BIOCHEMISTRY
Topic list of Final Exam
Faculty of General Medicine, 2nd year
2nd semester

1. Chemical nature of enzymes, general properties of proteins
2. Classification of enzymes; isoenzymes
3. Coenzymes
4. Enzymatic catalysis: general concepts and the molecular mechanism of catalysis
5. Enzyme kinetics
6. Modulation and regulation of enzyme activity
7. Thermodynamics of the living system and high-energy compounds
8. Digestion and absorption of carbohydrates, pathobiochemical aspects, uptake to the cells (GLUT)
9. Steps of glycolysis, energy generation, regulation and interrelationship to other metabolic pathways
10. Steps of gluconeogenesis, regulation and interrelationship to other metabolic pathways
11. Glycogenesis and glycogenolysis, regulation of glycogen metabolism, pathobiochemical aspects
12. Pentose phosphate pathway (hexose monophosphate shunt) and formation of glucuronides, pathobiochemical aspects
13. Metabolism of fructose and galactose, hexose interconversions, pathobiochemical aspects
14. Structure, synthesis and importance of glycoproteins
15. Digestion and absorption of lipids, transport (metabolism of lipoproteins), pathobiochemical aspects
16. Storage and mobilization of triacylglycerols
17. Synthesis of saturated and unsaturated fatty acids and its regulation. Formation and importance of bioactive unsaturated fatty acid derivatives (eicosanoids)
18. Degradation of fatty acids, regulation, pathobiochemical aspects
19. Ketone bodies, pathobiochemical aspects
20. Importance of phospholipids, their synthesis and degradation

21. Metabolism of sphingolipids, pathobiochemical aspects
22. Synthesis of cholesterol, hypercholesterolemia. Importance and formation of compounds derived from cholesterol, pathobiochemical aspects
23. Digestion and absorption of proteins, pathobiochemical aspects
24. Metabolism of glutamine and asparagine, glutathione and its importance, pathobiochemical aspects
25. Urea cycle
26. Metabolism of branched chain amino acids and tryptophan, lysine, threonine, pathobiochemical aspects
27. Metabolism of histidine, proline and arginine (creatine), pathobiochemical aspects
28. Metabolism of phenylalanine and tyrosine, pathobiochemical aspects
29. Metabolism of glycine, serine and alanine, pathobiochemical aspects
30. Metabolism of sulfur-containing amino acids; SAM and its significance, pathobiochemical aspects
31. Biochemical importance of one-carbon units, production and use of one-carbon groups, characterization and importance of THF, pathobiochemical aspects
32. Porphyrin synthesis, pathobiochemical aspects
33. Synthesis of purine nucleotides, pathobiochemical aspects
34. Catabolism of purine nucleotides; salvage pathways, pathobiochemical aspects
35. Synthesis and breakdown of pyrimidine nucleotides. Synthesis of deoxyribonucleotides (characterization of thioredoxine system)
36. Compounds influencing the nucleotide metabolism, their clinical importance and pathobiochemical aspects
37. Individual steps of the citric acid cycle and its regulation
38. Relationship between the citric acid cycle and other metabolic pathways
39. Structure of mitochondria; mitochondrial transport systems
40. Mechanism of respiratory chain and oxidative phosphorylation; energetics and inhibitors, pathobiochemical aspects
41. Structure and function of biomembranes, dynamics of membrane components
42. Transport across the biomembranes
43. Components of blood plasma, their functional role
44. Biochemistry of red blood cells, iron metabolism

45. Synthesis and characterization of bile pigments, pathobiochemical aspects
46. Structure and types of hemoglobin (myoglobin), oxygen transport and pathobiochemical aspects
47. Biochemistry of leukocytes, characteristic metabolism and chemotaxis of neutrophil granulocytes, pathobiochemical aspects
48. Biochemical basis of blood clotting and fibrinolysis
49. The role of qualitative composition of nutrients (macronutrients, dietary fibres, antioxidative vitamins)
50. Biochemical background of obesity, metabolic syndrome
51. Pivotal role of liver in the metabolism
52. Role of liver in the biotransformation
53. Pathobiochemical effects of ethanol
54. Metabolism and energy source of muscle, characteristic metabolism, muscle diseases
55. Molecular mechanism and regulation of muscle contraction
56. Synthesis and types of collagen, pathobiochemical aspects. Biochemistry of elastin and fibrillin, pathobiochemical aspects
57. Metabolism and types of proteoglycans, pathobiochemical aspects. Organic and inorganic components of cartilage and bone.
58. Types of adhesive glycoproteins and adhesion receptors (integrins, selectins, Ig-superfamily, cadherins)
59. Types, components, importance of cytoskeletal systems, pathobiochemical aspects
60. Characteristic metabolism of nervous tissue. Synthesis, inactivation and receptors of amino acid-, biogenic amine- and peptide-type neurotransmitters
61. Cholinergic and catecholaminergic neurotransmission (synthesis, inactivation, receptors and inhibitors)
62. Biochemistry of vision
63. Mechanism of neuroendocrine regulation; hormones of the hypothalamus and hypophysis
64. Thyroid hormones
65. Hormonal regulation of blood glucose level; pathobiochemistry of diabetes mellitus
66. Calcium metabolism; hormonal regulation of the extracellular calcium level
67. Steroid hormones; their metabolism, function and intracellular mechanism of action

68. Tissue hormones and growth factors: biochemistry and mechanism of action; Tyr kinase receptor
69. The structure of DNA, the structure of chromosome, euchromatin, heterochromatin, regulation of transcription, enhancer, silencer, the difference between prokaryotic and eukaryotic gene expression.
70. Histones and their function, nonhistone proteins, regulation of replication of the eukaryotic cell: exit from G_0 phase, protooncogenes, cyclines, tumor suppressor genes.
71. Repair mechanisms, tumorous cell proliferation, apoptosis, tumor sensitivity of knock out mutants of p53 protein.
72. The structure of eukaryotic genes, exon, intron, splicing, coding and noncoding fragments, classification of genomic sequences by repetative character.
73. RNA types, RNA polymerases, the transcription process, maturation of mRNA, mechanism of splicing, tissue specific and development dependent splicing, thalassemias, antisense RNA.
74. Transcription factors, HLH proteins, Zn-finger proteins, Leu-zipper, intracellular hormone receptors, *fos* and *jun* proteins, *p53*, *hox* proteins, relation of transcription to the chromatin structure.
75. The mechanism of translation, the initiation complex, the three steps of elongation, termination, the signal peptide and signal recognition protein.
76. Regulation of metabolism at the cellular level; compartmentalization; significance of the multienzyme complexes
77. Regulation of metabolism at the tissue level; cyclic nucleotides as second messengers, importance of G proteins
78. Regulation of metabolism at the tissue level; PIP_2 system, Ca^{2+} as second messenger
79. Regulation of metabolism at the organism level: metabolic adaptation in starvation
80. Regulation of metabolism at the organism level: metabolic adaptation in well-fed state
81. Regulation of metabolism at the organism level: metabolic adaptation in stress, physical exercise, pregnancy
82. Limits of the biochemical regulation, adaptation; supraindividual regulation; biochemical interpretation of health and disease