Translocation and Biological Fate of Protein corona: A dynamic study

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Abstract

When nanomaterials are exposed to biological fluids, their surface is spontaneously covered by biomolecules. .[1,2] In blood and cell media this coating is formed mainly by proteins and has been called protein corona (PC) . Electrostatic interactions, hydrogen bonding as well as hydrophobic interactions between the nanomaterial and proteins play a role on corona formation,.[4–6] . Proteins tightly bound to the nanomaterial surface are known as the hard corona, while those weekly bound, which are easily exchangeable with other proteins in the media, form the so-called soft corona .[2-3]

Protein corona brings a biological identity to the nanomaterials, influencing on the interaction of the nanomaterials with cells, on cell trafficking and in toxicological endpoints of nanomaterials.[3-4] Composition of corona in biological fluids changes with time, depending on protein abundance and their affinity for the nanomaterial. Protein corona will as well change during circulation and translocation in different organs, being the corona exposed to different tissue environments and to free circulating proteins that could be exchanged with the proteins in the PC. Intracellular trafficking can also lead to changes in the corona composition as the proteins of the corona can be exchanged by proteins present in the cell.

In this presentation we will address issues related to the dynamics and fate of protein corona during translocation and circulation, and in presence of other biomolecules. In vitro by means of fluorescence correlation spectroscopy (FCS) and fluorescence cross correlation spectroscopy (FCCS) we will show how surface chemistry of nanoparticles affects PC formation and correlates with the aggregation of nanoparticles intracellularly.[4] We will also show that the affinity of proteins for the nanoparticle surface will impact on the stability of the corona after intracellular translocation.[5] We will show as well the corona can interact with lectins and that this interaction will depend on the glycosylation of the proteins on the corona.[2]

In vivo, we will use radiolabelling and positron emission tomography (PET) to study the fate of protein corona. We will form a hard and a soft radiolabelled corona on nanoparticles and administrate the nanoparticles with the radiolabelled corona intravenously. In this way, we will simulate the corona formed on the nanoparticles when are first exposed to blood. We will demonstrate that the soft corona is easily exchanged and follows a pattern of biodistribution similar to free injected albumin while the hard corona to large extend follows the pattern of distribution of the nanoparticles, meaning that it is retained on nanoparticle surface.[6]

References

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Figures

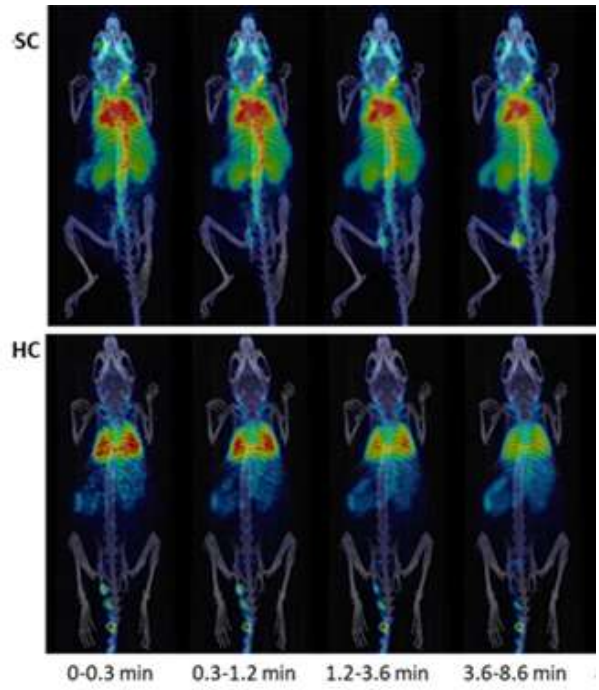

Figure 1. Representative PET images (coronal views, maximum intensity projection) obtained after intravenous administration of PEI-stabilized PLGA NPs with soft corona (mtop; injected amount of radioactivity: 2.0 ± 0.37 MBq), and PEI-stabilized PLGA NPs with hard corona (bottom; injected amount of radioactivity: 3.8 ± 0.06 MBq). PET images were co-registered with computerized tomography (CT) images for anatomical localization of the radioactivity.