

## A Scattering Approach to Understanding Protein-Nanoparticle Interactions within Ionic Liquids and Deep Eutectic Solvents

Zachary P.J. Candiloro<sup>a\*</sup>, Qi Han<sup>a</sup>, Andrew J. Christofferson<sup>a</sup>, Calum J. Drummond<sup>a</sup>, Tamar L. Greaves<sup>a</sup>,

<sup>a</sup>RMIT University, Melbourne, Australia

\*s3785198@student.rmit.edu.au

Nanoparticles have garnered attention in recent decades as strong candidates for drug delivery of many different medicines. While nanoparticle-based medicines have great customizability in their size, structure and functionality, many face limitations upon entering the human body. Protein corona are one such limitation, being a dynamic, multi-layered shell-like structure which can have profound effects on the stability, distribution, uptake, and efficacy of intravenous drug delivery, due to human serum proteins readily forming corona within biological fluids. However, the protein corona formation process is still not fully understood.<sup>1,2</sup>

In this study, we aim to use small angle X-ray scattering (SAXS) to present a comprehensive analysis of protein corona formation, including bovine serum albumin, human serum albumin and human serum, on four different nanomaterials: solid silica, mesoporous silica, graphene oxide and metal organic framework UiO-66. The effect of added ionic liquids (ILs) and deep eutectic solvents (DESs), which readily interact with nanoparticles and proteins, will be explored. With a focus on IL and DES impact on the formation of a protein corona, to decode interactions between solvents, proteins, and nanoparticles. This builds upon our previous work where we have utilised SAXS to observe protein-nanoparticle complexes in solution with silica and amine-functionalised silica nanospheres<sup>3</sup>. The ILs to be investigated possess ammonium and cholinium cations and DESs including glycerol and ethylene glycol as hydrogen bond donors.

### References

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Zachary is a second year PhD student at RMIT under the supervision of Tamar Greaves, Qi Han, Andrew Christofferson and Calum Drummond. He has an undergraduate background in nanotechnology and physics, and has since focussed primarily on small-angle x-ray scattering. He has been involved in two publications which studied protein corona complexes with scattering techniques and protein crystallisation in alginate-ionic liquid hydrogels. His other previous projects have focussed on ionic liquid solvation layers on nanoparticles as well as corrosion and electrochemistry.