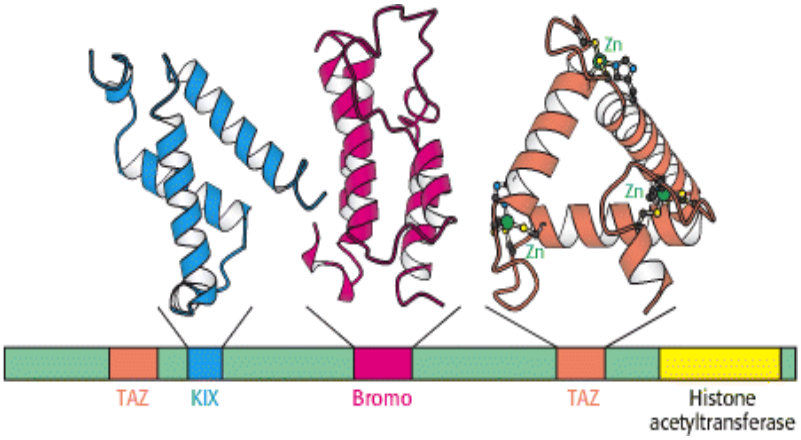
STATE UNIVERSITY OF MEDICINE AND PHARMACY
"NICOLAE TESTEMIŢANU"

**Gavriliuc Ludmila**

# BIOCHEMISTRY

Tests for students

**(Methodic material)**




**CHIŞINĂU**
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**STATE UNIVERSITY OF MEDICINE AND PHARMACY**
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Medical education worldwide is undergoing major change. An integrated approach to teaching and learning has resulted in a blurring of the distinctions between the individual basic medical sciences and the clinical specialities. Integration of pathology, including clinical chemistry, with other clinical specialities, should emphasize its relevance and importance to clinical practice.

This book includes the Program, Tests and Biochemical indices (parameters) of the blood serum, urine and saliva.

These tests are based on materials in Biochemistry and Clinical Biochemistry (also known as Clinical Chemistry or Chemical Pathology) according to the Program and not as an isolated speciality and in a context in which it is used clinically. The central function of Chemical Pathology or Clinical Chemistry laboratory is to provide biochemical information for the management of patients. Such information will be of value only if it is accurate and relevant, and if its significance is appreciated by the clinician so that it can be used appropriately to guide clinical decision-making. Biochemical tests are used extensively in medicine, both in relation to diseases that have an obvious metabolic basis (diabetes mellitus, hypothyroidism) and those in which biochemical changes are a consequence of the disease (renal failure, malabsorption). Biochemical tests are used in diagnosis, prognosis, monitoring and screening.

## PROGRAM OF BIOCHEMISTRY SUBJECT

### INTRODUCTION

Subject of Biochemistry. Biochemistry importance for medicine. The greatest discoveries in Biochemistry in the $XX^{th}$ century. Peculiarities of the alive matter, levels and methods of its study.

### Chapter I

### PROTEIN STRUCTURE

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## AMINO ACIDS. CHEMICAL STRUCTURE OF PROTEINS. ENZYMES

**1.5. 0,0,1,0,0**

**Which compounds are structural units of simple proteins and what type of linkage does connect these structural elements?**

| | |
|---|---|
| A. Mononucleotides | β-glycosidic |
| B. Glucose | ester |

| | |
|---|---|
| C. Amino acids | peptide |
| D. Fatty acids | ether |
| E. Glycerol | disulfide |

**2.5. 0,1,1,0,1**

**Which of the groups of amino acids are present in the proteins and what are their characteristics?**

| | |
|---|---|
| A. Hydroxyamino acids | refer to the D-series |
| B. Thioaminoacids | refer to the L-series |
| C. Heterocyclic amino acids | are α-amino acids |
| D. Diamine dicarboxylic amino acids | are β-amino acids |
| E. Diamine monocarboxylic amino acids | have optical activity |

**3.5. 1,0,1,0,0**

**Tryptophan:**

A. is a heterocyclic amino acid
B. is a homocyclic amino acid
C. contains the heterocycle of indole
D. contains the heterocycle of imidazole
E. has acidic properties

**4.5. 1,0,0,1,1**

**For methionine and threonine the following statements are correct:**

A. their pI is in the neutral zone of pH
B. they have one asymmetric carbon-atom
C. they have identical functional groups in the structure
D. they are derivatives of the butyric acid
E. they are essential amino acids

