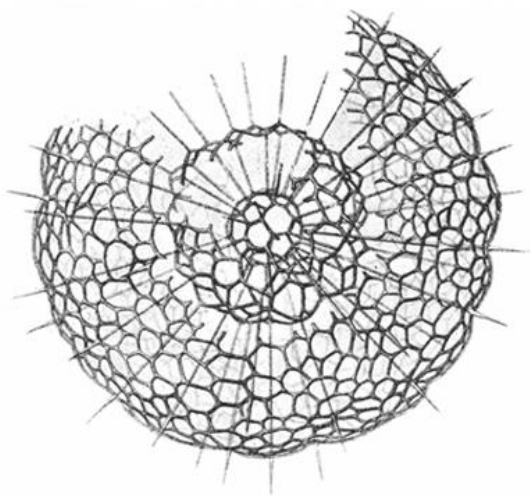
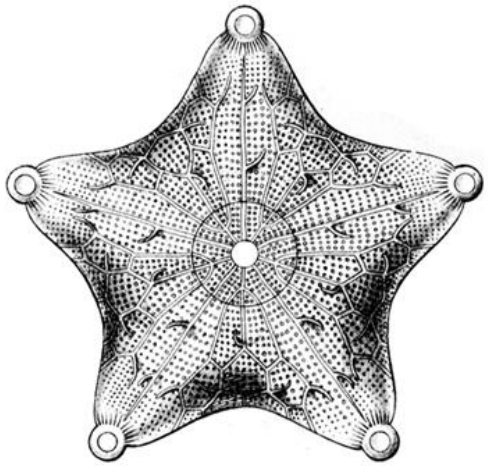
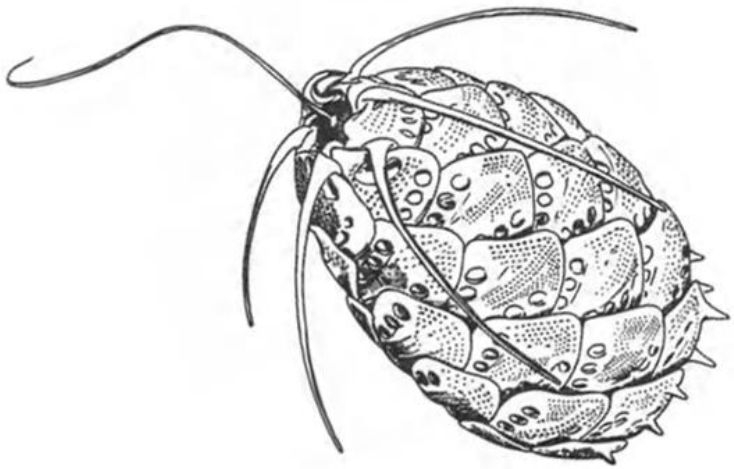
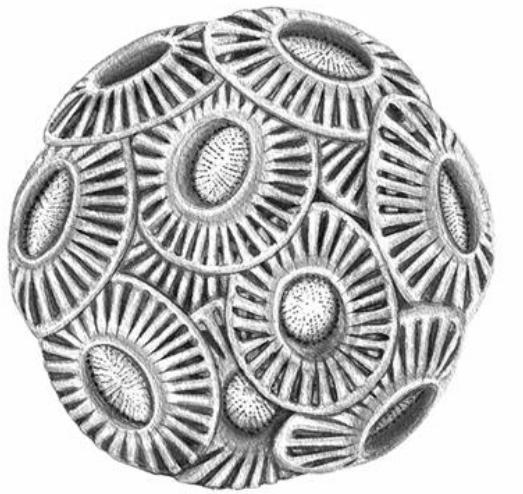
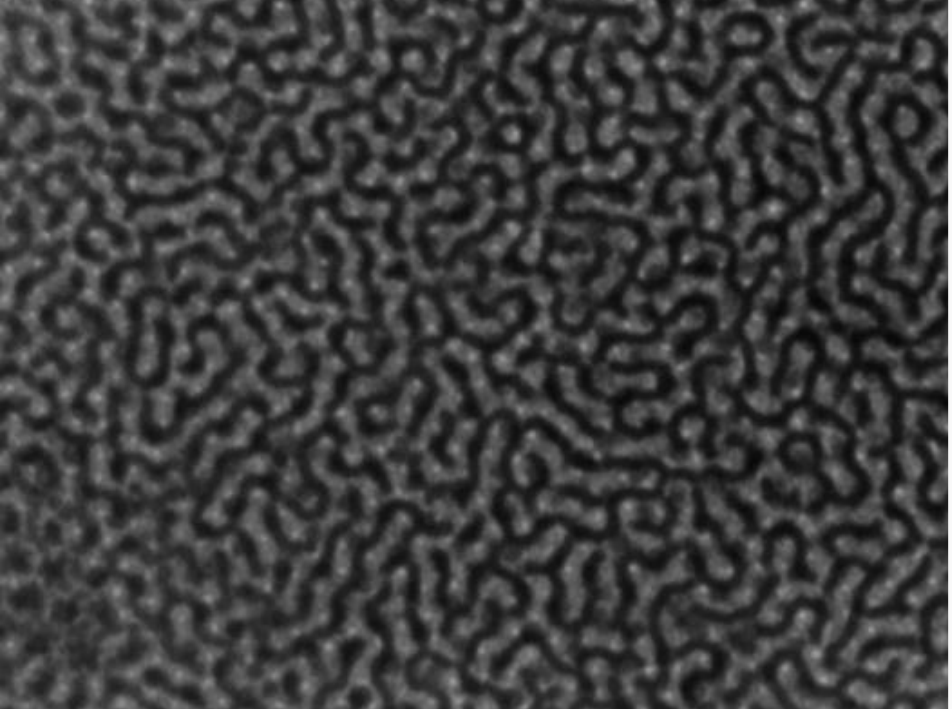
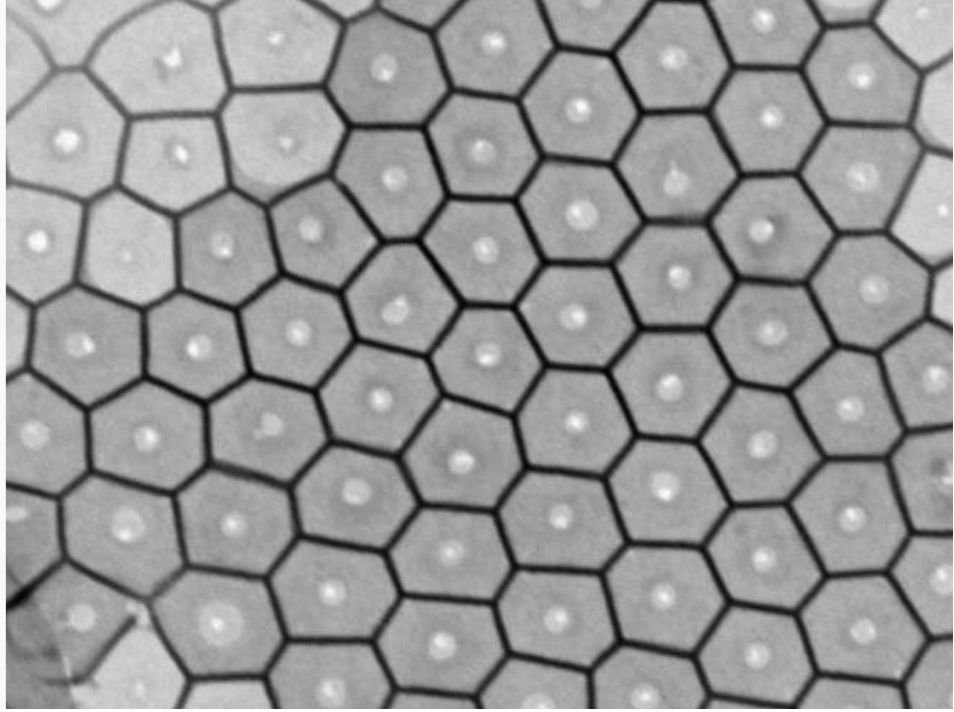
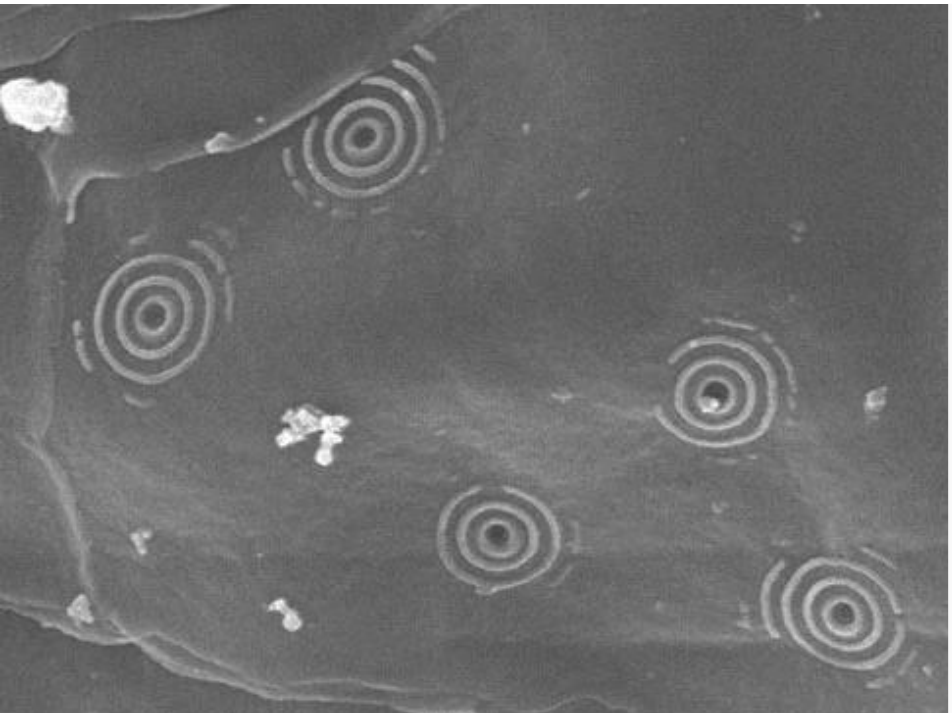
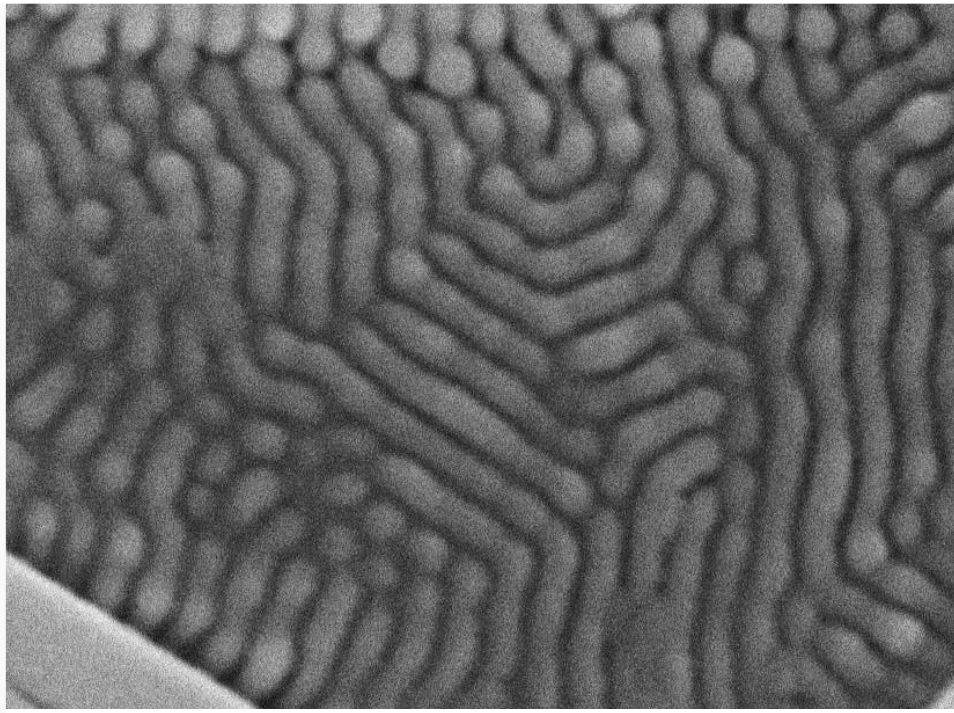




