Educational Program for Dental Medicine

Biochemistry exam questions

(2022-2023)

Water and Buffers

1. Water function and distribution in a body.

2. Specificity of water molecule structure.

3. Hydrogen bonds.

4. Water as a universal solvent.

5. Water and thermoregulation.

6. Strong and week electrolytes.

7. Dissociation of water.

8. The ion product of water.

9. Osmolarity and water movement between different compartments.

10. Electrolytes distribution between different compartments.

11. pH. Significance of pH.

12. Some of biological fluids' pH.

13. Definition of acids and basis.

14. Weak and strong acids.

15. Dissociation constant.

16. Definition and significance of pK.

17. Metabolic acids.

18. The Henderson-Hasselbalch equation.

19. Buffers.

20. Buffer capacity.

21. Acetic acid/acetate buffer couple.

22. Buffer systems in a human body.

23. Bicarbonate and hemoglobin buffer systems. Breathing rate dependence on pH.

24. Changing of pH in clinical practice.

25. Acidosis. The types of acidosis.

26. Alkalosis. The types of alkalosis.

27. Proteins.

28. Amino acid composition of proteins.

29. General description of amino acid's structure.

30. Side chain importance for amino acids characteristics and function.

31. Amino acids classification.

32. Hydrophobic amino acids.

33. Polar, not charged amino acids.

34. Amino acids containing aromatic rings.

35. Sulfur containing amino acids.

36. Positively charged amino acids.

37. Negatively charged amino acids.

38. 21th amino acid.

39. Derived amino acids. Examples.

40. Peptide bond. Formation of peptide bond.

41. Characteristics of peptide bond.

42. Peptides. Their example.

43. pH and proteins and amino acids groups that can be ionized and pH.

44. Titration of amino acids.

45. Determination of isoelectric point.

46. Definition of zwitter ion.

47. Primary structure of proteins.

48. Conservative and non-conservative changes in the primary structure of proteins.

49. Non-conservative mutation during sickle cell anemia.

50. Description of primary structure of pro-insulin and insulin.

51. Insulins that are used for the treatment of diabetes mellitus.

52. Secondary structure of proteins.

53. Importance of hydrogen bonds for secondary structure of proteins.

54. α–helical structure formation in proteins.

55. Regular structural unites of β–folds

56. Position of side chains in the secondary structure of proteins.

57. Structural motifs and folds of the proteins.

58. Tertiary structure. Importance of tertiary structure.

59. Folding process of proteins and conformation formation.

60. Bonds that participate in the formation of native conformation of proteins.

61. Destruction of native structure of proteins.

62. Quaternary structure of proteins.

63. Protein examples that have tertiary and quaternary structure.

64.Fibrous proteins. Their general description.

65. Collagen. Amino acid composition of collagen.

66. Derived amino acids in collagen.

67. Hydroxylated products function in collagen structure formation.

68. 5-hydroxylysine function for collagen.

69. Collagen amino acids sequence.

70. Glycine function in the formation of collagen superhelix.

71. Specificity of collagen structure.

72. Description of polyproline II helix.

73. Collagen cross-links formation.

74. Disorders in the process of synthesis in a collagen fiber.

75. Elastin. Specificity of elastin structure.

76. Allysine formation in fibrous proteins.

77. Heterocycle structures that are characteristic for elastin.

78. Keratin. Keratin specific structures.

79. Polar and apolar edges formation in the α- helixes of keratin.

80. Correlation between structure and function of the proteins.

81. General description of globular proteins.

82. Function and the types of hemoglobin.

83. Structure of hemoglobin.

84. Structure and function of heme group.

85. Function of myoglobin.

86. Structure of myoglobin.

87. Primary, secondary and tertial structures of myoglobin and hemoglobin.

88. Oxygen binding in myoglobin and hemoglobin

89. Oxygen saturation curves for myoglobin and hemoglobin

90. Hill coefficient and its interpretation

91. Molecular mechanism of cooperativity during oxygen binding in hemoglobin.

92. Conformation changes of heme and polypeptide bound to heme during changing deoxyhemoglobin into its oxygenated form.

93. His146 /Asp94 ionic couple and dissociation of hydrogen ions.

94. Bohr effect.

95. Biochemical mechanism of transportation H+CO2 and O2.

96. Transportation of CO2 using isohydric transport and in the form of carbaminohemoglobin.

97. Buffering function of hemoglobin.

98. Description of 2,3-bisphosphoglycerate.

99. Regulation of hemoglobin affinity by concentration of 2,3-bisphosphoglycerate.

100. Hypoxia and 2,3-bisphosphoglycerate.

101. Function of hemoglobin and glutathione in the transportation of NO.

102. Clinical aspects of formation nitrogen monoxide.

103. Functioning of nitroglycerin.

104. Hemoglobinopathies.

Enzymes

105. Classification of enzymes.

106. Steps of the reactions catalyzed by enzymes.

107. Structure of enzymes.

108. Substrate binding center.

109. Catalytic site of an enzyme.

110. Lock and key model for enzyme-substrate complex formation.

111. „Induced fit" model for substrate binding.

