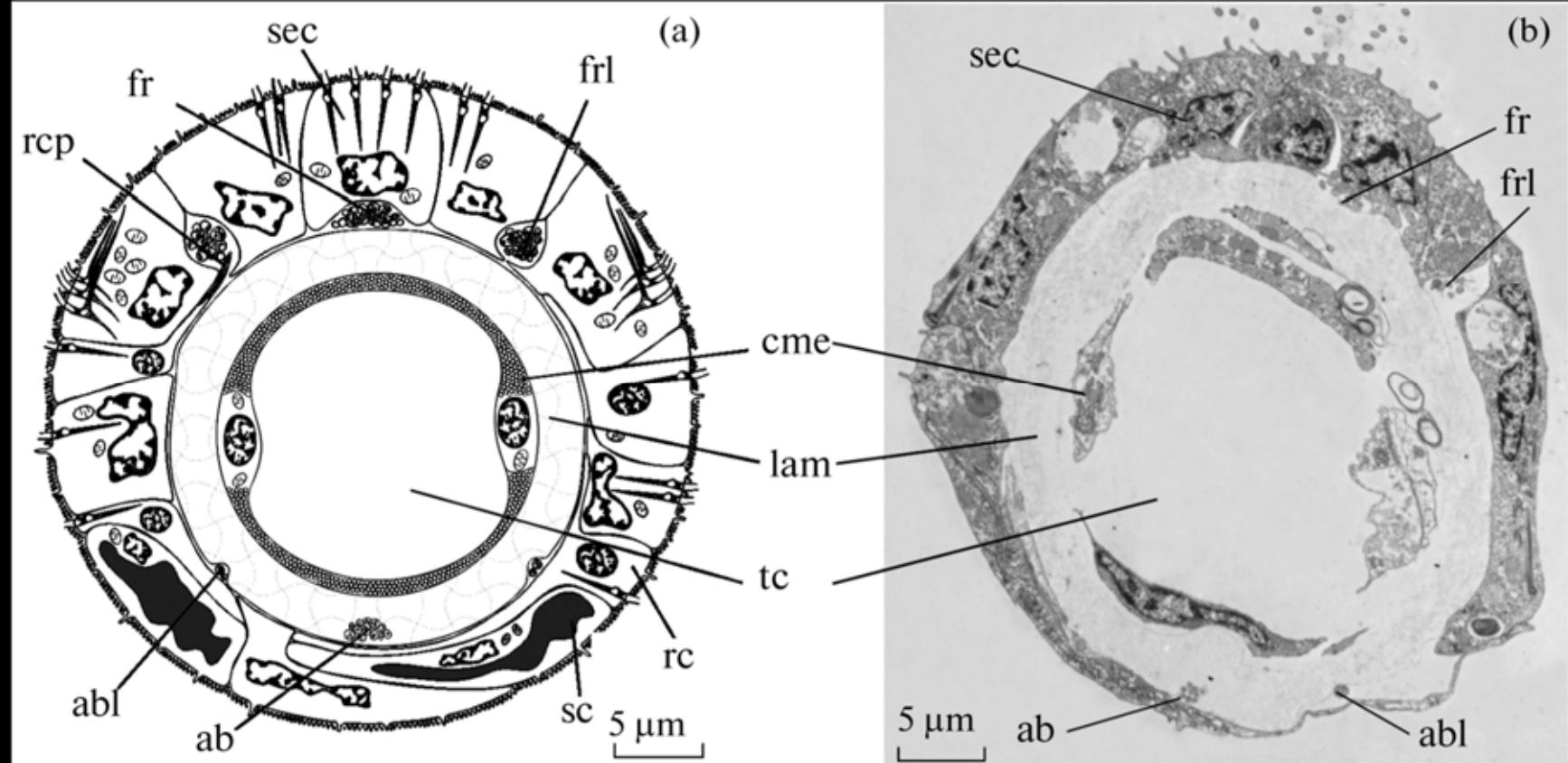


Nervous system



Phylactolaemata
Plumatella fungosa

Tentacle nerves



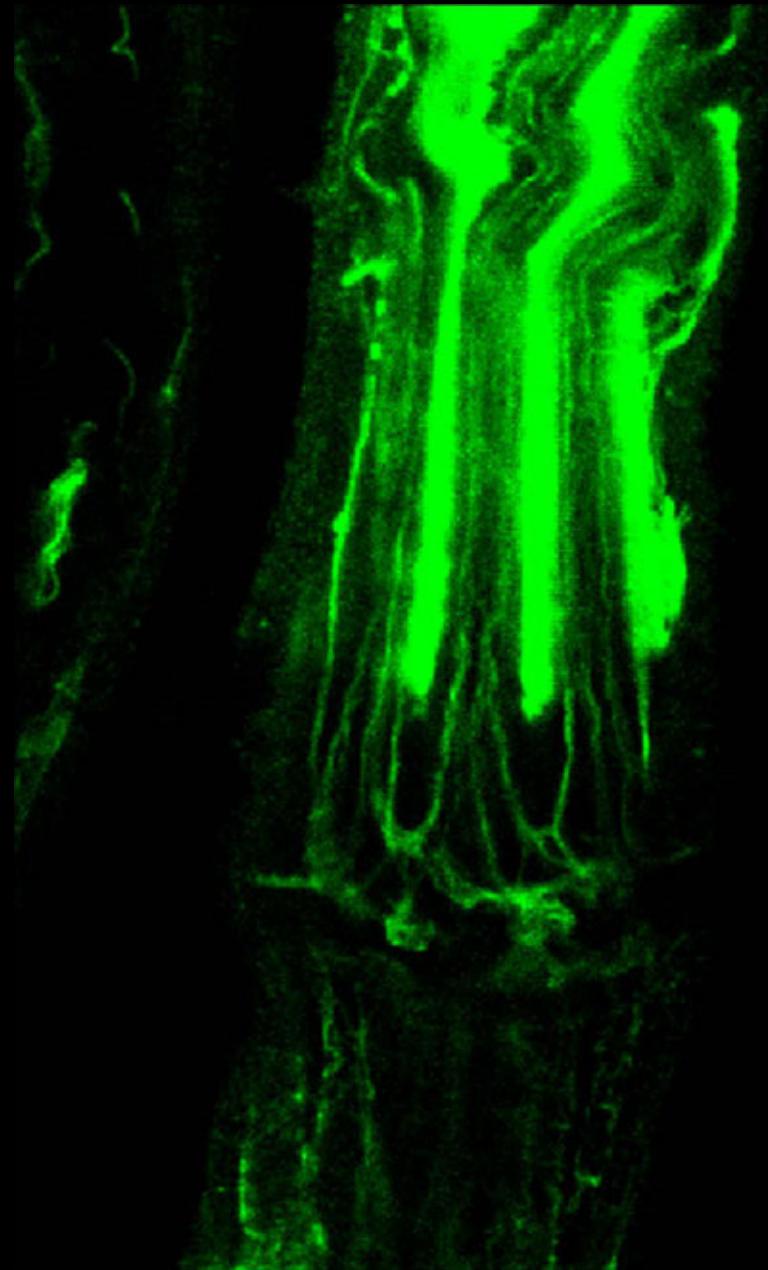
Phylactolaemata

Shunkina et al.