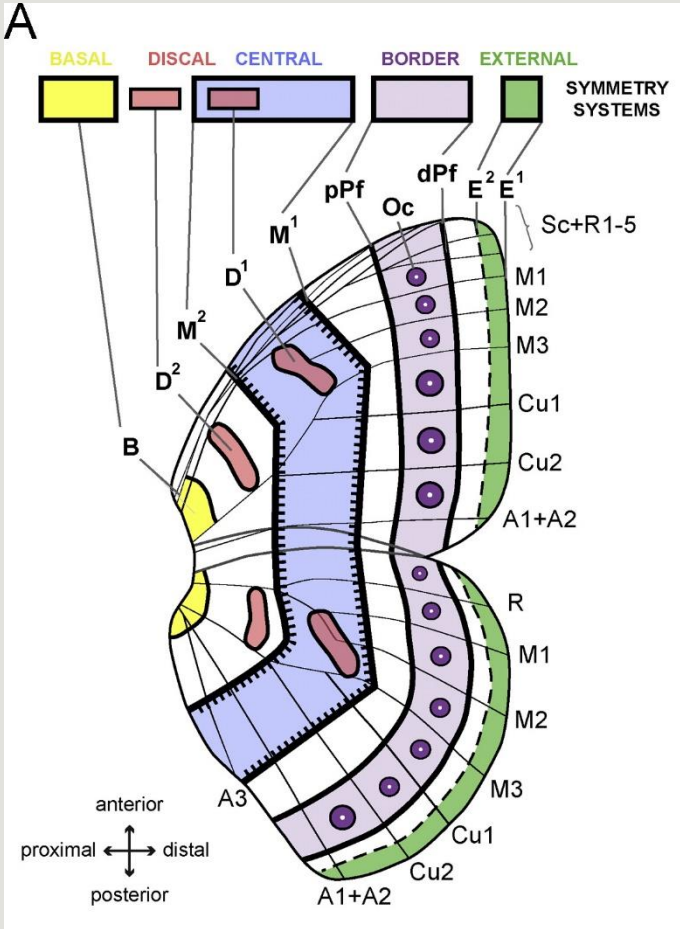


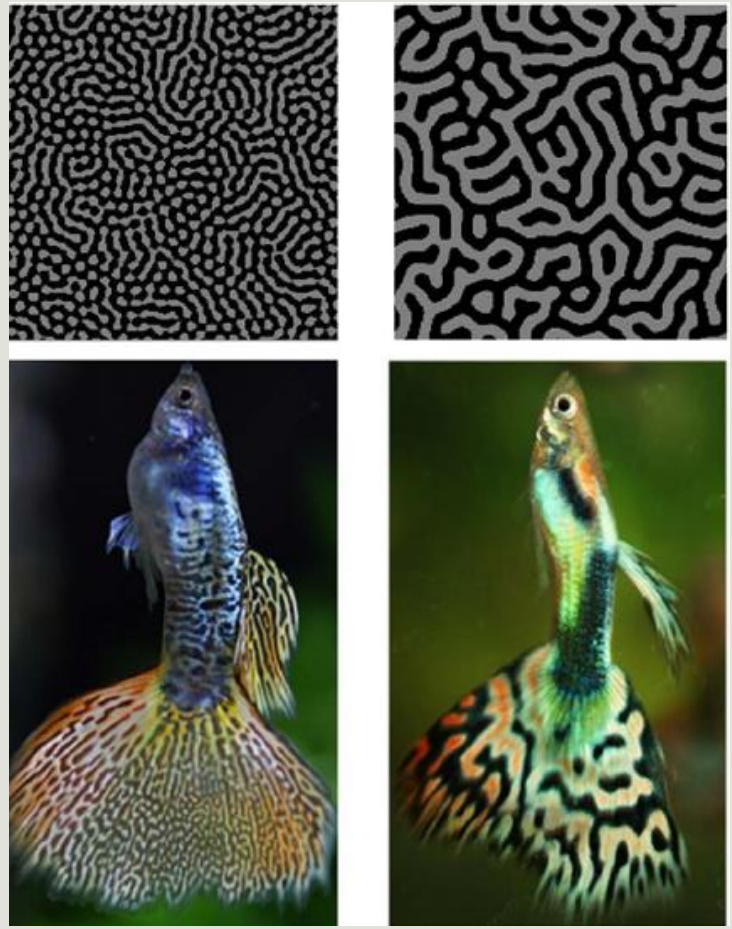


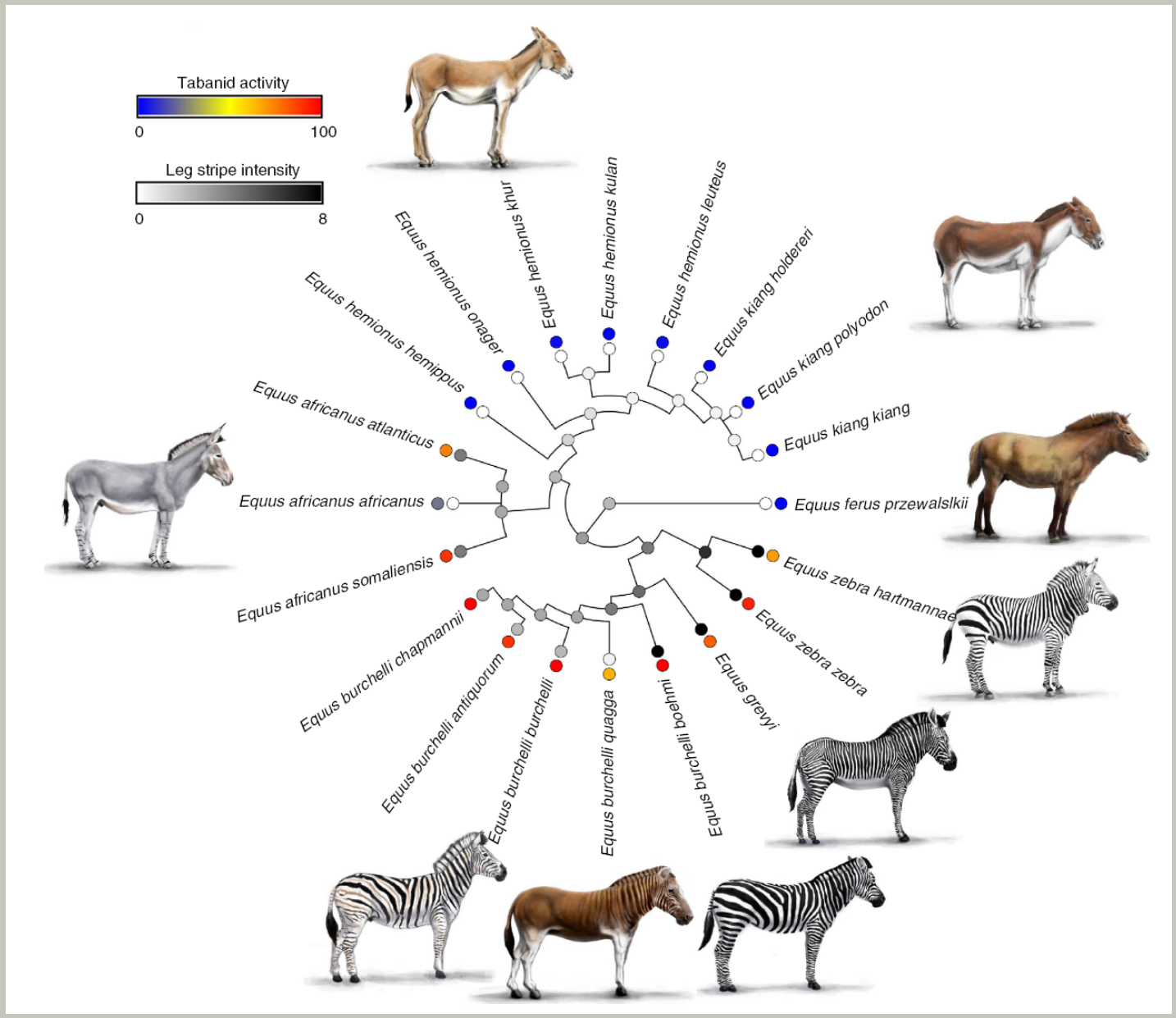
Study of ornaments and patterns

- Evolution and function of patterns is studied rarely, focusing on various macroorganisms