112. Transition state for enzyme catalyzed reactions.

113. Activation energy.

114. Energy diagrams for reactions catalyzed by enzymes and without them. enzyme catalyzed

115. Catalytic Triade in the active center of serinoproteases.

116. General principles of enzymes kinetics.

117. Essence of Michael constant Km.

118. Significance of different Km of glucose binding for hexokinase isozymes.

119. Biochemical roots of Asians high sensitivity toward alcohol.

120. Dependence of enzymatical reactions velocity on the substrate concentration.

121. Michael-Menten's equation and its interpretation.

122. Coenzymes in the process of catalyzes.

123. Classification of coenzymes.

124. Differences between coenzymes and prosthetic groups.

125. Oxidation-reduction coenzymes.

126. Coenzyme forms for niacin.

127. NAD^+ participation in oxidation-reduction process using lactate dehydrogenase example.

128. Coenzyme forms for riboflavin.

129. Activation-Transfer coenzymes.

130. Thiamine pyrophosphate (TPP), its structure and functional groups.

131.TPP participation in metabolic conversion processes.

132. Coenzyme A, its structure and functional groups.

133. Function of coenzyme A in transfer reactions.

134. Pyridoxal phosphate, its structure and functional groups.

135. Function of pyridoxal phosphate in the metabolism of amino acids.

136 Biotin, its structure.

137. Participation of biotin in carboxylation reactions.

138. Common characteristics for activation-transfer coenzymes.

139. Metal ions as cofactors.

140. Factors acting on enzymes activity: optimal pH.

141. Optimum pH differences in the isoenzymes using the example of alcohol dehydrogenase.

142. Influence of the temperature on enzyme catalyzed reactions.

143. Importance of enzyme thermolability using glucose-6-phosphate dehydrogenase example.

144. Mechanism based inhibitors.

145. Covalent inhibitors.

146. Inhibition by heavy metals.

147. Regulation of enzyme activities by conformation changes.

148. Allosteric enzymes.

149. Allosteric activation.

150. Allosteric inhibition.

151. Dependence of allosteric enzyme velocity on the concentration of substrate.

152. Allosteric enzyme in metabolic pathways.

153. Conformation changes that are caused by covalent modification of enzymes.

154. Phosphorylation/dephosphorylation – covalent modification discussed with the example of muscle glycogen phosphorylase.

155. Conformational changes caused by protein-protein interactions.

156. Proteolytic cleavage.

157. Inhibition of enzyme activity.

158. Competitive inhibition.

159. Non-competitive inhibition.

160. Mechanism of action of elective inhibitors using the example of aspirin.

161. Transition state inhibitors.

162. Penicillin, analog of transition state complex.

163. Suicide inhibitors.

164. Irreversible inhibitors.

165. Regulation of metabolic pathways.

166. Regulation of intracellular concentration of enzymes.

167. Regulated synthesis of enzymes.

168. Regulated degradation of enzymes.

169. Feedback inhibition.

170. Feed forward regulation.

171. Compartmentalization of enzymes.

172. Clinical use of enzymes.

173. Determination of enzymes activity for diagnostic reasons.

174. Isoenzymes and their diagnostic importance using creatine kinase and lactate dehydrogenase example.

175. Therapeutic use of some enzymes.

176. Enzymopathies: Examples from clinics.

Signal transduction, Bioenergetics

177. Main principles and pathways for signal transduction.

178. Contact dependent signal transduction.

179. Signal transduction using endocrine pathway.

180. Signal transduction using paracrine pathway.

181. Signal transduction using synaptic pathway.

182. Signal transduction using autocrine pathway.

183. Receptors for messenger molecules. Their types and general description.

184. Chemical messengers.

185. Water soluble and fat-soluble secondary messengers.

186. Transducer proteins.

187. Effector proteins.

188. Plasma membrane receptors.

189. Protein phosphorylation in signal transduction pathways.

190. Energy producing and energy consuming processes.

191. Structure of acetyl CoA.

192. Sources of acetyl CoA.

193. Metabolic pathways of acetyl CoA.

194. Metabolic sources of pyruvate.

195. Pyruvate conversion pathways.

196. Composition of pyruvate dehydrogenase complex (PDH).

197. Insulin and catecholamines action on pyruvate dehydrogenase.

198. Pyruvate dehydrogenase deficiency.

199. Krebs (TCA) cycle. Its essence and importance.

200. Substrates and products of Krebs cycle.

201. Reactions of Krebs cycle.

202. Description of the reaction catalyzed by citrate synthase.

203. First stage of NADH and CO2 production in TCA cycle.

204. α-ketoglutarate dehydrogenase complex and its similarity to PDH.

