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(organização: Conselho Científico do IPIMAR)



Parasitic dinoflagellates - and "novel alveolates"



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"novel alveolates"

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Dinoflagellates:

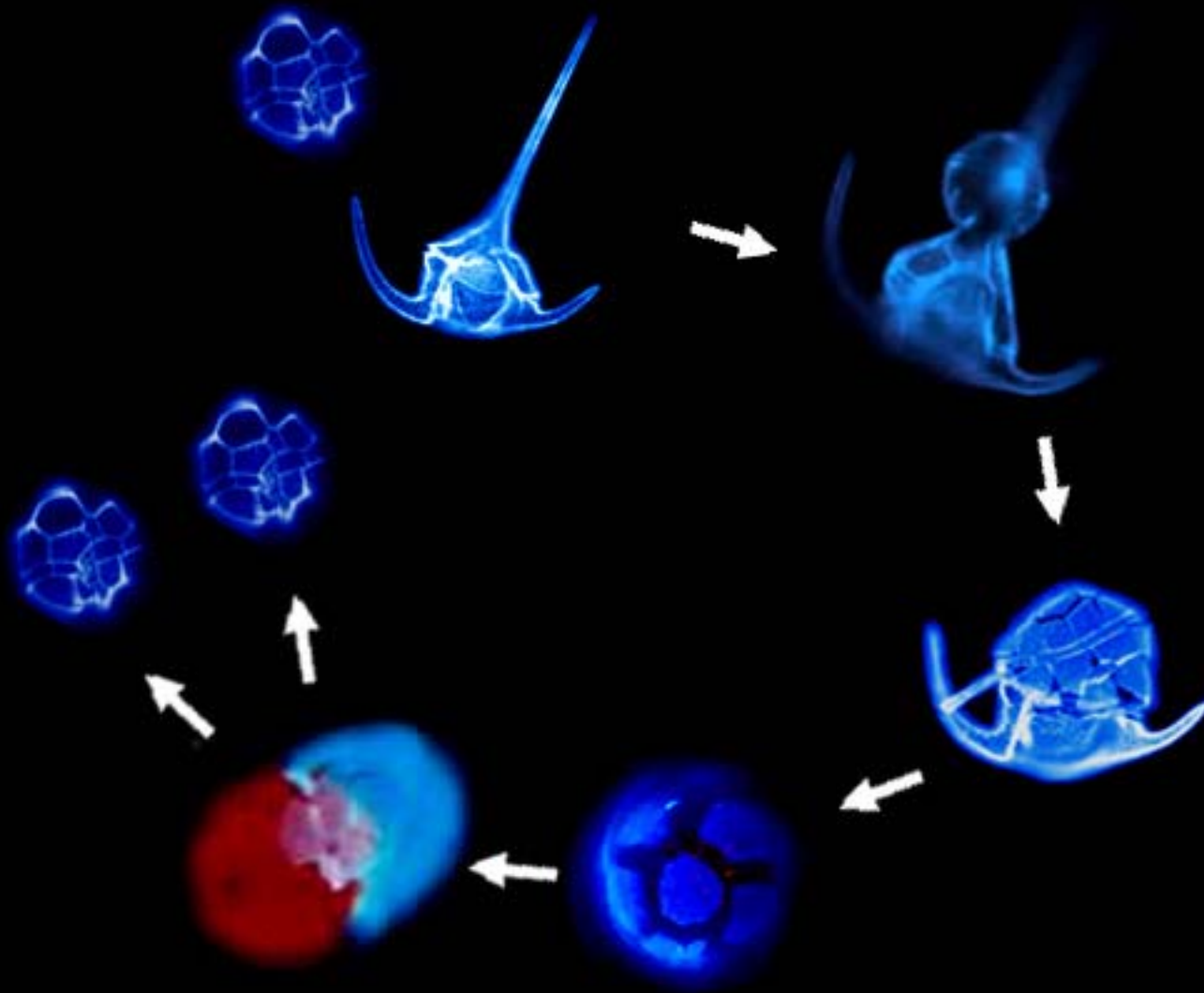
- Unicellular organisms with two flagella
- Estimated 2,000 dinoflagellate species
- Most are phytoplankton, but roughly half of them are heterotrophic
- ~140 species are parasites

What makes a dinoflagellate parasitic?

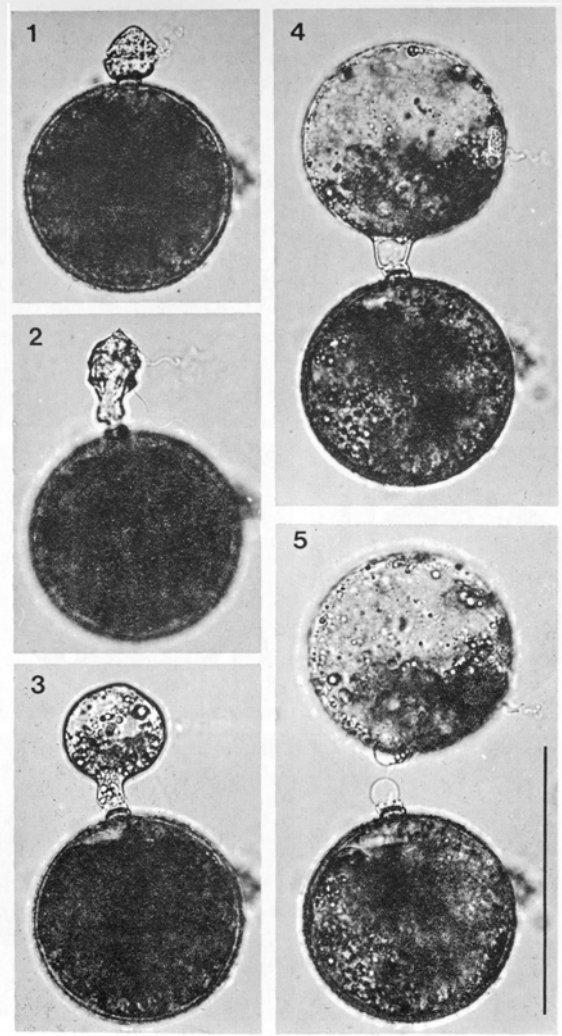
- They have morphologically differentiated feeding and reproductive stages.
- After a feeding event, more than 2 daughter cells are produced.

(According to Gaines & Elbrächter 1987)

Fragilidium – a phagotrophic (mixotrophic)
dinoflagellate



Dissodinium pseudolunula a parasite of copepod eggs

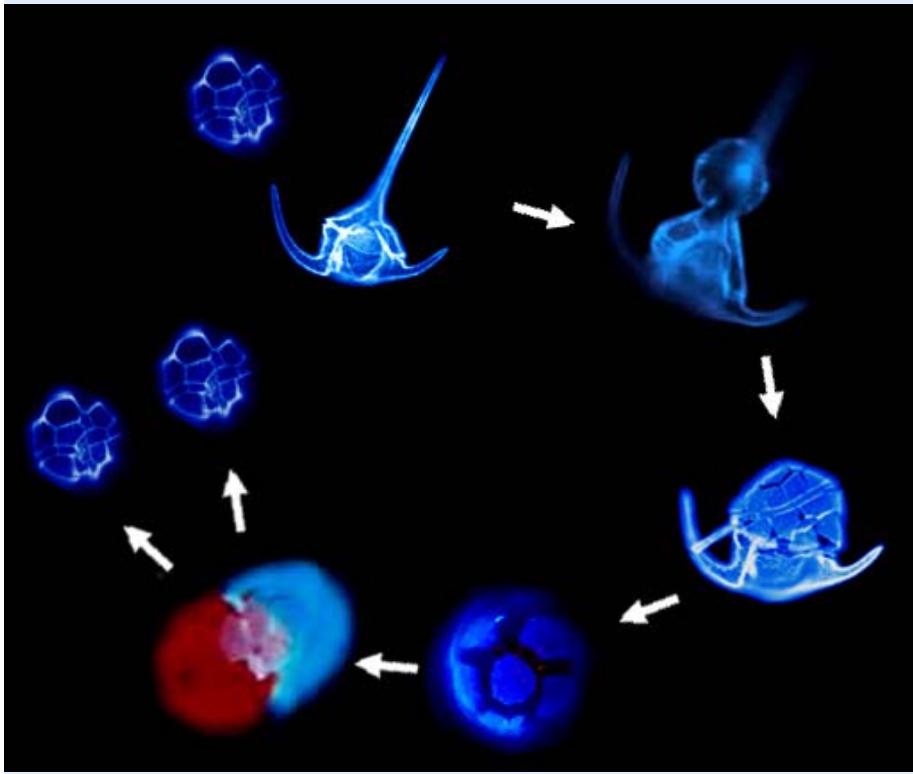


(Drebes 1978)

