PROTEIN CORONA FOR PROTEOME FINGERPRINTING

VIANELLO Fabio, MAGRO Massimiliano, BARATELLA Davide, BONAIUTO Emanuela, COZZA Giorgio, MIOTTO Giovanni, ZBORIL Radek

University of Padova, Padua, Padua, Italy, EU
Palacky University of Olomouc, Regional Centre of Advanced Technologies and Materials, Olomouc, Czech Republic, EU

Abstract

Proteome modifications in a biological system can potentially mirror the occurrence of pathologies, even if the individuation of the proteome fingerprint correlated to a specific disease represents a very complex task. When a nanomaterial is introduced in a biological fluid, protein compete for the formation of a protein corona on the nanoparticle surface, thus, depending on the specific proteome, different patterns of proteins will form the final protein corona shell, depending on their affinity for the nanoparticle surface. Novel surface active maghemite nanoparticles (SAMNs) display a remarkable selectivity toward protein corona formation, thus they are able to concentrate proteins and peptides presenting high affinity for their surface even if present in very low amount. Among 3000 proteins present in fetal calf serum, SAMNs lead to the formation of a self-assembled corona shell with 22 selected proteins, representing minor plasma proteins, conversely bovine serum albumin (BSA), representing 80% of the total serum proteins, shows negligible absorption. Moreover, SAMNs were introduced in milk samples from healthy cows and from animals affected by mastitis, and the selectively bound protein corona shell was easily analyzed and quantified by gel electrophoresis and characterized by mass spectrometry. Upon incubation in mastitic milk, SAMNs were able to selectively bind αs2-casein fragments containing the FALPQYLK sequence, which were not present in healthy samples. The present report proposes protein competition for SAMN protein corona formation as a mean for mirroring proteome modifications, thus the selected protein shell on nanoparticles can result in a fingerprint of a specific pathology.

Keywords: Magnetic nanoparticles, protein corona, biomarker, mass spectrometry

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