

The questions for oral part of exam from Medical Biochemistry

General Medicine

The questions for oral part of exam from Medical biochemistry for students of general medicine are divided into three parts:

I. Energetic metabolism and metabolism of nutrients.....	1
II. General and molecular biochemistry	2
III. Biochemistry of organs and tissues	3

The student will choose 3 questions, by 1 from each part.

I. Energetic metabolism and metabolism of nutrients

1. Respiratory chain – composition, function, inhibitors
2. Transport of electrons and H^+ – oxidative phosphorylation, ATP-ase, uncouplers
3. Transfer of reducing equivalents from the cytosol to the mitochondria, glycerolphosphate and malate shuttle
4. Phosphorylation on substrate level – macroergic compounds and their role in metabolism
5. The citric acid cycle – reactions, importance, amphibolic character, regulation
6. Anaplerotic reactions of citric acid cycle – biochemical importance
7. Significance of acetyl-CoA in the intermediary metabolism
8. Glycolysis – importance of glucose-6-phosphate, regulation and its energetic balance
9. Gluconeogenesis – substrates, reactions, regulation
10. Metabolic pathway of pyruvic acid – enzymes, importance
11. Cori cycle and glucose-alanine cycle – importance, basic tasks
12. Pentose phosphate cycle – biological and biochemical role, regulation
13. Synthesis and degradation of glycogen – significance, regulation, disorders
14. Metabolism of monosaccharides (e.g. galactose, mannose, fructose) – significance, disorders
15. Metabolism of glucuronic acid, and its importance in organism
16. Biosynthesis and degradation of oligosaccharides – significance, disorders,
17. Metabolism of amino saccharides – proteoglycans, GAG, glycoproteins, biochemical importance
18. Oxidation of fatty acids – energetic balance, carnitine system
19. The most important unsaturated fatty acids – significance, metabolism (e.g. desaturases, elongases)
20. Biosynthesis of FA – reactions, regulation, disorders
21. Biosynthesis and degradation of triacylglycerols
22. Biosynthesis and degradation of phospholipids, glycolipids and sphingolipids
23. Biosynthesis and degradation of eicosanoids – biochemical importance, enzymes (e.g. cyclooxygenase, lipoxygenase)
24. Formation and utilization of ketone bodies – metabolic causes and consequences, the importance of ketone bodies
25. Metabolism of cholesterol – regulation, significance, transport of endo-/exo- genic cholesterol, disorders
26. Cholesterol as a precursor of biochemically important substances – steroid hormones, bile acids, vitamin D
27. Lipoproteins – structure and classification, composition, functions
28. Synthesis and degradation of chylomicrons, VLDL, LDL and HDL – disorders in lipoprotein metabolism
29. General mechanisms of amino acids conversion – deamination, transamination, nitrogen balance
30. Glucogenic and ketogenic amino acids – role in intermediary metabolism

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31. Formation of ammonia in the organism and its fate – transport and detoxification of ammonia
32. Urea synthesis (formation of urea) – a mechanism, importance, disorders
33. Metabolism of amino acids of pyruvate and oxaloacetate groups – synthesis, degradation, the involvement of these amino acids into metabolic processes, disorders
34. The metabolism of sulphur containing amino acids – synthesis, degradation, the involvement of these amino acids into metabolic processes, disorders
35. Metabolism of amino acids of 2-oxoglutarate and succinyl CoA groups – synthesis, degradation, the involvement of these amino acids into metabolic processes, disorders
36. The metabolism of aromatic amino acids – synthesis, degradation, the involvement of these amino acids into metabolic processes, disorders
37. The metabolism of branched-chain amino acids – synthesis, degradation, the involvement of these amino acids into metabolic processes, disorders
38. The biogenic amines and polyamines – biosynthesis, degradation, functions
39. Synthesis and degradation of catecholamines – reactions, enzymes, significance
40. Conversion of amino acids to specialized products – e.g. creatine, SAM, carnosine, glutathione, coenzymes
41. Importance of nucleotides (NTP, dNTP) for cell and organism functions – role in the regulatory processes, nucleotides as coenzymes
42. Degradation of exogenous and endogenous NA, nucleotides and nucleosides
43. Biosynthesis and degradation of pyrimidine nucleotides – reactions, importance, regulation, disorders
44. Biosynthesis and degradation of purine nucleotides – reactions, importance, regulation, disorders, salvage reactions
45. Biosynthesis and degradation of deoxyribonucleotides – regulation, inhibition, disorders

II. General and molecular biochemistry

1. Compartmentalization of biochemical processes in the cell
2. The structure, composition and properties of the cell membrane – transport of substances across membranes, principle of pumps and channels, importance
3. Formation and toxicity of reactive oxygen and nitrogen species – antioxidants (enzymatic and low molecular antioxidant systems), role in living systems
4. Enzymes – general characteristics, structure and functions, terminology, classification and distribution of enzymes
5. Catalysis of biochemical reactions. Mechanism of enzyme action. Specificity of enzymes
6. Constitution and induction enzymes – repression of enzymes, regulation of enzymatic activity
7. Kinetics of enzymatic reactions – Michaelis-Menten constant K_m , inhibition of enzymatic reactions
8. Allosteric enzymes – effectors and inhibitors, significance in metabolism
9. Isoenzymes. Multienzyme complexes - examples, biologic roles
10. Coenzymes of oxidoreductases and ligases
11. Coenzymes of lyases, transferases and isomerases
12. Coenzymes of carboxylation and decarboxylation reactions
13. Coenzymes that carry single carbon units
14. General regulation mechanisms of catalytic activity in living systems – expression, allosteric effects, covalent modification
15. The structure and function of nucleic acids – the genetic code and its features, organization of prokaryotic, eukaryotic and mitochondrial genome
16. DNA replication in eukaryotic and prokaryotic cells – regulation, inhibition, DNA repair (significance and limitations of reparations)
17. Transcription of DNA – regulation of gene expression, transcription factors, inhibitors
18. Biosynthesis of mRNA, rRNA, tRNA and snRNA – specifics of biosynthesis, significance