205. Second stage of NADH and CO2 production in TCA cycle.

206. Substrate level phosphorylation in TCA cycle.

207. Description of succinate dehydrogenase.

208. Production of L-malate in the Krebs cycle.

209. Regeneration of oxaloacetate in the last step of TCA cycle.

210. Coenzymes in TCA cycle.

211. Total energy production in the citric acid cycle.

212. Functioning of TCA cycle as open cycle.

213. Usage of TCA cycle intermediates in the processes of biosynthesis.

214. Anaplerotic reactions.

215. Regulation of TCA cycle.

216. Factors that define TCA cycle velocity.

217. Supplying TCA cycle with the substrates.

218. Breathing rate control influence on the course of TCA cycle.

219. Electron transport chain.

220. I complex of mitochondrial respiratory chain.

221. II complex of mitochondrial respiratory chain.

222. III complex of mitochondrial respiratory chain.

223. IV complex of mitochondrial respiratory chain.

224. Electron transfer by cytochromes.

225. V complex of mitochondrial respiratory chain – ATP synthase.

226. Inhibitors of electron transport chain.

227. Inhibition of respiratory chain by cyanide.

228. Oxidative phosphorylation.

229. Formation of ATP from NADH.

230. Formation of ATP from FADH2

Carbohydrate metabolism

231. ATP delivery from glucose.

232. Idea and importance of glycolysis.

233. Cells and tissues that are dependent on glucose.

234. Pasteur effect.

235. Glucose transporters (GLUT).

236.GLUT1 and metabolic pathways of glucose conversion inside erythrocytes.

237. GLUT2 and metabolic pathways of glucose conversion inside a liver.

238. GLUT3 and glucose usage by brain.

239. Insulin dependent glucose transporter.

240. Glucose metabolic conversion in the muscle and adipose tissues.

241. Three stages of glycolysis.

242. Priming of glucose.

243. Production of glucose-6-phosphate and its importance in the glucose metabolism.

244. ATP,, investment" steps in glycolysis.

245. Phosphorylated intermediates cleavage in glycolysis.

246. Reaction products catalyzed byaldolase.

247. Importance of triose phosphate isomerase.

248. Getting 1,3-bisphosphoglycerate and reduction of NAD+ in the glycolysis.

249. Substrate level phosphorylation in the glycolysis.

250. Differences between oxidative and substrate level phosphorylation.

251. Shuttle of 2,3-bisphosphoglycerate.

252. 2,3-bisphosphoglycerate function in erythrocytes.

253. Production of phosphoenolpyruvate in the glycolysis.

254. Second step of ATP delivery in glycolysis.

255. Final step of anerobic glycolysis.

256. Energetical outcome of anerobic glycolysis.

257. Following conversions of NADHreceived from glycolysis.

258. Mechanism of malate-aspartate shuttle action.

259. Energetical outcome of malate-aspartate shuttle action.

260. Mechanism of glycerol phosphate shuttle action.

261. Energetical outcome of glycerol phosphate shuttle action.

262.Energetical outcome of glucose complete oxidation.

263. Main principles of glycolysis regulation. Three irreversible steps of the glycolysis.

264. Main aspects of hexokinase and glucokinase regulation.

265. Glucokinase localization.

266. Different kinetic characteristics of hexokinase and glucokinase.

267. Lactic acidosis.

268. Hemolitic anemia caused by pyruvate kinase genetic deficiency.

269. Definition and importance of gluconeogenesis.

270. Substrates of gluconeogenesis.

271. Four main reactions of gluconeogenesis

272. Cori cycle.

273. Glucose-Alanine cycle.

274. Produced and used ATP quantity inGlucose-Alanine cycle.

275. Comparing Cori and alanine cycle.

276. Glucose production from lactate.

277. Energy usage steps during conversion of pyruvate into phosphoenolpyruvate.

278. Hydrolyses of fructose-1,6-bisphosphate.

279. Producing free glucose in the last step of gluconeogenesis.

280. Usage of amino acids in the gluconeogenesis process.

281. Gluconeogenesis pathways starting from alanine and their correlation with urea cycle.

282. Compounds that can not enter in the gluconeogenesis.

283. Odd carbon numbered fatty acids as the precursors of gluconeogenesis.

284. Producing glucose from glycerol.

285.Use of ATP in the process of gluconeogenesis.

286. Role of fatty acids in gluconeogenesis.

287. ,,Choice" of pyruvate conversion pathway.

288. Mechanism of developing hypoglycemia during alcohol consumption.

289. Tendency of hypoglycemia development in premature infants.

290. Glycogen, as the carbohydrate storage form in a human body.

291. Structure of glycogen molecule.

292. Functional differences for muscle and liver glycogen.

293. Description of glycogen degradation (glycogenolysis).

294. Key enzymes in the process of glycogenolyses.

295. Comparison of glycogen phosphorylase and α-amylase.

296. The product produced by the action of glycogen phosphorylase.

297. Mechanism of action of debranching enzyme (DB).

298. The product produced by the action of DB enzyme.

299. Glycogen storage diseases.

300. Description of glycogen biosynthesis (glycogenesis).

301. Enzymes involved in the process of glycogenesis.

302. Reversible reaction for glycogenolyses and glycogenesis.

303. Production of,, activated glucose'' in the process of glycogenesis.

304. α–1,4 glyosidic linkage formation in the process of glycogen biosynthesis.

305.α–1,6glyosidic linkage formation in the process of glycogen biosynthesis.