**5.5. 0,1,0,0,0**

**The amino acids of arginine and lysine have the following common properties:**

A. contain the guanidine residue

B. have a positive charge at the physiological pH
C. are derivatives of the capronic acid
D. have several asymmetric carbon atoms
E. form peptide bonds using both amino groups

**6.5. 1,1,0,1,0**
**The total charge of proteins depends on:**
A. amino acids structure
B. pH of the solution
C. β-COOH and γ-$NH_2$ groups of the polypeptide chain
D. COOH and $NH_2$ groups of the amino acids radicals
E. hydrophobic radicals

**7.5. 0,0,1,1,1**
**Which of the statements about protein denaturation are correct?**

| | |
|---|---|
| A. Destruction of primary structure | increase of the biological activity |
| B. No changing in the protein activity | increase of the hydrophility |
| C. Destruction of tertiary structure | increase of the hydrophobity |
| D. Destruction of quaternary structure | decrease of the biological activity |
| E. No changes in the primary structure | changes in the form of molecules |

**8.5. 0,1,1,1,1**
**Colloidal solutions of the proteins have the following properties:**
A. increased speed of diffusion
B. low osmotic pressure
C. insignificant diffusion rate
D. high viscosity
E. optical properties

**9.5. 1,1,0,0,1**

**The primary structure of proteins:**

A. represents a sequence of amino acids
B. is determined genetically
C. is stabilized by weak and noncovalent bonds
D. is broken after denaturation
E. is broken after hydrolysis

**10.5. 1,1,1,0,0**

**The correct statements concerning the peptide bond:**

A. each peptide bond forms 2 hydrogen bonds
B. it exists in two resonant forms
C. atoms O and H are situated in trans-position with regard to the bond C-N
D. the bonds of α-carbon atom forbid the free rotation
E. the atoms of the peptide bond and 2 α-carbon atoms are situated in the same plane

**11.5. 0,0,1,1,0**

**Secondary structure of proteins:**

A. is stabilized by hydrophobic and ionic interactions
B. there is only α-spiral or only β-structure
C. is a result of the interaction of closely located radicals of amino acids
D. is stabilized by hydrogen bonds
E. the bonds are formed within the limits of one chain only

**12.5. 0,1,0, 1,1**

**Secondary structure of proteins:**

A. appears at the interaction of the closely situated chains only
B. represents α-spiral and β-structure
C. is stabilized by disulfide bonds between the methionine radicals
D. is stabilized by disulfide bonds between the cysteine radicals
E. appears at the interaction within a single chain or between two closely situated chains

**13.5. 1,0,1,0,1**

**Tertiary structure of proteins:**

A. is packing of the polypeptide chain is in three-dimensional space
B. is stabilized by covalent bonds
C. is determined by the sequence of amino acids, their form and polarity
D. does not cause biological activity
E. is broken at denaturation

**14.5. 1,1,0,0,0**

**Quarternary structure of proteins:**

A. is the result of protomers interaction with the formation of the functional protein
B. is the result of the interaction of the contact surfaces of domains
C. is stabilized by covalent bonds
D. does not collapse at denaturation
E. the protein molecule has mobility

**15.5. 0,1,1,1,0**

**The following proteins have the quarternary structure:**

A. mioglobin
B. hemoglobin
C. fibrinogen
D. lactate dehydrogenase ($LDH_1$)
E. serum albumin

**16.5. 1,0,0,1,0**

**The correct statements about enzymes:**

A. are biological catalysts
B. are inorganic catalysts
C. exist only in an active form
D. in organism exist also in an inactive form
E. catalyze only reactions of synthesis

**17.5. 1,1,0,0,1**

**General properties of both enzymes and non-biological catalysts are:**

A. don't change the direction of reaction
B. don't change the equilibrium of a reversible reaction
C. catalyze the reaction in mild conditions
D. catalyze the reaction in both directions
E. not spent during reaction

**18.6. 0,1,1,1,0**

**Enzymes differ from inorganic catalysts by that they:**

A. accelerate thermodynamically possible reactions
B. have specificity
C. have a much greater catalytic efficiency
D. catalyze the reactions in mild conditions
E. reduce the energy of activation for the chemical process