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19. Specifics of genetic material of viruses – e.g. HIV, SARS-CoV-2
20. Proteosynthesis in prokaryotic, eukaryotic cells and mitochondria – regulation, inhibition
21. Posttranscriptional and posttranslational modifications of proteins – sorting and transport of proteins, folding, chaperons
22. Biosynthesis and modification of selected proteins – e.g. collagen, elastin, keratin, hemoglobin
23. Methods of study and use of NA in diagnostics (e.g. restriction endonucleases, PCR, sequencing, gene therapy)
24. Phosphorylation as regulatory mechanism (e.g. protein kinases, phosphatases)
25. Degradation of endogenous proteins – ubiquitin, proteasome, lysosome
26. Importance of NA modification – epigenetics, histone modification, DNA methylation
27. Hormones with receptors on surface of cells – chemical structure, function in the regulation, disorders
28. Hormones with intracellular receptors – chemical structure, function in the regulation, disorders
29. Insulin and glucagon – importance in the regulation of metabolism
30. The role of Ca^{2+} phospholipase under the action of hormones
31. Biochemistry of apoptosis
32. Membrane receptors and their ligands, G-proteins
33. Intracellular receptors and their ligands – heat-shock proteins, interactions of intracellular receptors with DNA
34. Signal molecules – first and second messenger, transduction cascades of cytokines and growth factors
35. Biochemistry of extra-/intra- cellular communications – mechanism of signal transmission depending on the type of signal molecule

III. Biochemistry of organs and tissues

1. Biosynthesis and degradation of tetrapyrrols – regulation, disorders
2. Metabolism of hemoglobin – regulation, importance in disease diagnosis
3. Biochemistry of digestion and resorption of saccharides – glucose transport in the target organs, glycemia, regulation, disorders
4. Non-hydrolysable saccharides – prebiotics, effect of saccharides in food on the resorption of mineral
5. Biochemistry of digestion and resorption of lipids – enzymes, transport, significance, disorders
6. Biochemistry of endo-/exo- genous protein digestion – resorption of fission products, enzymes, significance, disorders
7. Mutual relation between metabolism of saccharides, lipids and proteins
8. Metabolism of water – function in living systems, hormonal regulation of the water content
9. Blood – composition and biochemical functions
10. Buffering systems of the organism – function and significance for acid-base balance
11. Proteins of blood plasma – source, function, diagnostic significance
12. Metabolism of erythrocytes
13. Biochemical mechanism of coagulation – coagulation cascade, role of thrombocytes
14. Transport of O_2 and CO_2 – biochemical mechanisms and disorders
15. Disorders of acid-base balance – the role of the lungs, kidneys and other organs
16. Factors affecting resorption of minerals from food – roads of resorption and excretion
17. Metabolism of Ca, P and Mg – regulation and associated diseases
18. Metabolism of Na, K and Cl – regulation, osmotic balance
19. Fe metabolism – occurrence in the body, the role, regulation of resorption, transport and storage
20. Nutritional disorders – quantitative (malnutrition, obesity) and qualitative (lack of proteins, essential AAs and FAs, vitamins, mineral substances)

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21. Proper nutrition – biological value of proteins, importance of ω 3, ω 6 FAs and their impact on health, intolerance of food ingredients and food allergies
22. Biochemistry of liver – functions, metabolic pathway which occur only, or almost exclusively in the liver, different metabolic activity of hepatocytes located in lobulus hepaticus
23. Metabolism of xenobiotics – reactions of activation phase and reactions of conjugative phase
24. Significance of cyt P450 in xenobiotic degradation – mechanism of action
25. Biochemical diagnostic of hepatocytes damage and liver functions
26. Biochemistry of kidney – actions taking place in the proximal tubule and loop of Henle, actions taking place in the distal tubules and collecting ducts
27. The role of the kidneys in regulation – e.g. of ABR, blood pressure and extracellular and intracellular fluid volume
28. Diagnostic possibilities of nephrons damage and renal functions – clearance, markers of damage
29. The composition and metabolism of hard tissue – mineralization and bone demineralization, inorganic and organic composition of bones and teeth, markers of bone remodeling
30. Biochemistry of skin – importance of vitamin D
31. Extracellular matrix, connective tissue metabolism – e.g. collagen, elastin, GAG
32. Biochemistry of the senses – e.g. vision and taste
33. Biochemistry of CNS – the importance and influence of the hematoencephalic barrier to energy metabolism and metabolism of nutrients
34. Biochemistry of nervous tissue – synaptic transmission, cholinergic and adrenergic receptors, receptors of excitatory and inhibitory neurotransmitters, synthesis and elimination of neurotransmitters
35. Proteins of muscle fibers and their role in muscle contraction – the role of creatine, glycogen, oxidative processes and anaerobic processes, the possibility of biochemical diagnosis of muscle disease
36. Biochemistry of contraction and relaxation of skeletal, heart and smooth muscle
37. Composition and function of saliva, microbial dental plaque
38. Biological material and its processing in clinical biochemistry
39. Factors affecting reliability of biochemical results and their interpretation
40. Urine – physiological and pathological components, the diagnostic value