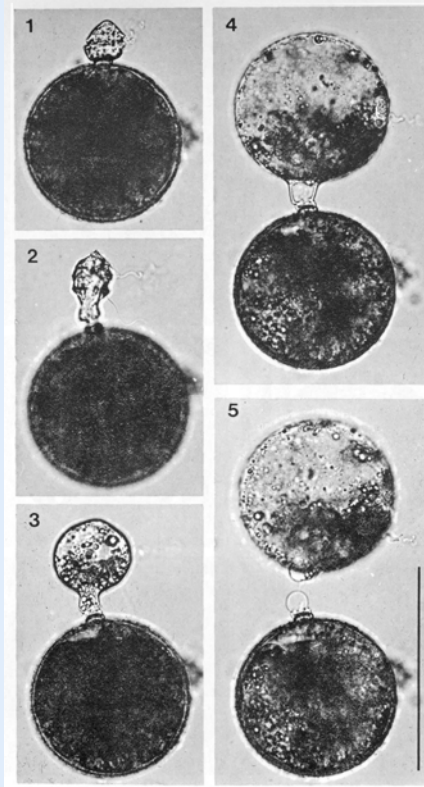


(From www)

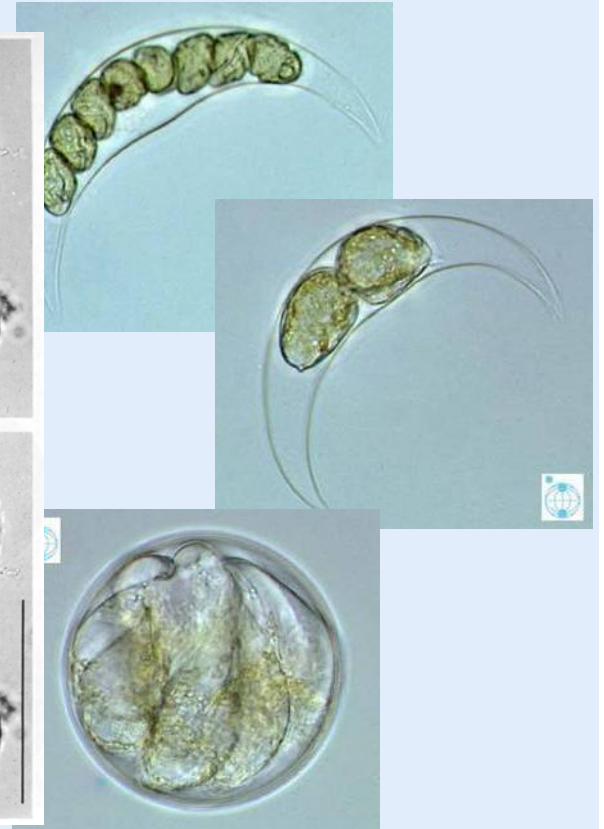
Phagotrophic vs. parasitic dinoflagellate



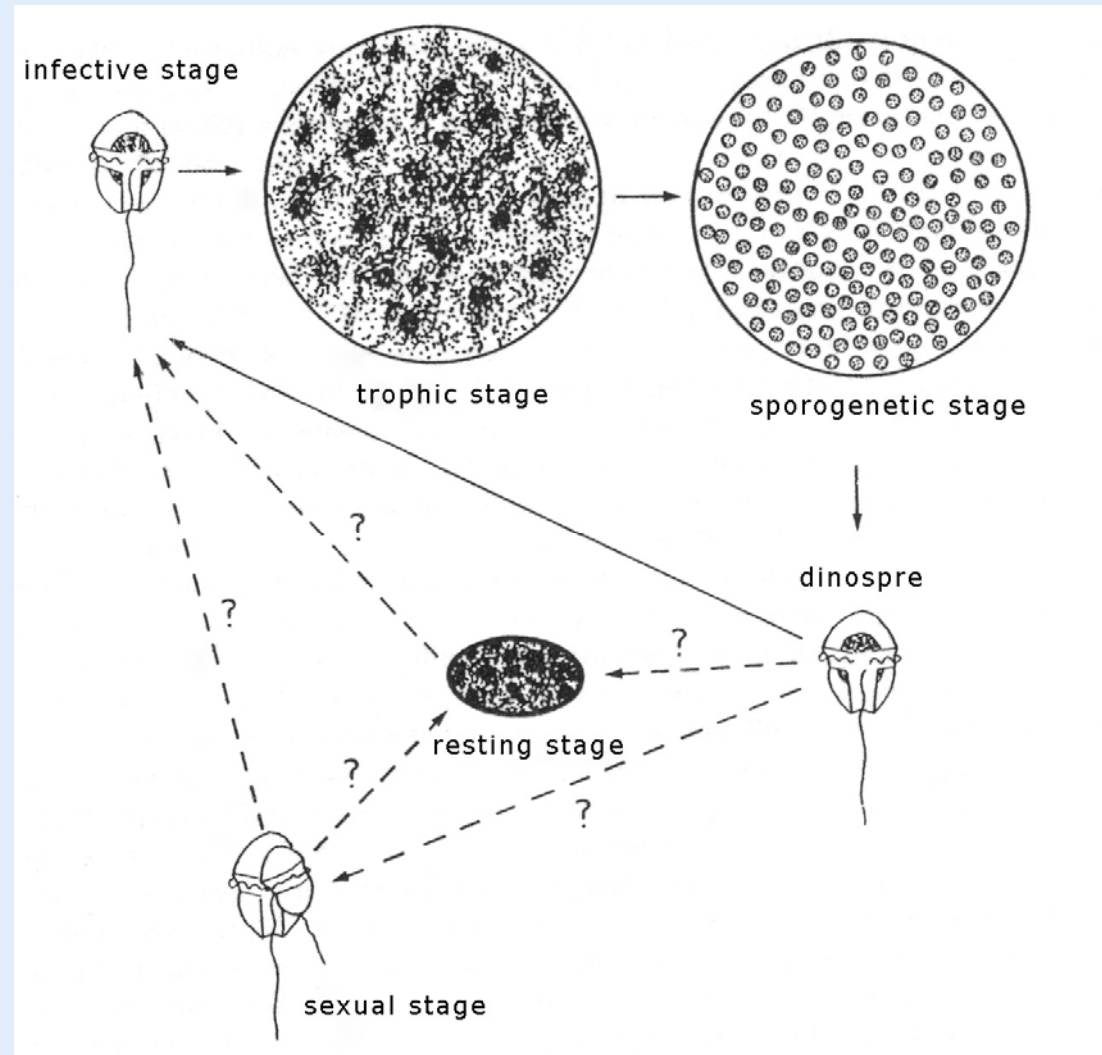
Fragilidium
(phagotrophic)



Dissodinium
(parasitic)



Generalized life cycle of parasitic dinoflagellates



(Drebes 1984)

Classification of dinoflagellates (Dinoflagellata)

