Bioengineered inorganic nanomaterials for healthcare applications

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Abstract: Nanomedicine is an innovative research field combining nanotechnology and medicine, radically changing the healthcare treatments. The application of nanotechnology in medicine is expected to make the therapy more efficient and painless, enhancing the bioavailability of drug molecules, improving the tumor targeting ability, and reducing the systemic drug toxicity. An emerging field of nanomedicine is the nanotheranostics, combining therapeutic and diagnostic functionalities into a single nanoplatform. Nanoparticles (NPs) are the most important components in theranostics. Gold NPs have been demonstrated both as effective contrast agents in photoacoustic imaging and therapeutic agents in hyperthermia treatments; paramagnetic iron oxide NPs as contrast agents in magnetic resonance imaging (MRI) and drug delivery systems; light-emitting semiconductor NPs (*i.e.*, quantum dots) as fluorescent probes in fluorescence imaging.
We focus on porous silicon-based NPs and their biomedical applications. In particular, the use of synthetic fluorescent porous silicon NPs, functionalized in order to make them more chemically stable in aqueous-based solution, is investigated for bioimaging in both *in vitro* and *in vivo* systems [1, 2]. Porous biosilica NPs obtained by diatomite are also explored as nanovectors for drug delivery purposes; several functionalization strategies are investigated to make the nanovectors more stable and biocompatible [3, 4].
The use of porous silicon nanostructures for the fabrication of optical biosensors characterized by high sensitivity and selectivity is also explored for the detection of several biomolecules (*e.g.*, DNA, RNA, proteins, antibodies) [5].

References

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