2014

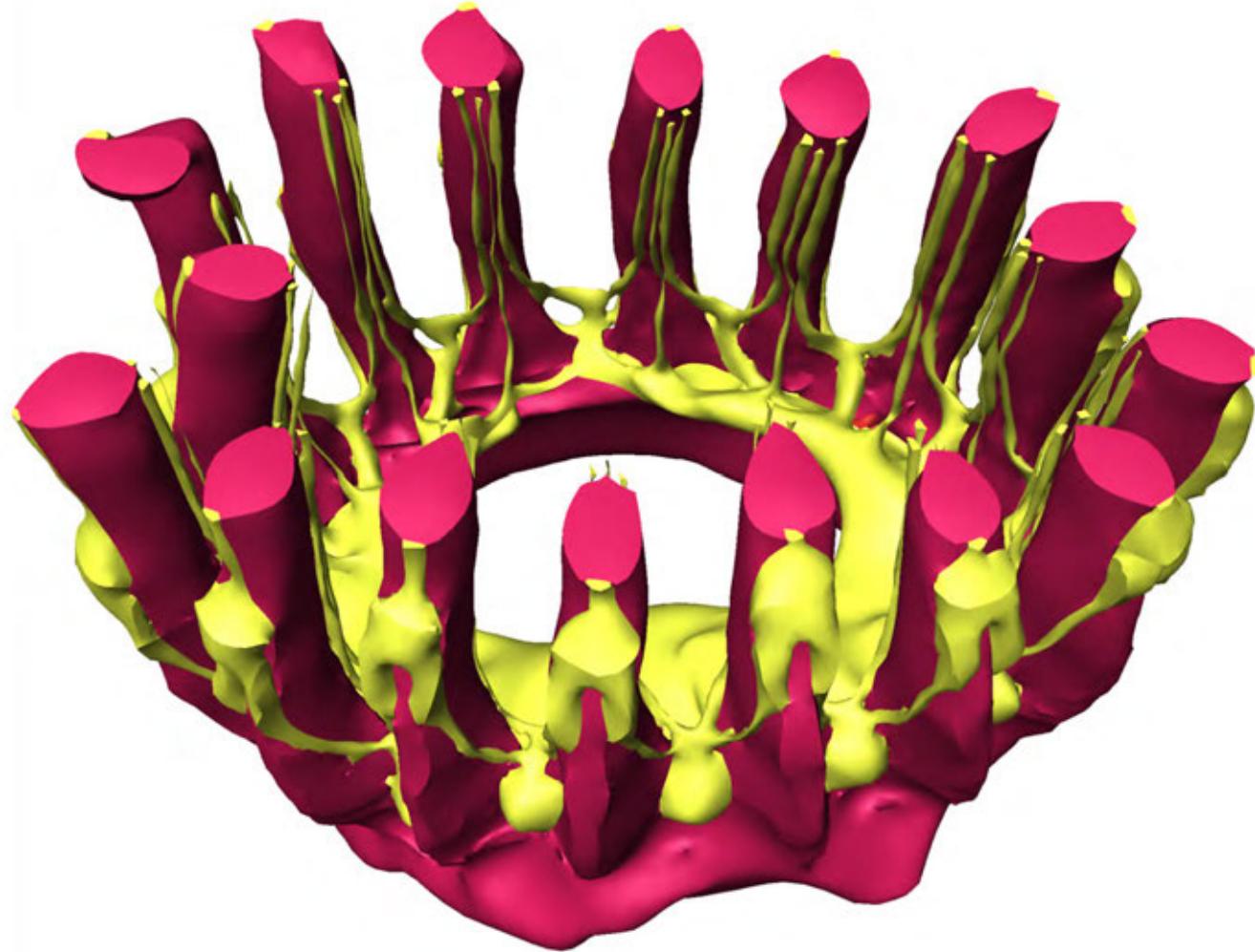
Cristatella mucedo

Nervous system

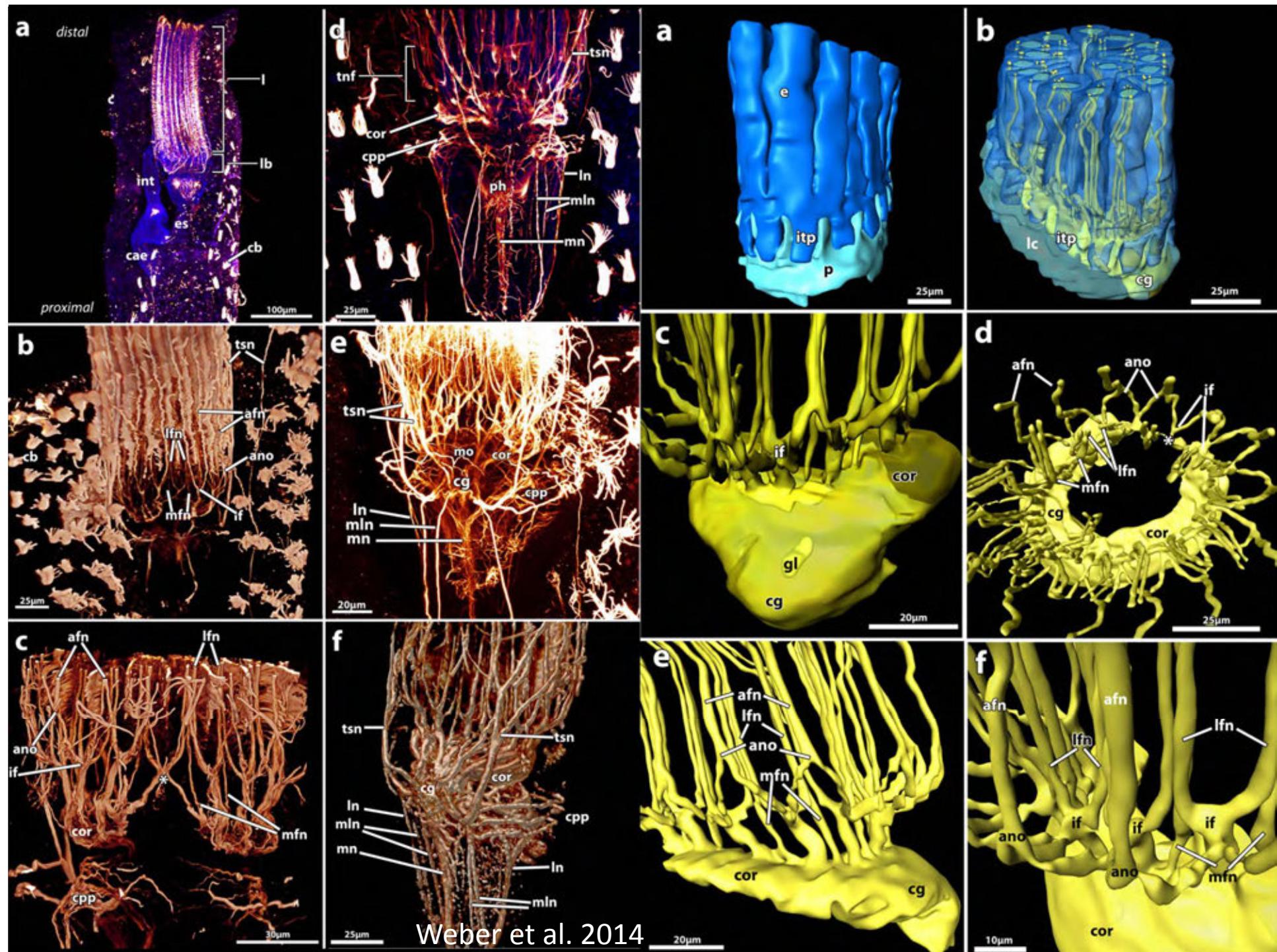


Cyclostomata
Crisia sp.

