4th International Symposium on
Energy Challenges & Mechanics
- working on small scales

11-13 August 2015
Aberdeen, Scotland, UK

New inspirations from nature: Picotechnology

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Accepted for publication on 13th February 2015

The inspiration for the use of nanotechnology across all scientific disciplines comes from nature, which enables the production of materials with unique features. Biological systems clearly work at the nanoscale from cellular interactions to intracellular events. First, biomolecules, proteins, nucleic acids, lipids and carbohydrates are all examples of materials that possess unique properties determined by their size, folding and patterns at the nanoscale. Specifically, bone and teeth are composed of numerous nanostructures, such as collagen and hydroxyapatite, which provide a unique nanostructure for strength, bioactivity, and numerous other attractive properties for bodily function. Until now, numerous techniques have been utilized in order to mimic the natural features of bone to create a variety of nanotopographical features on implant surfaces. Specifically, techniques like lithography, anodization, and electrospinning have all been used to design nanospheres, nanotubes, or nanofibers. Following their creation, different types of proteins like fibronectin, vitronectin, and laminin adsorb in greater amounts on these nanosurfaces to efficiently regenerate bone. Although the nanoscale nature of biological molecules has been paramount for these applications, various ions such as several metallic ions (calcium phosphate, iron oxide, magnesium, etc.) are known to act with high reactivity when their concentration in solution is decreased towards picomoles, which results in their crucial role in the function of numerous biological events proteins. Small concentrations of ions at the picomolar level can effect molecular conformation of proteins and thermodynamic events as well as energy activation by increasing enthalpy and entropy. However, the picomolar range needs high technical development to realize its advantages in medicine, such as in the use of pico-biochips. Therefore, new trends at the cutting edge of science should be focus on the understanding of different features of biological nano as well as pico devices such as proteins, peptides, DNA or other biomolecules at the picolevel to integrate them into advanced medical technology. This talk will summarize some of the more exciting advances in picotechnology in medicine, an emerging field called picomedicine.

Keywords: Picotechnology, biomolecules, nanotechnology, nature