FROM BIOFACTORIES TO GENERAL ANAESTHESIA: USING NEUTRONS AS A PROBE FOR BIOLOGICAL CHALLENGES

R.D. Barker*

Large Scale Structures, Institute Laue-Langevin,
6 rue Jules Horowitz, Grenoble, 38042 France

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* *e-mail*: barker@ill.eu

A combination of neutron reflection and diffraction studies coupled with advances in lipid model membranes offer exciting new opportunities for probing new biological scientific boundaries. With reference to a number of recent examples, the use of neutrons to address biological challenges will be discussed. A brief outline of some topics covered follows:

General Anaesthesia - General anaesthetics (GAs) are widely used in medicine, however, the structural interaction of GAs with the membrane and the mechanism by which reversal on application of pressure occurs is still poorly understood. A detailed structural study using neutron reflection from model floating lipid bilayers to identify both the position of GAs and the resultant effect on the membranes will be presented. When combined with a Langmuir trough, pressure reversal can also be studied for comparison with recent MD results.

Nanodiscs - Nanodiscs (NDs) are self-assembled $\sim$50 nm^2 patches of lipid bilayers stabilized by amphipathic belt proteins. We demonstrate that a well-ordered dense film of nanodiscs serves for non-destructive, label-free studies of isolated membrane proteins in a native like environment using neutron reflectometry. Particularly, these can be used to study the electron transfer pathways similar to those in plants, the first step towards building nano-biofactories, harnessing sunlight to synthesise drug targets.

Titanium Implants - Titanium is an ideal substrate for use in biomedical applications. It is strong, lightweight and, due to the protective coating of native oxide (titania), both non-toxic and resistant to corrosion under physiological conditions. However, little is known about the surface interactions of the metal with the body and eventual osteointegration of the implant. Using the techniques discussed, we present the first study of purely zwitterioinic supported lipid bilayers on model implant surfaces using neutron reflection.