

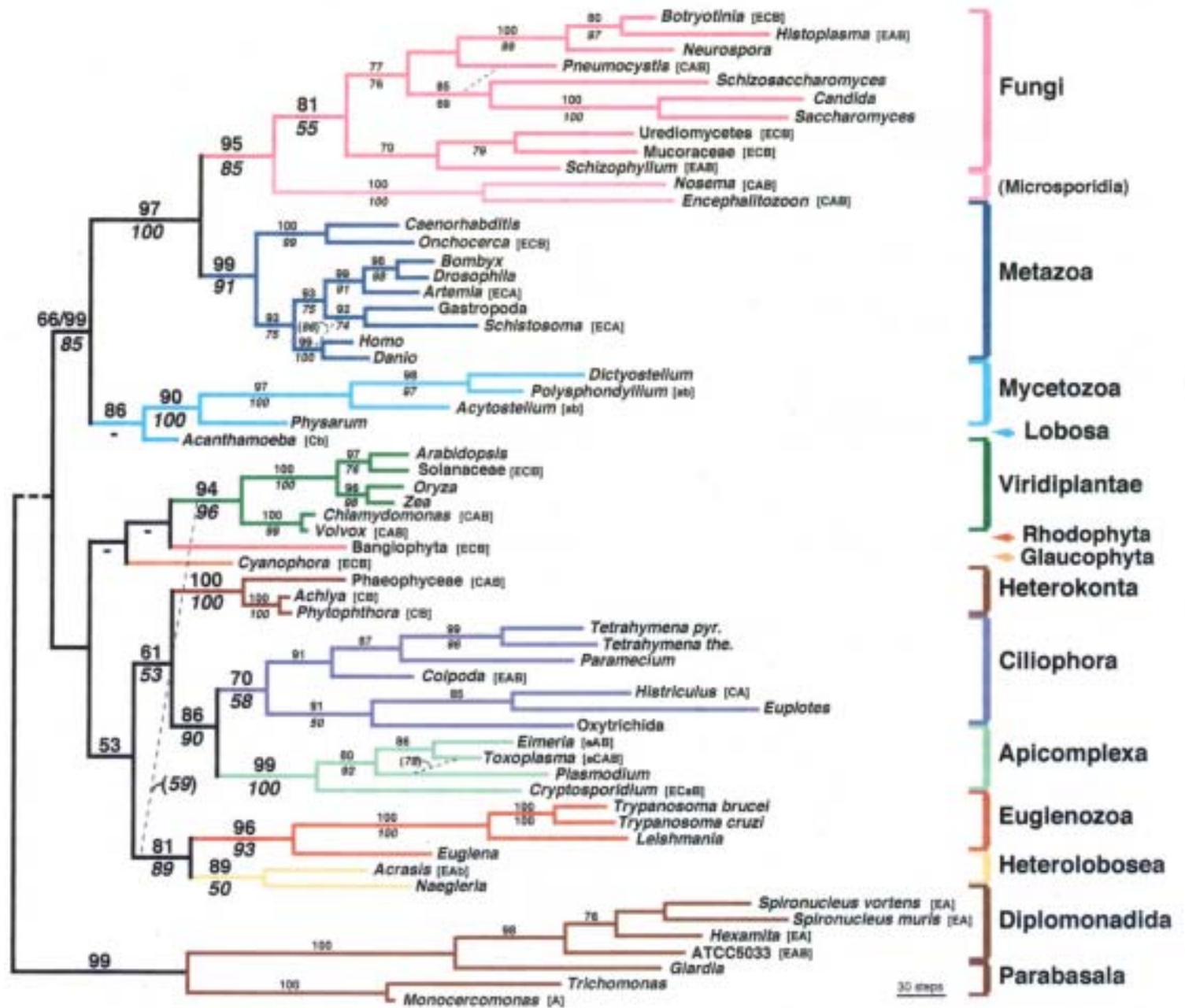
Telonema a probable common
ancestor of major eukaryotic lineages
with tubular cristae

