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SESSION: Advanced in materials for nanobiotechnology

Hybrid nanoparticles and hydrogels for biomedical applications

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Advancements in the use of nanoparticles for biomedical applications have clearly shown their potential for the preparation of improved imaging and drug-delivery systems. However, only a few successfully translate into clinical practice, because, a common "barrier" preventing nanoparticles from delivering efficiently their payload to the target site after administration, is related to the nanoparticle uptake by macrophages. We have recently reported disulfide-bridged organosilica nanoparticles with cage-like morphology, and assessed in detail their bioaccumulation *in vivo*. [1] The fate of intravenously injected 20 nm nanocages was investigated in both healthy and tumor bearing mice. Interestingly, the nanoparticles exclusively co-localize with hepatic sinusoidal endothelial cells (LSECs), while avoiding Kupffer-cell uptake (less than 6%), in both physiological and pathological condition. Our findings suggest that organosilica nanocages hold the potential to be used as nanotools for LSECs modulation, potentially impacting key biological processes such as tumor cell extravasation and hepatic immunity to invading metastatic cells or a tolerogenic state in intrahepatic immune cells in autoimmune diseases.

Recently we have also shown that nanoparticles can be an interesting component for hybrid hydrogels. [2] We have shown that injectable nanocomposite hydrogel able to form *in situ* a tissue mimicking matrix as an innovative material can be employed for the treatment of esophageal fistulas. [3]

The hydrogel is based on hyaluronic acid (HA), the cross-linking process occurs at physiological conditions leading to a hydrogel made of >96% by water and with a large-pore microarchitecture. The material, easily injectable with an endoscopic needle, is formed in a time compatible with the surgical procedure and has final mechanical properties suitable for cell proliferation. The *in vivo* experiments (porcine model) on esophageal-cutaneous fistulas, showed improved healing in the animals treated with the hydrogel compared with the control group.

References

[1] P. Picchetti et al. *ACS Nano* **2021** ASAP, DOI: 10.1021/acsnano.1c00316
[2] G.Alonci et al. *ACS Appl. Bio Mater.*, **2018**, 1, 1301.
[3] E. Piantanida et al. *Materials Today Bio*, **2021**, *10*, 100109.