# Biocolloid Systems

**Schedule:**

**Week 1:** Relationships between Colloid Science and Biology. Theories about the formation of life in the past and now. The occurrence of organic matter in space. Hyperresistant organisms and survival under the conditions prevailing in space. Shadow biosphere, "artificial life".

**Week 2:** Making films and membranes. Self-assembling formation of monomolecular and determined thickness films. Langmuir and Langmuir-Blodgett layers, their properties. Properties of interfacial films, surface coverage and the p-A diagrams. The structure of the eukaryotic membrane, membrane fluidity.

**Week 3:** Diffusion and transport phenomena across membranes, osmosis and dialysis. Transport phenomena in living organisms. Kidney function and artificial kidney.

**Week 4:** Association colloids, micelles and reverse micelles. The critical micelle concentration and its importance. Detergents and their use. Biological detergents in digestion: the bile acids. Solubilization with polar molecules. Lung surfactants and their role in the respiration.

**Week 5:** Macromolecules, their types and importance. Characterization and importance of dispersity, shape, conformation, physical properties.

**Week 6:** Modern examination methods for biological macromolecules. Ultracentrifugation, electrophoresis, size exclusion chromatography, scanning confocal and electron microscopy, scanning probe microscopy, X-ray diffraction. NMR techniques.

**Week 7:** Some important or interesting biomacromolecules, their properties, importance (polysaccharides: cellulose, starch, chitin; proteins: collagen, silk, green fluorescent protein; chlorophylls, hemoglobin).

**Week 8:** The surface tension and its importance in nature. Movement of striders on the surface of water. Reproduction helped by the surface tension: fungal ballistospores. Wetting, contact angle, influencing wetting. Capillary effect, the water transport in higher plants and the transpiration-adhesion-tension-cohesion theory. Importance of capillarity under arid climates. Adhesion to smooth surfaces. Atherosclerosis and the interfacial influences leading to the formation of the disease.

**Week 9:** Dispersion colloids in nature. Bioaerosols and smokes. Importance of foams and emulsions in nature. The eye as a natural lyogel system. Biocomposites: the structure and formation of bones. A complex disperse system: the soil.

**Week 10:** Electrokinetic effects, precipitation from liquids. The kidney and bile stones and the process of their formation. Flow properties, biorheology. The rheology of blood.

**Week 11:** Nanotechnology and its appearance. Nanostructures from non living matter. Natural nanostructures, the fine structure of the butterfly scales. Nanotools. Natural nanomotors: kinesins, dyneins, the actomyosin complex. DNA machines, active molecular tweezers.

**Week 12:** Separation techniques for biological systems. Nucleation, demixing, desolvation, evaporation, pervaporation, freeze-drying. Adsorption and absorption. Chromatographic techniques.

**Week 13:** The critical processing of a scientific article in the topic of the course.