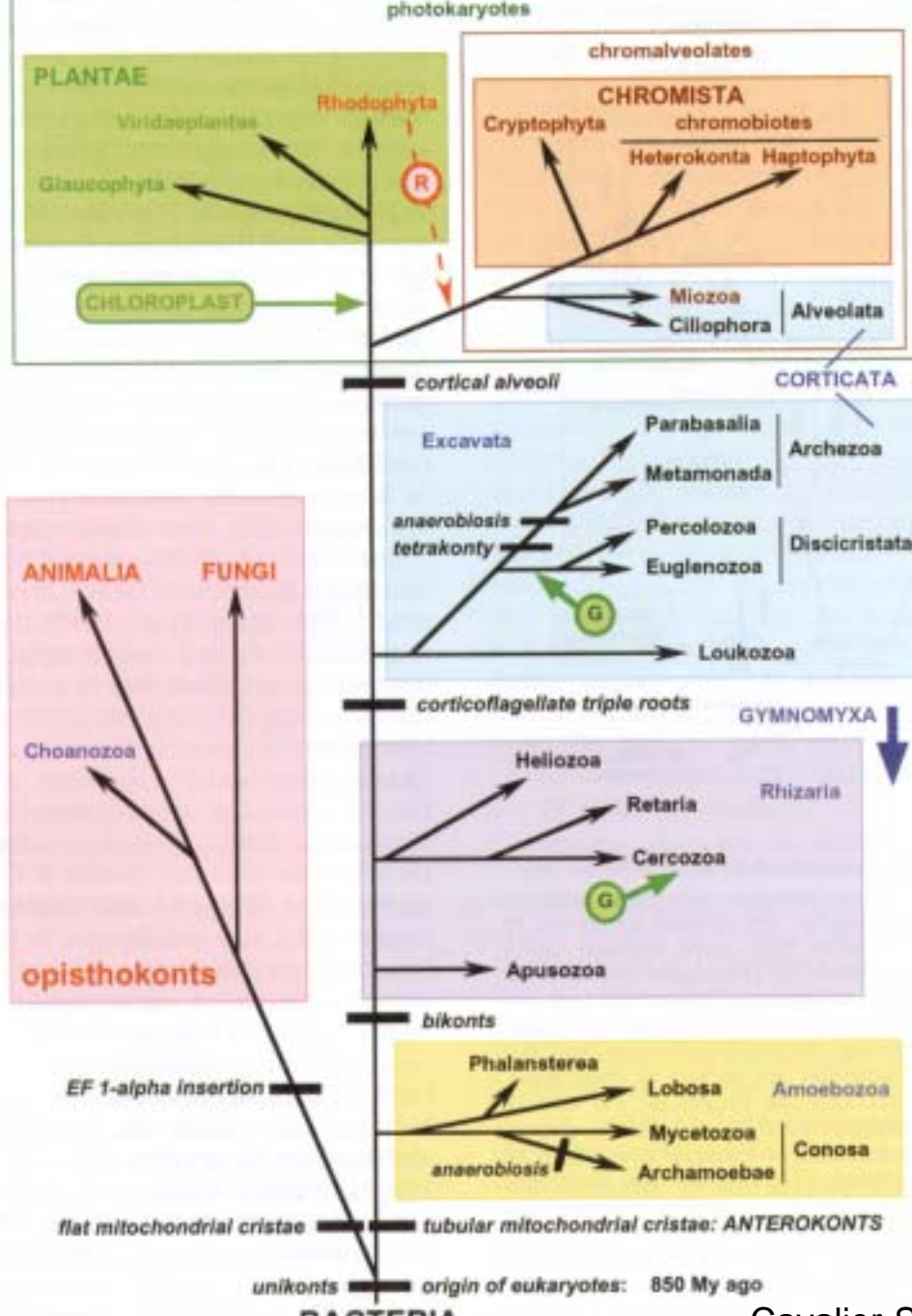
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University of Oslo

Background

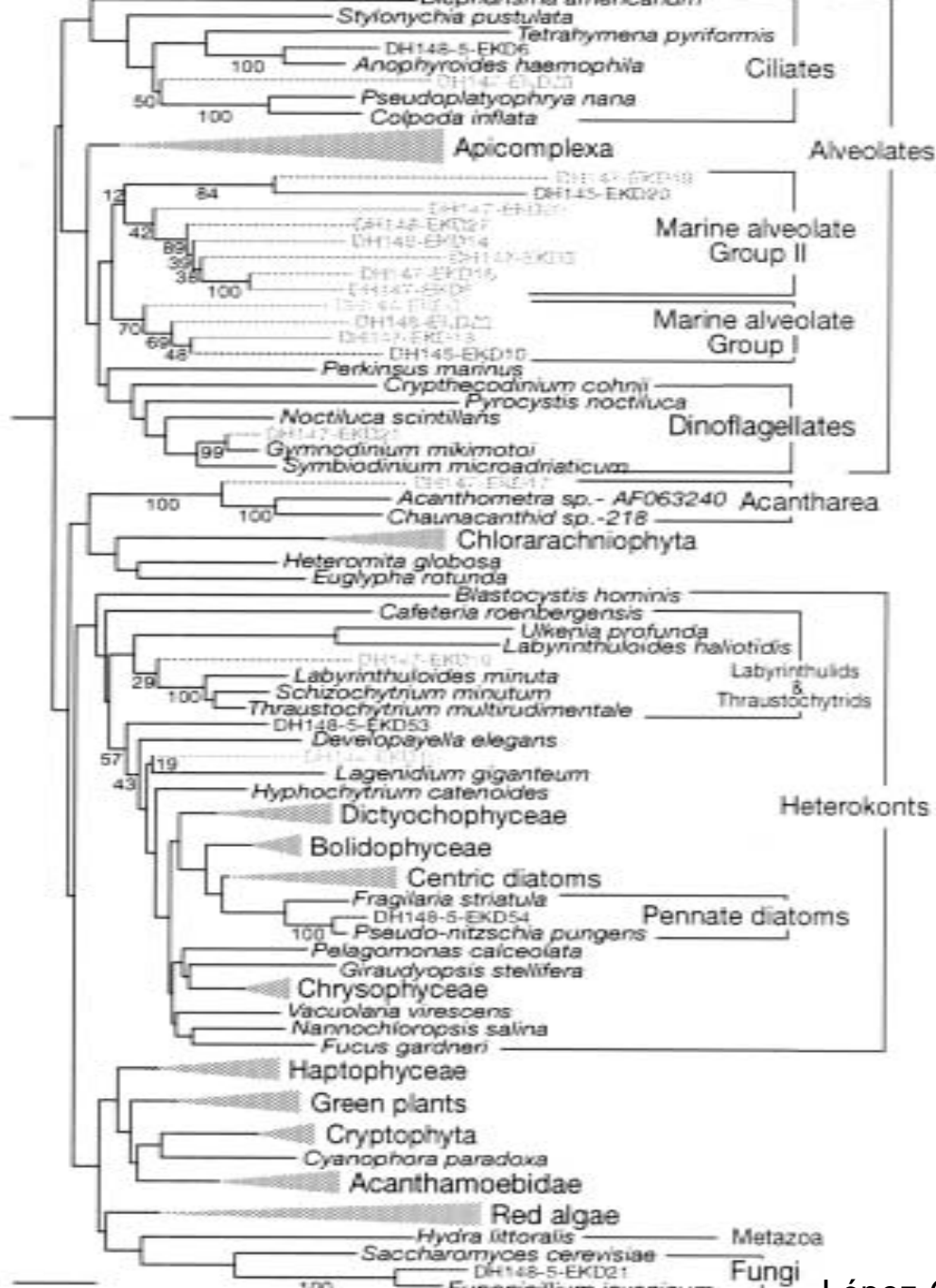
- Phylogenetic inferences:
 - Phylogeny of rDNA and protein coding genes.
 - Rare events such as shared insertions/deletions or gene fusions
 - 11 AA insertion in EF-1 α
 - Fusion of dihydrofolate reductase and thymidylate synthase genes