Nervous system

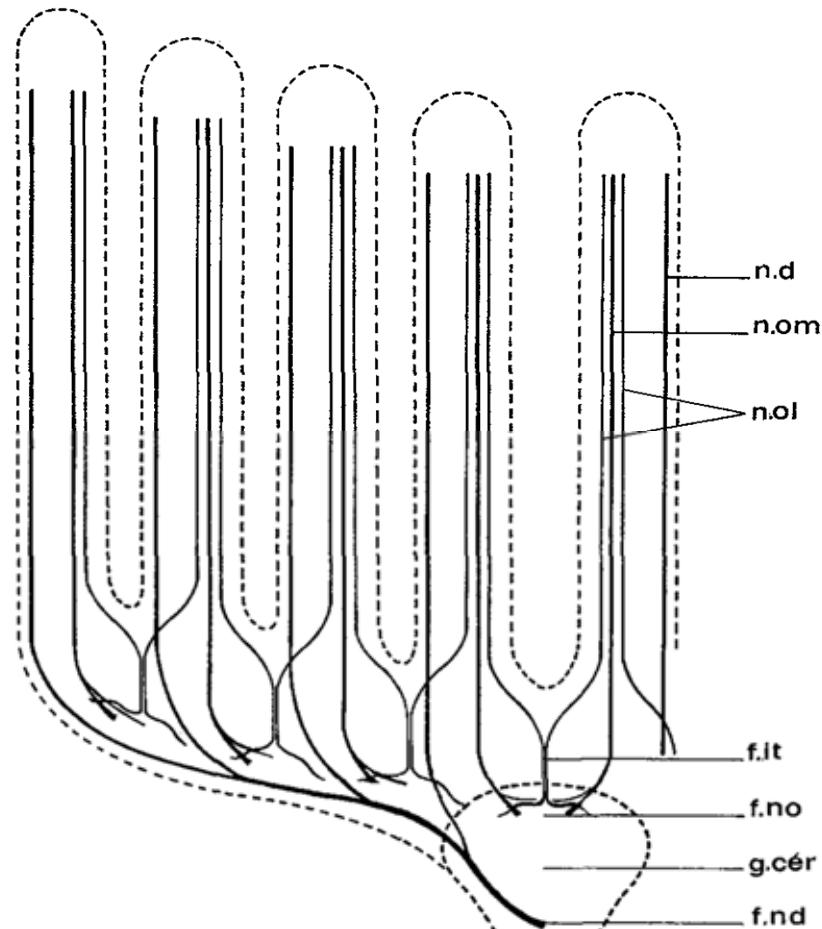


Ctenostomata
Hislopia malayensis



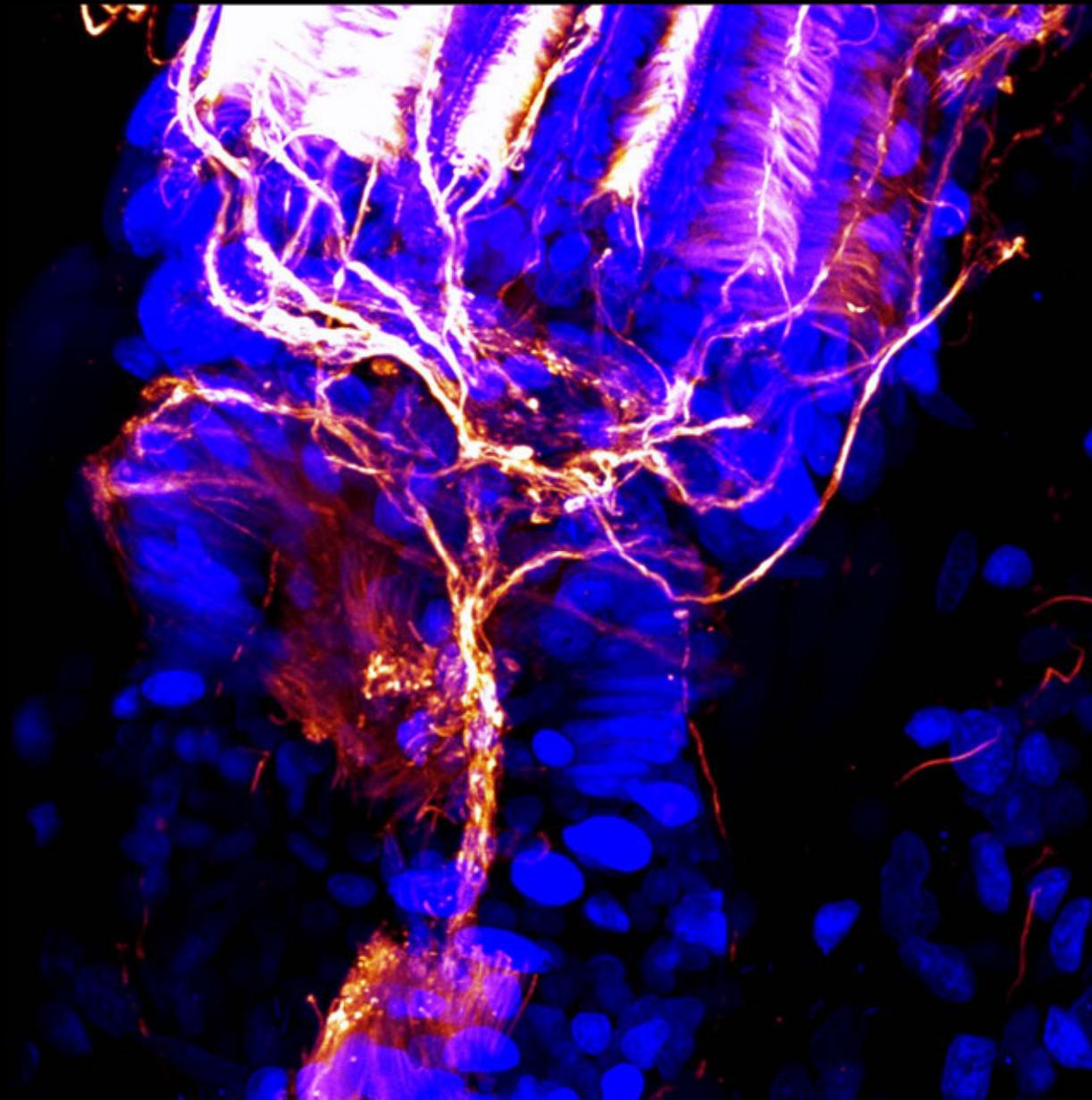
Nervous system

G. Lutaud:



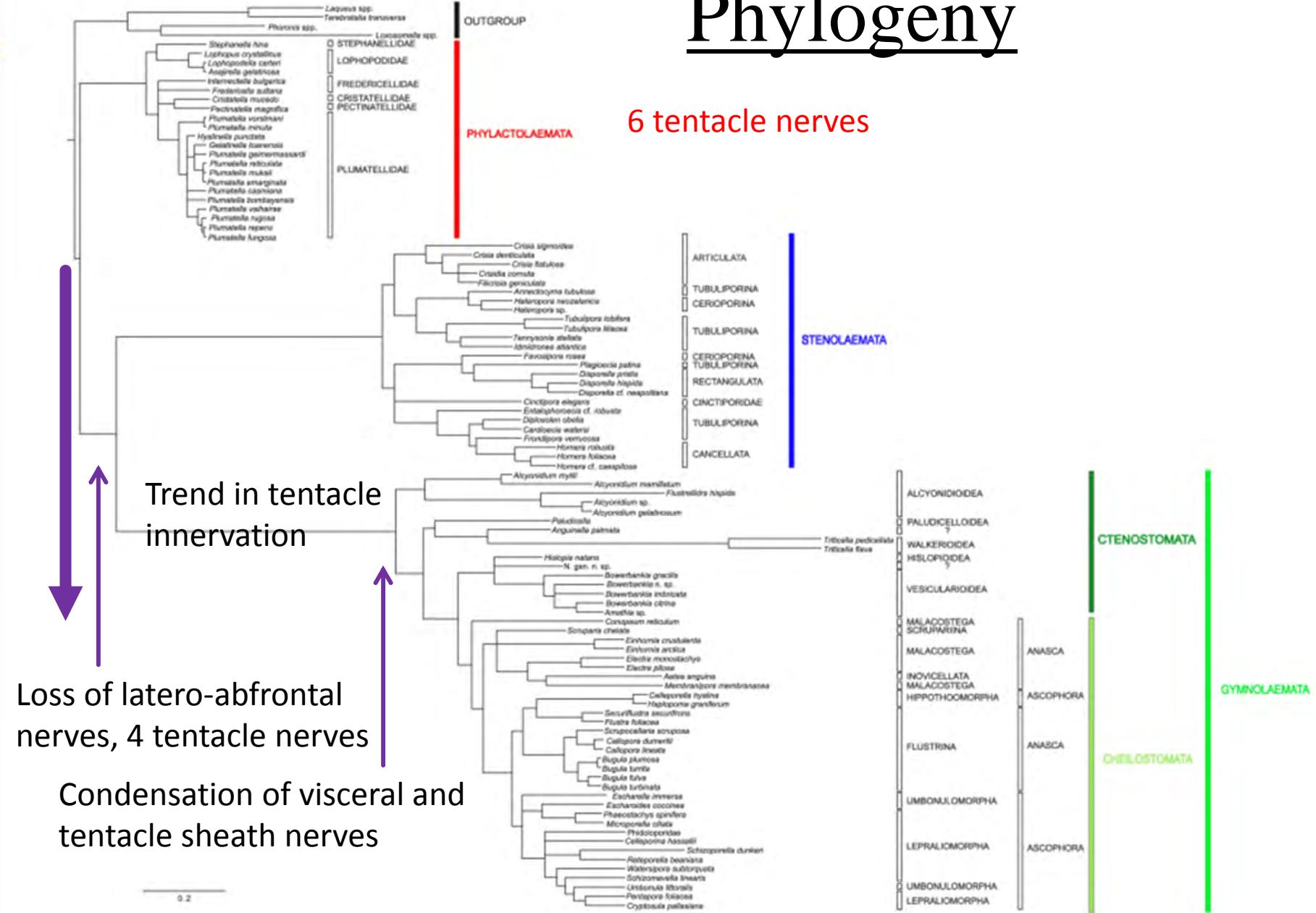
Cheilostomata
Electra pilosa
Lutaud 1973