306. Glycogenin and its function in the process of glycogen biosynthesis.

307. Advantages of glycogen as the storage form.

308. General aspects of glycogen metabolism regulation.

309. Glucose synthesis from fructose.

310. Function of aldolase B.

311. Fructolysis.

312. Glucose conversion into fructose.

313. Fructose intolerance.

314. UDP-glucose synthesis and importance.

315. Interconversion of glucose and galactose.

316. Galactosemia.

Lipid metabolism

317. General description of lipids.

318. Structure and chemical characteristics of triacylglycerols.

319. Importance of triacylglycerols as the storage form.

320. Classes of plasma lipoproteins.

321. Structure of plasma lipoproteins.

322. Hyperlipidemias.

323. Lipoprotein lipase. Its substrate, activator, product.

324. Lipases in adipocytes.

325. Perilipin.

326. Products of intracellular lipolysis and their use.

327. Ways of glycerol use.

328. Function of glycerol kinase and place of action.

329. Glucose as the precursor for fatty acids synthesis.

330. General description of fatty acid synthesis.

331. Function of palmitic acid in fatty acid metabolism.

332. Starting compound for fatty acids biosynthesis.

333. Limiting step in fatty acid synthesis.

334. Active and non-active forms of acetyl-CoA carboxylase.

335. Stoichiometry of acetyl-CoA conversion in palmitate.

336. Transport of acetyl-CoA required for fatty acid biosynthesis from cytosol into mitochondria.

337. Citrate synthase and citrate lyase.

338. Role of citrate in fatty acid synthesis.

339. Function of cytosolic NAD-dependent malate dehydrogenase.

340. Function of NADP-dependent malate dehydrogenase (malic enzyme).

341. Sources of NADPH required for fatty acid biosynthesis.

342. The place and the mechanism of fatty acids storage.

343. Production of fatty acyl-CoA.

344. Ways of producing glycerol-3-phosphate.

345. Steps of triacylglycerols synthesis.

346. Specificities of triacylglycerol synthesis in the brush border small intestine.

347. Fatty acid use for energy production.

348. Comparing fatty acid oxidation and synthesis.

349. Activation of fatty acids.

350. Carnitine as the transporter of CoA and its derivatives.

351. Carnitine palmitoyl transferase I(CPT I).

352. Carnitine acyl carnitine translocase.

353. Carnitine palmitoyl transferase II(CPT II).

354. Disorder of carnitine transporting mechanism and its treatment.

355. Reactions of fatty acid βoxidation.

356. FADH2 delivery in the process of fatty acid βoxidation.

357. NADH delivery in the process of fatty acid βoxidation.

358. Reaction catalyzed by ketothiolase.

359. Substrate specificity for acyl CoA dehydrogenases.

360. Trifunctional protein in the process of long chain fatty acid βoxidation.

361. Energy production in the process of palmitic acid βoxidation.

362. Specificities in the oxidation process of odd chain fatty acids.

363. Genetic deficiency of acyl CoA dehydrogenases.

364. Ketone bodies.

365. Localization of ketone bodiessynthesis process.

366. Starting compound in ketone bodies synthesis

367. Production of acetoacetyl-CoA- first step in the ketone bodiesbiosynthesis.

368. HMG-CoA synthase.

369. HMG-CoA lyase.

370. Importance of mitochondrial NADH/NAD+ ratio for defining direction of the reaction catalyzed by β–hydroxybutyrate dehydrogenase.

371. NADH/NAD+ changes in the fast state.

372. Producing acetone from acetoacetate.

373. Isozymes of HMG-CoA synthase.

374. Importance and location of ketone bodies usage.

375. Atkins diet.

376. Enzymes required for ketone body utilization.

377. Hyperketonemia and ketoacidosis.

378. General principles of fat metabolism regulation after a meal.

379. Stimulating influence of insulin on the key enzymes for lipid biosynthesis and storage.

380. Role of GLUT 4 in adipocytes.

381. Influence of insulin on the process of lipolysis.

382. General principles of lipid metabolism regulation in the fast state.

383. Function of epinephrine and glucagon in lipid metabolism.

384.Ways for the activation of lipolysis.

385. Ways for down regulation of fatty acid synthesis.

386. Preconditions for the activation of ketogenesis.

387. Regulation of CPT I.

388.General description of cholesterol structure and function.

389. Structural role of cholesterol.

390. Cholesterol as the precursor of important compounds.

391. Synthesis and the excretion of cholesterol.

392. Location of cholesterol synthesis process.

393. Starting compound of cholesterol synthesis and steps of the synthesis process.

394. Comparing starting steps of cholesterol and ketone bodies biosynthesis.

395. Description of HMG-CoA reductase.

396. Clinical use of HMG-CoA reductase inhibitors.

397. Production of farnesyl pyro phosphate.

398. Last steps of cholesterol biosynthesis.

399. Transport of triacylglycerols, cholesterol and cholesterol esters.

400. Classes of apoproteins and their importance.

401. Very low-density lipoproteins (VLDL).

402. Structure and function of chylomicrons.

403. Function of low-density lipoproteins (LDL).

404. Function of high-density lipoproteins (HDL).

405. Cholesterol ester transferring protein (CETP).

406. “Reverse transport of cholesterol”.