Sequences from cultured species

- If the chromist plastids were gained once, all chromist groups are monophyletic.
- If chromist and alveolate plastids have a single common origin: the plastid phylogeny will reflect the “host” phylogeny
- Stramenopiles seem to be sistergroup to the alveolates in most molecular phylogenies



Sequences from the environment

- New approach: Sequencing clone libraries (SSU rRNA gene) made from crude water samples
- Substantially number of new sequences identified
- But: are not adding crucial information to resolve the phylogeny among eukaryotic super-lineages.
 - SSU not an appropriate molecular marker

The *Telonema*-project

- Two parallel projects in Oslo and Roscoff.
- SSU sequencing and structural investigation of :
 - *T.antarctica* (Oslo),
 - *T.subtilis* (*PICODIV* - Roscoff and Oslo).

Why *Telonema*?

- *T. antarctica* and *T. subtilis* are ubiquitously present in most marine habitats including brackish waters.
- Previously classified in the phylum Opalozoa by Cavalier-Smith (1993), but has not been confirmed by molecular phylogeny.
- Preliminary BLAST search with SSU sequence against sequence data bases showed no particular affinity to any known group of protist.

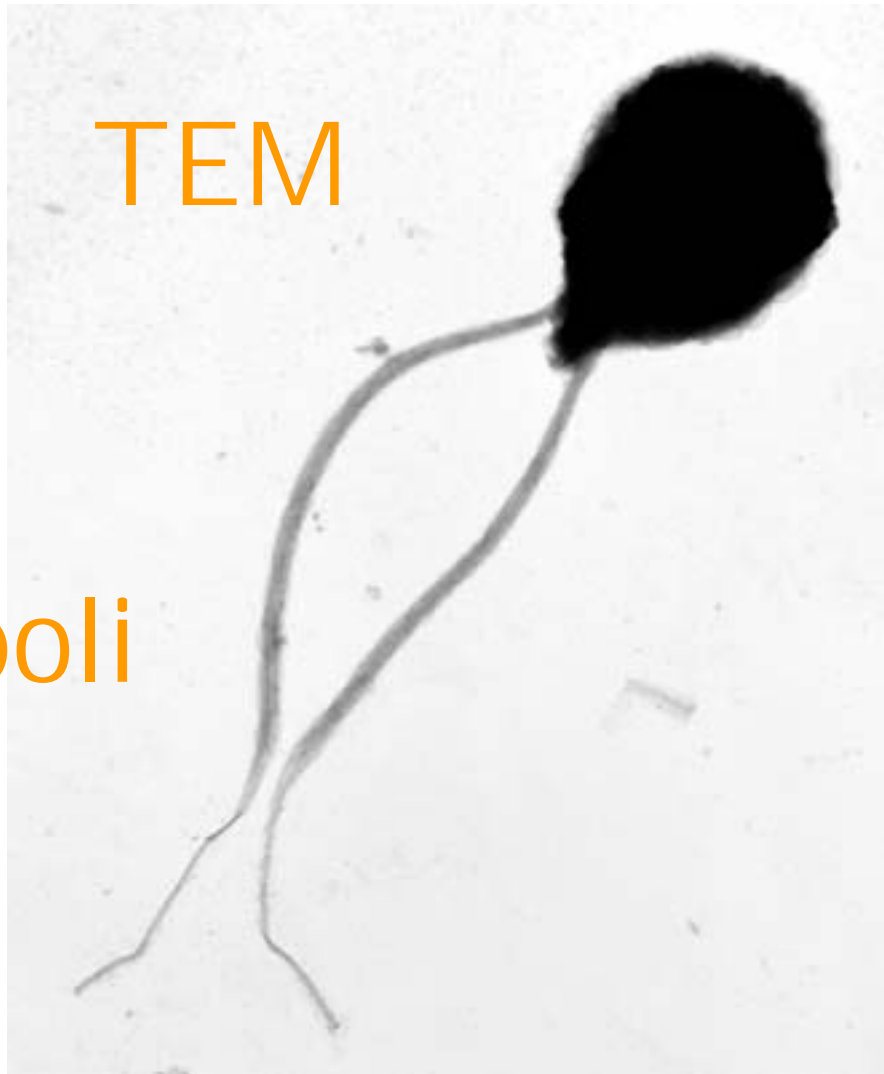
T. antarctica vs *T. subtilis*

- *T. antarctica* is:
 - longer: 7-13 μm .
 - has longer flagella (more than 2x cell size), one longer than the other.
 - has *tripartite* (or *dipartite*) hairs on the longest flagella.
 - has distinct *cortical vesicles* beneath the cell membrane