Nervous system



Cheilostomata
Chorizopora brongniartii

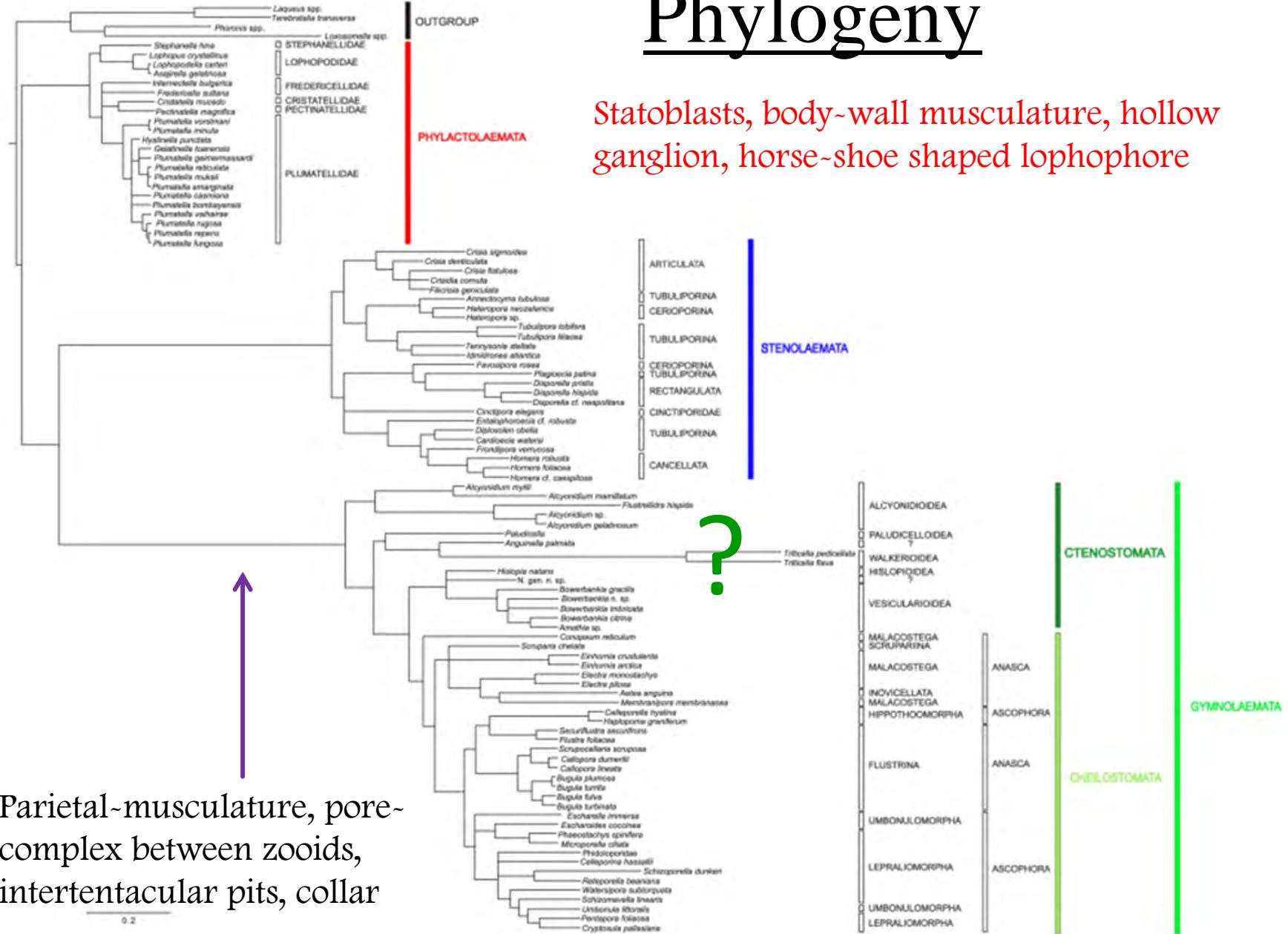
Phylogeny



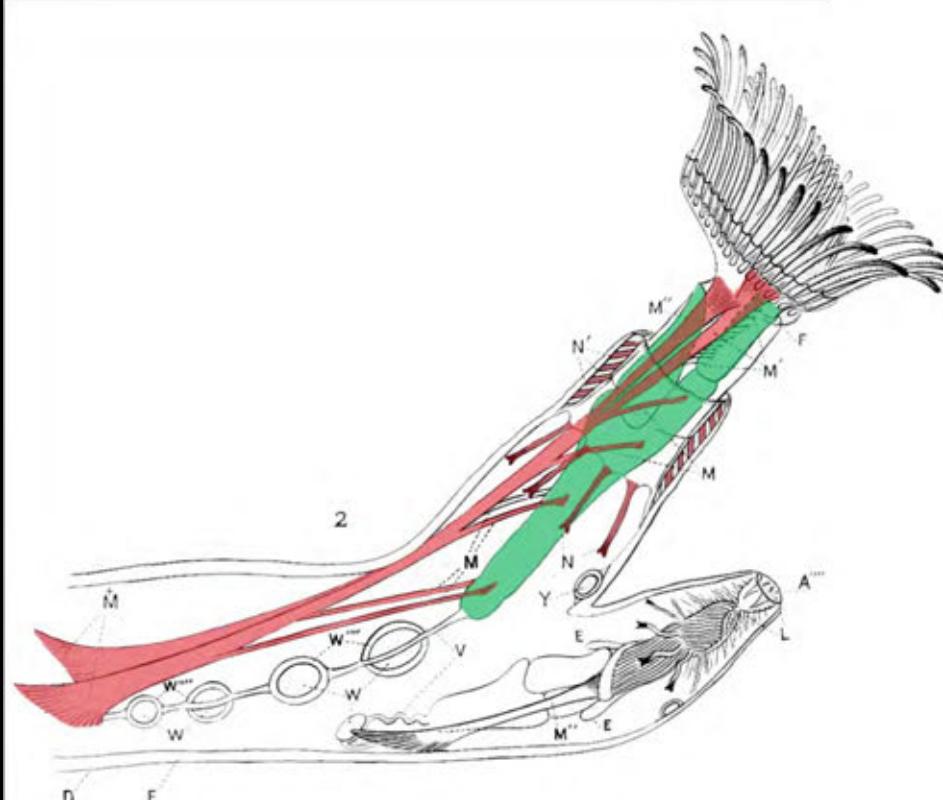
Waeschenbach et al. 2012

Phylogeny

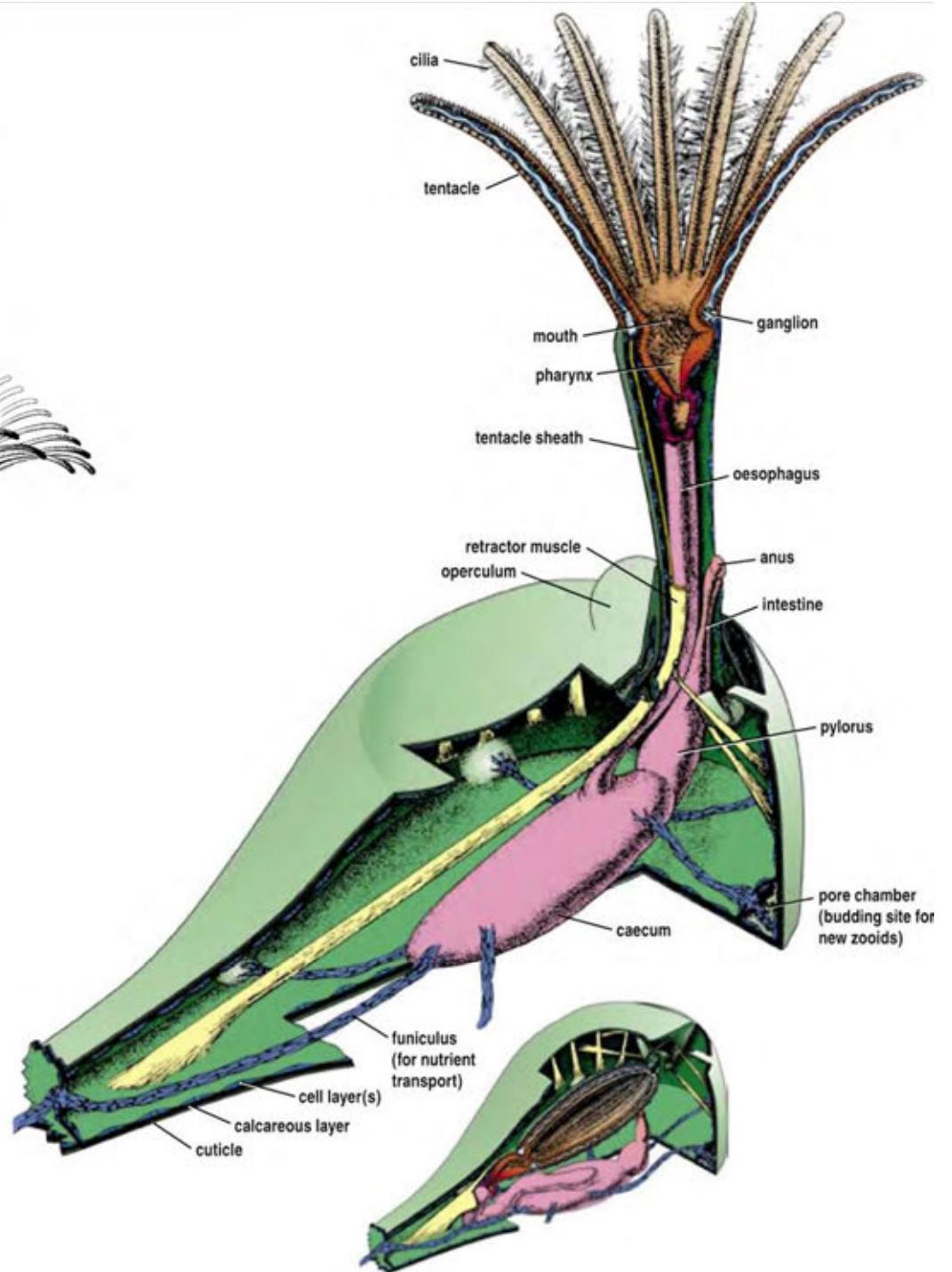
Statoblasts, body-wall musculature, hollow ganglion, horse~shoe shaped lophophore



