

EXCELENTNÍ VÝZKUM

OP VVV

**HY**bridní materiály pro  
**HI**erarchické struktury

## INVITATION TO LECTURE

# *Hybrid materials for biomedical applications*



**When:** 20.05.2022, 10:45 – 12:00

**Where:** TUL, building G, hall G312

**Lector:** *prof. Luísa De Cola*

*University of Milano, Department DISFARM, Milan Italy*

*Istituto di Ricerche Farmacologiche Mario Negri, IRCCS, Milano, Italy*

*Institute of Nanotechnology, Karlsruhe Institute of Technology (KIT), Germany*

*Prof. De Cola is recipient of several awards, among which the ERC advanced grant (2010), IUPAC award as one of the Distinguished Women in Chemistry and Chemical Engineering (2011). She was elected as member of the Academia Europaea in 2012 and in 2014 member of the German National Academy of Sciences Leopoldina. In 2014 she has been Nominated “Chevalier de la Légion d' Honneur” by the President of the French Republic, François Hollande. In 2015 she received the International Prize for Chemistry “L. Tartufari” from Accademia dei Lincei and the Catalan -Sabatier prize from the Spanish Royal Academy of Science. In 2016 she was elected member of the Akademie der Wissenschaften un der Literatur of Mainz.*



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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. 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.*

*In addition they are able to stabilize out of equilibrium species and transport them inside cells where they can be released and evolve towards the equilibrium state.*

*We have also shown that nanoparticles can be used to entrap proteins and enzymes and in the talk we will illustrate their use in the transport of e-GFP (green fluorescent protein) through human barriers such as the epi-intestinal barrier and their internalization in the Caco2 cell line.*

*Finally we wish to attract the attention to the combination of nanoparticles with injectable hydrogels that can be used for tumor resection or tissue regeneration. As last case, injectable nanocomposite hydrogel able to form in situ a tissue are an innovative material that can be employed for the treatment of esophageal fistulas.*

*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.*



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