407. Lecithin: cholesterol acyl transferase (LCAT).

408. Multiligand receptor of lipoproteins on the plasma membrane of liver cells.

409. Evaluation of normal cholesterolemia.

410. Balance of exo- and endogenous cholesterols.

411. Liver role for maintenance of normal levels of cholesterol in the bloodstream.

412. Different mechanisms of HMG-CoA reductaseregulation.

413. Structure of LDL receptor.

414. Role of LDL-receptor in the regulation of cholesterol synthesis.

415. “Bad” and “good” lipoproteins.

416. Correlation of LDL and HDL concentrations with the development of atherosclerosis and ischemic heart disease.

417. Familiar hypercholesterolemia.

418. Screening of hypercholesterolemia.

419. Main directions in the treatment of hypercholesterolemia.

420. Biochemical aspects in the pathogenesis of atherosclerosis.

421. Excretion of cholesterol in the form of bile acids.

422. Enterohepatic circulation of bile acids.

423. Functions of bile acids and phospholipids.

424. Importance of cholesterol in the synthesis of Vitamin D.

Amino acids metabolism

425. Turnover of proteins and nitrogen balance.

426. Pathological conditions for which negative nitrogen balance is characteristic.

427. Reasons of developing positive nitrogen balance.

428. Synthesis of non-essential amino acids.

429. General description of amino transferases.

430. Examples of transamination reactions.

431. Importance of transamination reactions.

432. Amino acids that do not participate in transamination reactions.

433. Importance of the couple Glutamate/α-ketoglutarate in amino acids conversions.

434. Usage of α-ketoisovalerate for the treatment of hyperammonemia.

435. Role of pyridoxal phosphate in the transamination reactions.

436. Description of glutamate dehydrogenase.

437. Coenzymes of glutamate dehydrogenase.

438. Receiving ATP from glutamate.

439. Allosteric regulation of glutamate dehydrogenase.

440. Different pathways of ammonium production in human body.

441. Transportation of ammonium in the form of amine or amide group.

442. Role of glutamine synthetase.

443. Substrates of glutamine synthetase.

444. Role of glutaminase.

445. Products of the reaction catalyzed byglutaminase.

446. Role of glutamate in the synthesis, degradation and interconversion of amino acids.

447. Glutamine cycle in the liver cells.

448. Synthesis of asparagine.

449. Using exogenic asparaginase for the patients with the leukemia.

450. Importance of amino acids oxidases.

451. Comparison of the reactions catalyzed by amino acids oxidases and by glutamate dehydrogenase.

452. Proteolysis happening in the body.

453. Following conversions of amino acids delivered from the proteolysis.

454. Products of amino acids catabolism.

455. Mechanism for developing cachexia.

456. Essence and the importance of urea cycle in mammalian organisms.

457. Sources of urea nitrogens.

458. First and the last compound of urea cycle.

459. Differences according to the first and last compounds between two Krebs cycle.

460. Carbamoyl phosphate synthetase I.

461. Carbamoyl phosphate synthetase II.

462. ATP quantity required for carbamoyl phosphate formation.

463. Localization of urea cycle enzymes.

464. Receiving citrulline in the urea cycle.

465. Second step of ATP usage in urea cycle.

466. Receiving TCA cycle intermediates from urea cycle.

467. Last step of urea cycle.

468. Amino acid that can be converted into ornithine.

469. Factors that make arginine to be non-essential.

470. Following metabolism of urea cycle intermediate – fumarate.

471. Synthesis of N-acetyl glutamate.

472. Allosteric regulation of carbamoyl phosphate synthetase I.

473. Induction of urea cycle enzymes.

474. Hyperammonemia and the mechanism underlying coma development.

475. Treatment principles for urea cycle enzymes deficiencies.

476. Compounds delivered from glutamate.

477. Deficiency of urea cycle enzymes.

478. Derivatives of serine.

479. Metabolism of phenylalanine.

480. Pathways of tyrosine conversion.

481. Deficiency of folic acids.

482. Pathogenesis of phenylketonuria.

483. Tyrosinemia.

484. Alkaptonuria.

485. Albinism.

486. Molecular mechanism of Parkinson disease.

487. Hyperhomocysteinemiaand its correlation with atherosclerosis.

488. Metabolism of tryptophan.

489. Catabolism of valine and isoleucine.

490. Ketogenic amino acids.

491. Synthesis and function of creatine.

192. Synthesis of glutathione.

493. Importance of glutathione.

Heme metabolism

494. Structure of protoporphyrin IX.

495. Porphyrinogens.

496. Porphyrins.

497. Porphyrias.

498. General description of heme biosynthesis.

499. Tissue and cell localization of heme biosynthesis.

500. δ–aminolaevulinic acid (ALA) synthase.

501. Production of ALA synthase.

502. Regulation ALA synthasesynthesis and activity.

503. Clinical and diagnostic specificities of acute intermittent porphyria.

504. First stage of heme biosynthesis.

505. Function of pyridoxal phosphate in the heme biosynthesis.

506. Isoforms of ALA synthase and sideroblastic anemia.

507. Description of aminolaevulinic acid dehydratase.

508. Substrates and products of aminolaevulinic acid dehydratase.

509.Influence of lead on ALA dehydratase.

