**Lecture 6:** [**Non-equilibrium thermodynamics**](http://en.wikipedia.org/wiki/Non-equilibrium_thermodynamics)

*Linear non-equilibrium thermodynamics. Definition and basic terms. Force and motion. Phenomenological coefficients. Conjugated fluxes*

**Lecture 7:** **Dissipative function. Entropy and stability**

*Stationary state. Prigogine principle of minimum entropy production. Time hierarchy of stationary states*

**Lecture 8:** **Bioenergetics. Energy transfer in living systems**

*Energy. Metabolism. Oxidation as a source of metabolic energy. ATP and energy transduction. Oxidative phosphorylation reactions*

**Lecture 9:** **Membrane transport. Free diffusion of uncharged and charged particles**

*Membrane transport – classification. Fick's law. Nernst-Planck molar flux equation*

**Lecture 10:** **Diffusion through membranes**

*Simple diffusion through membranes. Permeability. Transport of water. Filtration and osmosis. Facilitated diffusion*

**Lecture 11:** **Active transport**

*Primary active transport. Sodium-potassium ATP-ase. Calcium ATP-ase. Basic steps of ion transport processes. Secondary (ion gradient-driven) active transport. Lactose permease requires a proton gradient. Putative mechanism of lactose transport in E. coli.*

**Lecture 12:** **Bioelectrical potentials**

*Diffusion potential. The Henderson equation. Time dependence of diffusion potential. Membrane (equilibrium) potential. The Nernst equation. Donnan potential. The Gibbs-Donnan equilibrium. Osmotic consequences of the Gibbs-Donnan equilibrium*

**Lecture 13:** **Resting membrane potential**

*Generation of resting membrane potential. The Goldman and Thomas equations. Factors contributing to the resting potential*

**Lecture 14:** **Action potential**

*Generation of action potential. Voltage-gated channels. Saltatory conduction*

**Lecture 15:** **Free-radical processes**

*Sources of free radical generation in human body. Lipid peroxidation. Basic stages. Antioxidant defense system. Enzymic and nonenzymic antioxidants. Lipid peroxidation and toxicology*