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Learning from Diatoms: Biomimetic Nanotechnology Approaches

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Biomimetics, i.e. knowledge transfer from biology to technology, has been around since many centuries. Yet, nowadays, the field experiences major growth. Reason for this development are current analysis methods that allow us to investigate and understand basic biological properties down to the nanoscale. Recurring principles of biology are correlation of form and function, modularity and incremental change, genetic basis, competition and selection, hierarchy and multi-functionality. General principles that can be applied by engineers who are not at all involved in biology comprise integration instead of additive construction, optimization of the whole instead of maximization of a single component feature, multi-functionality instead of mono-functionality, energy efficiency and development via trial-and-error processes. Systematic technology transfer from biology to engineering thereby becomes generally accessible.

Exemplified by diatoms, unicellular microalgae with a cell wall consisting of a siliceous skeleton enveloped by a thin organic case, these points will be illustrated. Diatoms produce self-repairing tough underwater adhesives that serve as inspiration for novel man-made adhesives, fossil chain-forming diatoms made us come up with the idea of a new micropump, diatom hinges and interlocking devices can give hints towards optimisation of micromechanics and surface functionalisation in emerging three-dimensional micro-electro-mechanical systems (MEMS) and diatom spores and resting stages are of interest for novel building approaches in architecture.

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