510. Synthesis of porphyrin ring.

511. Production of hydroxymethylbilane.

512. Uroporphyrinogen III synthase and erythropoietic porphyria.

513. Production of coproporphyrinogens.

514. Disorders caused by the deficiency of uroporphyrinogen decarboxylase.

515. Role of coproporphyrinogen oxidase in the process of heme biosynthesis.

516. Hereditary coproporphyria.

517. Protoporphyrinogen oxidase and its deficiency.

518. Last step of heme biosynthesis.

519. Regulating factors for the limiting step of heme biosynthesis.

520. Specificities of heme containing proteins catabolism.

521. Description of heme oxygenase.

522. Substrate of heme oxygenase.

523. Participation of NADPH in the heme catabolism.

524. Production of endogenic carbon monoxide.

525. Index of degraded heme quantity.

526. Product of heme oxygenase.

527. Production of bilirubin.

528. Manifestation of heme metabolism in erythrocytes.

529. Manifestation of heme containing protein turnover in liver.

530. Indicator of non-efficient erythropoiesis.

531. Cytoprotective role of heme oxygenase.

532. Comparing action of CO and NO.

533. Positive effects of biliverdin.

534. Transport of insoluble bilirubin in the blood plasma.

535. Reasons causing bilirubin toxicity.

536. Mechanismof bilirubin transport in hepatocytes.

537. Production of mono- and diglucuronides of bilirubin in liver.

538. Pathway of bilirubin diglucuronides from liver toward intestines.

539. Determination of conjugated bilirubin by direct van den Bergh reaction.

540. Indirect van den Bergh reaction.

541. Definition of direct and indirect bilirubin.

542. Comparison of direct and indirect bilirubin.

543. Hyperbilirubinemia.

544. Hyperbilirubinemia caused by excessive destruction of heme.

545. Newborns isoimmune hemolysis and kernicterus.

546. Bilirubin-UDP-glucuronyl transferase and its isoforms.

547. Criglernajjar syndrome.

548. Gilbert syndrome

549. Hyperbilirubinemia caused by direct bilirubin.

Fed-fast cycle, integration of energetic compounds metabolism

550. Biochemistry of obesity.

551. Genetic and dietary components of obesity.

552. Obesity as the risk factor of development many disorders.

553. Adipocytes as endocrine cells.

554. Role of leptin in the development of obesity.

555. Biochemical strategy to lose weight.

556. Biochemical reasons of gaining weight again after weight lost.

557. Ways for energy production in the fed state.

558. Metabolic conversions of diet derived glucose in the liver.

559. Main pathways of using glucose as the source of energy.

560. Pathways of storage excess quantity of glucose.

561. Excess glucose quantity as precondition of obesity development.

562. Glucose as the source of NADPH required for biosynthetic and detoxification processes.

563. Distribution of amino acids derived from diet protein degradation between different tissues.

564.Amino acids metabolism in liver.

565. Catabolic conversions of amino acids.

566. Usage of amino acids for protein biosynthesis.

567. Amino acids involvement in lipogenesis.

568. Diet derived triacyl glycerol usage and distribution in the body.

569. Metabolism of chylomicrons.

570. Sources of triacylglycerols present in VLDL.

571. Metabolism of VLDL.

572. Molecular mechanism of insulin secretion from pancreatic β–cells.

573. Maintenance of glucose homeostasis in the beginning of fast state.

574. Maintenance of glucose homeostasis in the later stages of fast state.

575. Glutamine and glutaminolysisas the source of the energy for some cells.

576. Metabolic processes required for energy production in the fast state.

577. Protein malnutrition – Kwashiorkor.

578. Marasmus caused by starvation.

579. Insulin/glucagon and caloric homeostasis.

580. Biochemical mechanism of hyperosmotic coma development.

581. Hyperglycemia and glycation of proteins.

582. HemoglobinA1c. –glycosylated hemoglobin.

583. Importance of determining glycated hemoglobin during diabetes.

584. Importance of protein glycation in the development of diabetes complications.

585. Maintenance of glucose homeostasis during fast state.

586. Main directions of fighting obesity.

587. Role of fatty acid metabolism in type 2 diabetes.

588. Molecular mechanism of type 2 diabetes development.

589. Correlation of type 2 diabetes with the obesity.

590. Biochemical reasons of developing insulin resistance.

591. Metabolic disorders and complications accompanying type 1 diabetes.

592. Polyol pathway and complications of diabetes.

593. Reduction of insulin receptor kinase activity during diabetes mellitus in pregnant women.

594. Stomach and pancreas peptidases.

595. Zymogens and autoactivation in digestive enzymes.

596. Value of pH for different digestive enzymes.

597. Amino acids and peptides transporters.

598. Neutral aminoaciduria – Hartnup disease.

599. Digestion of hydrated starch and glycogen.

600. Products received from the digestive action of α–amylase.

601. Disaccharidase complexes of a small intestine.

602. Disaccharidases deficiencies.

603. Monosaccharide transporters.

604.Composition of dietary lipids.

605. Ways to overcome lipids hydrophobicity during digestion and absorption.

606. 5 stages of lipids digestion.