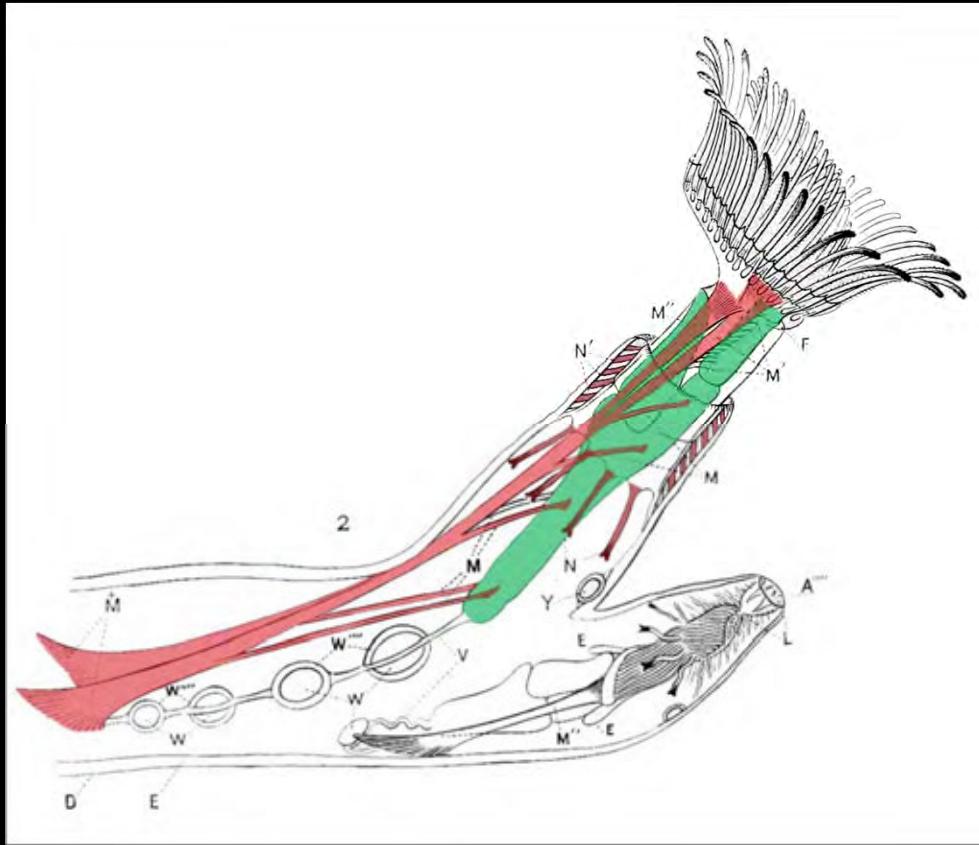
Funiculus



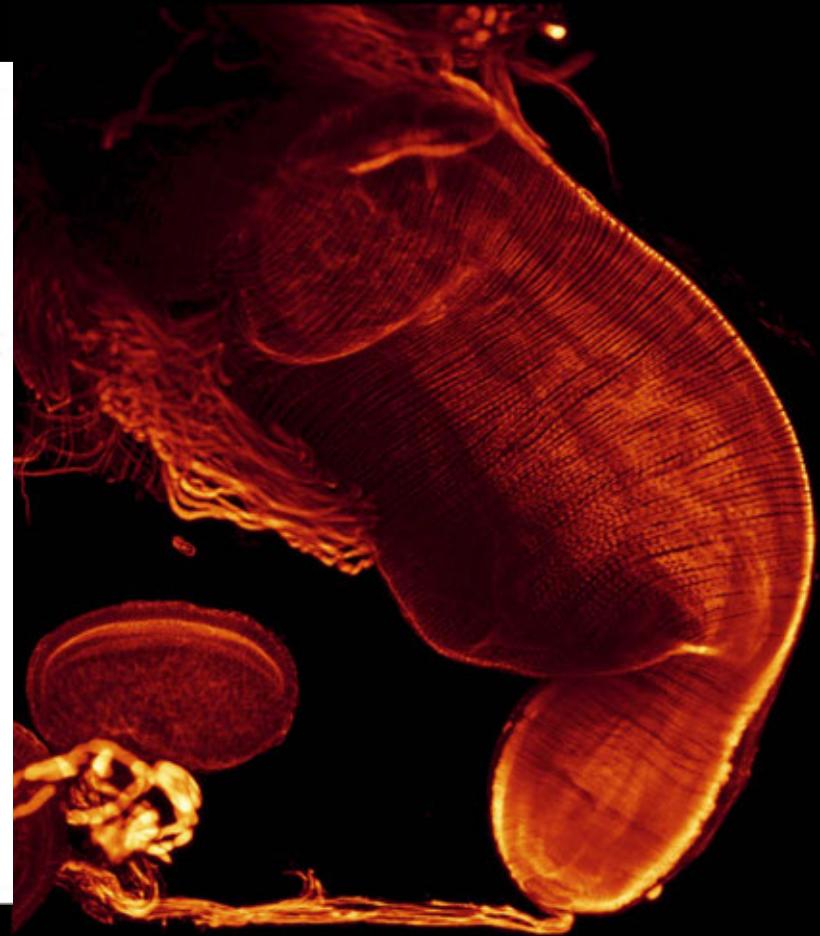
Plumatella fungosa



Funiculus ~ Phylactolaemata

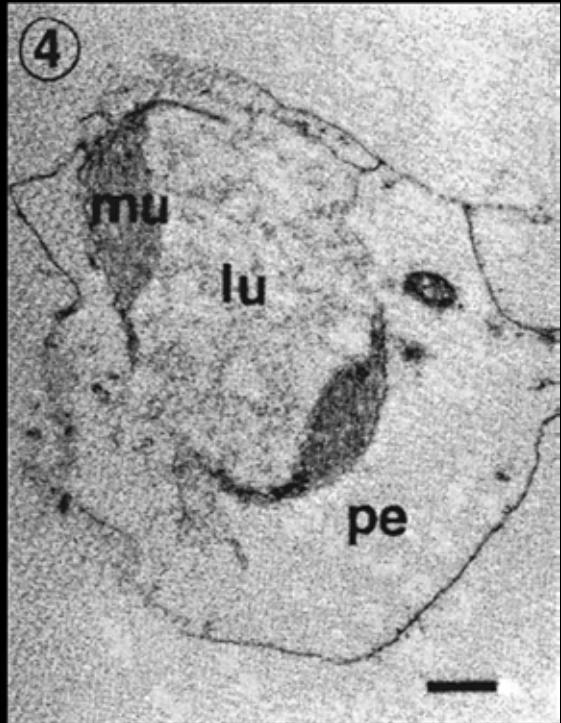


Plumatella fungosa

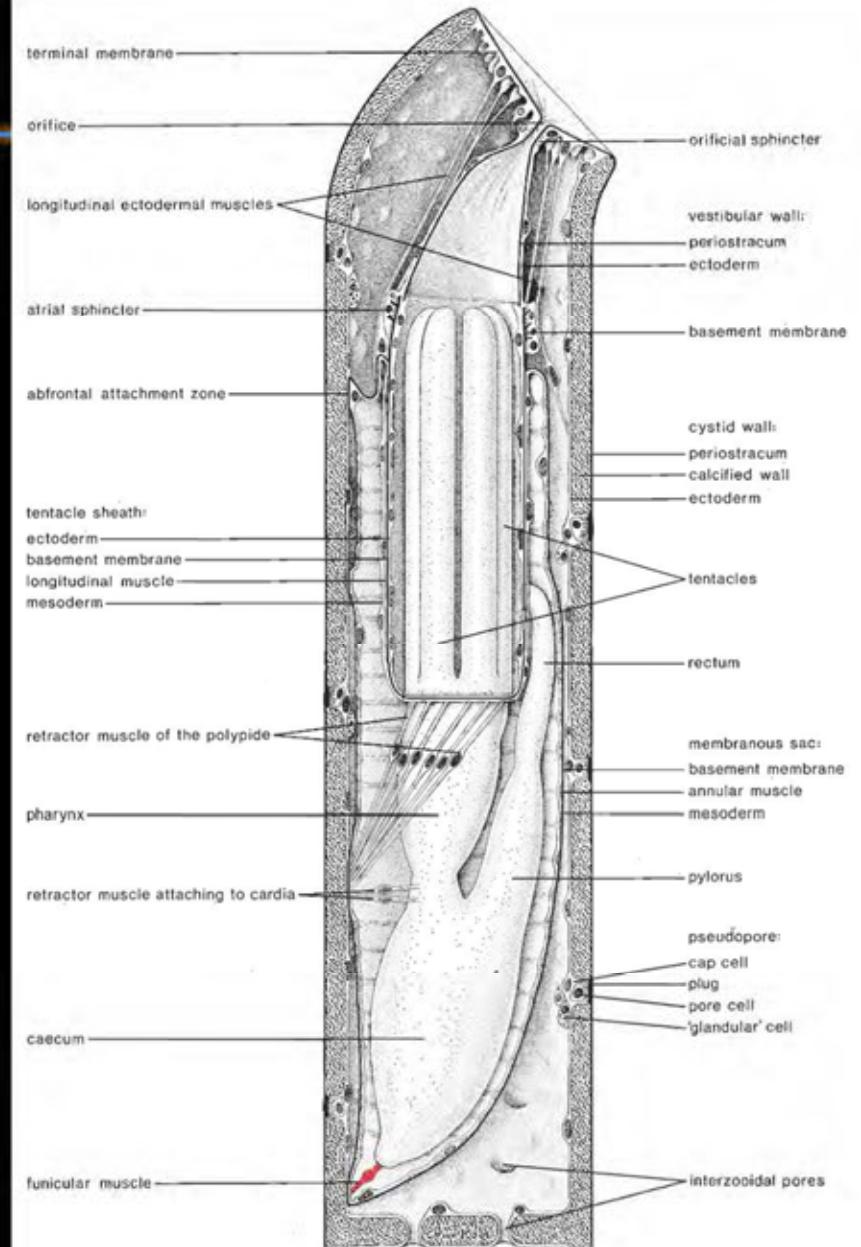


Plumatella fungosa

Funiculus ~ Cyclostomata



from Carle & Ruppert 1983



from Nielsen & Pedersen 1979

Funiculus – Gymnolaemata

Mukai et al. 1997

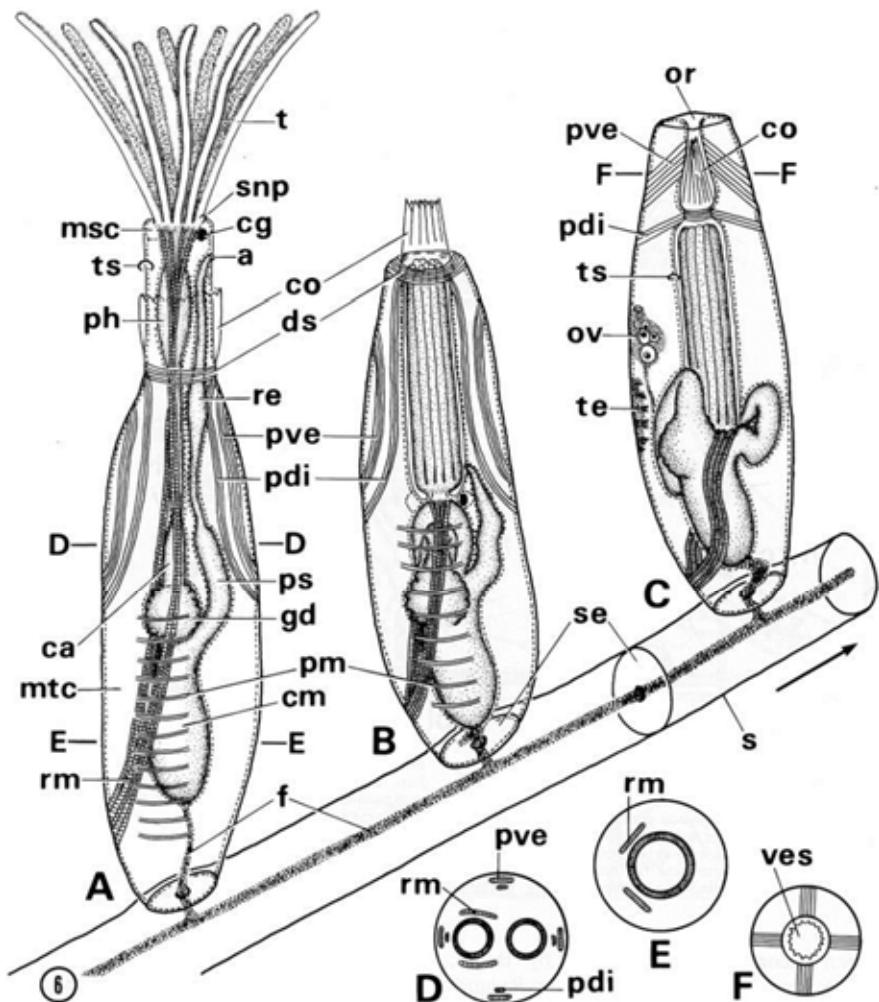


Fig. 6. Zoid structure of Ctenostomata, represented by *Bowerbankia*. A: Zoid with tentacles expanded. B: Zoid with tentacles partially retracted. C: Fully retracted zoid (parietal muscles omitted, gonads shown). D: Transverse section through A in the distal part. E: Transverse section through B in the proximal part. F: Transverse section through C in the vestibular region. The arrow indicates the distal direction of the stolon. a, anus; ca, cardia; cg, cerebral ganglion; cm, caecum; co, collar; D, E, F, areas shown in greater detail in corresponding insets. ds, diaphragmatic sphincter; f, funiculus; gd, gizzard; msc, mesocoel (ring coelom); mtc, metacoel; or, orifice; ov, ovary; pdi, parietodaphragmatic muscle; ph, pharynx; pm, parietal muscles; ps, pylorus; pve, parietoventibular muscle; re, rectum; rm, retractor muscle; s, stolon; se, septa; snp, supraneural pore; t, tentacles; te, testis; ts, tentacle sheath; ves, vestibule. (Redrawn from Ryland, 1970.)

