Biochemistry II

1. Metabolism, general features. Anabolism and catabolism, relationships, energetics. Primary and secondary metabolism.

2. Protein degradation, proteases, their specificity, types, representants. Aminoacid catabolism, transamination, deamination, biogenic amines. Degradation of aromatic aminoacids. Survey of degradation of other aminoacids. Genetic disorders..

3. Elimination of nitrogen compouds. Ornithine (ureosynthetic) cycle, reaction steps and energetics. Uric acid. Ammonia assimilation. The role of glutamate dehydrogenase and glutamine synthetaase.

4. The metabolism of nucleic acids and proteosynthesis. Synthesis and degradation of bases. Breakdown and synthesis of nucleic acids. Phosphodiesterases, palindrom, restriction endonucleases. The DNA replication, replication fork, DNA polymerases. Transcription, factors, mRNA, codons and their relations to the protein structure. Reverse transcription. Translation, tRNA – structure and role, anticodon. Ribosomes, posttranslation modifications. Mutations (point, insertion, deletion). Regulation of gene expression in prokaryons (inducible and repressive mechanisms, operon, repressor). Methods of study (DNA sequencing, oligonucleotide synthesis, PCR).

5. Biochemistry of hemoglobin, structure, properties, function. Allosteric effect, Bohr effect, R and T forms, myoglobin. Fetal Hb, HbS.
Immunoglobulins, structure, properties, function types. Applications in health care and technology.

6. Metabolisms of polysaccharides, breakdown of starch and glycogen, hormone regulation. Interconversions of monosaccharides. Hexosemonophosphate shunt and pentose cycle, reaction scheme, reasons. Glycolysis, reaction sequence, enproducts, energetics. Substrate phosphorylation in glycolysis. Cori cycle. Gluconeogenesis. Regulation principles.

7. Metabolism of lipids. Degradation and synthesis of fats and phospholipids. Fatty acids degradation and synthesis. Ketone bodies.

8. Citric acid cycle, reactions, energetics, importance. Anabolic relationships, anaplerotic pathways, glyoxylate shunt.

9. Biochemical redox reactions. Respiratory chain, composition, localization. RC complexes structure, role of cytochromes and ubiquinone. Mechanism of oxidative phosphorylation, chemiosmotic theory, protonmotive force, transmembrane potential. ATP synthesis, ATP synthase structure and function. Inhibitors and uncouplers, ionofors. Quantitative relations. Alternative respirations. Microsomal electron transport. Nitrogenase system.

10. Photosynthesis. Light reactions, chlorophylls, reaction center structure. Photosynthetic electron transport and its components (cytochromes, quinones, PC, ferredoxin). Photosystems 1 and 2. Mechanism of ATP synthesis. Equation of light phase and its balance. Dark reactions, CO_2 fixation, RUBISCO, Calvin cycle.

11. Membrane transport. Facilitated diffusion, active transports, permeases, mobile carriers, ion channels. Trasport of amino acids, sugars and ions. Uniport, symport, antiport. Membrane fusion. Structure and operation of NaK-ATPase. Lactose carrier, structure of K-channell. Nerve cell excitation membrane transports.

12. Isoprenoids, carotenoids, steroids (cholesterol and its synthesis, conformation, bile acids, vitamins D, steroid hormones). Porfyrine synthesis, heme, its degradation, regulation.

13. Principles of metabolic regulations, levels, mechanisms (endpoduct feedback inhibition). Allosteric regulations, cooperativity, Hill’s equation. Molecular principles of hormone regulation, hierarchy and structure of hormone system.