607. Products delivered from pancreatic lipase digestive action.

608. Nonspecific lipid esterase and phospholipases in the process of digestion.

609. Pharmacological treatments against fat absorption and obesity.

610. Solubilization of lipids by bile acids.

611. Biochemical mechanisms of cholesterol stones formation.

612. Absorption of fatty acids with different chain length

613. Synthesis of triacyclglycerols and cholesterol esters in the epithelial cells of the intestines.

614. Differences between the transportation of absorbed fatty acids with medium and long chain.

615. a-β–lipoproteinemia.

616. Chemical composition an synthesis of bile acids.

617. Transportation of bile acids.

618. Enterohepatic circulation.

619. Metabolic alkalosis caused by familiar chloridorea.

620. Bacterial toxicogenic diarrhea and substitutive therapy by electrolytes.

621. Main energetic sources of the body.

622. Carbohydrates present in the diet.

623. Energetic function of carbohydrates.

624.Proteins present in the diet.

625. Energetical and other functions of proteins.

626. Lipids present in the diet.

627. Structural and energetical functions of lipids.

628. Ways of getting ATP.

629. ATP/ADP cycle.

630.Storage of energy sources in the body.

631. Daily energy expenditure.

632. BMR (Basal Metabolic Rate)

633. RMR (Resting Metabolic Rate)

634. Factors influencing RMR.

635. Principles to calculate basal metabolic rate.

636. Diet induced thermogenesis.

637. Healthy body weight.

638. Body mass index BMI.

639. Factors causing weight gain and weight loss.

640. Dietary requirements of the body.

641. Essential substances.

642. Essential fatty acids.

643. Complete proteins.

644. Importance of adequate content of vitamins in the diet.

645. Role of mineral components in the processes important for life.

646. Xenobiotics.

647. Metabolic homeostasis.

648. Signals regulating metabolic homeostasis.

649. Main hormones of metabolic homeostasis.

650. Insulin synthesis and secretion.

651. Stimulation and inhibition of insulin secretion.

652. Mechanisms of resistance development toward insulin.

653. Hyperinsulinemia.

654. Glucagon synthesis and secretion.

655. Regulators of glucagon secretion.

656. Changes of hormone levels after a meal.

657. Secretion of insulin and glucagon after taking a meal reach in the proteins.

658. Signal transduction by peptide hormones and catecholamines.

659. Signal transduction by insulin.

660. Signal transduction by glucagon.

661. Signal transduction by glucocorticoids.

662.Signal transduction by epinephrine and norepinephrine.

663. Metabolic pathways activated by insulin.

664. Lipoproteins metabolism in the absorption phase.

665. Factors acting on chylomicrons and VLDL metabolism.

666. Metabolism of amino acids in the absorption phase.

667. Usage of amino acids to synthase different compounds.

668. Energetic function of amino acids.

669. Turnover of proteins.

670. Changes in hormone levels in the fast state.

671. Metabolic pathways activated by insulin antagonist hormones.

672. Role of liver in the fast state.

673. Metabolic status of night sleep.

674. Adipose tissue in the fast state.

675. Integration if carbohydrates and lipid metabolism.

676. General description of metabolic pathways regulation.

677.Regulation of carbohydrates and lipid metabolism in the fed state.

678. Regulating mechanisms of glycogen and triacylglycerol synthesis in the liver.

679. Role of glucokinase in the fed state.

680. Regulation of glycogen synthase activity in the fed state.

681. Importance of phosphofructokinase-1 and pyruvate kinase for lipogenesis.

682. Activity of pyruvate dehydrogenase complex – precondition of fatty acids biosynthesis.

683. Production pathways of citrate as the compound participating in lipogenesis.

684. Regulation of enzymes producing acetyl CoA that is required for fatty acids synthesis.

685. Regulation of enzymes producing NADPH that is required for fatty acids synthesis.

686. Importance of insulin/glucagon ration for the quantity of fatty acid synthase.

687. Regulatory mechanisms for triacylglycerol storage in the adipose tissue.

688. Insulin influence on lipoprotein lipase.

689. Transport of glucose in the adipocytes.

690.Regulation of carbohydrates and lipids in the fast state.

691. Changes in insulin/glucagon ration during.

692. Regulatory mechanisms of lipolysis in the adipose tissue.

693. Regulatory mechanisms of ketogenesis.

694. Regulation of gluconeogenesis during fasting.

695. Regulation of glycolysis during fasting.

696. Usage of glucose, fatty acids and ketone bodies by different tissues during fasting.

697. Regulation of hormone sensitive lipase during fasting.

698. Utilization of glucose and fatty acids in muscle.

699. Necessity of essential amino acids to be present in the diet.

700. Requirement of an adult for proteins.

701. Vegetarian diet.

702. Requirement for proteins for growing organism.

703. Requirement for proteins during illness.

704. Protein rich diet and kidney diseases.

705. Protein – consumption of excess energy.

706. Loading with carbohydrates in athletes.

707. Recommendations to choose correct diet for diabetic patients.

708. Concept of food glycemic index.

709. Glycemic index and glycemic loading.

710. Importance of plasma cholesterol levels.

711. Influence of diet components on the levels of plasma cholesterols.

712. Correlation between polyunsaturated /saturated fatty acids and the levels of cholesterol and triacylglycerols.

713. Influence of dietary fiber on the levels of cholesterols.

714. ω3 –polyunsaturated fatty acids (PUFA) and the risk factors for cardiac disease development.