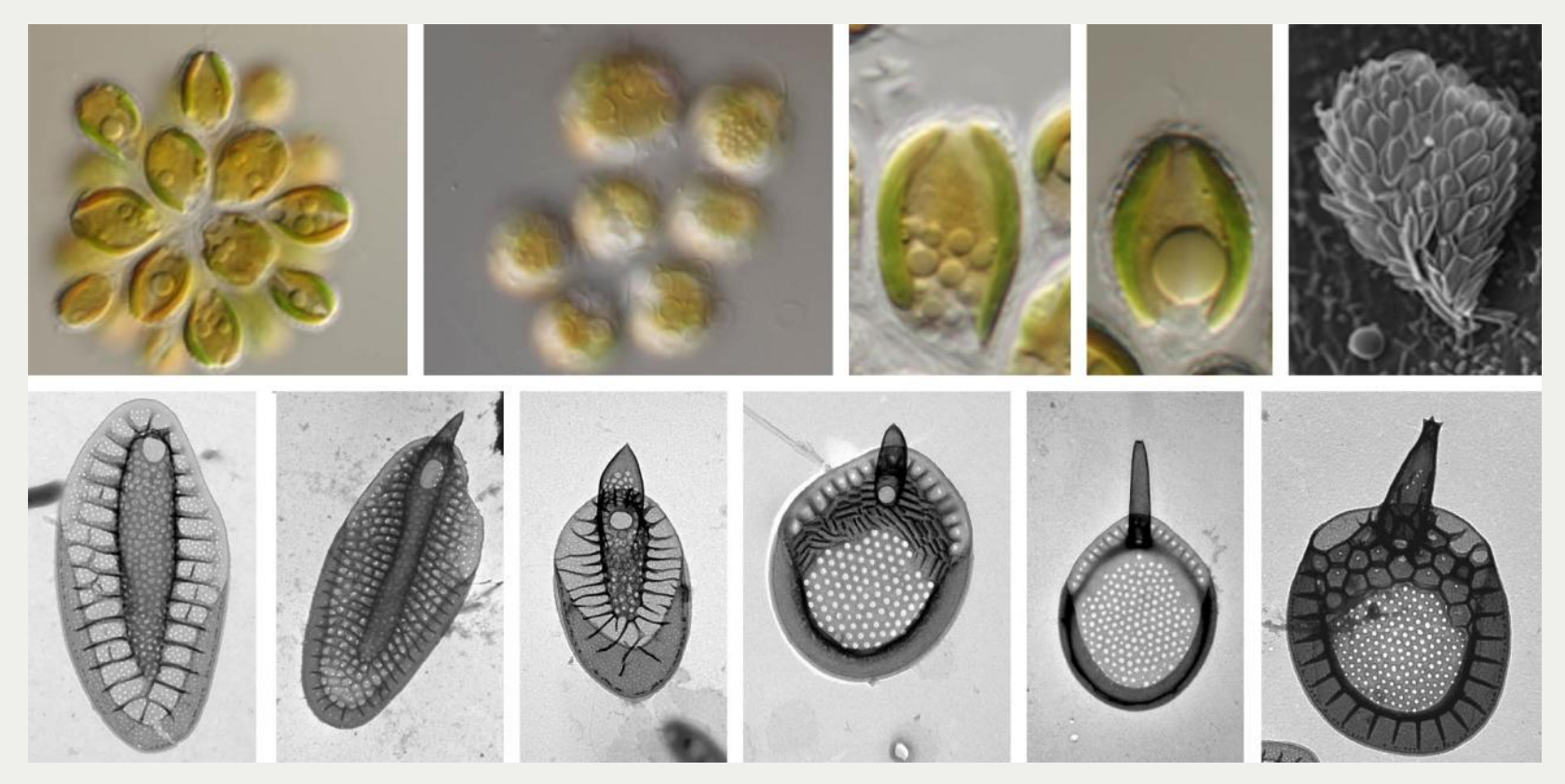
Study of ornaments and patterns



Caro et al. (2013): Nature Comm. 5:3535

The genus *Synura* (Synurales, Chrysophyceae)

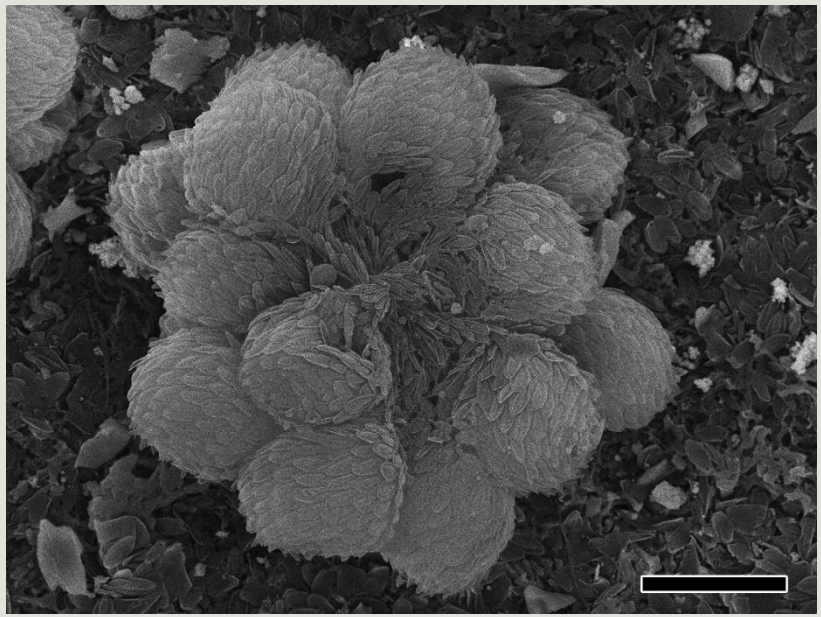
- A common freshwater genus of silica-scaled chrysophytes
- Colonies of a variable number of cells joined together at their posterior ends
- Cells covered by imbricate silica scales



Objectives

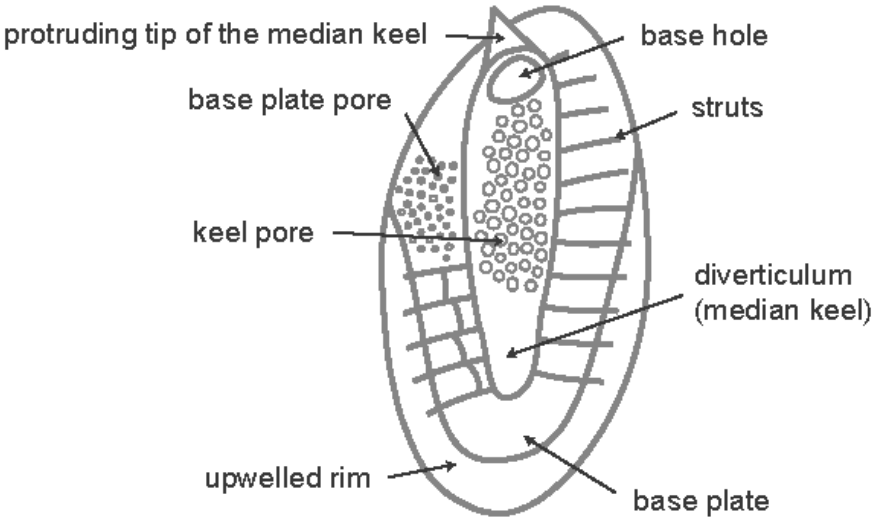
- **To uncover evolutionary patterns in scale design**

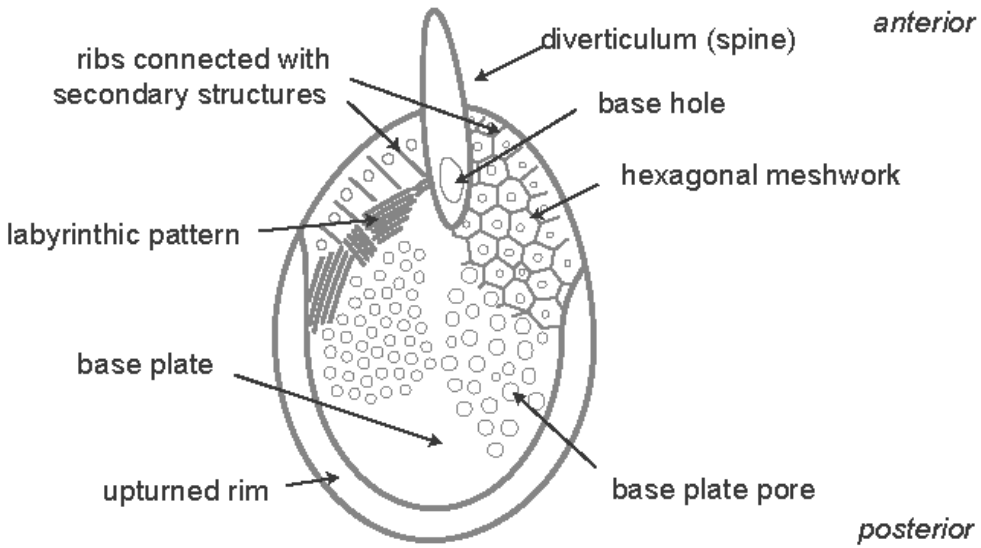
  - Are there any evolutionary trends in morphological traits within the group?
  - How do ancestral species differ from modern taxa?
  - What is the putative function of particular ornamental structures?