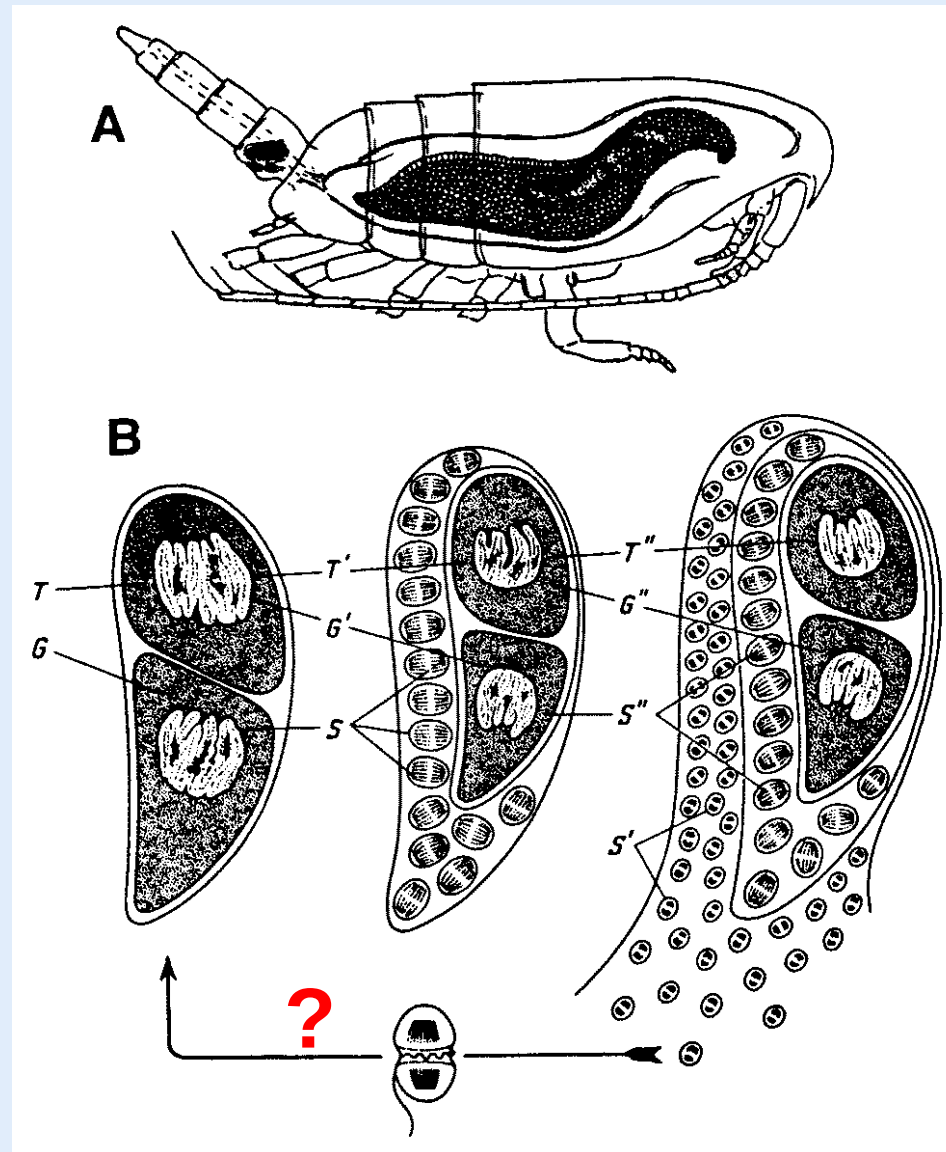
- **Dinokaryota**
 - Typical dinoflagellates, with dinokaryon
 - Free-living and parasitic species, most species are classified in the order **Blastodiniales**
- **Syndiniales:**
 - No dinokaryon
 - All species are parasitic

Dinoflagellates parasitize:

- Microalgae and other protists
- Cnidaria (jellyfish)
- Annelids
- Ctenophores (comb jellies)
- Chaetognates (arrow worms)
- Crustaceans (crabs, *Nephrops*, copepods)
- Appendicularia
- Fish (marine and freshwater) and fish eggs

Blastodiniales

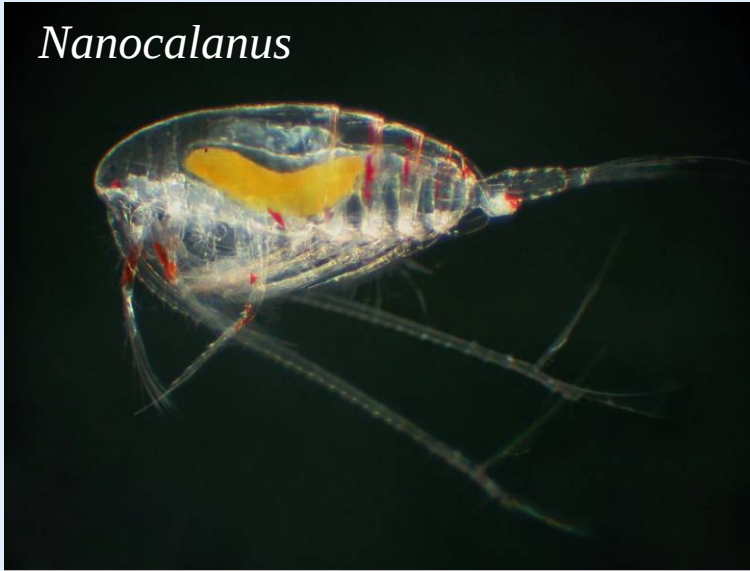
Blastodinium life cycle



(Chatton 1952)

