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Andrea Desii

Dipartimento di Ingegneria Meccanica e Aerospaziale, Politecnico di Torino, Torino
Smart Bio-Interfaces, Istituto Italiano di Tecnologia, Pontedera (PI)

Hybrid Nanostructured Materials for Advanced Biomedical Applications

Abstract

Nanotechnology has enabled unprecedented control of the interactions between materials and biological entities, from the microscale down to the molecular level. For example, nanosurfaces and nanostructures have been used to mimic or interact with biological microenvironments, to support specific biological functions such as cell adhesion, mobility and differentiation, as well as tissue healing.

Recently, a new paradigm has been proposed for nanomedicine to exploit the intrinsic properties of nanomaterials as active devices rather than as passive structural units or carriers for medications. In this view, the nanomaterial itself is the active device that responds to external stimuli by modifying its intrinsic chemical and/or physical characteristics, so as to provide useful bio-stimulation and/or bio-signaling.¹

Our research approach falls into this latter, “active” category: we develop “smart” nanomaterials that change their structural/functional properties in response to specific external stimuli (electric or magnetic fields, electromagnetic radiation, ultrasound, etc.). Specifically, we develop multifunctional nanostructured materials that are pharmacologically active and that can be actuated by virtue of their magnetic, dielectric, optically active, or piezoelectric properties.²

More in details, in this talk I will approach applications of smart nanomaterials such as piezoelectric nanotransducers³, nanotechnological antioxidants⁴, and hybrid lipid/magnetic nanovectors for advanced theranostic applications⁵.

This presentation will summarize our main results to date, and highlights the most promising examples that could have a practical translation into the clinical or technological realms.

- [1] Genchi G.G., [...], Ciofani G. *Frontiers in Bioengineering and Biotechnology*, 5: 80 (2017)
- [2] Genchi G.G., [...], Ciofani G. *Advanced Healthcare Materials*, 6(9): 1700002 (2017)
- [3] Marino A., [...], Ciofani G. *Nano Today*, 14: 9-12 (2017)
- [4] Tapeinos C., [...], Ciofani G. *ACS Omega*, 3(8): 8952-8962 (2018)
- [5] Tapeinos C., [...], Ciofani G. *Nanoscale*, 11: 72-88 (2019)