Silicon and organo-silica porous materials for biomolecules delivery

Luisa De Cola,[a,b] Alessandro Ajó,[a] Alessia Lucrezia Fenaroli,[b] Michael J. Sailor,[c]

[a]*Università degli Studi di Milano, Italy*
[b]*Istituto di Ricerche Farmacologiche Mario Negri, Italy*
[c]*University of California San Diego, USA*

Delivering nucleic acids and biomolecules for therapeutic purposes remains a great challenge because of their low cell uptake, instability in blood, difficulties in crossing body barriers.[1]

Porous silicon nanostructures have been recently explored for such use and their *in vivo* applications have shown their possible role as carriers also in view of their biocompatibility. The high porosity of these structures allows large amount of RNA entrapment and the structures prevent the degradation of the biomolecule and allow the specific drug release in a targeted area. However, due to the fast degradability of the silicon, a coating with a polymeric layer is necessary to increase its stability and control the time of release. In this contribution a strategy to load a high amount of RNA and, to avoid its early release, by the use of hyaluronic acid (HA) wrapped around the particles is reported. A comparison with coated and uncoated particles is made as well as the loading and biodistribution of such materials have been investigated.

In contrast with such high porous silicon materials we have also investigated silica nanoparticles incorporating synthetic nucleic acids and analogs as constitutive components of the organosilica structures. We prepared different nanomaterials containing single-stranded nucleic acids that are covalently embedded in the silica network, that respond to various biological, physical, and chemical inputs through detectable physicochemical changes.[2] Also supramolecular organo-silica systems based on PNA- derivatives that can self-assemble through direct base paring or can be joined through a bridging functional nucleic acid, such as the ATP-binding aptamer are reported.

References

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