Scientific recognition for Dr. Abbas Montazeri Hedesh

A paper by Dr. Abbas Montazeri Hedesh with his collaborations entitled “Disease-related metabolites affect protein–nanoparticle interactions” has been accepted for publication in the Nanoscale journal (IF=7.367). The School of Nano Science congratulates this achievement to Dr. Montazeri, our part-time associate, and his colleagues.

Description:

Despite the advances in nanoparticle (NP) development for nanomedicine and numerous publications in the field, few NPs have made it to clinical trials, and even fewer have reached clinical practice; virtually none have made a marked improvement in patient survival. The wide gap between bench discoveries and their effective clinical translation is, at least in part, due to the existence of multiple “overlooked factors” in the *in vitro* environments, poor understanding of the nanobio interface and misinterpretation of the data collected *in vitro*. Recently, extensive studies have been performed to diminish the gap between bench discoveries and clinical application of NPs by introducing overlooked factors at the nanobio interfaces. Such efforts aim at achieving a more in-depth understanding of the biological identity of NPs (e.g., protein corona) and modifying available cytotoxicity assays for NPs.

In this paper, they introduced “metabolomes” as another overlooked factor at the nanobio interface that can significantly affect the biological identity of NPs and may influence their biological fates. As different diseases have distinct metabolomic profiles and metabolites can interact with proteins, it is legitimate to hypothesize that metabolomic profiles in plasma may have the capacity to drive the formation of a personalized protein corona. To test this hypothesis, they employed a multi-scale approach composed of coarse-grained (CG) and all atom (AA) molecular dynamics (MD) simulations to probe the role of glucose and cholesterol (model metabolites in diabetes and hypercholesterolemia patients) in the interaction of fibrinogen protein and polystyrene NPs. Their results revealed that glucose and cholesterol had the capacity to induce substantial changes in the binding site of fibrinogen to the surface of NPs. More specifically, the simulation results demonstrated that increasing the metabolite amount could change the profiles of fibrinogen adsorption and replacement, what is known as the Vroman effect, on the NP surface. In addition, they also found that metabolites can substantially determine the immune triggering potency of the fibrinogen–NP complex. Their proof-of-concept outcomes further emphasize the need for the development of patient-specific NPs in a disease type-specific manner for high yielding and safe clinical applications.

- **M. Tavakol , A. Montazeri, R. Naghdabadi, M. J. Hajipour, S. Zanganeh, G. Caracciolo, M. Mahmoudi, "Disease-related metabolites affect protein-nanoparticle interactions", Nanoscale, 10 (2018) 7108-7115.**