**19.5. 1,0,1,1,1**

**The active center of an enzyme represents:**

A. a unique complex of three-dimensional structure
B. a point in the tertiary structure
C. a cofactor enters in the structure of the active center
D. the active center consists of catalytic and contact sites
E. the substrate is connected in the active center

**20.5. 0,1,1,1,0**

**The correct statements about the mechanism of enzymes' action:**

A. Substrate isn't changed in the enzyme-substrate complex
B. Substrate is deformed in the enzyme-substrate complex
C. The complementarity of the active center is induced by the substrate
D. Enzyme-substrate complex reduces the substrate's entropy, promoting the achievement of a transitive state
E. Enzyme-substrate complex raises the entropy

**21.5. 1,1,0,0,1**

**The primary structure of proteins is:**

A. represented as a sequence of amino acids
B. determined genetically
C. stabilized by weak and noncovalent bonds
D. broken at denaturation
E. broken at hydrolysis

**22.5. 1,1,1,0,0**

**The correct statements concerning the peptide bond:**

A. Each peptide bond forms 2 hydrogen bonds
B. It exists in two resonant forms
C. Atoms O and H are situated in trans-position with regard to the bond C-N
D. The bonds of α-carbon atom forbid the free rotation
E. The atoms of the peptide bond and 2 α-carbon atoms are situated in the same plane

**23.5. 0,0,1,1,0**

**Secondary structure of proteins:**

A. Is stabilized by hydrophobic and ionic interactions
B. There is only α-spiral or only beta-structure
C. Is a result of the interaction of closely located radicals of amino acids
D. Is stabilized by hydrogen bonds
E. The bonds are formed within the limits of one chain

**24.5. 1,0,1,0,1**

**The correct statements about the chemical nature of enzymes:**

A. The main its components are amino acids
B. Enzymes are thermostable compounds
C. They form colloidal solutions in water
D. Enzymes are micromolecular compounds
E. They can be degraded by proteases

**25.5. 1,1,0,1,0**

**The correct statements about the mechanism of enzyme action:**

A. It reduces the energy of activation of the reaction
B. An enzyme-substrate complex is formed
C. Enzyme-substrate complex is a stable, rigid structure
D. Enzyme-substrate complex is an unstable structure
E. The formation of enzyme-substrate complex does not change the physical properties of the enzyme

**26.5. 0,1,1,1,0**

**The correct statements about the mechanism of enzyme action:**

A. Substrate isn't changed in the enzyme-substrate complex
B. Substrate is deformed in the enzyme-substrate complex
C. The complementarity of the active center is induced by the substrate
D. Enzyme-substrate complex reduces the substrates entropy, promoting the achievement of a transitive state
E. Enzyme-substrate complex raises entropy, increasing the level of the substrate freedom

**27.5. 0,0,1,1,1**

**Specificity of enzymes:**

A. depends on coenzyme
B. depends both on protein and coenzyme
C. can be absolute: the enzyme catalyzes the transformation of only one substrate
D. can be relative: the enzyme catalyzes the transformation of several substrates with an identitic chemical bond
E. depends on apoenzyme

**28.5. 1,0,0,0,1**

**Allosteric center is:**

A. separated spatially from the active center
B. a place of substrate binding

C. characteristic for all enzymes
D. the place for binding the compounds that have structural similarity to the substrate
E. a place of metabolites, ligands binding

**29.5. 1,0,1,0,0**
**Allosteric enzymes, the correct statements:**
A. consist of two or more protomers
B. can have only one active and one allosteric center
C. the allosteric center can join both the activator and the inhibitor
D. the modulators are joined by covalent bonds to allosteric centers
E. reaction kinetics is identical for allosteric and usual enzyme

**30.5. 0,0,1,0,0**
**The free COOH-group and $NH_2$-group are present in:**
A. simple lipids complex proteins
B. carbohydrates lipids
C. amino acids nitrogenous bases
D. nitrogenous bases nucleotides
E. nucleotides homopolysaccharides

**31.5. 1,0,1,1,1**
**Which of the following substances are biopolymers?**
A. simple proteins nucleosides
B. neutral lipids amino acids
C. glycogen DNA
D. DNA mRNA
E. mRNA proteins

**32.5. 1,0,1,1,0**
**Which of the following statements about serine are correct?**
A. has one asimmetric C-atom
B. has isoelectric point in acidic medium
C. has isoelectric point in neutral medium
D. is an nonessential amino acid
E. is an essential amino acid

