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BIOMIMETICS

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Biologists and engineers generally do not see many overlaps of their professions. However, both deal with constructions, processes, and developments. Biomimetics is a still exceptional field that deals with transfer of knowledge from biology to technology. Biomimetics encompasses a creative conversion that is often based on various steps of abstractions and modifications, i.e., an independent successive construction that is rather a 'new invention' than a blueprint of nature.

In "Biomimetics by Analogy" biological research is applied in order to find solutions to specific engineering problems. A successful example for such an approach is the Biomimicry Innovation Method (© Biomimicry Guild, Helena, MT, USA, 2008) that comprises the following steps: Identify function, biologize the question, find nature's best practices and generate product ideas. In "Biomimetics by Induction", general principles derived from basic biological research are used for development of technical implementations. Some general principles that can be applied by engineers who are not at all involved in biology have already been identified: 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. These two biomimetic approaches entail different time frames and prospects.

Examples for biomimetics useful in micro- and nanotribology are 3D-MEMS inspired by biological hinges and interlocking devices on the nanoscale and functional texturing of surfaces inspired by texturing as it occurs in organic material. The latter yield, e.g., selective, switchable coatings that allow for collection and release-on-demand in micro-fluidic systems and in the positioning of microparts, as well as reactive colour coatings signalling material parameters indicating upcoming material failure.

Biomimetics can aid micro- and nanotribologists to manage the specific requirements in systems or product design, which are even more relevant than for conventional products, especially to create products and processes that are sustainable and perform well (e.g. to overcome stiction), to integrate new functions, to reduce production costs, to save energy, to cut material costs, to redefine and eliminate "waste", to heighten existing product categories, to define new product categories and industries, to drive revenue and to build unique brands.