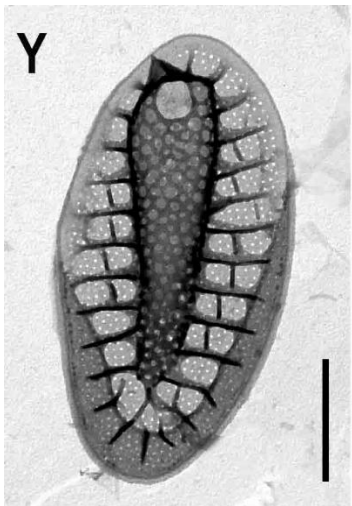


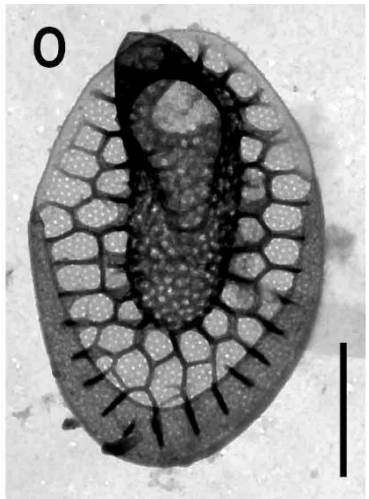
The genus *Synura* (Synurales, Chrysophyceae)

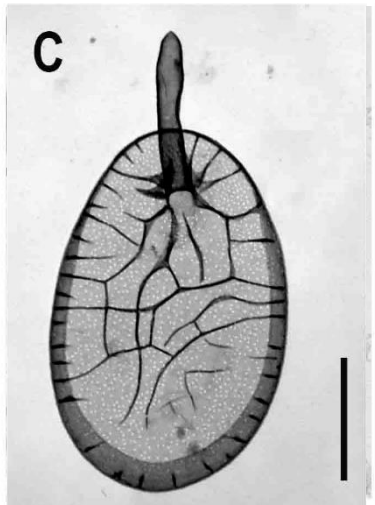
- Two major types of silica scales possessing a number of patterns

