Surface characterization of biological monolayers using by surface sensitive non-linear optical spectroscopies, Surface vibrational spectroscopies and X-ray reflection.

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Many important biological processes are well known to be regulated at the surface and the interface of a cell membrane. For examples, the biological cell membrane acts as a reaction front for the immune response, cell metabolism and adherence, protein transfusion, and other crucial life activities. Although the constitution of an eukaryotic cell is a multi-component lipid with various types of embedded biological macro-molecules, yet the most important, components in the cell membranes in human living cells are two kinds of phospholipids, phosphocholine (PC) and phosphoserine (PS). The presence of charged domains at cell membranes can give rise to biologically important electrostatic properties; the electrostatic interaction between lipids, as well as charged extracelluar macromolecules and phospholipid headgroups, can induce lipid phase separation and lateral demixing under appropriate conditions, yielding the formation of segregated domains, the nucleation of transient pore and raft domains, and so on. Furthermore, the air-water interface has been the preferred choice of many investigators, due to its neutrality, its strong surface attraction for biologically active molecules, and its smooth surface, which permits the free conformational movement of the adsorbed molecules, including amphiphilic peptides and phospholipids [1,2]. A number of biologically interesting membranes were formed and investigated; lipid monolayer at the air/water interface is used to investigate 1) the binding mechanism of interpenetration of biologically-mimicked molecules (malachite green), 2) cyclic peptides. I will introduce various in situ optical characterization techniques, which allow monitoring the monolayer structures without transferring to any substrate, including non-linear optical spectroscopies (sum-frequency generation and second-harmonic generation), vibrational spectroscopy (polarization modulation IR reflection-absorption), and their complementary spectrometry (X-ray reflection).

References

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