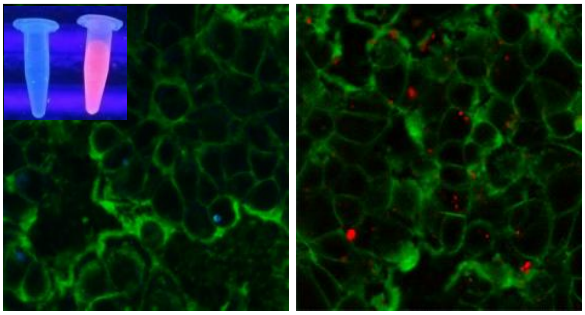
Porous silicon: a biodegradable semiconductor for nanomedecine

Frederique Cunin (Institut Charles Gerhardt Montpellier-CNRS, France)

The choice and interest of nanotechnologies is now well established for applications in nanomedecine and for the development of targeted and personalized therapies. Besides the interest in the possibility to miniaturize the therapeutic or diagnostic tools, nanomaterials exhibit chemical, physical and textural properties interesting for the encapsulation, the targeting and the controlled release of active molecules, as well as for cell labeling and medical imaging. Despite the rapid growth and development of the field of functional nanostructured materials, the current main reason to the limited clinical progress of nanotherapeutics is the potential toxicity of the materials or their degradation byproducts, and their unknown fate once administered. Porous silicon (pSi) nanostructures are fully biodegradable, and nontoxic *in vivo*[1]. The primary biodegradation product of pSi is orthosilicic acid, which is the bioavailable form of silicon. PSi is easily prepared by electrochemical etching of crystalline silicon, it displays tunable textural properties (surface area, pore diameter, etc). Chemical modification provides a means to adjust the degradation rate of pSi, as well as to load drugs or molecules of interest. PSi has an interesting osteoconductive potential and is especially favorable for osteoblast adhesion, growth and mineralization[2]. Due to their electronic semiconductor-derived properties, pSi nanostructures exhibit intrinsic photoluminescence amenable for imaging. Moreover, they can be excited by near infrared (NIR) two photon excitation light[1,3] offering possibilities for phototherapies, and for light triggered and targeted treatment, based on tissue-penetrable NIR light response.

The development of photoactive pSi nanostructures functionalized with organic ligands for applications in imaging, drug delivery and photo-activated therapies, as well as for bone tissue engineering will be presented[4-9].



Functionalized luminescent pSi nanoparticles in cells

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