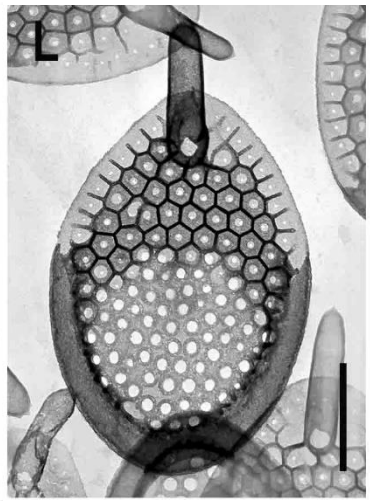


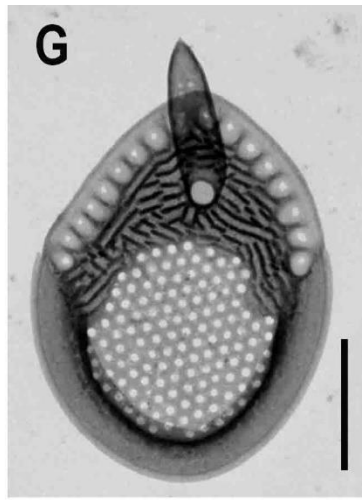






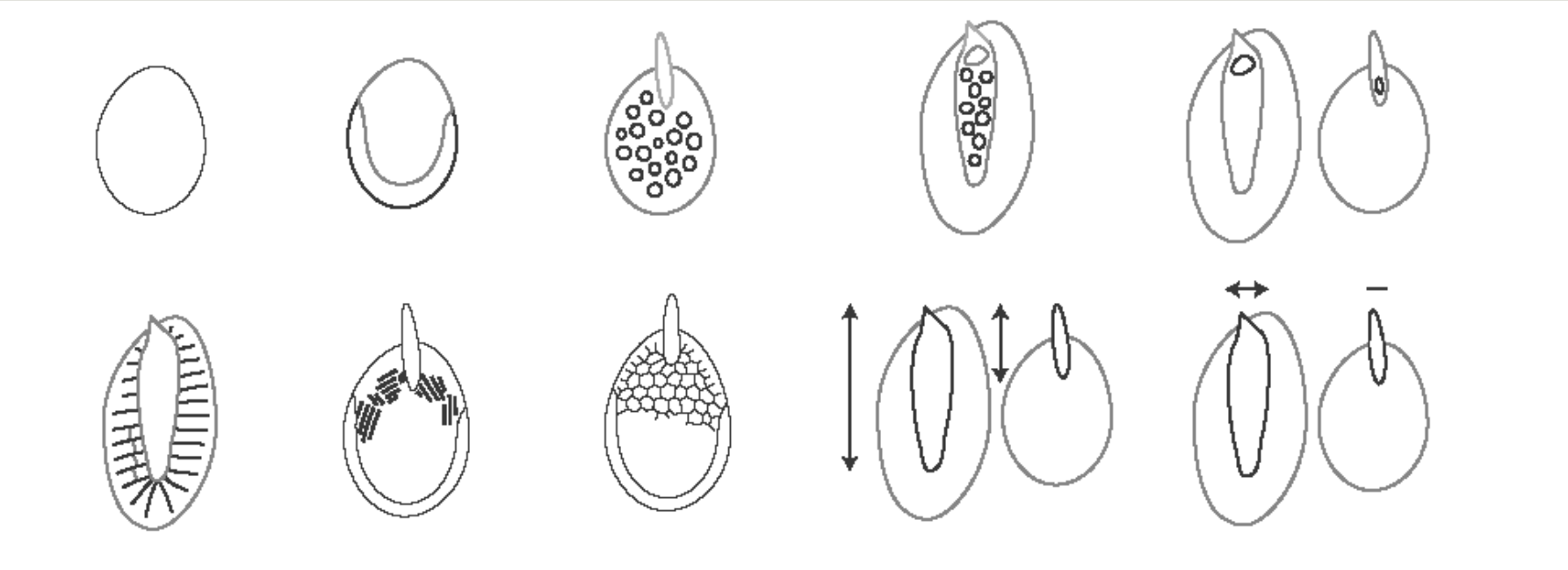




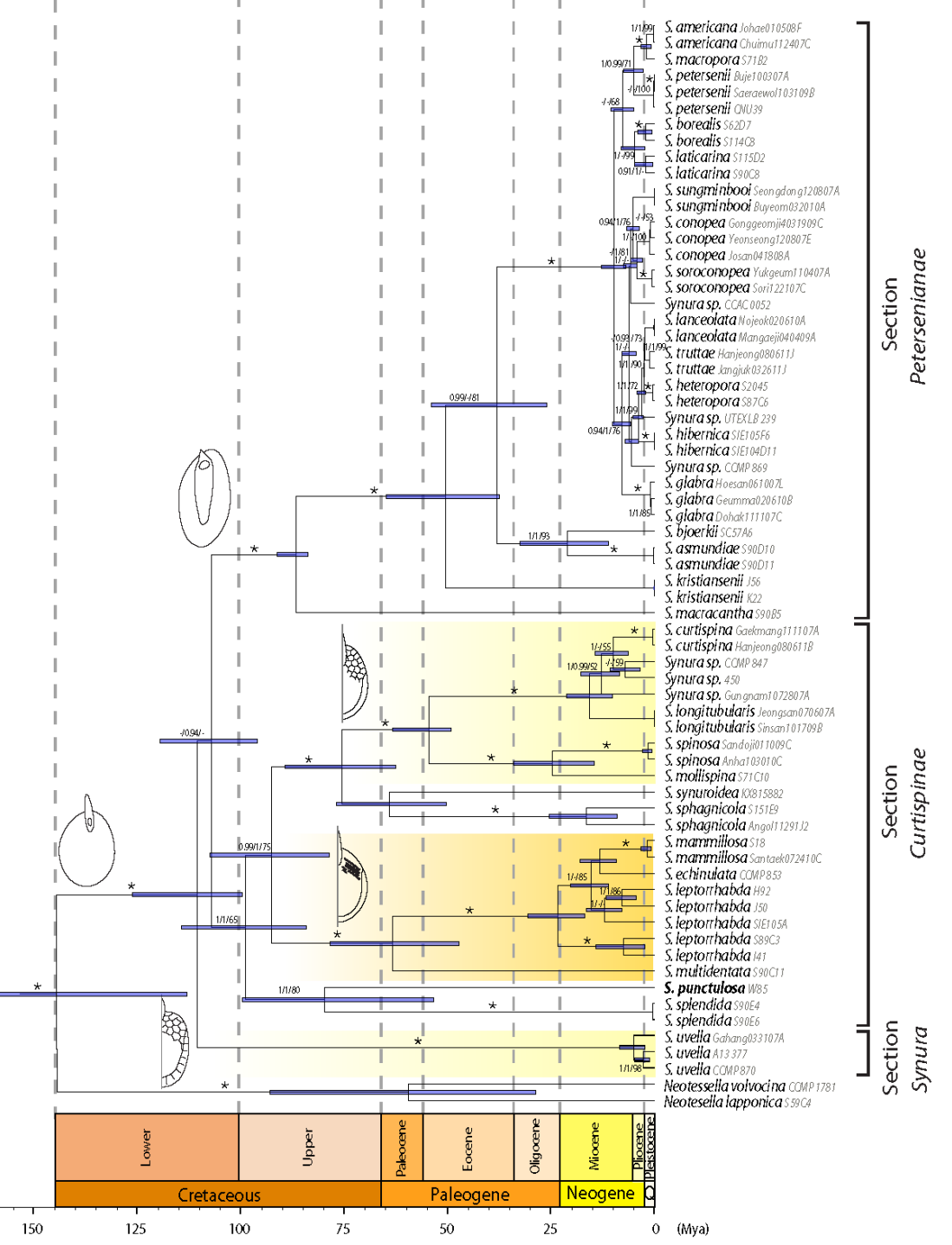


Methods

- Phylogenetic analyses of thirty extant *Synura* species based on six molecular loci
- Morphological analyses of both extant and fossil species
  - a minimum of 10 scales per species investigated
  - a total of 44 morphological traits measured
- Tracing the morphotype evolution of silica scales
  - NMDS, phylomorphospace plots, ancestral states reconstruction



Molecular evolution

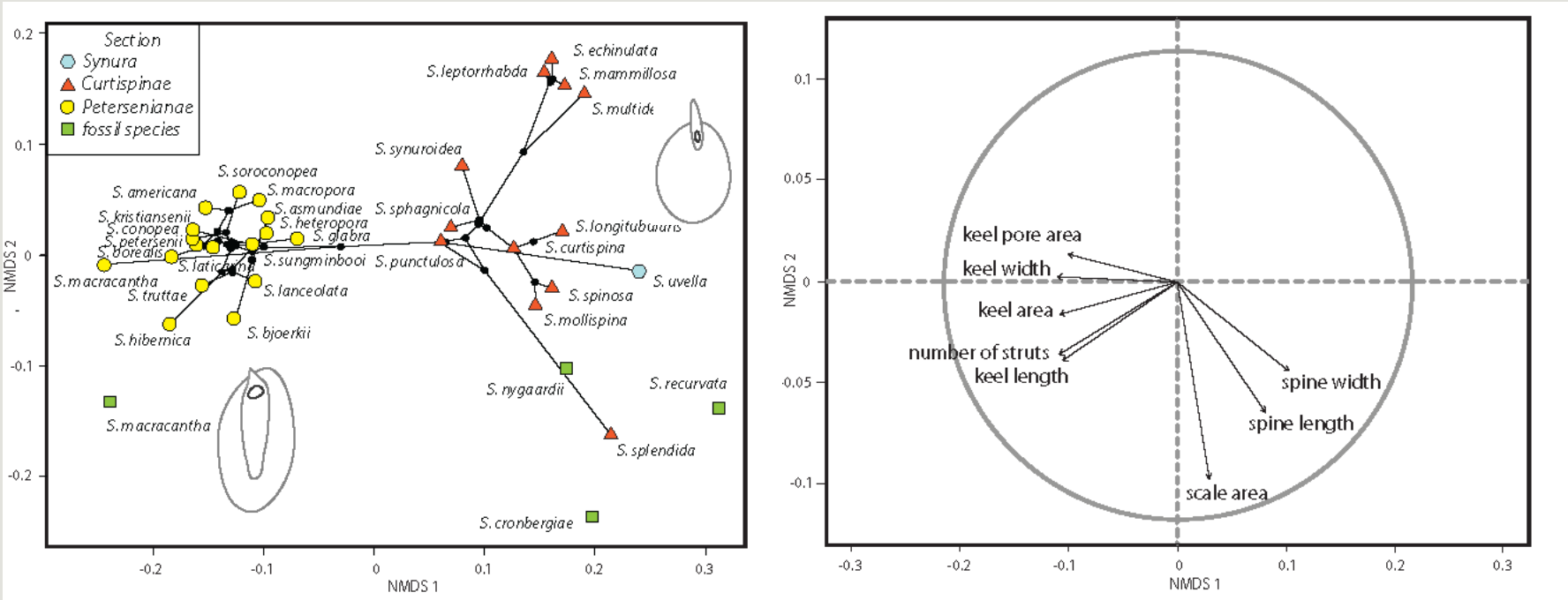


- Origin of the genus Synura dated in the Early Cretaceous, about 145 mya.
- Radiation into the three sections **Synura**, **Curtispinae**, and **Petersenianae**
