Small angle x-ray scattering (SAXS) for vesicles characterization

Background
Lipid-based vesicles are widely used in various biomedical applications, in particular as the next generation nanoscopic biological drug carriers, as well as for fundamental biophysical research purposes, as mimics of the natural cell membrane and even as labels in, for example, diagnostic applications.

Problem Description
Based on their application, vesicles must be prepared in different ways to achieve the desired goals. Characteristics, such as composition, size, membrane phase and structure play crucial role for their desired function in biological applications. In spite of more than two decades of research in the field, there is no agreement in literature about how to prepare vesicles and how to store them for a certain application, as for example, for forming supported lipid bilayers, being one of the most commonly used cell membrane mimics, or adjuvants in vaccine formulations or drug carriers, being fields where the Biological Physics division is presently very active in collaboration with Sahlgrenska Academy and AstraZeneca. There is therefore a need to revisit these preparation and storage protocols and characterize the vesicles and check their suitability for the above-mentioned applications using cutting edge tools and technique that only became readily available in the last few years.

Work plan
As a student participating in the project, you will prepare nanoscopic (size from 30 to a couple of hundred nm) vesicles using different protocols for different applications. The size and structure of the produced vesicles will be characterized using the in-house SAXS (at the Chalmers Material Analysis Laboratory), dynamic light scattering (DLS) and nanoparticle tracking analysis (NTA). The project will thus allow you to work at the frontier between physics, biology and analytical chemistry, and gain insight into the forefront of medical research. This project will also give you a sound introduction to x-ray (and neutron research), two emerging and very important fields of research in Sweden, in time with the construction of MAX IV and ESS. The project report should be written in Swedish.

Group size
Ca 3–6 students for 1 or 2 groups.

Target Group
(F), (GU Physics), (Kf), (K).

Supervision
Antonius Armanious, antonius@chalmers.se, MC2 F5105, +46 721 55 32 37.
Fredrik Höök, fredrik.hook@chalmers.se