EM-graphs

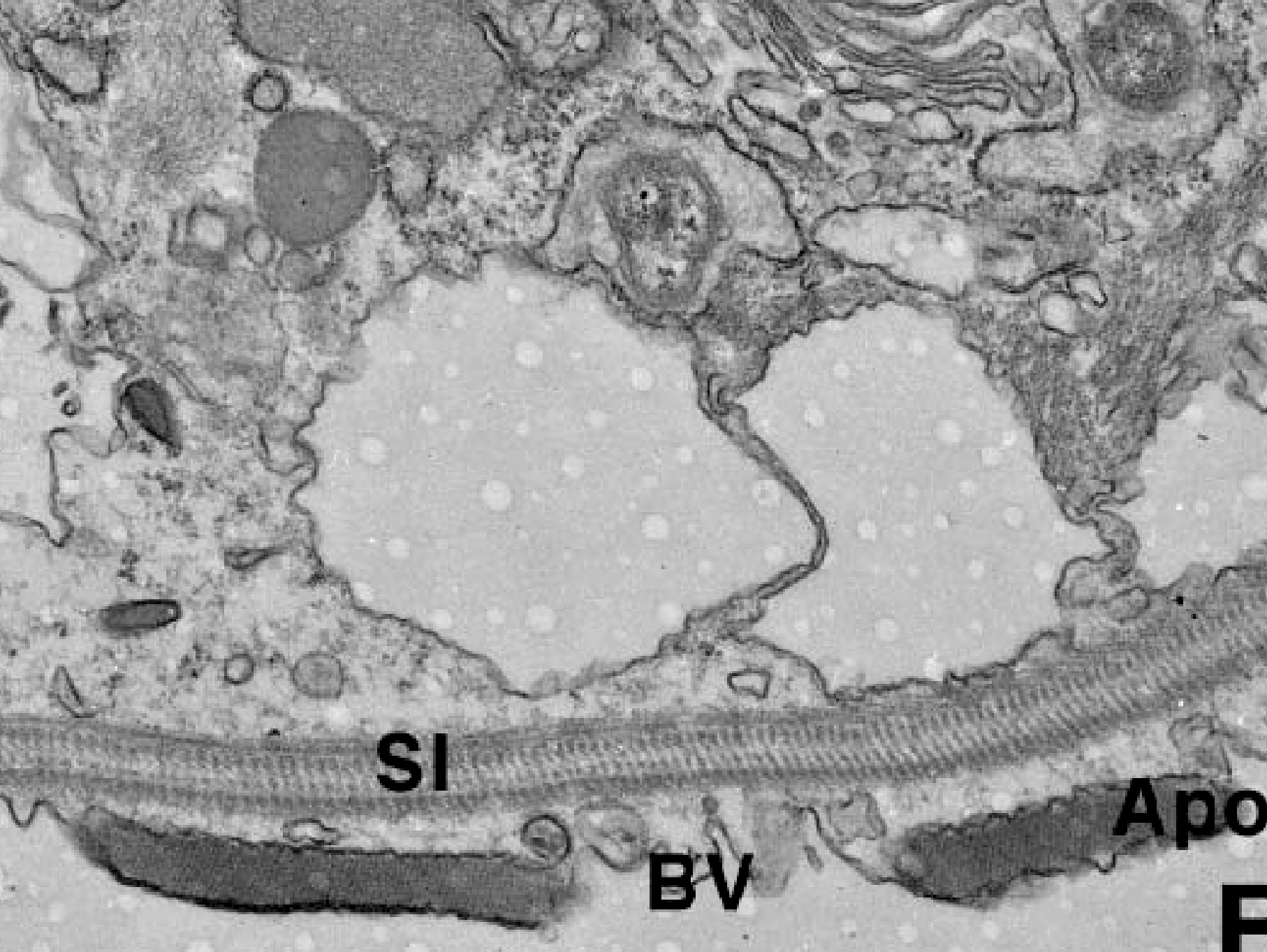
SEM

Golfo
di Napoli





A



SI

BV

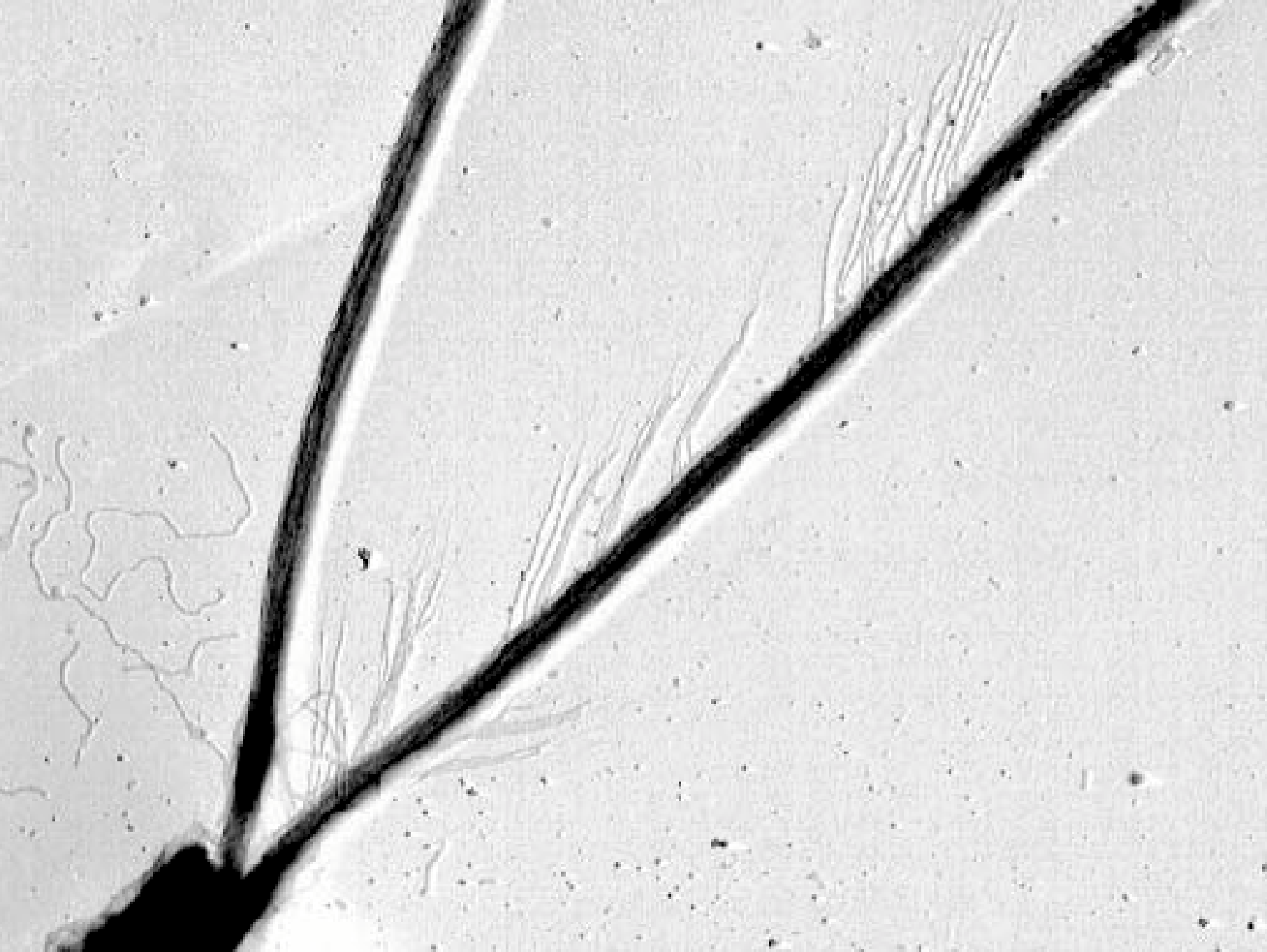
Apo

E



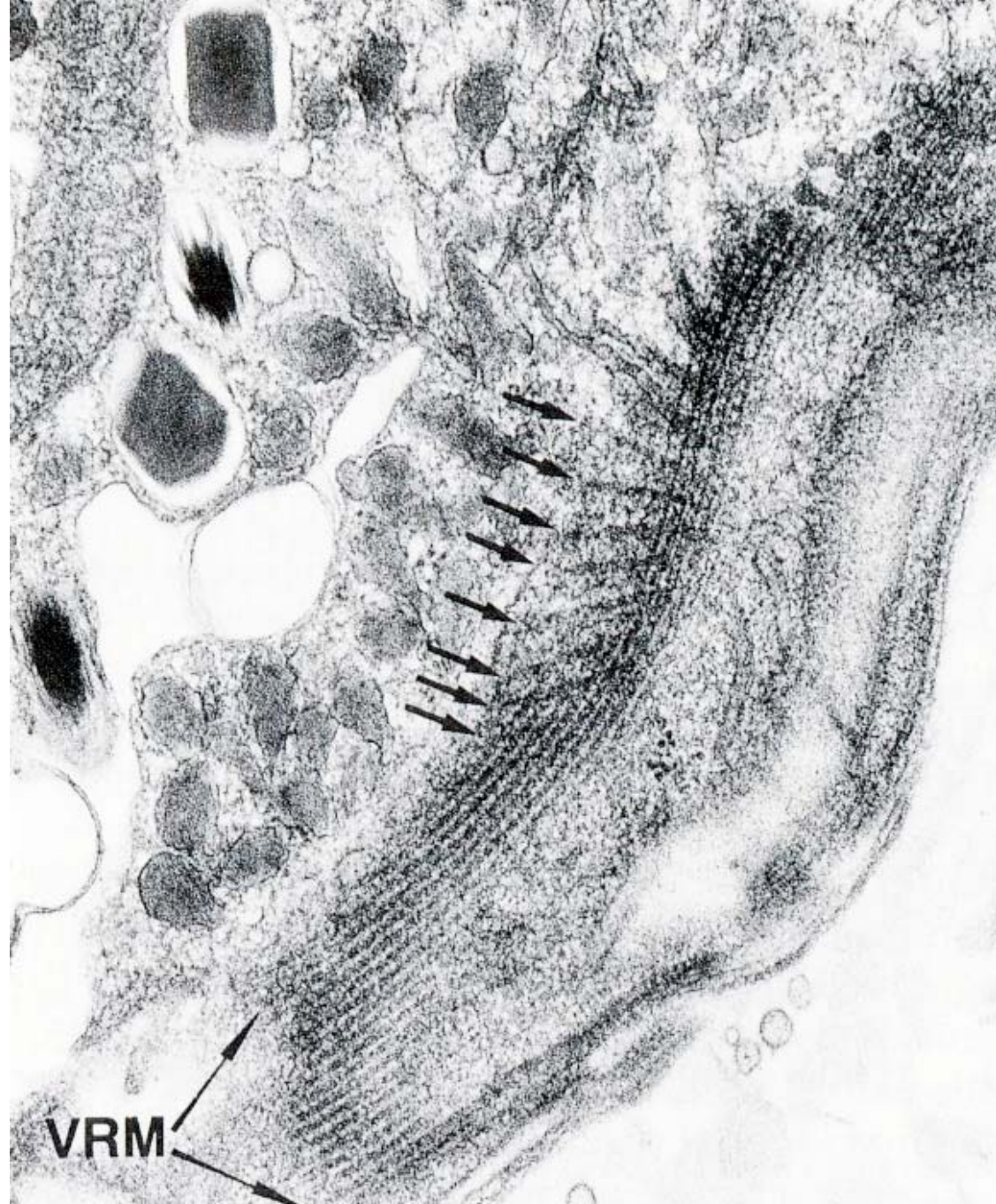
0.5um





Common features of *T.antarctica* and *T.subtilis*:

- Mitochondria with tubular crista.
- Complex cytoskeleton (*subcortical lamina*)
 - Similar cytoskeleton has been observed in the alveolate *Oxyrrhis marina*.

