



Arachnoidiscus

Unicellular planktonic organisms such as diatoms constitute the most important basis of marine food webs. They make a major contribution to global primary production and have an essential effect on the oceans' biogeochemistry. Marine key taxa like krill, fish, and whales basically depend on them. The diatoms' success is largely due to the development of complex, species-specific silica shells - the frustules - , which protect them against predators such as copepods and krill.

We explore the principles that turn the exoskeletons (shells) of these organisms into extremely light and stable constructions. We found that the shells' highly complex geometries have a large share in these characteristics. Based on these research results, we developed the bionic product creation process [ELiSE](#) in 2005, which we have continuously improved ever since.

Recently, we started projects to examine the nanostructure and morphogenesis of diatom shells in order to be able to optimally adapt the [ELiSE process](#) to highly developed composite material and manufacturing techniques like investment casting or [Additive Manufacturing \(AM\)](#). Reversely, we use new developments from industrial projects, such as the parametric optimization with the aid of genetic algorithms, to obtain new findings on the functional morphology of plankton organisms. Furthermore, we develop and apply microscopic analyses and 3D reconstructions, micromechanical tests, culture experiments, and ecologic examinations.

We aim at systematically refining fundamental research, applied research, and product development in the field of lightweight design in nature and technique, consequentially using strong synergy effects. We therefore closely cooperate with other divisions in AWI, particularly the Friedrich Hustedt Diatom Study Centre and the Polar Biological Oceanography, application-oriented institutes like KIT, organizations like BioKon and VDI as well as industrial companies from diverse sectors.



Christian\_Hamm\_2018.png (Photo: Alfred-Wegener-Institut)

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[Patents / IP](#)

[Video über den Bioniker Paul Bomke zur Entwicklung des "Bionik Bike" \(only in german available\)](#)

## Current Projects