11+ species of *Blastodinium*

Nanocalanus



Oithona



B. contortum



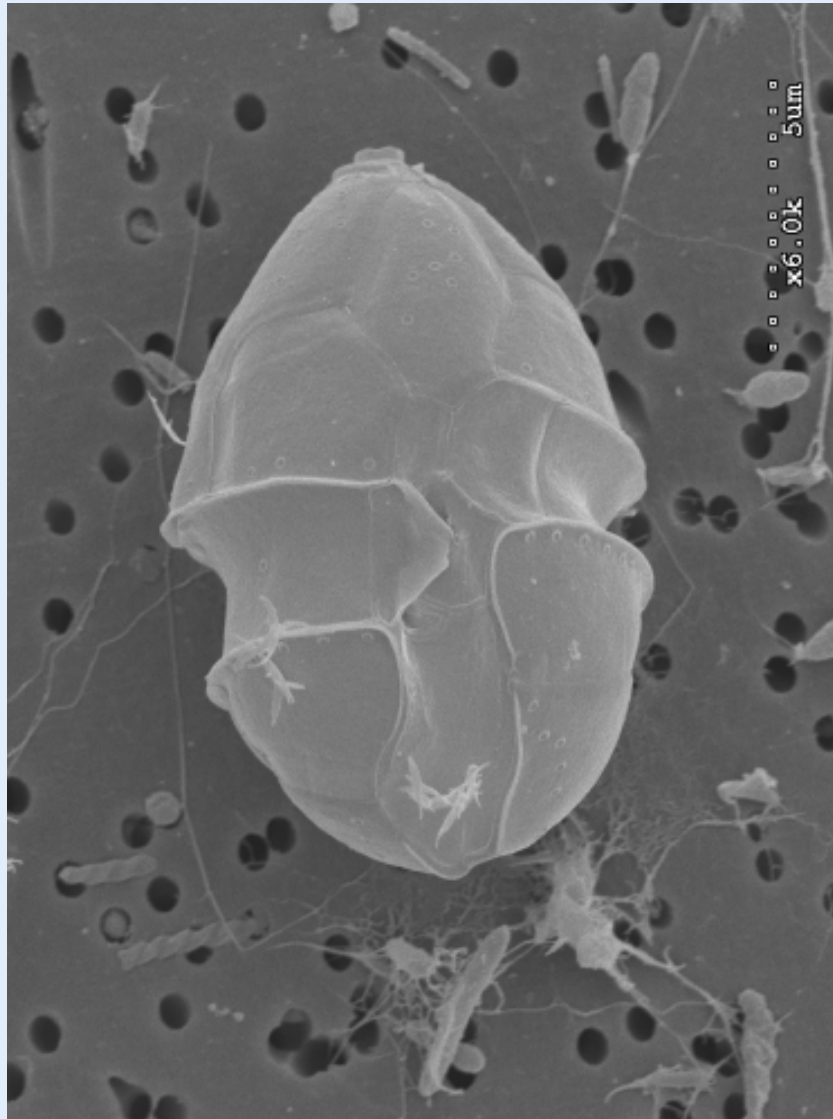
B. oviforme



Blastodinium spp. posses chloroplasts

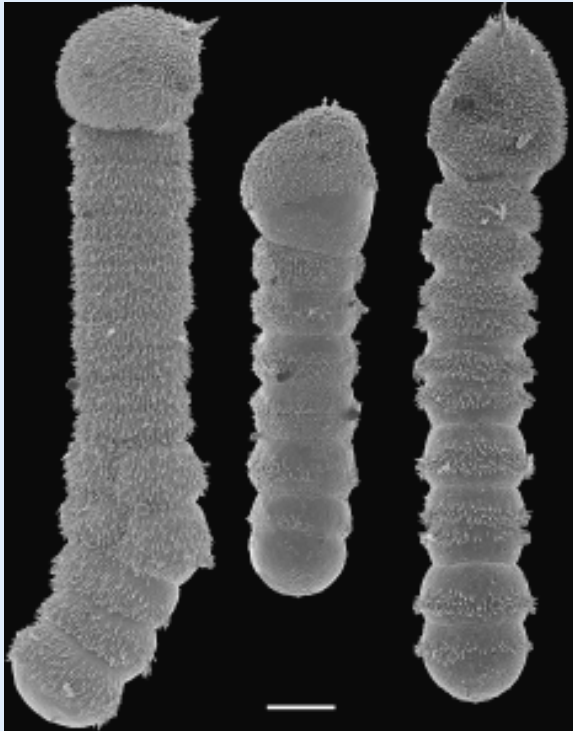


Zoospores of *Blastodinium* are gymnodinoid in textbooks. In real life they are peridinioid – meaning with a thick theca.



Blastodinium contortum
- SEM

Haplozoon axiothellae

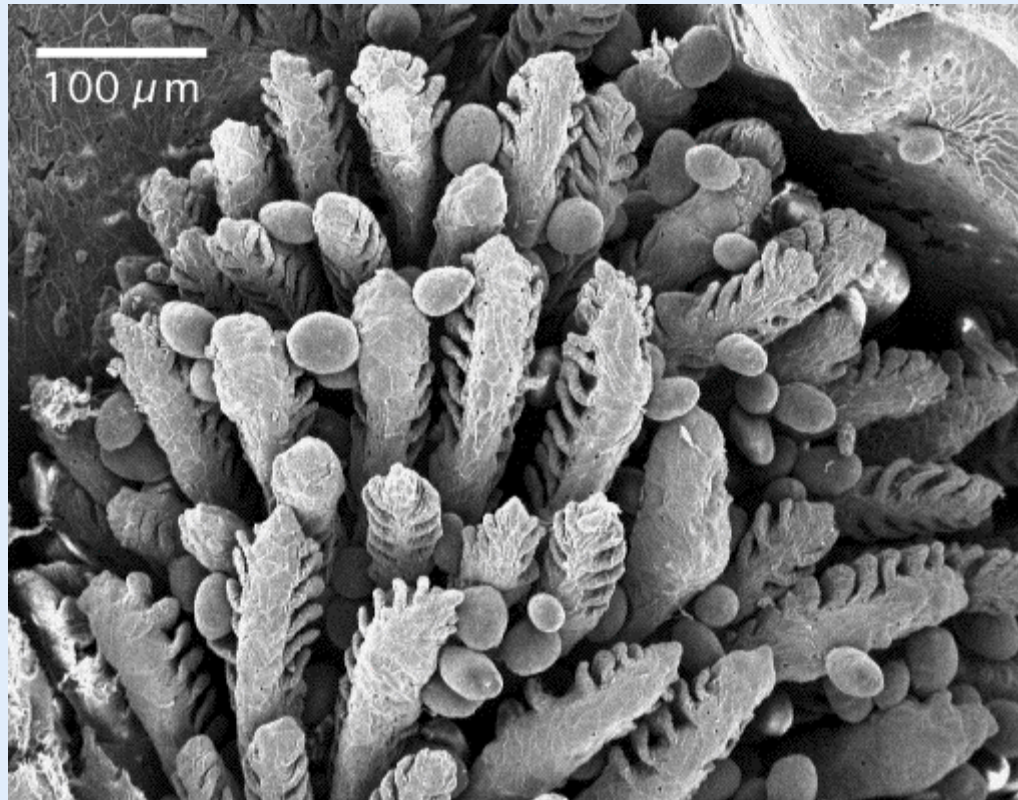


Parasite of the bamboo worm (*Axiothella rubrocincta*)

(Leander et al. 2002)

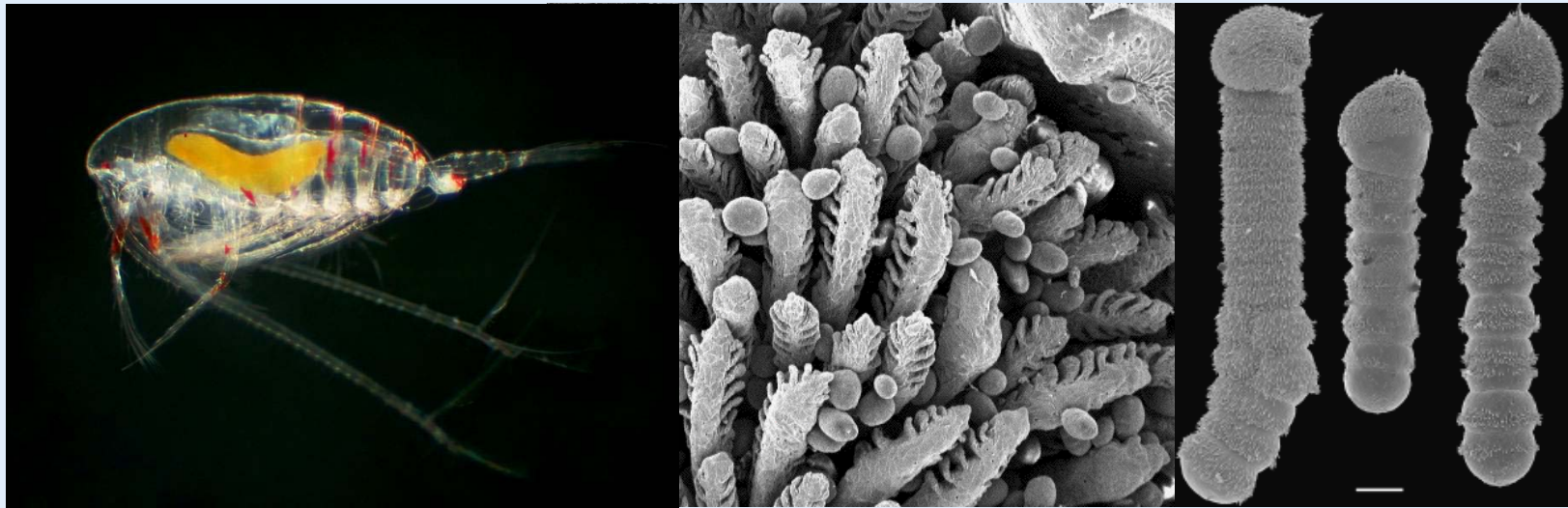
Amyloodinium and Piscinoodinium





(From [www](#))