**33.5. 0,1,0,1,1**
**The correct statements for arginine:**
A. has negative electric charge on pH=3
B. has electric point in basic medium
C. hydroxyarginine present in collagen structure
D. is a polar amino acid
E. guanidine presents in arginine's composition

**34.5. 0,0,1,1,0**
**The correct statements for lysine:**
A. has 2 asimmetric C-atoms in its structure
B. is a nonessential amino asid
C. moves to catod in solution with physiological pH
D. may be hydroxylized during posttranslation modifications
E. has two negative electric charges on pH=8

**35.5. 1,1,1,0,1**
**The correct statements for glutamic acid:**
A. doesn't have electric charge on pH=8
B. amid is product of glutamic amino acid amination
C. moves to catod into solution with physiological pH
D. is a diaminoderivative of succinic acid
E. is an aliphatic amino acid

**36.5. 0,0,0,1,0**
**Which of amino acids solution (pH=2.0) has a positive electric charge?**
A. Glu, Asp, Ser
B. Glu, Pro, Tyr
C. Pro, Val, Cln
D. Lys, Arg, Gly
E. Cys, Met, Tyr

**37.5. 0,0,1,0,0**
**Isoelectric point of tetrapeptide Glu-Asp-Cys-Ser is on pH:**
A. 1,0-2,5
B. 2,6-3,5
C. 4,0-4,5
D. 6,8-7,4
E. 7,6-8,2

**38.5. 0,0,1,0,0**
**Which of amino acids solution (pH=8.0) has a great negative electric charge?**
A. Glu, Pro, Tyr
B. Pro, Val, Gly
C. Lgu, Ala, Asp
D. Lys, Arg, His
E. Cys, Met, Trp

**39.5. 1,0,0,0,0**
**Which of the statements are correct for histidine and tryptophan?**
A. They are heterocyclic amino acids
B. They have positive electric charge on physiological pH
C. They have 2 N-atoms in molecules
D. They have 2 asymmetric centers
E. They are present as hydroxyamino acids in the proteins

**40.5. 0,1,1,0,0**
**For identification of N-ending amino acid is used:**
A. hidrazin
B. F-dinitrobenzen
C. phenylisotiocianate
D. trypsin, pepsin
E. chymotrypsin

**41.5. 0,1,0,0,0**
**For identification of C-ending amino acid is used:**
A. urea
B. carboxylases A and B
C. guanine's hydrochloride
D. perphormin acid
E. p-dimethyl-aminobenzaldehyde

**42.5. 0,1,1,1,1**
**The correct statements for proteins:**
A. they are the main energetic substrates
B. they are components of cell membranes
C. they are biocatalysts
D. they are regulators for oncotic pressure of blood
E. they have transport function

**43.5. 1,1,0,1,1**
**The correct statements according to the primary structure of protein:**
A. sequence of amino acids
B. determined by genome
C. stabilized by noncovalent bonds
D. hydrolysis breaks it
E. the high levels of proteins organization is based on its structure

**44.5. 1,0,0,0,0**
**The correct statements for secondary structure of protein:**
A. has a definitive conformation
B. stabilizes by hydrophobic and iones interactions
C. presents only α-helix
D. presents only β-structure
E. chemical bonds form only into one chain

**45.5. 1,0,1,0,1**

**According to α-helix, the following statements are correct:**

A. predominates in globular proteins
B. predominates in fibrilar proteins
C. is a symmetric helix
D. hydrogen bonds form between CO-group and NH-group of different polypeptide chains
E. hydrogen bonds form between CO-group and NH-group of one polypeptide chain

**46.5. 0,0,1,0,0**

**Tertiary structure of protein, the correct statements:**

A. is stabilized by covalent bonds
B. is a result of spatial connections of nearest amino acids
C. is a result of accidental connections of amino acids and $H_2O$ radicals
D. is an absolute strong structure
E. includes only α-helix

**47.5. 1,0,0,0,0**

**According to quarternary structure of the protein, the following statements are correct:**

A. $\alpha_2\beta_2$ are protomers of $HbA_2$
B. $H_2M_2$ are protomers of $LDH_1$ isoenzyme
C. $H_3M_1$ are protomers of $LDH_5$ isoenzyme
D. $\alpha_2\gamma_2$ are protomers of $HbA_1$
E. S-S-bonds there are between protomers