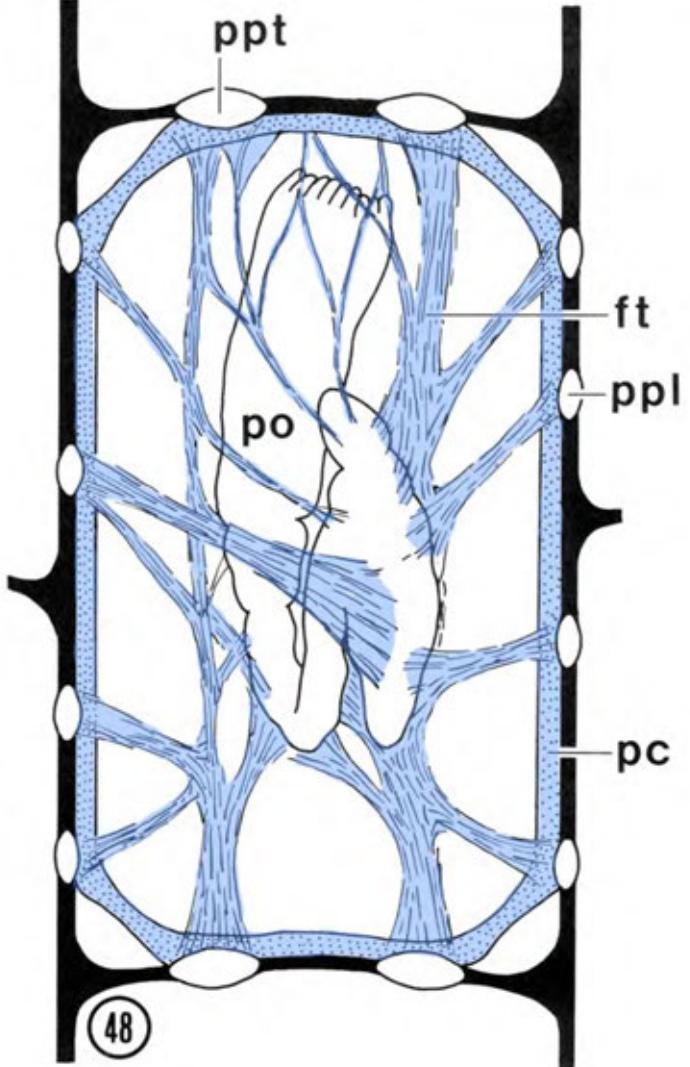
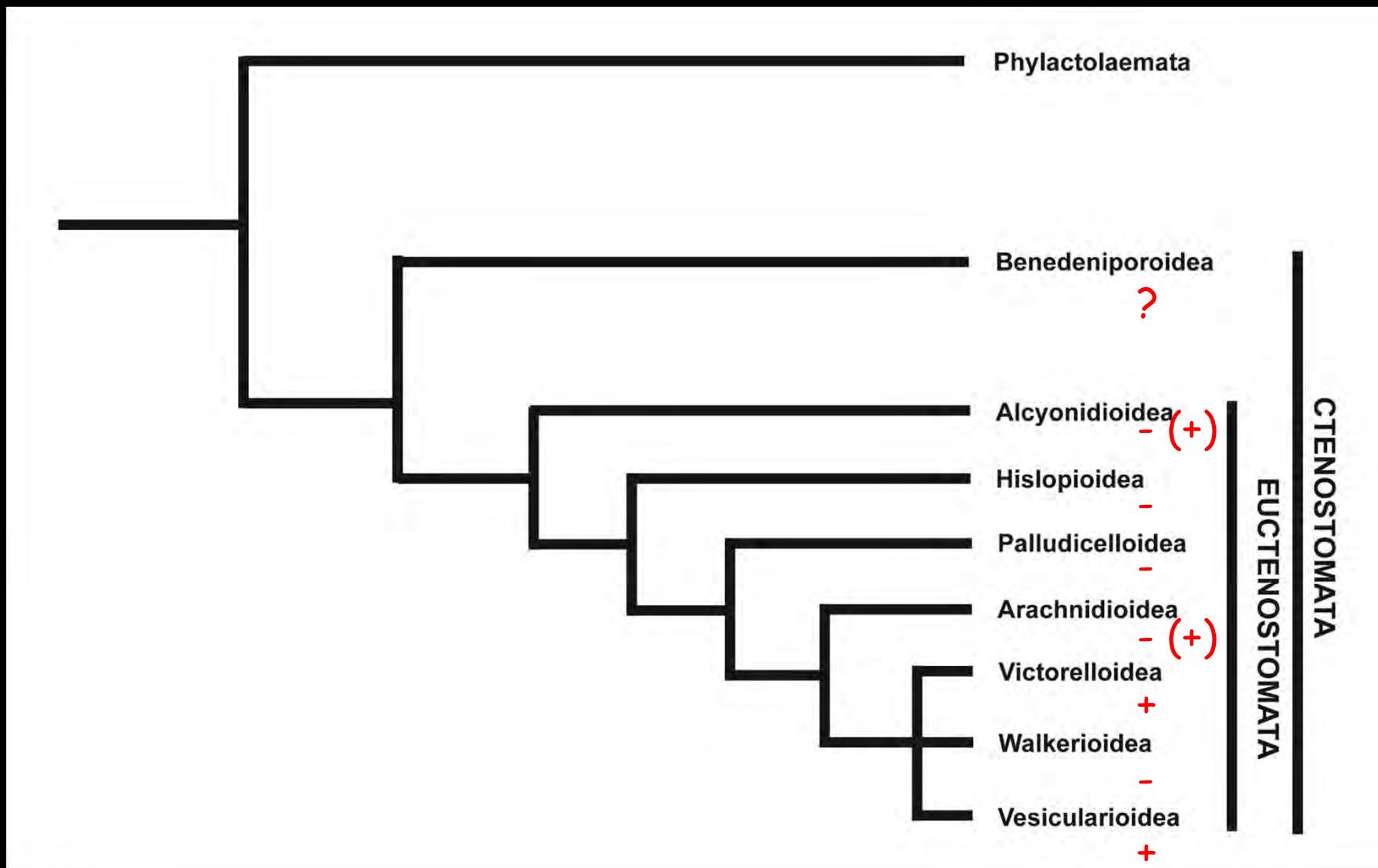


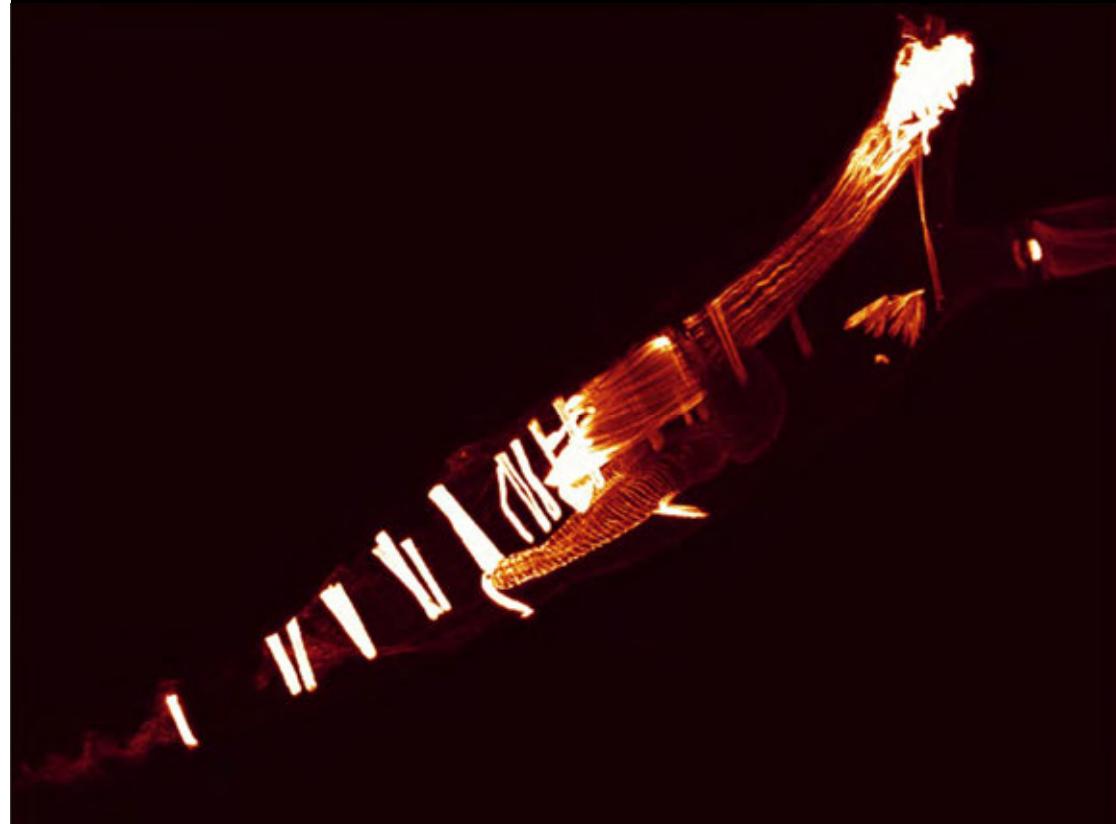
Fig. 48. Diagrammatic representation of the funicular system in a zooid of *Membranipora membranacea*. ft, funicular trunk; pc, peripheral canal; po, polypide; ppl, pore plate in lateral wall; ppt, pore plate in transverse wall. (Redrawn from Lutaud, 1961.)

