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Nature has often provided inspiration for man in the design and manufacture of materials with superior properties. Many biological structures, materials and organisms display fascinating physical and mechanical properties that up to now have been hard to replicate in artificial materials. An example of this is in the field of adhesion: organisms from fungi to insects, or to larger vertebrates, exploit complex mechanical or chemical strategies to optimize the way they "stick" to and detach from a surface, with advantages compared to common artificial materials. These biological adhesives are able to function both in dry and wet conditions, in wider temperature ranges, or on different substrates. The objective of this Special Issue is thus to focus on fundamental aspects of bioadhesion, on the experimental characterization of natural and bioinspired adhesives, on the evaluation of relevant chemical and environmental effects, mechanical properties, and the design and manufacturing of bioinspired adhesives, including innovative designs.

One of the most important issues related to biological adhesion is the production of nontoxic antifouling treatments for surfaces, to reduce the attachment of organisms that can lead to corrosion and material deterioration, or to reduce bacterial colonization in biomedical devices. Two such antifouling polymer brushes are proposed by Lopez-Mila B, Alves in [1] to reduce the adhesion of *E. coli*, in particular in the presence of shear strain, such as that deriving from the flow of biological fluids. The observed insensitivity to these strains and resistance to adsorption of macromolecules make these treatments attractive for the reduction of biofilm formation and cell attachment in biomedical devices. Another application related to biological adhesion is presented by Roque et al. in [2], where polymeric nanoparticles based on polylactic acid and polylactic-co-glycolic acid are adopted as mucoadhesive systems to encapsulate treatments for oral fungal infections and deliver them more efficiently. In [3], Combie et al. provide a comprehensive review of the properties and potential applications of the bioadhesive Levanol, which combines strong adhesion with low viscosity and biocompatibility, and is therefore an attractive solution in fields ranging from bioresorbable electronics to tissue engineering. Turning to biological examples, Langowski et al. [4] analyze the attachment performance of tree frogs, discussing the role of mechanical interlocking between toe pad structures and surface asperities on substrates of varying roughness, and highlighting their biomimetic potential. Similarly, Greco et al. [5] theoretically discuss the influence of hierarchical structure, i.e. the presence of hairs, on the adhesive properties of octopus suction cups, showing how enhanced performance can be achieved with one or two hierarchical levels. Instead, Beňová-Liszeková et al. [6] study the fine structure of salivary glue secretion, a particular extracellular composite glue matrix, hypothesizing that the inner infrastructure of the solidified glue is responsible for its high adhesive strength, and highlighting possible biomimetic characteristics, such as high hydration capacity, speed in dying up, protein composition and spongious infrastructure. Finally, a more theoretical work is provided by Ciavarella et al. [7], who use fracture mechanics concepts to describe sliding adhesive contact, suggesting alternative formulations to existing ones to better capture experimental data.

These contributions include work deriving from research activities in the COST Action CA15216 "European Network Bio-Adhesion Expertise - ENBA", and also includes other related invited contributions. It aims to provide further insight into the possibilities open to researchers to design and fabricate bioinspired adhesives with improved performance, bridging some of the gaps remaining in their fundamental understanding and providing indications on how to optimize their desirable characteristics.

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