

Evan Evans

BE506 Physical Chemistry of Cell Structure and Machinery

short description:

Chemical thermodynamics and physics are used to establish a material science perspective of the molecular components – chemical kinetics – and structural properties needed for understanding cell behavior and advancing biotechnology.

syllabus:

I. Introduction (2 weeks)

Molecules of life; length/energy/time scales; chemical bonds and strong linkages

Weak-noncovalent interactions in water; ions and solvation; hydrogen bonds and hydrophobic interactions

II. Chemical Thermodynamics and Kinetics (4 weeks)

Solution thermodynamics: solubility and mixing entropy, phase equilibria

Chemical reactions, equilibrium, and kinetics

Physics of molecular transitions, nonequilibrium processes and chemistry under stress

Mechano-chemical *enzymes* and *motors*

III. Polymers (3 weeks)

Freely-jointed and worm-like chains

Entropic forces and polymer elasticity

Polymers in confined geometries

IV. Lipid Surfactants (4 weeks)

Energetics of self assembly; mesophase aggregates and interfaces

Interface thermodynamics, elasticity of monolayers - films - and membranes

Membrane thermodynamics, chemical equilibrium, elasticity and mechanics

Strength and survival of biomembranes