- Single origin of median keel; two lineages possessing a honeycomb pattern on their scales

Phylogeny: Multigene time-calibrated phylogenetic tree based on nuclear SSU, LSU, ITS and plastid LSU, *rbc*L, *psa*A sequences. Calibration by four time constrains based on well-preserved fossil scales.

Trends in silica scale evolution

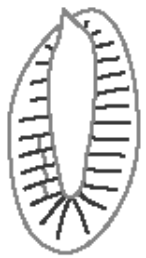
- Clear morphological separation of two lineages based on the formation of scales with either a projecting spine or a keel
- Shifts in morphology of fossil specimens in relation to their modern counterparts



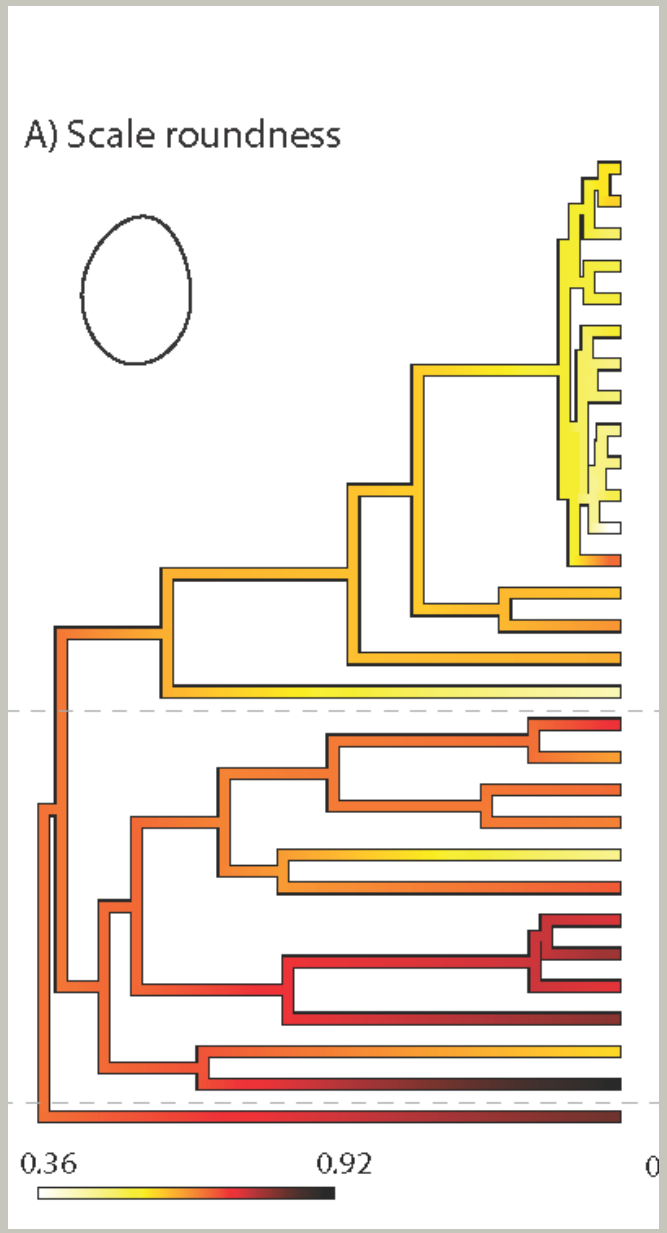
Phylomorphospace plot: The projection of phylogenetic relationships among selected *Synura* species onto the ordination diagram (NMDS) based on morphological characters of siliceous body scales.