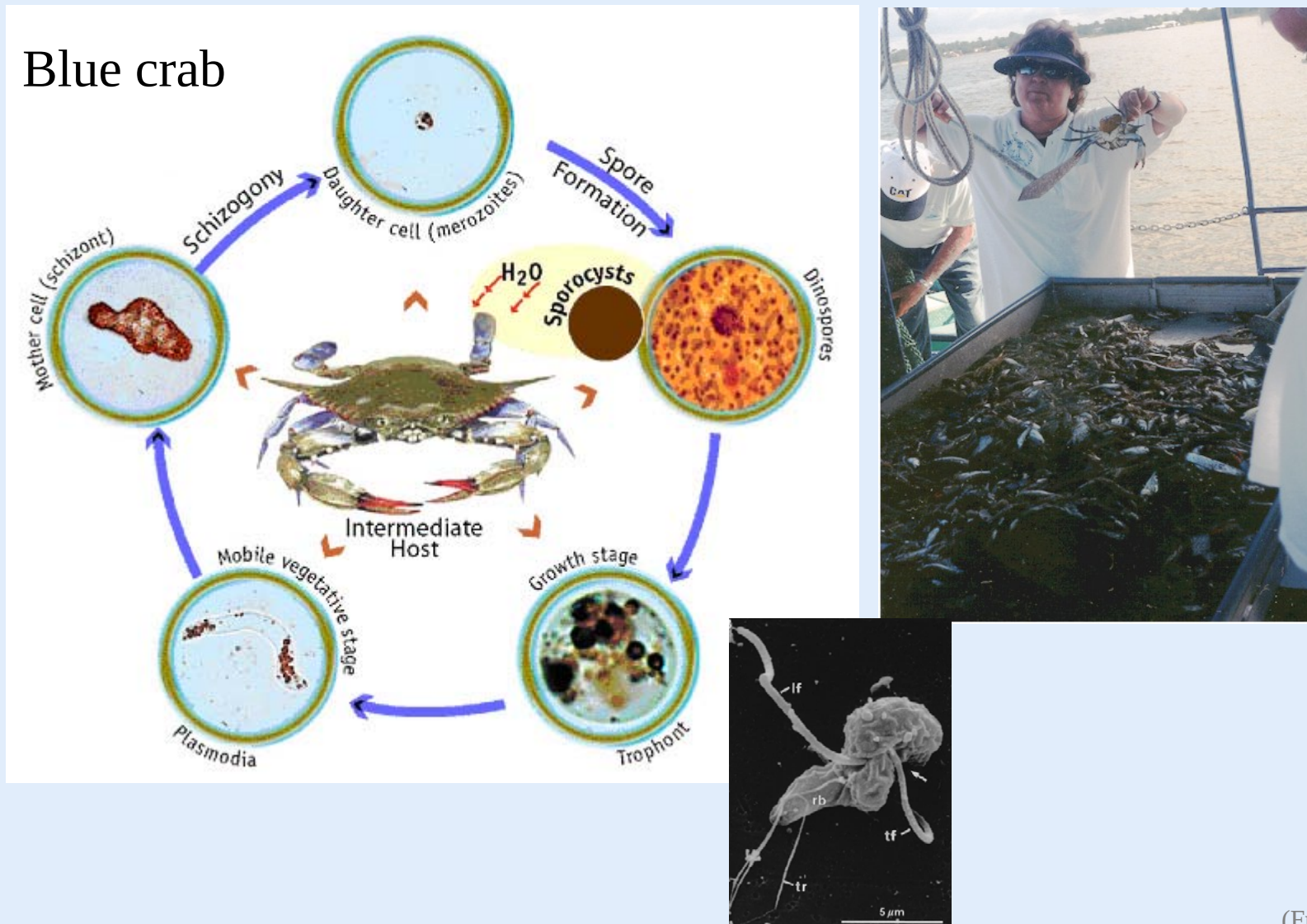
Blastodiniales is a "garbage bag" in containing a lot of parasitic dinoflagellates that have little in common – except from being parasitic.



Syndiniales

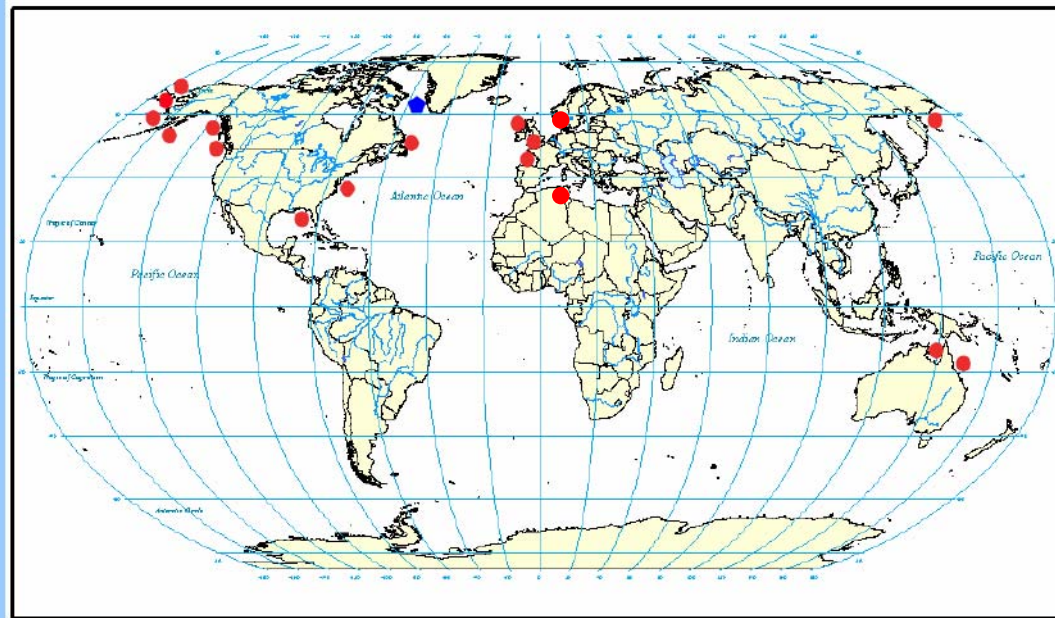
Hematodinium (Syndiniales)

Blue crab



(From www)

Worldwide Occurrence of *Hematodinium* spp.



(From www)

Hematodinium in Europe

Edible crab



Norway lobster

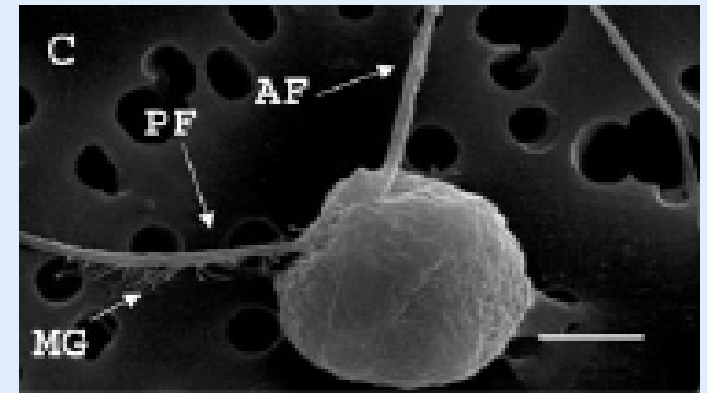
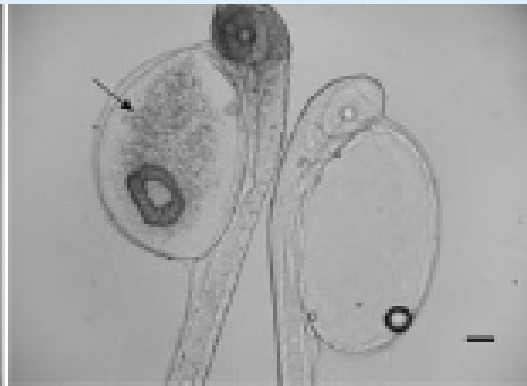
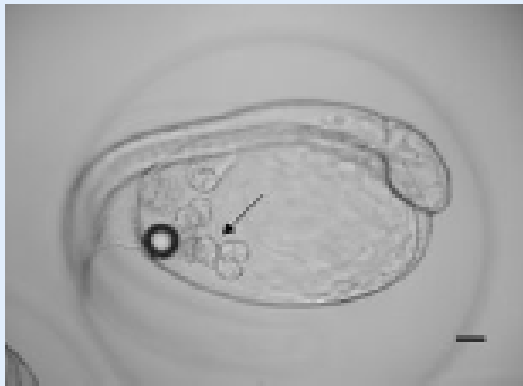


Ichthyodinium chabelardi (Syndiniales?)