**48.5. 0,1,1,1,0**

**The correct statements about the chemical structure of human hemoglobin (Hb):**

A. is tetramer of 4 α-subunits
B. is tetramer of two types subunits
C. a prosthetic hemo-group is on each of its subunit

D. connection between heme and protein is based on the $Fe^{2+}$-his-bond
E. is a dimer of two β-subunits

**49.5. 1,0,0,0,0**
**Collagen, the correct statements:**
A. includes about $^1/_3$ of glycine
B. almost doesn't include alanine
C. polypeptide chain composes a small content of amino acids
D. polypeptide chain has α-helix conformation
E. is disolved in water

**50.5. 0,0,1,0,0**
**Enzymes are:**
A. only simple proteins
B. glycolipids
C. macromolecules
D. only nucleoproteins
E. heteropolysaccharides

**51.5. 1,1,0,0,0**
**Cofactors are:**
A. cations of certain metals
B. derivatives of vitamins
C. anions of certain metals
D. lipids
E. only easily dissociated components

**52.5. 0,0,0,0,1**
**Mechanism action of enzyme (E):**
A. a strong complex forms between substrate (S) and active center of enzyme
B. structure of S can not change on active center of E
C. during connection S with E only conformation of S changes

D. during connection S with E only conformation of E changes
E. during connection S with E both conformations of E and S change

**53.5. 0,0,0,1,0**
**Specificity of carboanhydrase:**
A. is relative
B. is a relative group
C. is stereochemical
D. is absolute
E. it doesn't have specificity to chemical bond

**54.5. 0,1,0,0,0**
**Alcohol dehydrogenase specificity:**
A. is relative
B. is a relative group
C. is stereochemical
D. is absolute
E. it doesn't have the substrate specificity

**55.5. 1,0,1,0,1**
**The correct statements about pepsin and its activity regulation:**
A. is hydrolase
B. is lyase
C. is produsedduring partial proteolysis of pepsinogen
D. partial proteolysis is a reversible process
E. partial proteolysis is an irreversible process

**56.5. 1,0,0,0,1**
**The correct statements about α-amylase:**
A. is hydrolase
B. is lyase

C. during activation process the primary structure of enzyme changes
D. NaCl is a denaturative agent for α-amylase
E. NaCl is an activator for α-amylase

**57.5. 1,0,0,0,0**
**Sulfanylamides action mechanism for enzymes:**
A. They are competitive inhibitors
B. They are reversible competitive inhibitors for bacteria enzymes
C. They change the primary structure of the enzyme
D. They are noncompetitive inhibitors
E. They act as allosteric inhibitors

**58.5. 0,0,1,1,1**
**Which type of chemical reaction is specific for LDH?**
A. isomerization
B. hydrolysis
C. convertion of pyruvic acid to lactic acid
D. convertion of lactate to pyruvate
E. oxido-reduction

**59.5. 1,0,0,0,0**
**Which of the following statements are correct for LDH-isoenzymes?**
A. They are tetramers of two types "M" and "H"
B. They are dimers of two types "M" and "H"
C. Their chemical reaction is irreversible
D. Isoenzymes of blood plasma are produced in the liver
E. Isoenzymes of blood plasma are produced in the heart

**60.5. 1,0,1,1,0**
**The correct statements about vitamin $B_2$ (riboflavin):**
A. FMN is a complex monophosphate ether of vitamin $B_2$
B. FAD is dinucleoside of vitamin $B_2$

C. vitamin $B_2$ includes isoalloxazinic heterocycle
D. FMN and FAD are coenzymes of oxido-reductases
E. only FMN is a coenzyme of oxido-reductases

**61.5. 1,0,1,1,0**
**For $NADP^+$ is correct:**
A. NADP- dependent enzymes participate in anabolic processes
B. this is a reduce form of coenzyme
C. this is an oxidized form of coenzyme
D. active portion of coenzyme is amid of nicotinic acid
E. it includes $Cu^{2+}$-ion

**62.5. 0,0,1,0,0**
**Vitamin $B_6$ and its coenzymes:**
A. coenzyme is only pyridoxamine
B. it is coenzyme for some oxido-reductases
C. both its forms, pyridoxal phosphate and pyridoxamine phosphate, participate during transamination
D. in pyridoxal phosphate its aldehyde group is phosphorilated
E. it is coenzyme only for transamination