715. Positive effects of ω3 PUFA.

Vitamines

716. Classification of vitamins.

717. Fat soluble vitamins.

718. Active forms of vitamin A.

719. Precursor of vitamin A found in plants.

720. Getting retinol from carotenoids.

721. Retinol containing products from the diet.

722.Antioxidant properties of βcarotene and other carotenoids.

723. Biological function of retinol.

724. Receptors of retinoic acid.

725. A vitamin participation in visual cycle.

726. Biochemical mechanism of dry skin and skin keratinization during vitamin A deficiency.

727. Symptoms of vitamin A deficiency.

728. Vitamin A toxicity.

729. Vitamin D as a prohormone.

730. Synthesis of cholecalciferol in the skin.

731. Food reach in vitamin D.

732. Metabolism of cholecalciferol and ergocalciferol in liver.

733. Production of 1,25-dihydroxy cholecalciferol (calcitriol) in kidneys.

734. Synergic action of calcitriol and parathyroid hormone (PTH).

735. Regulation of calcium concentration by vitamin D and parathyroid hormone.

736. Influence of PTH levels on the production of 1,25(OH)2D and 24,25(OH)2D.

737. Synthesis of a protein calbindin induced by 1,25(OH)2D.

738. Importance of bone resorption in the maintenance of calcium homeostasis.

739. Regulation of calcium excretion by kidneys.

740. Function of calcitonin in the regulation of plasma calcium concentration.

741. Renal osteodystrophy.

742. Bone as the reservoir of calcium and phosphate.

743. Vitamin D deficiency in kids.

744. Vitamin D deficiency in adults.

745. Osteomalacia and osteoporosis.

746. Target cells of 1,25(OH)2D.

747. Risk groups in which vitamin D deficiency can be developed.

748. Reasons for vitamin D metabolism disorders.

749. Hypercalcemia and metastatic calcification.

750. Vitamin E forms in food.

751. Antioxidant characteristics of tocopherols and tocotrienols.

752. Localization of tocopherols and tocotrienols.

753. α–tocopherol action.

754. γ–tocopherol action.

755. Role of tocopherols and tocotrienols in the prevention of cardio-vascular diseases.

756. Function of vitamin E in heme biosynthesis.

757. Positive influence of vitamin E on immune system.

758. Natural forms of vitamin K.

759. Function of vitamin K in γ–carboxylation reactions.

760. Vitamin K dependent activation of proteins participating in the blood coagulation.

761. Influence of vitamin K on osteocalcin.

762. Reasons of developing vitamin K deficiency.

763. Clinical symptoms of vitamin K deficiency.

764. Anticonvulsants and vitamin requirement.

765. General description of water soluble vitamins.

766. General signs of hypovitaminosis for water soluble vitamins.

767. Vitamin thiamine as a coenzyme.

768. Participation of coenzyme derived from thiamine in metabolic processes.

769. Symptoms of mild thiamine deficiency.

770. Severe deficiency of thiamine – Beri-beri.

771. Nutritional problems in alcoholics.

772. Riboflavin and coenzymes derived from riboflavin.

773. Clinical symptoms of riboflavin deficiency.

774. Food reach in riboflavin.

775. Niacin derived from food, as the precursor of oxidation-reduction coenzymes.

776. Synthesis of niacin in the body.

777. Function of NAD+ and NADP+ in metabolic pathways.

778. Pellagra, risk groups for its development.

779. Pyridoxine, pyridoxamine and pyridoxal.

780. Coenzyme function of pyridoxal phosphate.

781. Vitamin B6 and synthesis of neurotransmitters and sphingolipids.

782. Function of vitamin B6 in heme biosynthesis.

783. Correlation of vitamin B6 deficiency with cardio-vascular diseases.

784. Requirement for vitamin B6.

785. Test of tryptophan loading.

786. General description of ascorbic acid.

787. Vitamin C as a cofactor for mixed function oxidases.

788. Vitamin C in the reactions of amino acids hydroxylation.

789. Function of ascorbic acid in the synthesis of carnitine.

790. Function of ascorbic acid in the synthesis of norepinephrine.

791. Reason of developing capillary cell wall fragility during vitamin C deficiency.

792. Mechanism of overall weakness development during carnitine deficiency.

793. Function of vitamin C in corticosteroids biosynthesis.

794. Role of ascorbic acid in the absorption of iron.

795. Symptoms of mild vitamin C deficiency.

796. Symptoms of scurvy and their biochemical reasons.

797. Reasons causing vitamin C deficiencies.

798. Daily requirement for vitamin C in smoking and non-smoking populations.

799. Usage of vitamin C for preventive and for therapeutic reasons.

800. Negative outcomes of hyper dosage of ascorbic acid.

801. Calcium as one of the main minerals for the body.

802. Importance of calcium homeostasis.

803. Reservoirs of calcium.

804. Multifunctional action of calcium.

805. Calcium requirement in the diet.

806. Symptoms of calcium deficiency.

807. Diet recommendations for the risk groups of osteoporosis.