UNIVERSITÀ DEGLI STUDI DI TRENTO

CIBIO Centre for Integrative Biology

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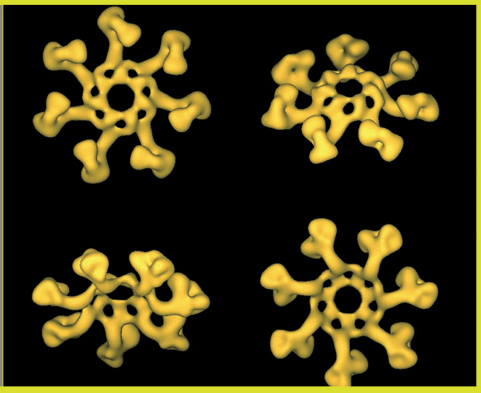

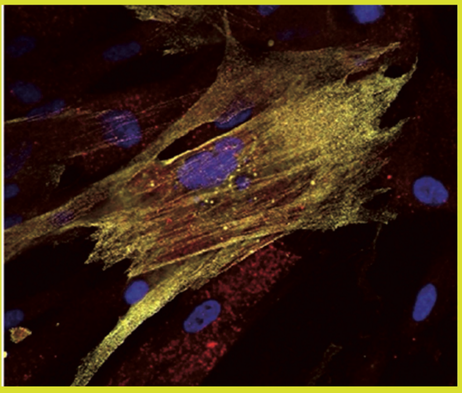

SEMINAR

March, 24th
2.00 p.m Room B103

Povo 2
via Sommarive, 9
Povo, Trento

Extreme Mechanics in Nature

Nanomaterials like carbon nanotubes (CNTs) or graphene have been shown to exhibit outstanding mechanical properties. Unfortunately, transferring their superior characteristics from the nanoscale to macroscale, e.g., through their integration in polymeric or inorganic matrices, is a challenging task. Current graphene- or CNT-based nanocomposites display characteristic strength and toughness values more than 10 times below the best biological structural materials. Moreover, current engineering materials are in general neither multifunctional, nor self-healing, nor self-cleaning, nor do they display stiffening or tunability in constitutive properties. All of these features however are defining properties of natural biological composites, such as spider silk, limpet teeth, beetle armours, gecko toes, or lotus leaves, to cite only few examples. Thus, bioinspired approaches can be pursued to mimic natural (usually hierarchical) materials and design novel synthetic ones with superior mechanical properties, artificially emulating the way Nature fabricates materials. Here, we will review some of the most promising results obtained in the course of our ERC Starting Grant on “Bioinspired Hierarchical Super Nanomaterials” and the related ERC Proof of Concepts, involving strength/toughness optimization, smart adhesion, super-hydrophobicity, reduced/increased friction, impact, vibration control, buckling, etc. We will also discuss emerging perspectives for future work, including the possibility of producing so-called “Bionic composites” obtained through direct/natural mixing of carbon-based nanoscopic reinforcements into natural materials (e.g. spider or silkworm silk, yeast films, etc.), taking advantage of optimized natural mechanisms (e.g. spider or silkworm spinning, fermentation, etc.). Thus since extreme Mechanics is emerging in Biology, Mechanics is fundamental to better understand even Biology.

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