**63.5. 1,0,0,0,1**
**Vitamin $B_{12}$ is a coenzyme for the following reactions:**
A. methylmalonyl-SkoA→ succinyl-SkoA
B. pyruvate→ oxaloacetate
C. proline→ hydroxyproline
D. succinate→ fumarate
E. homocysteine→ methionine

**64.5. 1,0,0,0,0**
**Ascorbic acid is:**
A. used in hydroxylation reactions in the presence of $O_2$
B. a precursor of HS-coA

C. a coenzyme for conversion of noradrenalin to adrenalin
D. deposited only in the liver
E. used during convertion of Ser to Gly

**65.5. 0,0,1,1,1**
**Zn-containing enzymes are:**
A. cytochrome oxidase
B. glutathione peroxidase
C. alcohol dehydrogenase
D. carboanhydrase
E. RNA- and DNA-polymerases

**66.5. 1,1,1,0,1**
**Biologically active peptides (for animals) are:**
A. liberins and statins
B. angiotensins
C. secretin and gastrin
D. aldosterone
E. endotheline

**67.5. 1,1,1,0,0**
**Antibiotics – peptides:**
A. cycloserine
B. azaserine
C. penicillin
D. thyreoliberin
E. somatothropin

## NUCLEIC ACIDS. PROTEIN SYNTHESIS

**1.5. 0,1,0,1,1**
**The main nitrogenous bases of DNA are:**
A. 5-methylcytosine
B. cytosine

C. 2-methyladenine
D. guanine
E. thymine

**2.5. 1,0,1,0,1**
**The main nitrogenous bases of RNA are:**
A. adenine
B. xantine
C. guanine
D. thymine
E. uracil

**3.5. 0,1,1,1,0**
**The structural components of DNA are:**
A. dihydroxyuracil
B. deoxyribose
C. phosphoric acid
D. thymine
E. ribosylthymine

**4.5. 0,1,0,0,1**
**The structural components of tRNA are:**
A. inosine
B. pseudouridine
C. thymine
D. deoxyribose
E. adenine

**5.5. 0,1,1,0,0**
**The following chemical bonds are in the nucleic acids:**
A. peptide bond
B. 3',5'- phosphodiester
C. N-glycosidic

D. disulphidic
E. ester

**6.5. 1,0,1,0,1**
**According to the secondary structure of DNA, it is correct:**
A. it is the double helix
B. the chains are combined by the phosphodiester bonds
C. the nitrogenous bases protrude into the interior of the helix
D. the chains don't separate at a high temperature
E. it doesn't have anticodon sites

**7.5. 0,1,0,1,1**
**For RNA, it is correct:**
A. the cellular RNA content is constant
B. is a single-stranded ribonucleotide
C. is composed of AMP, GMP, TMP, CMP
D. the RNA-chain is polar
E. the nucleotides are combined by 3',5'-phospho-diester bonds

**8.5. 1,0,0,1,0**
**For mRNA, it is correct:**
A. it transfers the genetic information from nucleus to ribosomes
B. is the double-chain polynucleotide
C. the 5'-end contains the CCA sequence
D. it contains the methyl-containing bases
E. it has a small molecular mass

**9.5. 1,1,0,0,1**
**The typical characteristics of DNA biosynthesis:**
A. replication is semiconservative process
B. it needs the presence of mDNA double-chain
C. a primer is not necessary
D. deoxyribonucleoside phosphates are only necessary
E. nucleus is the place for DNA synthesis

**10.5. 0,1,1,1,0**
**Transcription:**
A. the entire chromosome works simultaneously
B. is asymmetric
C. only certain DNA sites work
D. the double-helix of DNA is template
E. template is the noncodogenic DNA chain (-)

**11.5. 0,0,1,1,0**
**The common characteristics of DNA and RNA biosynthesis:**
A. using the deoxyribonucleoside triphosphates
B. using the ribonucleoside triphosphates
C. the motive power of elongation is pyrophosphate hydrolysis
D. the synthesis of chains goes in 5' to 3' direction
E. the conservation of DNA template

**12.5. 0,1,0,0,1**
**The RNA processing is:**
A. Okazaki fragments binding
B. the 7'-methylguanine connection with 5'-end
C. the addition of CCA-sequence
D. the place for processing is cytosol
E. nucleus is site for RNA processing

**13.5. 1,0,0,0,1**
**Genetic code:**
A. is the triplet
B. is the singlet
C. codons are read in 3' to 5' direction
D. on mRNA the codons are divided by nonsense codons
E. cod is degenerate (redundant)

