

QUESTIONS FOR THE ORAL EXAM FROM MEDICAL BIOCHEMISTRY

Metabolism

1. Formation and significance of acetyl-CoA and its involvement in metabolic processes.
2. Sources of glucose for tissues at various metabolic states. Regulation. Glycosuria.
3. Metabolism of glucose at aerobic and anaerobic conditions. Regulation in tissues.
4. Pentose phosphate pathway and utilization of its products for metabolic processes in different tissues.
5. Metabolism of galactose, fructose and other monosaccharides. Disorders.
6. Biosynthesis and degradation of glycogen in the liver and muscle. Regulation.
7. Significance of acids and alcohols formed from saccharides.
8. Gluconeogenesis, regulation of gluconeogenesis in relation to glycemia.
9. Significance of Cori cycle and glucose-alanine cycle in tissue metabolism.
10. Metabolism of glycosaminoglycans, glycoproteins and proteoglycans.
11. Metabolism of pyruvate, its sources and involvement in metabolic processes.
12. Significance of citric acid cycle in catabolic and anabolic processes. Regulation in tissues.
13. High-energy compounds.
14. Sources of ATP and other high-energy phosphates in tissues.
15. Oxidoreductases and their coenzymes, their significance in tissues.
16. Respiratory chain.
17. Oxidative phosphorylation.
18. Regulation and inhibitors of respiratory chain and oxidative phosphorylation.
19. Transfer of reducing equivalents from the cytosol to the mitochondrion.
20. Biosynthesis of fatty acids, regulation in tissues.
21. Oxidation of fatty acids, regulation, degradation in peroxisomes.
22. Metabolism of triacylglycerols, regulation in tissues.
23. Metabolism of glycerol phospholipids and sphingolipids. Regulation in tissues.
24. Biosynthesis of cholesterol. Regulation in tissues.
25. Significance and synthesis of bile acids, regulation. Enterohepatic circulation.
26. Lipids of blood plasma and the major classes of lipoproteins – differences in structure and properties.

27. Metabolism of lipoproteins transporting endogenous and exogenous TAGs in blood. Disorders.
28. Metabolism of lipoproteins transporting cholesterol in blood. Disorders. Atherosclerosis.
29. Metabolism of ketone bodies, possible causes of ketoacidosis. Regulation in tissues.
30. Synthesis, significance and organ effects of eicosanoids synthesized in cyclooxygenase pathway.
31. Synthesis, significance and organ effects of eicosanoids synthesized in lipoxygenase pathway.
32. Significance of omega-6 and omega-3 polyunsaturated fatty acids and their organ effects, eicosanoids.
33. Deamination and transamination of amino acids. Sources, transport and ways of ammonia detoxication.
34. Urea cycle, regulation, disorders.
35. Metabolism of glutamine. Glutamine as alternative source of energy in tissues.
36. Metabolism of amino acids converted via 2-oxoglutarate and their metabolites, metabolism of aspartate.
37. Metabolism of amino acids converted via pyruvate and acetyl-CoA.
38. Metabolism of amino acids containing sulfur and further conversions of their metabolites. Metabolism of tryptophan. Disorders.
39. Metabolism of phenylalanine and tyrosine. Disorders.
40. Metabolism of branched-chain amino acids. Disorders.
41. Conversion of amino acids to products with specific biologic functions (biogenic amines, neurotransmitters, creatine, carnosine, NO and others).
42. Synthesis and degradation of pyrimidine nucleotides. Regulation, disorders.
43. Synthesis and degradation of purine nucleotides. Regulation, disorders.
44. Conversion of nucleotides to deoxynucleotides, synthesis of thymidine nucleotides. Regulation and significance.
45. Biosynthesis of heme and hemoproteins. Regulation, disorders.

Principles of regulation in the living systems

1. General principles of metabolism regulation. Levels of regulation.
2. Metabolic interrelationships of saccharides, lipids and proteins in absorptive state, regulation in tissues.

