Chapter 8
Outlook

The presented combination of various X-ray and neutron scattering techniques on the one hand together with the use of oriented model systems on the other hand holds much promise for the systematic study of complex biological surfaces.

From a fundamental viewpoint, the shown strategy can be readily extended in order to study structure, mechanics, and dynamics of a broad variety of biological surfaces. This will allow for the systematic investigation of biologically highly relevant processes taking place at cell and bacteria surfaces, such as the mode of action of membrane-active drugs.

From the application side, the presented approach will for instance enable the comprehensive out-of-plane and in-plane characterization of wet electrochemical biosensors, where solid-supported membranes allow integration of biological soft matter functionality with hard semiconductor or metal devices.

Generally, in order to fully explore the potential of scattering experiments, modeling the measured scattering signals in DWBA can be used to extract structural information from the entire range of the recorded reciprocal space maps. This will be particularly important for the study of samples with weaker scattering length density contrast and/or weaker structural ordering (such as planar, supported membranes interacting with soft polymer interlayers), where relevant scattering features may be only located in the regions that cannot be treated in a kinematic approximation. Such scattering signals will be even more valuable if they are integrated with real-space computer simulations of the studied biological surfaces. Continuum-mechanical models as well as coarse-grained Monte Carlo simulations and atomistic molecular dynamics simulations provide a valuable estimate for the model parameterization of the scattering signals. Here, especially multi-scale approaches, where simulations representing molecular details are utilized to establish a coarse-grained or continuum-mechanical description of the systems, will have a great potential. Conversely, the computer models themselves can be continuously improved through detailed comparison with the experimental results.

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