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I SEMINARI DEL DIPARTIMENTO DI MEDICINA MOLECOLARE E TRASLAZIONALE

DOTTORATO IN SCIENZE BIOMEDICHE E MEDICINA TRASLAZIONALE

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Understanding the nanomaterial interaction with biomolecules, a journey from safety to applications in medicine

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Aula B Facoltà di Medicina

Tutti gli interessati sono invitati a partecipare

Abstract

Nanotechnology is one of the primary drivers of technology innovation, and it is one of the leading pillars of the six Key Enabling Technologies of H2020. Among the different application scopes of nanotechnology, its use in medicine has attracted considerable attention for its potential advances in healthcare, personalised medicine and to tackle complex issues such as the targeted and programmed delivery of drugs.

Because of their small size, nanoparticles (NPs) can directly interact with biomolecules in an entirely different way and their behaviour in biology is still not fully understood. Once in biological fluids, NPs rapidly interact with biomolecules from the environment that firmly and rapidly adsorb to the NP surface forming the long-lived biomolecular corona. [1,2] The biomolecular corona gives a new identity to NP in the biological milieu as it has been shown to interact with cellular receptors directly and can affect the journey as it travels through the body. [3,4]

It is now clear that these interactions lead to a dramatic surface changes and a new identity of the NP in biological fluid and the corona can induce unpredictable immunological responses and can hamper their therapeutic efficacy.

The protein corona is derived from proteins in biological fluids, many of which are glycosylated. We have now shown that the biomolecular corona has a strong glycosylation component that is biologically active, and this class of biomolecules plays a dramatic role in the NP colloidal stability and firmly controls the NP biological fate and, if controlled, can offer new opportunities in nanomedicine [5]

[1] Monopoli MP, Aberg C, Salvati A, Dawson KA. Biomolecular coronas provide the biological identity of nanosized materials. Nature Nanotechnology. 2012;7:779-86

[2] Nel AE, Madler L, Velegol D, Understanding biophysicochemical interactions at the nano–bio interface *et al* Nature Materials, 2009, 8, 543-557.

[3] Salvati A, Pitek AS, Monopoli MP, Prapainop K, Bombelli FB, Hristov DR, Mahon E, Dawson KD. Transferrin-functionalized nanoparticles lose their targeting capabilities when a biomolecule corona adsorbs on the surface. Nat Nanotechnol. 2013;8:137-43.

[4] Maiolo D, Bergese P, Mahon E, Dawson KA, Monopoli MP. Surfactant Titration of the Nanoparticle-Protein Corona. Analytical Chemistry. 2014; 86, 12055–12063

[5] Wan S, Kelly PM, Mahon E, Stockmann H, Rudd P, Caruso F, Dawson KA, Yan Y, Monopoli MP*. The "Sweet" Side of the Protein Corona: Effects of Glycosylation on Nanoparticle-Cell Interactions. ACS Nano. 2015