3. Metabolic interrelationships of saccharides, lipids and proteins in post absorptive state, regulation in tissues.
4. Metabolic interrelationships of saccharides, lipids and proteins in fasting state, regulation in tissues.
5. Regulation of metabolic processes in tissues in exercise. Randle effect.
6. Preference of metabolic pathways in pregnancy, lactation and stress.
7. Metabolic interrelationships at obesity. Adipokines.
8. Signal transduction by intracellular receptors. Examples.
9. Signal transduction by membrane receptors – ion-channel receptors and enzyme-linked receptors. Examples.
10. Signal transduction by membrane receptors – receptors linked with G_s and G_i proteins. Examples.
11. Signal transduction by membrane receptors – receptors linked with phospholipase C. Examples.
12. Regulation of hormonal cascade hypothalamus-pituitary-target endocrine gland. Second messengers in signal transduction.
13. Functions of growth hormone and prolactin.
14. Insulin, insulin receptor and their role in metabolism.
15. Glucagon and its role in metabolism.
16. Synthesis, significance and inactivation of mineralocorticoids and glucocorticoids.
17. Synthesis, significance and inactivation of female sex hormones.
18. Synthesis, significance and inactivation of male sex hormones.
19. Synthesis, significance and inactivation of thyroid hormones.
20. Hormonal regulation of menstrual cycle and pregnancy.
21. Vitamins of group B and their metabolic significance.
22. Vitamin C and its role in metabolic and detoxification processes. Role of vitamin B₁₂ and folate, disorders.
23. Vitamin A and its role in metabolism. Biochemistry of vision.
24. Exchange of calcium, magnesium, phosphates, vitamin D, regulation and significance for biologic functions of tissues.
25. Exchange of sodium, potassium and chlorides, regulation.
26. Significance and exchange of iron, copper and other trace elements.
27. Synthesis and degradation of catecholamines and acetylcholine.
28. Adrenergic and cholinergic synapses and their receptors.

29. Relationship of metabolism to proton production. Role of lungs and kidney in maintenance of acid-base balance. The pH buffers.
30. Sources of reactive oxygen and nitrogen species.
31. Oxidative stress – oxidative damage to lipids, proteins and DNA.
32. Nonenzymatic and enzyme antioxidants.

Functional biochemistry

1. Digestion, transport and resorption of saccharides, disorders.
2. Digestion, transport and resorption of lipids, disorders. Effect of diet on lipid profile.
3. Digestion of proteins and transport of amino acids. Disorders.
4. Nitrogen balance, biologic value and digestibility of proteins, interorgan exchange.
5. Tissue specificity of utilization of individual amino acids.
6. Basic metabolic functions of liver.
7. Exogenous and endogenous functions of the liver, regulation mechanisms.
8. Detoxification and biotransformation functions of liver.
9. Ethanol as xenobiotics, effects on the metabolism.
10. Degradation of hemoglobin. Basic disorders of bile pigments metabolism, hyperbilirubinemias and their differential diagnostics.
11. Significance of kidney metabolism for its function.
12. Markers of kidney function (clearance of creatinine, urea).
13. Disorders of acid-base balance – origin, principles of correction and compensation. Parameters of acid-base balance and their significance in clinical diagnostics.
14. Nervous tissue – metabolism, formation and transfer of nerve impulses.
15. Metabolisms of serotonin, histamine, GABA and glycine and their roles as neurotransmitters.
16. Biochemistry of contraction of skeletal and cardiac muscles. Disorders.
17. Biochemistry of smooth muscle contraction. Role of NO.
18. Metabolism of muscle cells in relation to duration and intensity of muscle work.
19. Composition and functions of extracellular matrix (ECM). Components of fibrillar and amorphous parts. Degradation of ECM.
20. Structure, biosynthesis and degradation of collagen.
21. Elastin, glycoproteins and proteoglycans of connective tissue.

22. Bone tissue – mineralization and remodeling. Regulations. Role of vitamin D and minerals in the bone metabolism. Biochemical markers of bone formation and resorption.
23. Plasma enzymes and significance of examination of plasma isoenzymes for differential diagnostics.
24. Phosphatases and aminotransferases, their cellular roles and utilization in clinical diagnostics.
25. Common and specific functions of plasma proteins. Synthesis and its regulation, generally with showing examples.
26. Important blood plasma proteins of individual fractions. Plasma proteins of acute phase.
27. Metabolism of erythrocyte.
28. Protein alterations as part of coagulation and fibrinolysis. Role of vitamin K.
29. Diabetes mellitus type I – biochemical characteristics, ketoacidosis.
30. Diabetes mellitus type II – biochemical characteristics.
31. Mechanism of endothelial damage in atherosclerosis.