

Learning from Nature: Biomimetic Adhesives

Ille C. Gebeshuber^{1,2,3} and Burhanuddin Yeop Majlis¹

¹ Universiti Kebangsaan Malaysia, Malaysia

² Institut für Allgemeine Physik, TU BIONIK & AC²T research GmbH, Austria

We live in interesting times. Biology has changed from being very descriptive to a science that can be acknowledged and understood (in terms of concepts) by researchers coming from “hard sciences” such as chemistry, physics, mathematics and engineering. The “hard sciences” rely on experimental, empirical, quantifiable data or the scientific method, and focus on accuracy and objectivity. The amount of causal laws in the new biology (indicated by the ratio of causal versus descriptive knowledge) is steadily growing and a new field that can be called “Biological Physics” is emerging. The languages of the various fields of science increasingly get compatible, and the amount of collaborations and joint research projects between researchers coming from the “hard sciences” and biologists have increased tremendously over the last years.

Biomimetics, i.e., technology transfer from biology to engineering, is especially promising concerning adhesives. Biomimetics is a growing field that has the potential to drive major technical advances. It might substantially support successful mastering of current challenges in adhesive science and development.

A novel way to describe the complexity of biological and engineering approaches concerning adhesives depending on the number of different materials in the system “adhesives and parts that are to be ‘glued’ together” is proposed: Either many materials are used (*material* dominates) or few materials (*form* dominates) or just one material (*structure* dominates). The complexity of the approach (in biology as well as in adhesive technology) increases with decreasing number of materials in the system (see Figure). Examples from biogenic as well as man-made adhesives (comprising wet and dry adhesives, switchable functional adhesives and self-healing adhesives) will be presented to illustrate the proposed description.

