The **Biological Algorithms** group offers a

Master Thesis Project

to students in, *e.g.*, physical sciences (or applied mathematics & computer science)

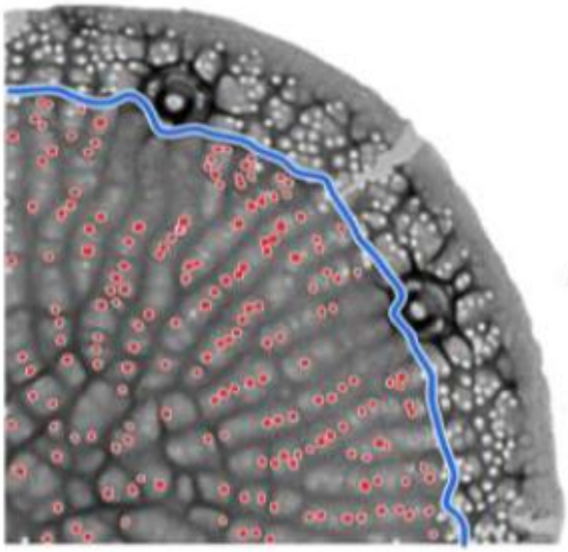
Pore pattern morphogenesis in diatom alga.

Diatoms are unicellular alga responsible for 20% of photosynthesis on our planet. To evade predators feeding on them, they encase themselves in a cell wall made of glass, giving rise to a multitude of intricate, highly regular forms, which fascinated already Darwin's disciple Ernst Häckel in Kunstformen der Nature a century ago. Yet, we are only beginning to unravel the biological processes that give rise to these genetically encoded patterns.

In this project, we address the self-organized pattern formation of arrays of nanometer-sized pores in diatom silica cell walls, which often exhibit hexagonal packing order, but also obey additional symmetries. These pores are believed to form by a phase-separation process, possibly templated by organic molecules. Building on preliminary work, we want to use particle-based stochastic simulations to understand how simple local interaction rules can give rise to observed patterns.
This project will thus combine: (i) optimization and extension of existing simulation code, (ii) using this code to make decisive quantitative predictions, and (iii) employ image analysis to quantitatively characterize pore patterns in different diatom species from electron microscopy images (provided by the Kröger lab at B CUBE, TUD). By studying the formation of pore patterns in diatoms, we theoretically address a prominent example of self-organized pattern formation at the cellular scale.

If you share our motivation to understand how biological systems operate, and are not afraid of modeling, programming, and image analysis, we will be happy if you contact us for further information and details.

Biological Algorithms Group. Our mission is to identify simple paradigms of robust motility control and pattern formation in complex biological systems. We reverse-engineer these biological algorithms in close collaboration with experimental biologists, using tools from physics, information theory, and engineering. https://physics-of-life.tu-dresden.de/en/research/core-groups/friedrich



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More information:
Heintze *et al.* The molecular basis for pore pattern morphogenesis in diatom silica (preprint).
www.researchsquare.com