**Bio-inspired nanomechanics**
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The Italian artist, inventor and scientist Leonardo da Vinci (1452–1519) can probably be considered the father of bio-inspired design, as illustrated by his artificial wings and flying machines, based on bird observation and dissection. Five centuries from his death, bioinspiration is attracting widespread attention worldwide, both in academia and industry.

This lecture provides an overview of my group's research activity at the University of Trento on bio-inspired nanomechanics, including nano (i) and bio-inspired materials (ii), as well as their natural evolution towards what we have defined as "bionicomposites" (iii).

Research on nanomaterials (i) has focused on models and experiments to provide reliable predictions for the mechanical properties of carbon nanotubes, graphene as well as related bundles, composites and porous materials such as aerographite. I will discuss graphene and aerographite and the role of defects using the theory of quantized fracture mechanics.

As examples of bio-inspired materials (ii) I will present new ideas on toughening mechanisms involving friction and adhesion such as in the toughest artificial fibres, inspired by spider silk and webs, capable of dissipating more than 1000J/g using a simple "trick" and a new fundamental bone toughening mechanism (as yet unpublished).

On the topic of bionicomposites (iii) I will discuss the case of "silkene", the bionic silk directly spun by spiders that we have obtained after feeding them with carbon nanotubes and graphene. The concept has since been verified also in silkworms and other living organisms.

The inspiration of this work comes not only from Nature (and da Vinci), but also from seminal papers published by estimated colleagues of our community, starting from A.A. Griffith, who 100 years ago (September 1920, in London) first orally presented his fundamental work, thus providing an ideal fil rouge for this talk.