

The properties of cells are defined by the properties of their membranes, including the cellular membrane, which encloses the cell itself, and all the internal membranes associated to organelles and other subcellular structures. These thin layers of lipids organize and direct cellular proteins, store energy and connect the cell with its surrounding environment. Faults in their operation may lead to pathologies affecting a full organism. Part of their function is accomplished by the evolving reorganization of the lipids within the membrane plane, in processes that are still unclear and that involve assembly into domains with properties different from those of the surrounding membrane. We want to understand how the molecular structure of lipids contributes to the lateral organization and properties of biological membranes. We do so by working on models of cellular membranes, such as phospholipid bilayers of simple composition, to understand their fundamental properties. We also extend this work to real cellular membranes. We pursue our objective by using cutting-edge techniques for high-resolution imaging that also measure properties of molecules such as orientation, order, packing, pairwise interactions and acidity. By these means we can see membranes change their organization and chemical composition in real time as they carry out their function. We hope that this understanding will eventually give us control of membrane functionality and the capability to correct faulty function. In human biology, this translates into the molecular basis for pharmacological development.