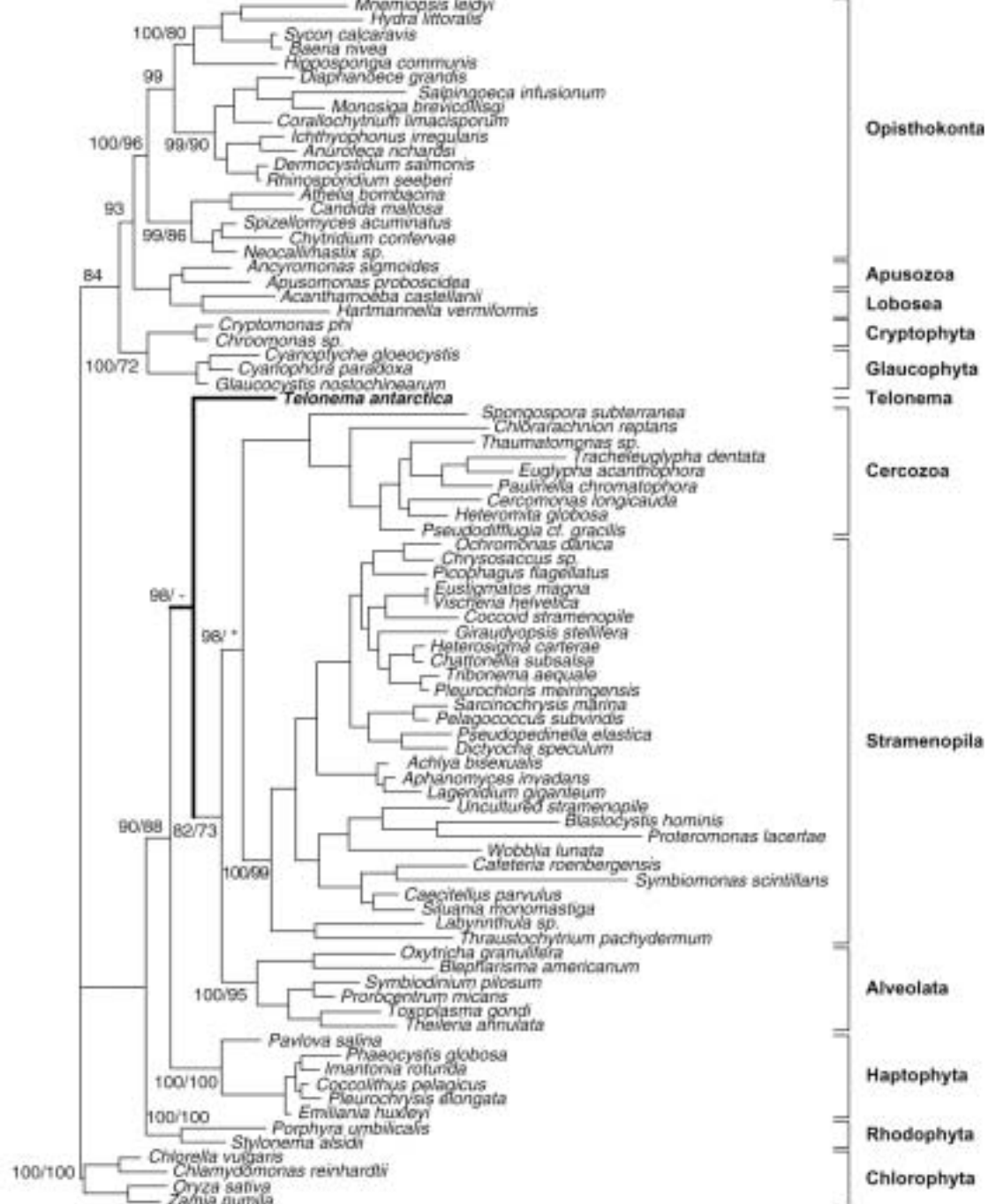


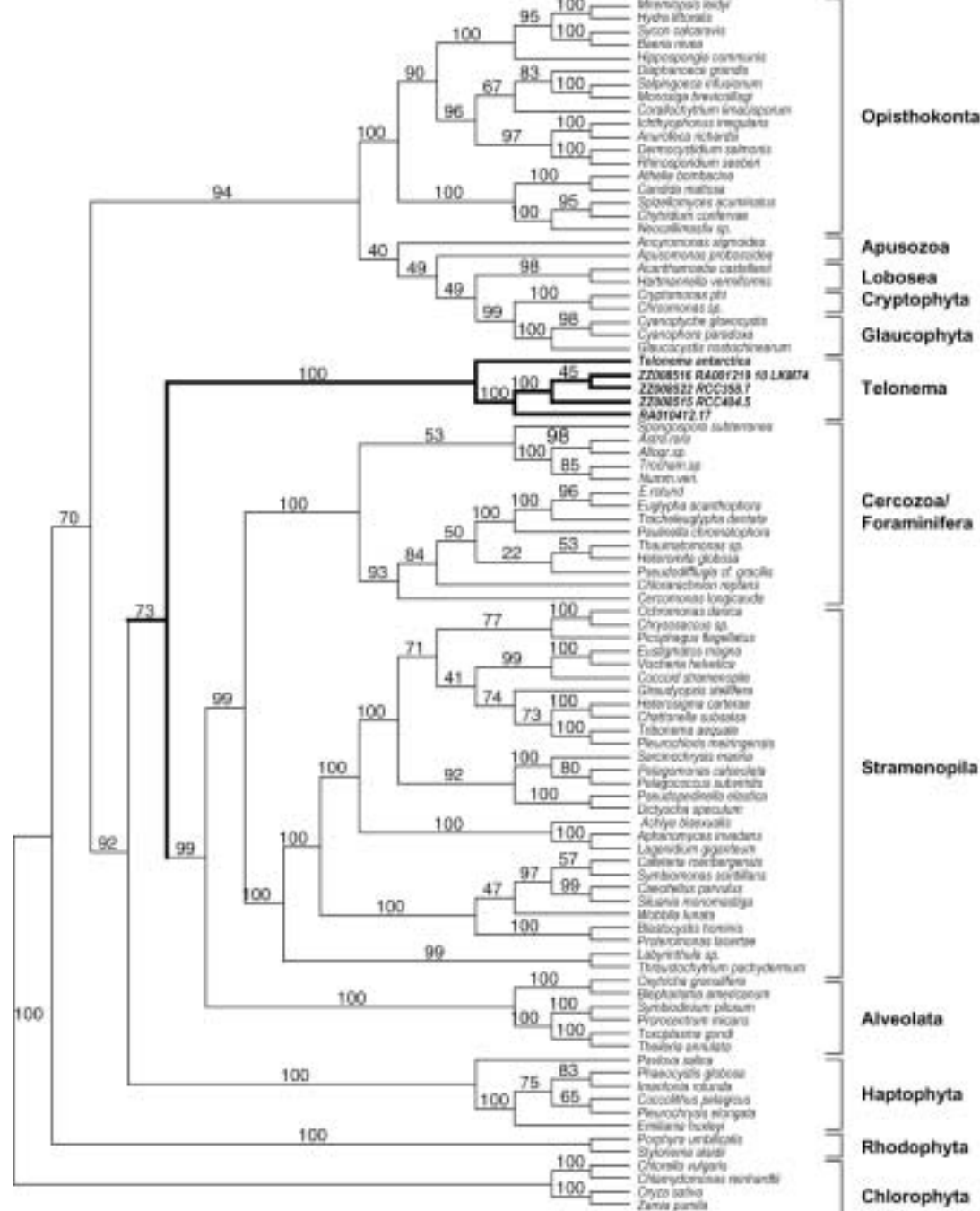
Unique collage of characters

- Mitochondria with tubular crista -> cromists, alveolates, cercomonads or foraminifers?
- Tripartite hairs -> stramenopiles?
- Cortical alveoli -> alveolates or stramenopiles?
- Subcortical lamina -> alveolate?
- But no trace of chloroplasts...

