The nano-bio interface imparts emerging properties to biomimetic nanoparticles

Ennio Tasciotti

Full Professor, San Raffaele University, Rome
Director Human Longevity Program, IRCCS San Raffaele, Rome

ennio.tasciotti@sanraffaele.it

The last decade has seen an escalation in the use of biomimetic principles for the design and synthesis of nanoparticles. The reason of this rising interest is that by leveraging on the replication, imitation or mimicking of biological structures it is possible to enhance the targeting and biodistribution of nanoparticles. The use of cell-derived building blocks to match the composition of naturally occurring entities allows to improve the biocompatibility, inherent bioactivity, and the remarkable emerging features that characterize biomimetic nanoparticles.

Most of these features are due to the favorable nano-bio interface that governs the interaction of all synthetic systems with the biology of the body. In particular, these versatile biomimetic nanoparticles can avoid, negotiate or overcome many of the biological barriers that are responsible for the reduced and the accumulation of a therapeutic or diagnostic payload at the target site. Modulating the surface properties of synthetic nanoparticles allows to control their interactions with the proteins and cells that they encounter once administered in the body.

The current challenge is to create biomimetic delivery systems that combine the intrinsic hallmarks of biological membranes with the delivery capabilities of established nano-therapeutic carriers. By tuning nanoparticles size, shape, and surface modification it is possible to develop nanocarriers endowed with biological identities that display improved circulation time, selective targeting, and controlled drug delivery. By focusing on the nano-bio interface and the intra- and inter-cellular trafficking we will define nanoparticles' behavior *in vivo* in different pathological scenarios and we will discuss on the optimization of biomimetic nanoparticles according to the different routes of administration.

Key words: *Biomimicry, nano-bio interface, targeted delivery, trafficking, administration route*