Proximal funiculus ~ Ctenostomata



From Todd 2000

Funiculus ~ Gymnolaemata



Paludicella articulata



Electra pilosa

Caecal muscle ligament ~ Gymnolaemata

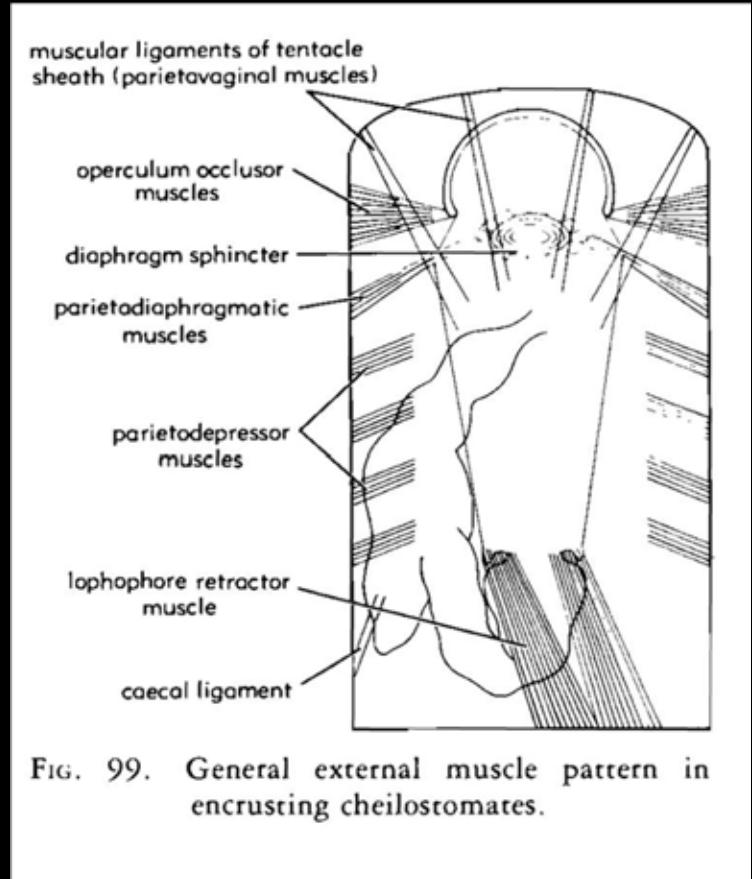
Lutaud 1962

Ctenostomata

Flustrellidra hispida
Alcyonidium gelatinosum
Amathia lendigera

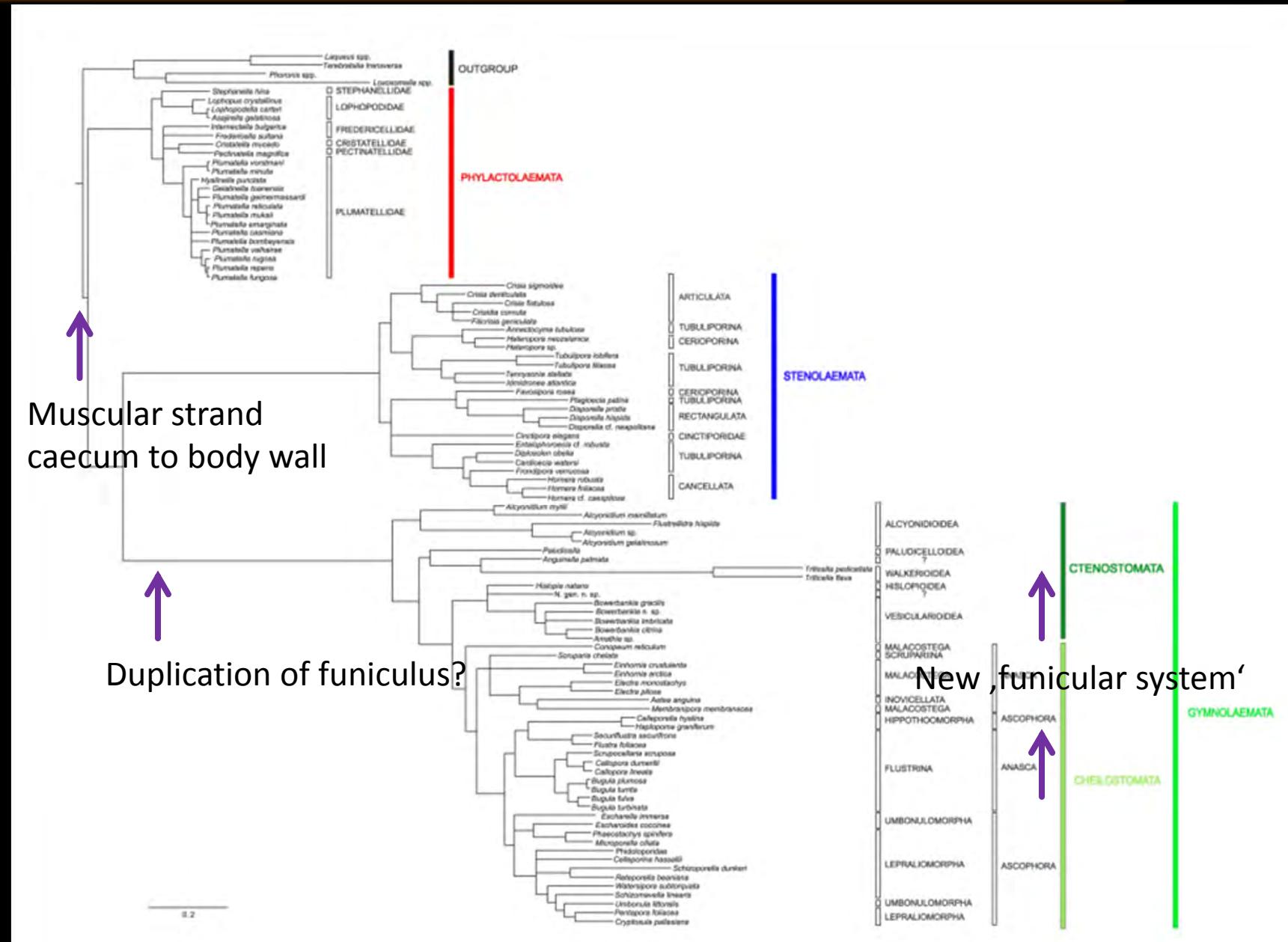
Cheilostomata

Scruparia chelata
Electra pilosa
Membranipora membranacea
Flustra papyracea
Carbasea papyrea
Callopora lineata
Bugula flabellata
Beania mirabilis
Figularia figularis
Hippothoa hyalina
Haplopoma impressum
Schizomavella auriculata
Schizobrachiella sanguinea
Smittia landsborovii
Mucronella variolosa

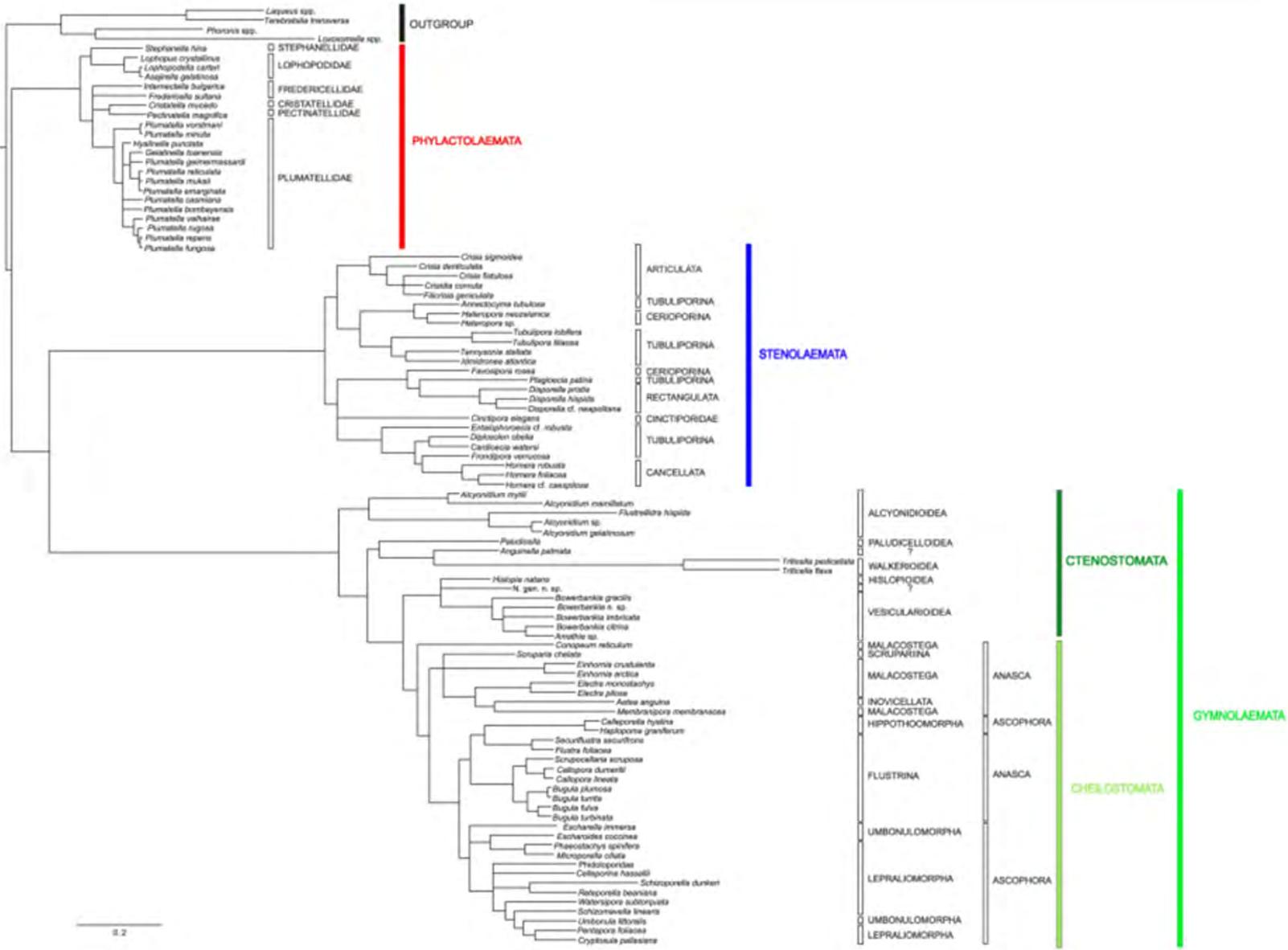


From Lutaud 1983

Funicular system



Outgroups?



Phylactolaemata ~ Phylogeny

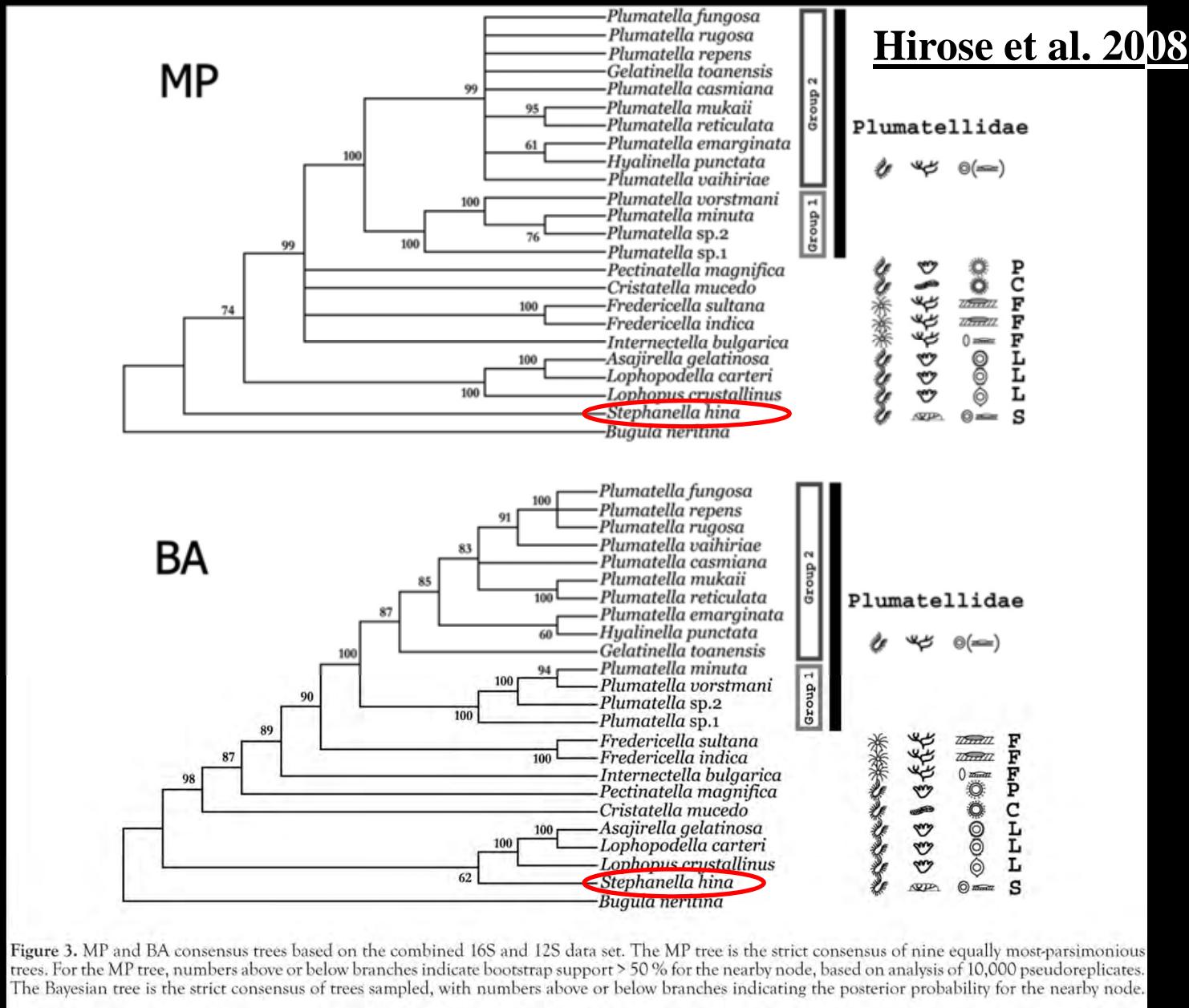


Figure 3. MP and BA consensus trees based on the combined 16S and 12S data set. The MP tree is the strict consensus of nine equally most-parsimonious trees. For the MP tree, numbers above or below branches indicate bootstrap support > 50 % for the nearby node, based on analysis of 10,000 pseudoreplicates. The Bayesian tree is the strict consensus of trees sampled, with numbers above or below branches indicating the posterior probability for the nearby node.