SSU rRNA-phylogeny

- PCR with universal primers on:
 - Cultured *T.antarctica* and *T.subtilis*.
 - Clone libraries of env. samples.
- Phylogenetic analyses with Bayesian inference and parsimony methods.
- Environmental sequences and *T.subtilis* sequences cluster robustly with *T.antarctica*.

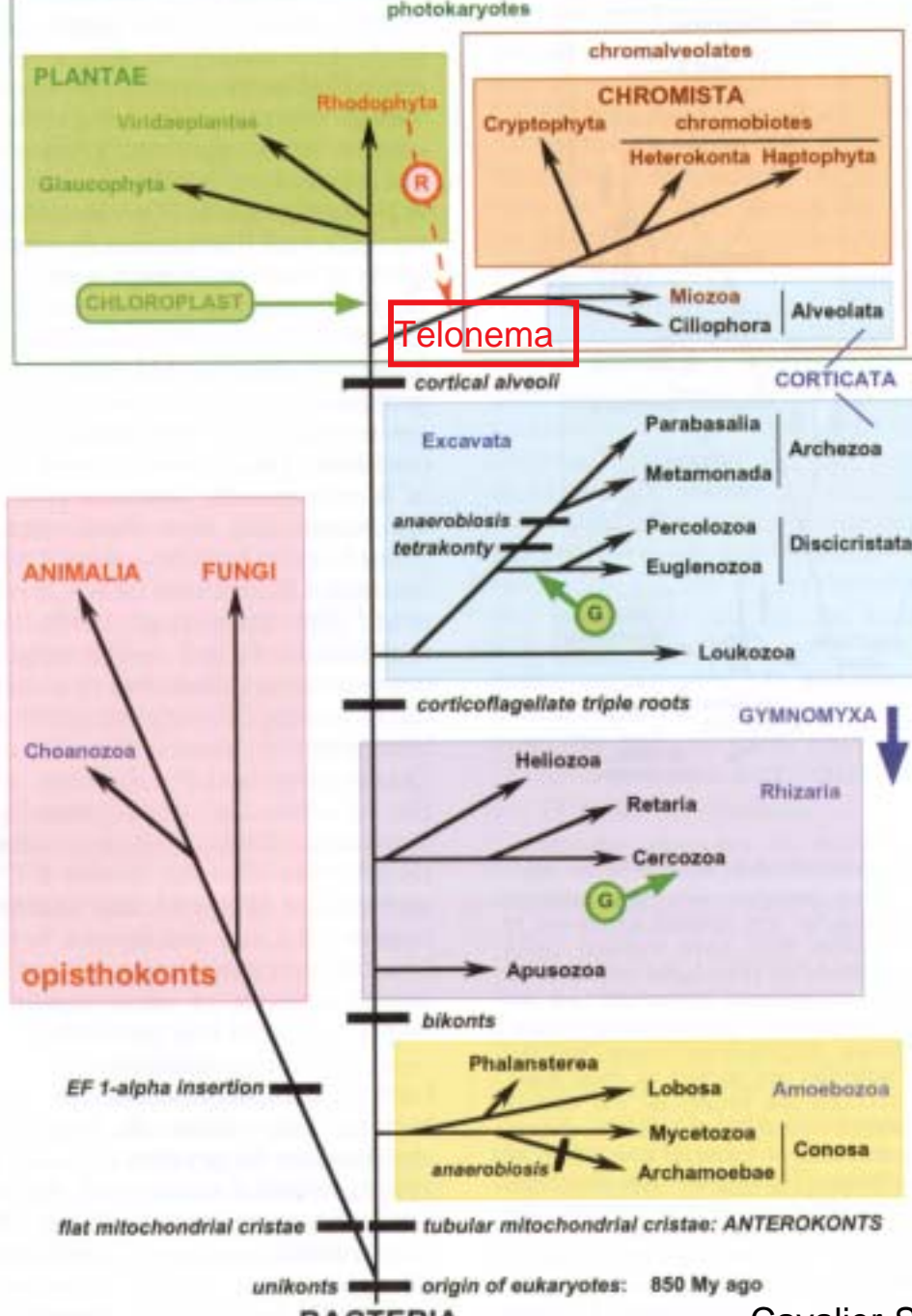






Telonema-phylogeny

- The *Telonema*-clade is placed at the base of stramenopiles/cercomonads and alveolates, with moderate support.
- Moderate- to high support for excluding *Telonema* from stramenopiles or alveolates.
- The phylogeny should be tested with other genes (ongoing project).
- However, based on ultrastructures and the molecular phylogeny, we believe *Telonema* is a deep clade at the base of the “tubulacristata”.



Telonema-phylogeny cont.

- *Telonema* is probably one of the best candidates to resolve the relationship between alveolates and ciliates.
- This work elucidate the importance of ultrastructural investigation of species obtained from environmental sampling.

Collaborators

- Picodiv:
 - Roscoff:
 - Daniell Vaultot
 - Khadidja Romari
 - Oslo:
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- University of Oslo:
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 - Kjetill S. Jakobsen
 - Joachim Nedreklepp
- University of Copenhagen
 - Helge A. Thomsen