(Menesses & Vendrell 2002)

Sardine egg



Sardine larva

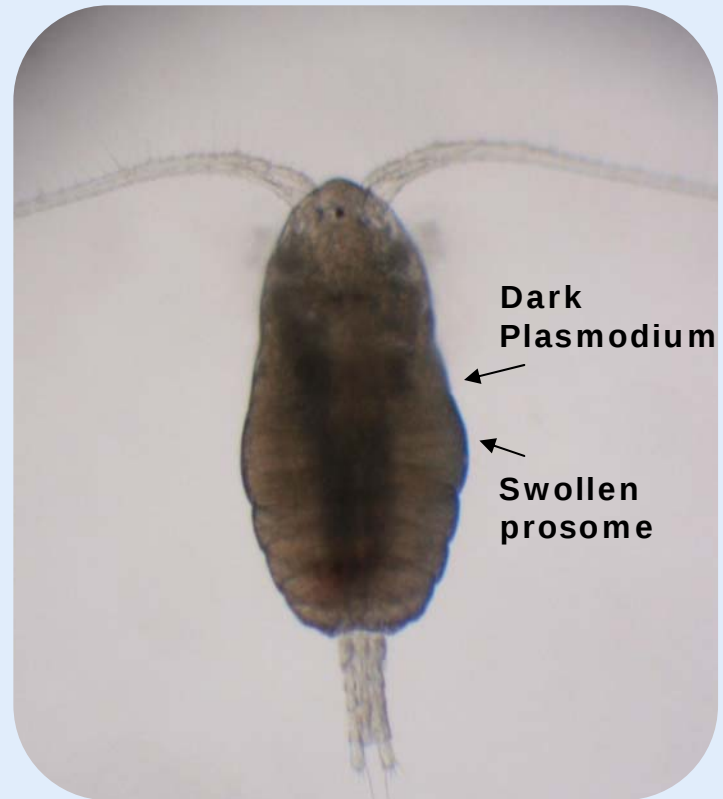
(Camino et al. 2006)