Evolution trends of *Synura* scale case

- **Median keel**
  - Evolutionary novelty strengthening the scale which, in turn, decreases potential breakage.

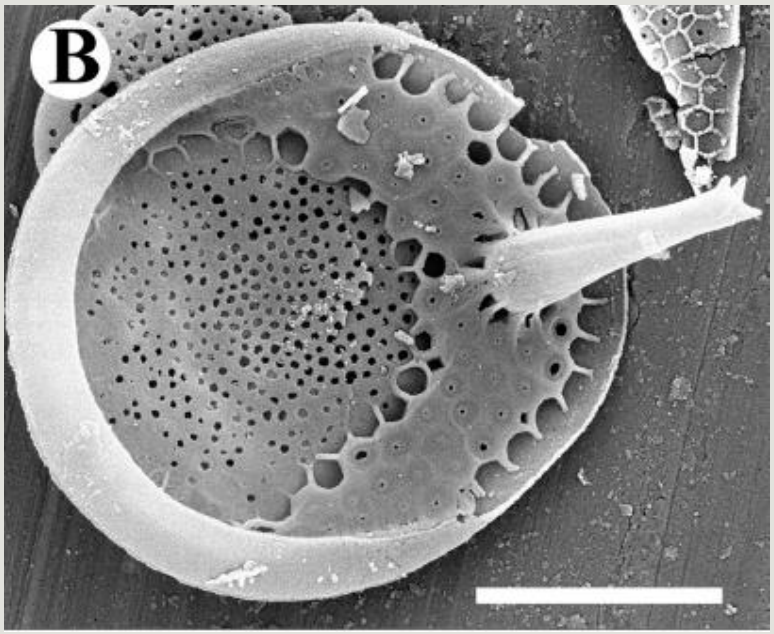


Allows to form more elongated scales which fit easier around elongated cells with reduced volume to surface ratio = > favoured at low nutrient conditions

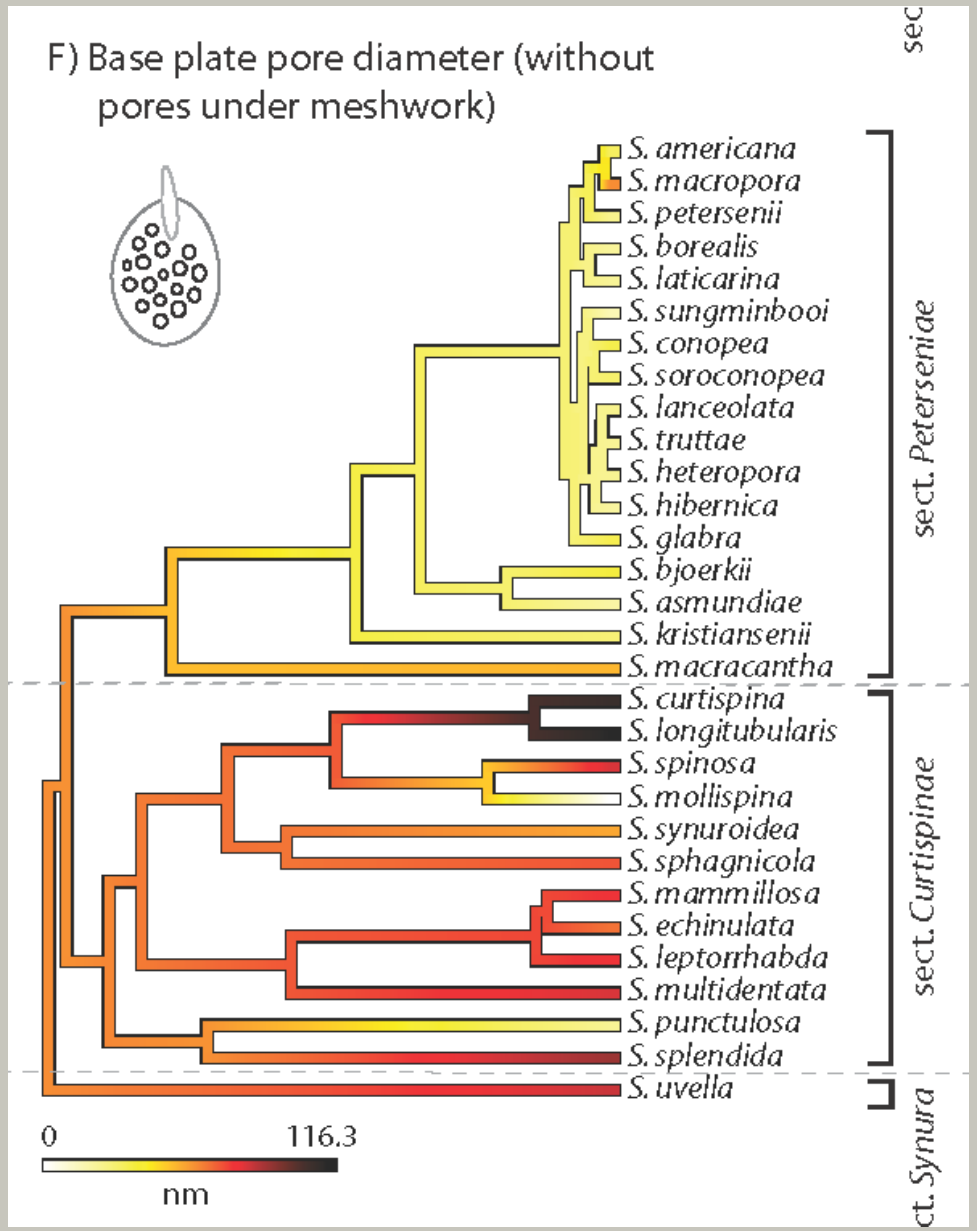


Evolution trends of *Synura* scale case

- **Scale pores**
  - Pore diameter decreased during evolution
  - A response to improving the protective barrier against viruses and parasites?