Stephanella hina, Oka 1908

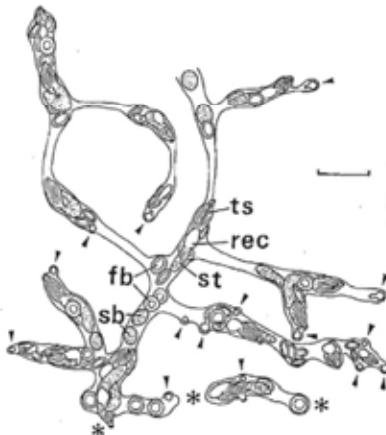


FIG. 1. Part of a repent colony (preserved specimen) of *Stephanella hina*. Polypides, buds (only those clearly recognized as such under a stereomicroscope), mature or nearly mature statoblasts are depicted. Ectocyst is not shown. Small buds are marked by arrowheads. Asterisks indicate parts probably broken in the field. fb, floatoblast; rec, rectum; sb, sessoblast; st, stomach; ts, tentacle sheath. Scale bar: 1 mm.

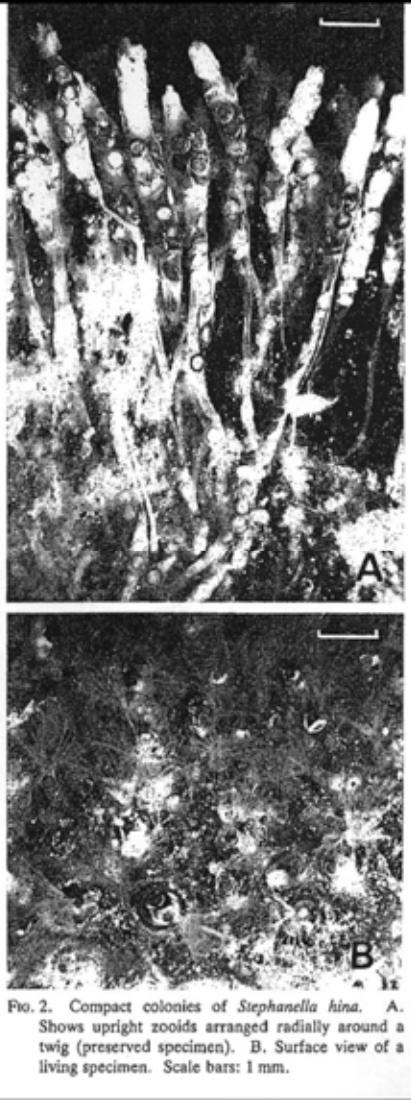


FIG. 2. Compact colonies of *Stephanella hina*. A. Shows upright zooids arranged radially around a twig (preserved specimen). B. Surface view of a living specimen. Scale bars: 1 mm.

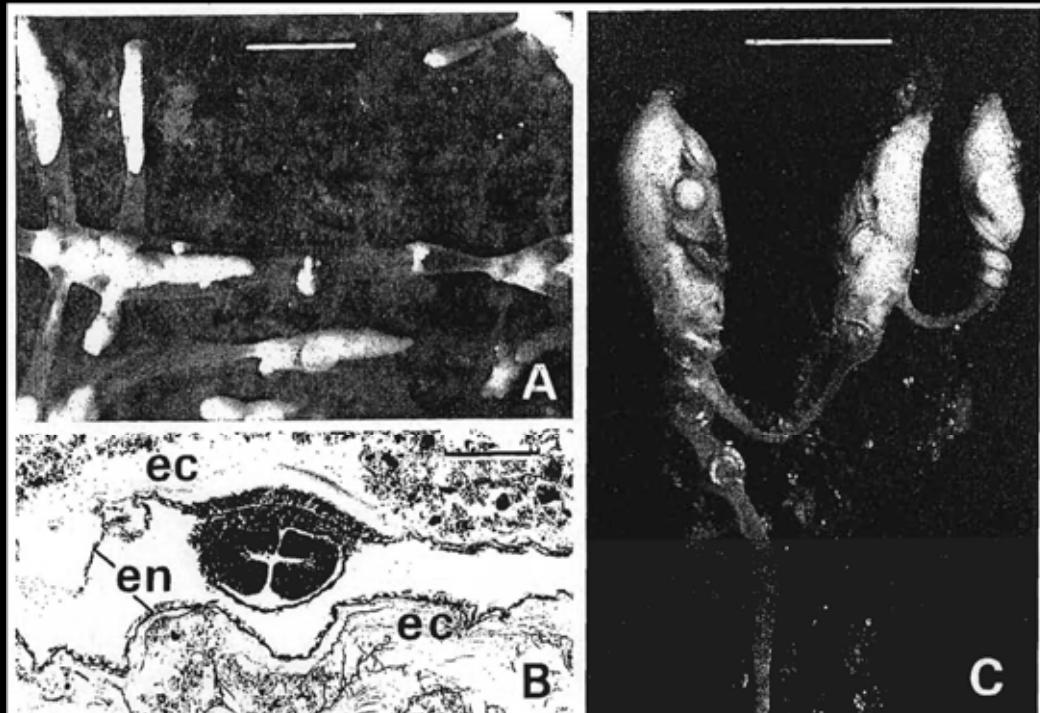
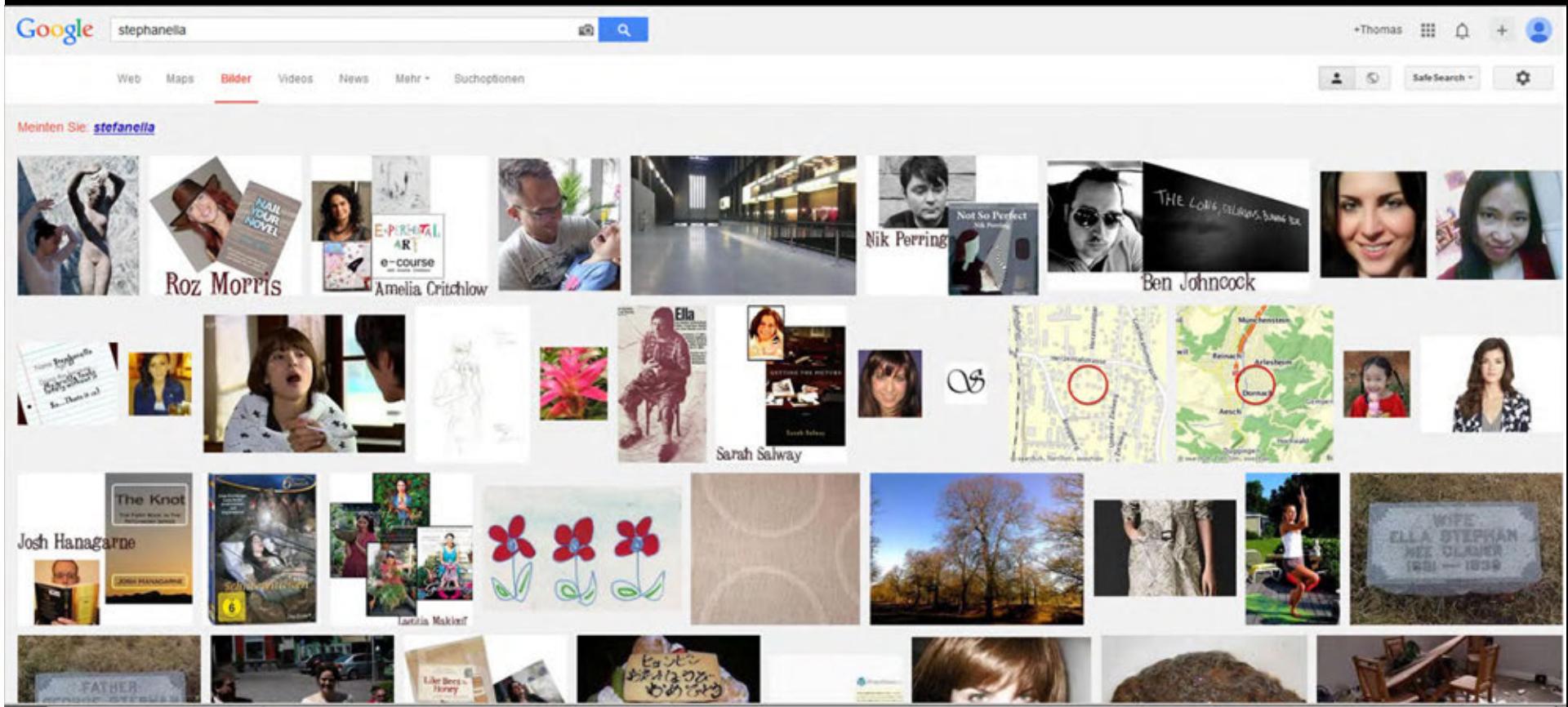


FIG. 4. Budding (preserved specimens) of *Stephanella hina*. A. Part of a repent colony (boxed area in Fig. 3A) showing the presence of lateral buds here and there along the endocyst (ectocyst removed). B. Longitudinal section of the stolon-like part of the cystid, showing a lateral bud attached to the endocyst (en). The ectocyst (ec) with debris stuck to it is seen. C. Terminal portion of a branch free of the substratum in a compact colony. Scale bars: A, 1 mm; B, 0.1 mm; C, 1 mm.

Mukai 1990

Stephanella from Google







Videos

1. Intro
2. single??
3. Headbanging
4. Tapping
5. Tapping-cyst space
6. solitary
7. coelomocytes
8. Pop-Out
9. DeCyst retraction

Conclusio

- no real cystid?
 - attachment at one place
- lack of colonial communication?
- separate family

- for the future
 - examination of sections
 - CLSM analysis

- back to Japan? Embryology?



Thank you for your attention!