Syndinium (Syndiniales) in *Paracalanus parvus*

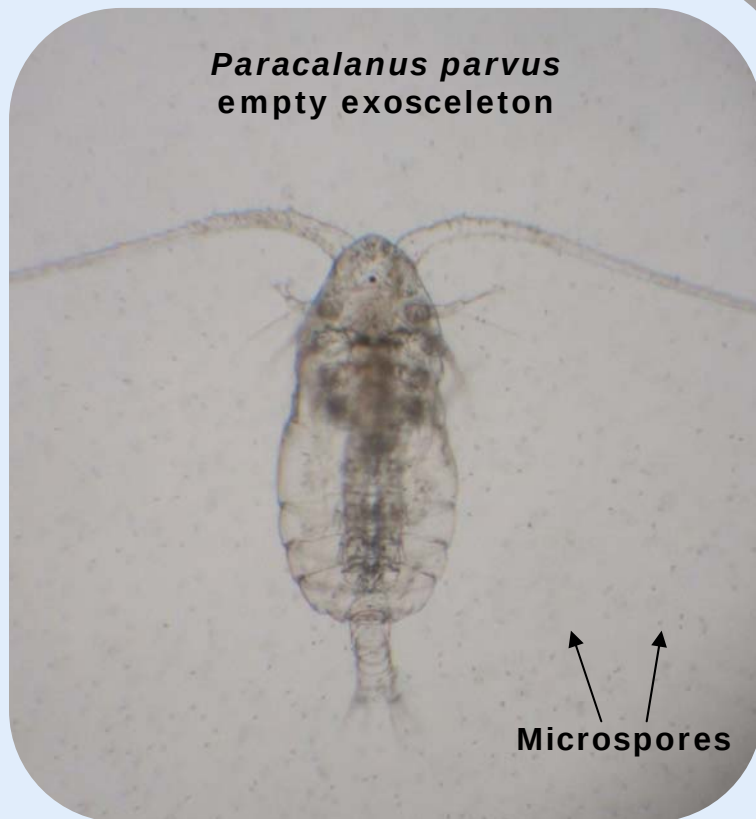
Paracalanus parvus
without *Syndinium*



Paracalanus parvus
infected with *Syndinium*



Syndinium turbo, release of zoospores

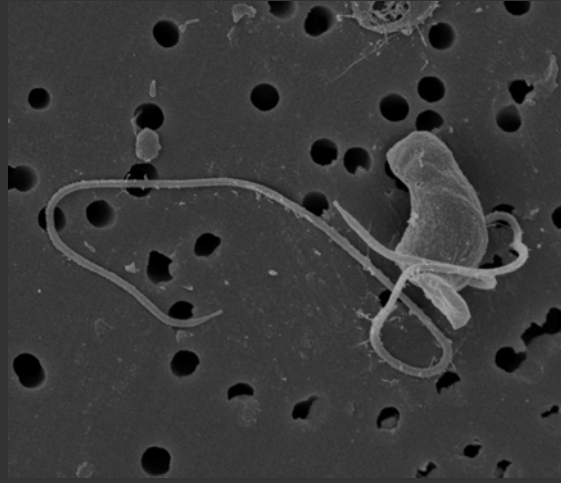


Syndinium turbo zoospores

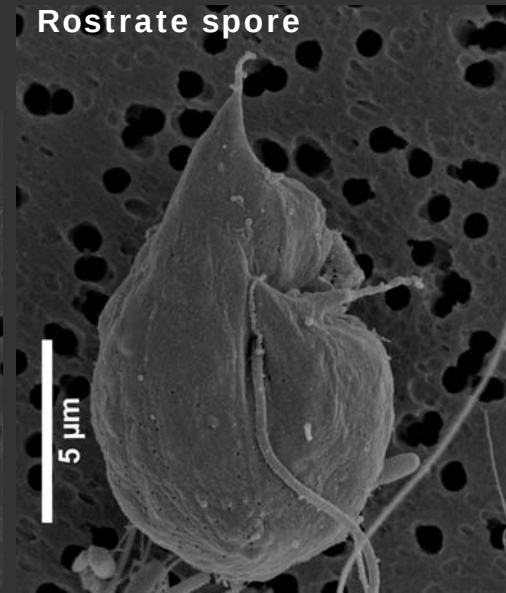
Macrospore



Microspore



Rostrate spore

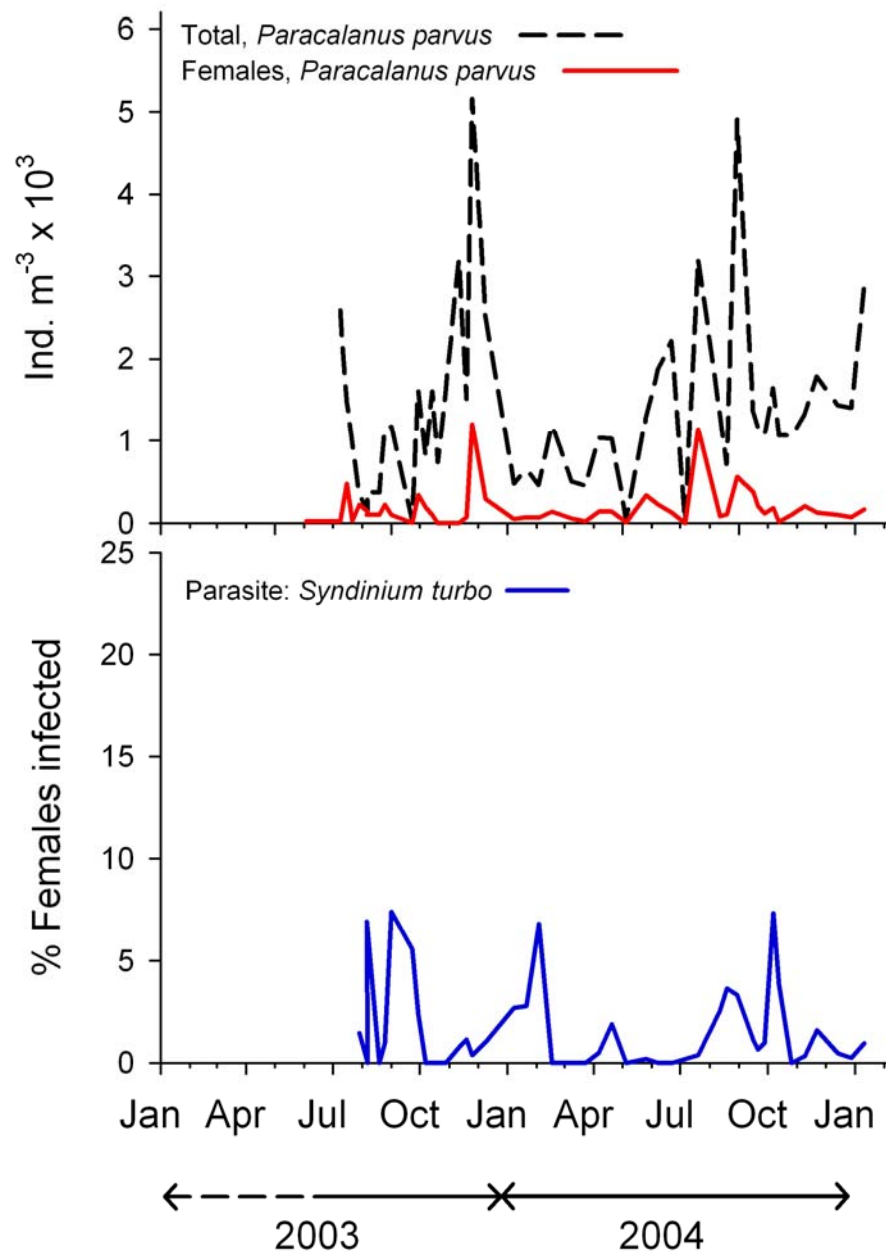


"Syndinium turbo"

"Syndinium minutum"

"Synhemidinium rostratum"

(Chatton's classification, 1922)



Yearly cycle of
Syndinium turbo
in the NW
Mediterranean



Amoebophrya (Syndiniales) in *Akashiwa sanguineum*



(Photos by D. W. Coats)

Amoebophrya (Syndiniales) in *Dinophysis norvegica*

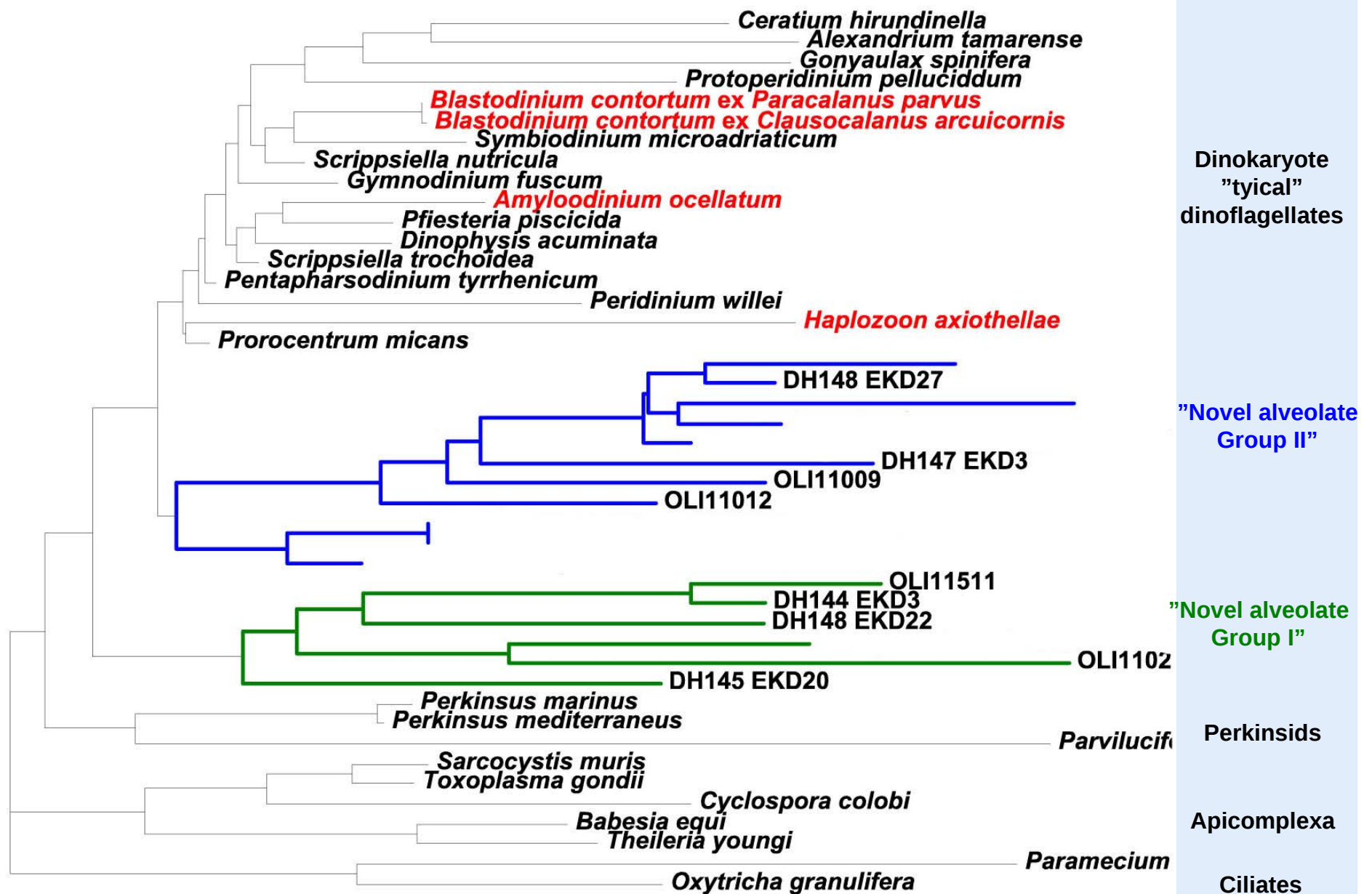


(Movie by P. Salomon)

