

Unravelling self-assembly of hemoglobin in a lipid environment

Wednesday, 18 October 2023 15:30 (20 minutes)

Understanding the intricate behavior of membrane proteins, their dynamics, insertion mechanisms, and investigating their adaptation to the lipid environment have been a popular field of study. Besides membranous proteins, deciphering the interaction between water-soluble, non-membranous proteins with lipids is equally important for fundamental biophysical investigations and potential applications in therapeutics and synthetic biology. Our current investigation primarily focuses on delving the nature of a non-membranous protein hemoglobin in a lipid environment after insertion. The investigation of hemoglobin within a lipid environment holds significant scientific merit, particularly in the field of lipid-protein interactions and can provide a deeper insight of its pathological effects of cell-free hemoglobin on surrounding cells in medical conditions such as hemolysis or also as an artificial oxygen carrier. In this study, we first reconstituted hemoglobin in 1-palmitoyl-2-oleoyl-sn-glycero-3-phosphocholine (POPC) liposomes via detergent mediated method using n-octyl- β -d-glucoside (NOG) [1] and then prepared supported lipid bilayer on a glass substrate. Microscopic studies revealed that the protein could be visualized without any external labelling agents on the lipid bed. It was interesting to note that these water-soluble protein molecules assembled themselves to form supramolecular structures to encounter the high hydrophobic stress. UV-Vis, Fluorescence and Circular Dichroism (CD) measurement indicated minor structural change to expose the hydrophobic regions of the protein to adjust the hydrophobic stress whilst Small Angle Neutron Scattering (SANS) results indicated that the hemoglobin molecules retained their overall tetrameric form in the system. The presence of a hydrophobic atmosphere induced such protein-protein self-assembly to adapt in the given environment. Collectively, these findings bear considerable scientific significance, particularly in the realm of protein-protein self-assembly, providing valuable insights into the dynamics of proteins within lipid environments [2].

Keywords: Lipid-protein interaction, Self-assembly, Supramolecular structures, Haemoglobin, Supported Lipid Bilayer

References:

1. Ghosh Moulick, R., Afanasenkau, D., Choi, S.E., Albers, J., Lange, W., Maybeck, V., Utesch, T. and Offenhausser, A., 2016. Reconstitution of fusion proteins in supported lipid bilayers

for the study of cell surface receptor–ligand interactions in cell–cell contact. *Langmuir*, 32(14), pp.3462-3469.

2. Kumari, A., Saha, D., Bhattacharya, J., Aswal, V.K. and Moulick, R.G., 2023.

Studying the structural organization of non-membranous protein hemoglobin in a lipid environment after reconstitution. *International Journal of Biological Macromolecules*, p.125212.

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Session Classification: Section 4