

The Importance of Nanotechnology in Biomedical Sciences

Bouزيد Menaa

R&D Senior Research Scientist, Principal Investigator in Nanobiotechnology, Fluorotronics, Inc., 2453 Cades Way, Vista, CA 92081, USA

Patients today are seeking better health care, while healthcare providers and insurance companies are calling for cost-effective diagnosis and treatments. The biomedical industry thus faces the challenge of developing devices and materials that offer benefits to both patients and the healthcare industry. The combination of biology and nanotechnology, is expected to revolutionize biomedical research by exploiting novel phenomena and properties (physical chemical and biological) of material present at nanometer length (10^{-9} m) scale and systems through control of matter on the nm scale and the direct application of nanomaterials to biological targets.

Today, nanomaterials have been designed for a variety of biomedical and biotechnological applications, including biosensors, enzyme encapsulation; neuronal nanotechnology is based on the introduction of novel nano-materials which can result in revolutionary new structures and devices using extremely biological sophisticated tools to precisely position molecules.

Carbon nanotubes (CNT) and functionalized fullerenes Bucky balls with bio-recognition properties provide tools at a scale, which offers a tremendous opportunity to study biochemical processes and to manipulate living cells at the single molecule level.

Many nanomaterials have novel chemical and biological properties and most of them are not naturally occurring. Carbon nanotubes have won enormous popularity in nanotechnology for their unique properties and applications. CNTs have highly desirable physicochemical properties for use in commercial, environmental and medical sectors. Inclusion of CNTs to improve the quality and performance of many widely used products, as well as potentially in medicine, will dramatically affect occupational and public exposure to CNT-based bio-nanomaterials in the near future. Even since the discovery of carbon nanotubes, researchers have been exploring their potential in bio ap-

plications. One focal point has been the production of nanoscale biosensors and drug delivery systems based on carbon nanotubes, which has been driven by evidence that biological species such as proteins and enzymes can be immobilized either in the hollow cavity or on the surface of carbon nanotubes.

Nanoparticles or nanoporous particles functionalized with organic groups can be used as biomarkers, tracer, and drug delivery systems with even all-in-one functionalities for the treatment of cancer [1]. Tumor cells can be imaged in-vivo or in-vitro by magnetic resonance imaging (MRI) using nanoparticles as contrasting agents. Many other supports such as of nanoporous sol-gel glasses [2] bioencapsulated with proteins can be used to mimic and to study folding/unfolding process *in-vitro* but also to trace and detect the interactions of encapsulated nanoparticles employed as biomarkers. This is a challenging task that we are trying to overcome with fluorinated nanoparticles at fluorotronics with the development and utilization of the new patented and emerging technique known as Carbon-Fluorine Spectroscopy [3].

Therefore, there is then an important issue of using nanotechnology to find new therapeutics but also as a way for theranostics and nanomedicine.

References

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***Corresponding author:** Dr. Bouزيد Menaa, R&D Senior Research Scientist, Principal Investigator in Nanobiotechnology, Fluorotronics, Inc., 2453 Cades Way, Vista, CA 92081, USA E-mail: bouزيد.menaa@gmail.com

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