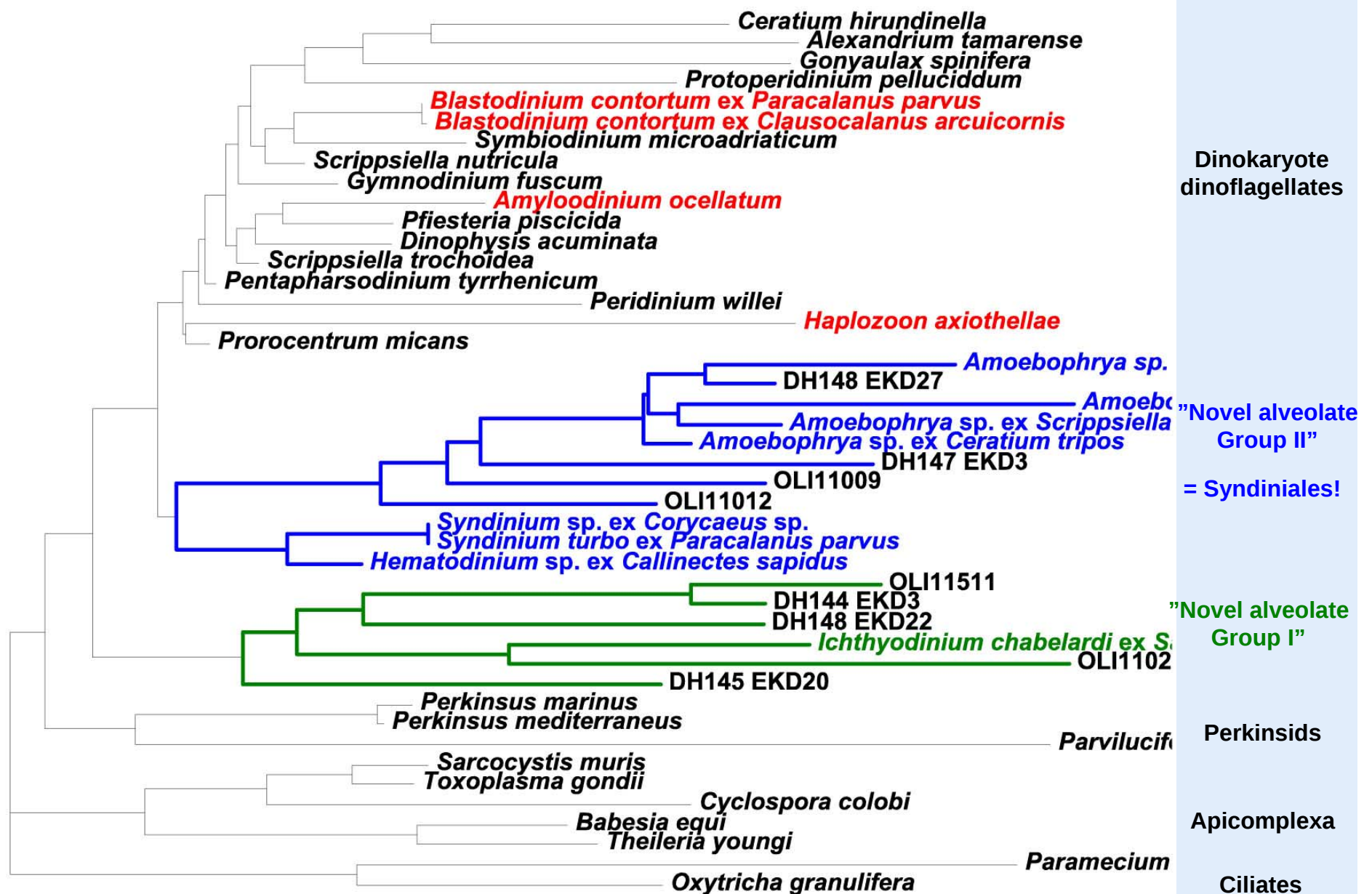
"Novel alveolates"

- Marine picoplankton
- Sequences from filtered seawater – only their sequences are known, not their morphology
- 2 Nature papers in 2001 (López-García et al. & Moon-van der Staay et al.)
- "New" groups of marine alveolates

18s rDNA-based phylogeny of Alveolata (schematic)

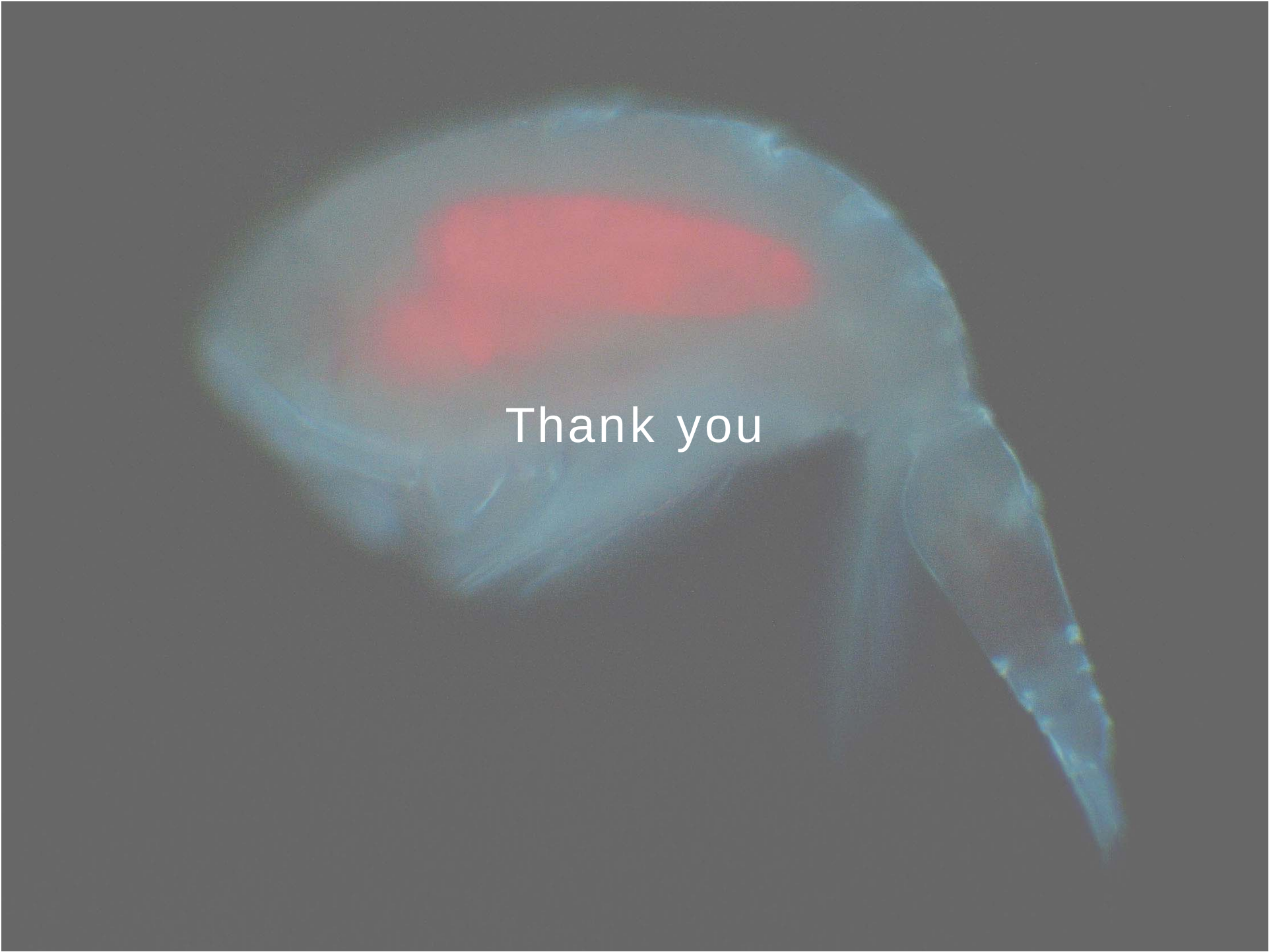


18s rDNA-based phylogeny of Alveolata (schematic)



Conclusions:

- Most parasitic dinoflagellates are still very poorly studied – and they are extremely common. They are also important.
- Parasitic species are found "spread out" among dinoflagellate lineages
- "Novel alveolates Gr I and II" are not new, but represent sequences of "old" syndinian parasites. Are they dinoflagellates?

A translucent blue jellyfish is shown against a dark background. The jellyfish has a glowing red internal structure, possibly a stomach or a specific organ, which is the focal point of the image. The jellyfish's body is somewhat bell-shaped, and it has long, thin tentacles hanging down. The overall lighting is dim, with the primary light source being the red glow from within the jellyfish.

Thank you