

MAR13-2012-007867

Abstract for an Invited Paper
for the MAR13 Meeting of
the American Physical Society

Structural dynamics of membrane proteins - time-resolved and surface-enhanced IR spectroscopy

JOACHIM HEBERLE, Freie Universitaet Berlin, Exp. Molecular Biophysics, Arnimallee 14, 14195 Berlin

Membrane proteins are the target of more than 50% of all drugs and are encoded by about 30% of the human genome. Electrophysiological techniques, like patch-clamp, unravelled many functional aspects of membrane proteins but suffer from structural sensitivity. We have developed Surface Enhanced Infrared Difference Absorption Spectroscopy (SEIDAS) to probe potential-induced structural changes of a protein on the level of a monolayer. A novel concept is introduced to incorporate membrane proteins into solid supported lipid bilayers in an orientated manner via the affinity of the His-tag to the Ni-NTA terminated gold surface. General applicability of the methodological approach is shown by tethering photosystem II to the gold surface. In conjunction with hydrogenase, the basis is set towards a biomimetic system for hydrogen production. Recently, we succeeded to record IR difference spectra of a monolayer of sensory rhodopsin II under voltage-clamp conditions. This approach opens an avenue towards mechanistic studies of voltage-gated ion channels with unprecedented structural and temporal sensitivity. Initial vibrational studies on the novel light-gated channelrhodopsin-2 (ChR2) will be presented. ChR2 represents a versatile tool in the new field of optogenetics where physiological reactions are controlled by light.