

BIOMEMBRANES

Main functions of biomembranes

- the essence of compartmentalization, its advantages (eukaryotes – prokaryotes)
- barrier function (semipermeability), regulated flow of materials and information
- chief functions of membrane proteins (enzyme, receptor, transporter, antigen)
- special functions of biomembranes (endo- and exocytosis, phagocytosis; receptor-mediated endocytosis /LDL, transferrin/; cell polarity, cell shape, cell movements; cell division; cell fusion /skeletal muscle/)

Composition of biomembranes

- „unit membrane“: uniform thickness and similar composition
- characteristic differences between the main biomembrane types
- chief types of membrane lipids, types of membrane phospho- and sphingolipids
- importance of membrane carbohydrates, glycoproteins, glycolipids
- antigenitás (ABO vércsoport)

Structure of biomembranes

- formation and characteristics of phospholipid bilayer; micelles, liposomes
- the essence of „fluid mosaic model“
- integral and peripheral membrane proteins (main features, examples)
- lipid-anchored membrane proteins
- membrane asymmetry (from the aspect of lipids and proteins), its alteration
- factors affecting the fluidity of the membrane

Dynamism of biomembranes

- mobility of lipids in the membrane (rotation, lateral movement, flip-flop); investigations on flip-flop
- mobility of proteins in the membrane (rotation, lateral movement); the basics of FRAP method (fluorescence recovery after photobleaching)
- mikrodomains in the membrane, lipid rafts

MEMBRANE TRANSPORT

Passive transport- diffusion

- characterization
- materials transported by passive transport (examples)
- importance of free diffusion in uptake of drugs and organic solvents

Passive transport- facilitated diffusion

- characterization, kinetics
- classification: uniport, symport, antiport types with examples
- Band 3 and GLUT transporters and their action

Active transport

- characterization, kinetics
- classification: uniport, symport, antiport types with examples
- classification, detailed characterization:
 - 1/ F-type-ATPases
inner mitochondrial membrane ATP synthase
 - 2/ P-type-ATPase
Na⁺ K⁺ ATPase - characterization, reaction cycle
Ca²⁺ ATPases (SERCA): types, characterization, reaction cycle
H⁺ / K⁺ ATPase (stomach mucosa)
 - 3/ V-type-ATPase
- ABC transporters: characterization, types, examples
- multidrug resistance: definition, importance
- ❖ cystic fibrosis
- secondary active transport, examples

Ion channels

- channel-forming proteins, their classification based on conductivity, selectivity, gating
- experimental approach for channel-forming proteins (electrical observations, inhibitors, antibodies, patch clamp)
- voltage-gated, ligand-gated, stretch-gated channels, examples, their role in physiological processes
- selectivity of ion channels
- definition and action of ionophores, ionophore antibiotics: valinomycin, gramicidin
- pore-forming proteins; structure, function and regulation of connexin and porin channels