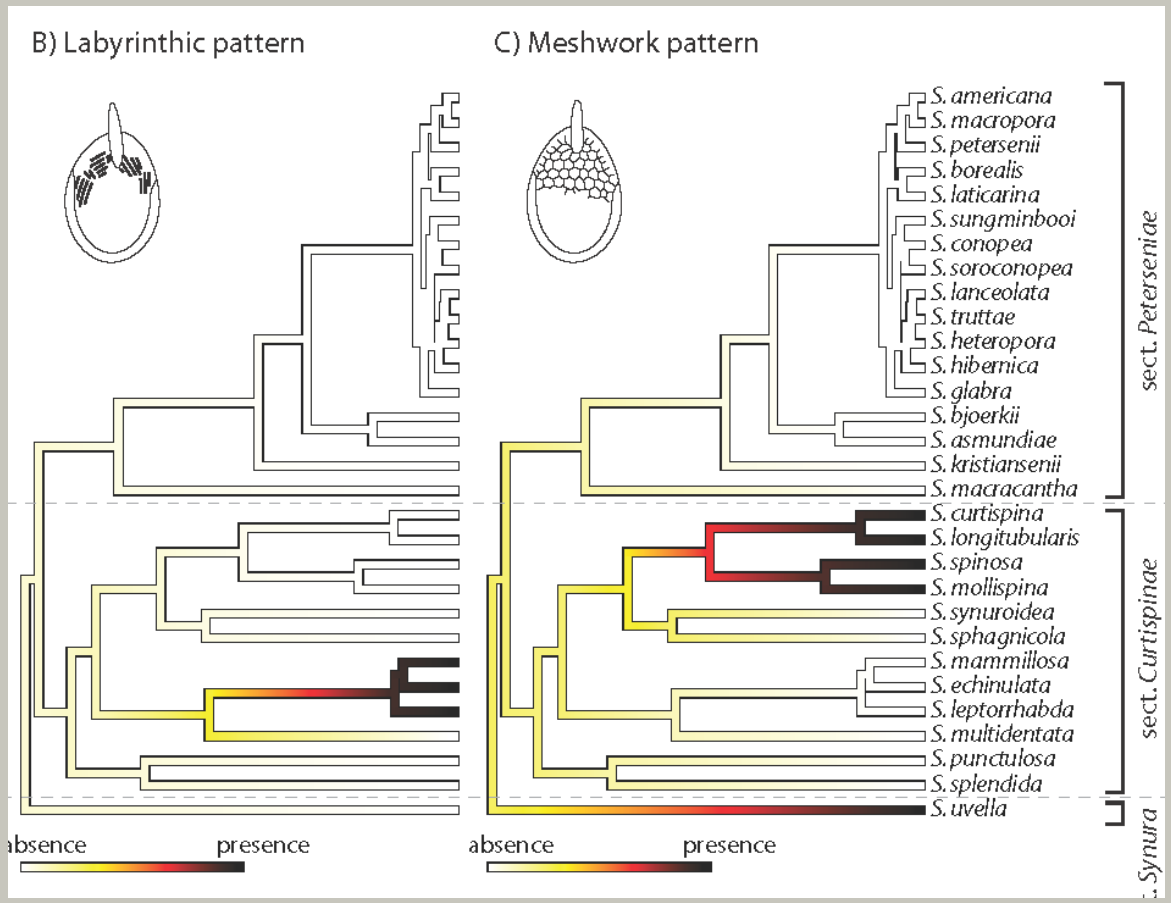


fossil species with big pores



Evolution trends of *Synura* scale case

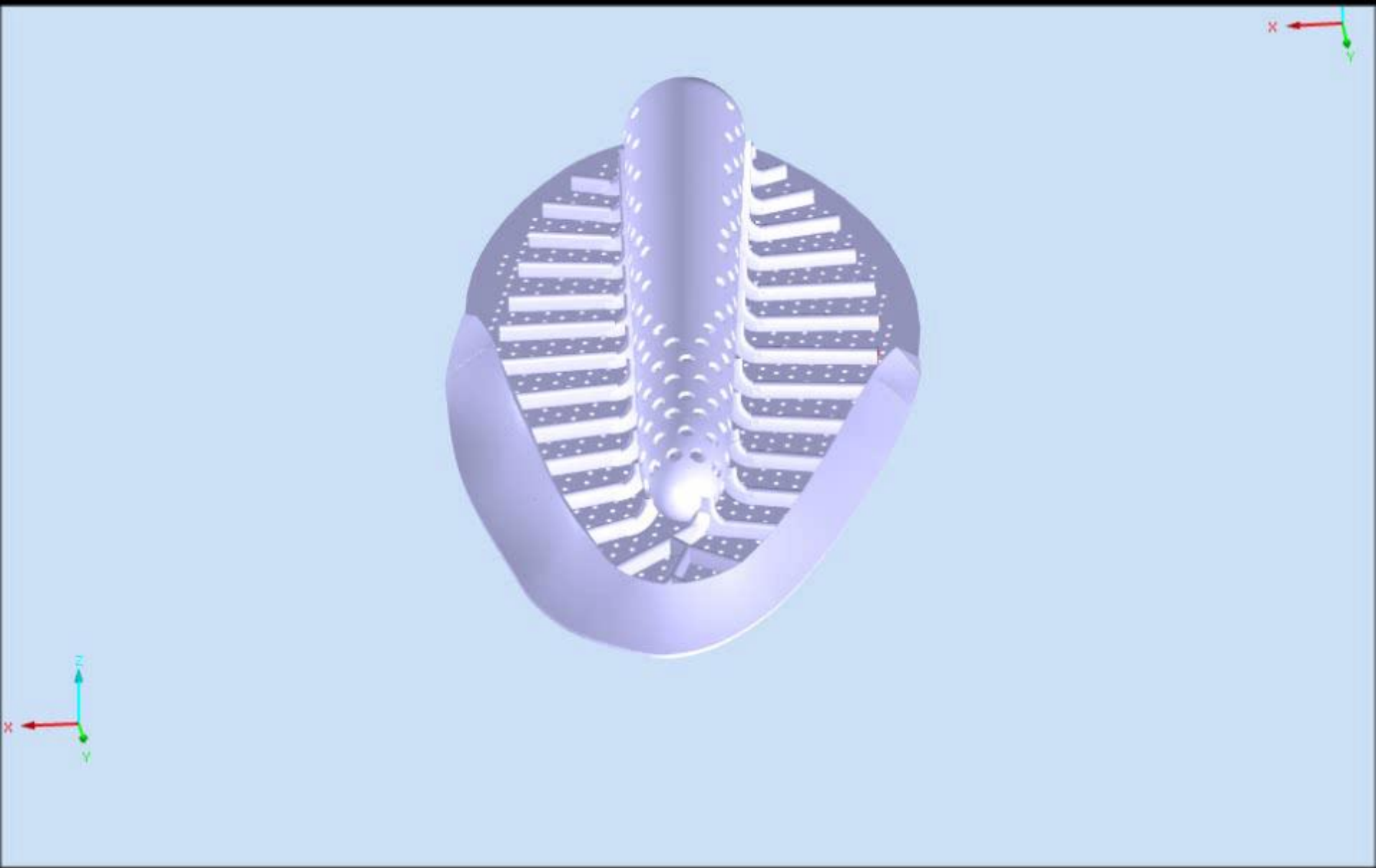
- **Secondary structures**
  - Independent origin of labyrinthic or meshwork patterns at the anterior part of the scale. The posterior part, covered by other scales, lacks these structures.
  - Adaptive roles?



Work in progress

- Growth experiments to assess the adaptive role of scale structures

- Computer modelling to analyse the mechanical behaviour of silica scales equipped by various structures.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algal speciation & evolution

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Publications

2021

---- **Pusztai, M.** & **Škaloud, P.** (2021)
Species delimitation within the colonial flagellates *Uroglena*, *Uroglenopsis* and *Urostipulosphaera* (Chrysophyceae).
European Journal of Phycology (in press).

Jadrná, I., Siver, P.A. & **Škaloud, P.** (2021)
Morphological evolution of silica scales in the freshwater genus *Synura* (Stramenopiles).
Journal of Phycology 57: 355-369.

2020

Černajová, I. & **Škaloud, P.** (2020)
Lessons from culturing lichen soredia.
Symbiosis 82: 109-122.

http://botany.natur.cuni.cz/skaloud

Thank you for your attention!

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