**14.5. 0,1,0,1,1**

**According to translation, it is correct:**

A. synthesis of polypeptide chain starts on the C-end
B. synthesis of polypeptide chain starts on the N-end
C. initiative amino acid for procaryotes is methionine
D. donor of formyl is the $N_{10}$-formyl-$FH_4$ (tetrahydrofolic acid)
E. formation of formyl-tRNA is catalized by specific transformylase

**15.5. 1,0,1,0,1**

**For the elongation of protein biosynthesis, it is correct:**

A. formation of peptide bonds
B. connection of met-tRNA on the P site
C. using the 2 GTP molecules
D. formation of a peptide bond between $NH_2$-group of the P center and COOH-group of the A center
E. ribosome's moving on one codon of mRNA

**16.5. 0,1,0,0,1**

**Regulation of the anabolic vital cell processes is dependent on the:**

A. presence of inductive enzymes
B. presence of repressive enzymes
C. presence of the constitutive enzymes
D. coordinative induction
E. coordinative repression

**17.5. 0,1,1,0,1**

**Enzymic characteristics for telomerases:**

A. enzyme has a small activity "in vitro"
B. the human enzyme has a high activity
C. process is dependent on the length primer
D. the primers are smaller than 10 nucleotides
E. when the primer is more than 10 nucleotides, the DNA can have thousands of nucleotides

**18.5. 1,0,1,1,0**

**Induction and repression of enzymes:**

A. induction is determined by the "de novo" synthesis of the enzymic molecules
B. repression is an analog of retroinhibition
C. repression and induction are based on the economic principle in the cell
D. repression is the inhibition of enzyme synthesis
E. induction doesn't define the new synthesis of enzyme molecules

**19.5. 1,1,1,1,1**

**Mechanisms of organism ageing:**

A. production of anomalous chromosome is increased
B. chromosomes loss predominates
C. gene extraction near telomerase takes place
D. after extraction of this gene the ageing repressor is inactivated
E. the telomer binding proteins (TBP) are included in process

**20.5. 1,0,0,1,0**

**The confirmations about thymidine are correct:**

A. it is a deoxyribonucleoside
B. it has only the lactim form
C. it contains two $N_1$-glycoside bonds
D. it has the $N_1$-$C_1$-glycoside bond
E. it has the molecular structure $C_9H_{11}O_5N_2$

**21.5. 1,0,0,1,1**

**For the adenilic acid, it is correct:**

A. it consists of nitrogenous base, pentose and phosphate
B. it is a deoxyribonucleotide
C. it has an $\alpha$-glycoside bond
D. it is AMP
E. it is cAMP

**22.5. 1,1,0,1,0**
**For mRNA, it is correct:**
A. has the structure of the “clover leaf”
B. an amino acid is composed with 3’-OH of adenine nucleotide
C. an anticodon loop consists of 3 nucleotides
D. an anticodon loop consists of 7 nucleotides
E. it contains about 50-60% of all RNA content of the cell

**23.5. 1,1,0,0,0**
**The Okazaki fragments:**
A. these are the short DNA fragments
B. are sintetized in the 5’ to 3’ direction
C. these are noninformative DNA sites
D. are sintetized in the 3’ to 5’direction
E. are formed on the leader DNA chain during replication

**24.5. 0,1,0,1,1**
**Codon AUG is the:**
A. codon for cysteine
B. initiative codon for translation
C. initiative codon for transcription
D. codon for methionine
E. codon for formyl-methionine

**25.5. 1,0,0,1,1**
**Choose the inhibitor for the replication:**
A. streptomycin
B. erythromycin
C. puromycin
D. mitomycin C
E. canamycin

**26.5. 0,1,0,1,1**
**The main nitrogenous bases of DNA are:**
A. 5-methylcytosine

B. cytosine
C. 2-methyladenine
D. guanine
E. thymine

**27.5. 1,0,0,0,1**
**The main nitrogenous bases of RNA are:**
A. adenine
B. 1-methylguanine
C. hypoxantine
D. thymine
E. uracil

**28.5. 1,0,1,0,0**
**The minor nitrogenous bases of nucleic acids are:**
A. thioguanine
B. 2,6,8-trioxypurine
C. $N_2$-dimethylguanine
D. 2,4-dihydroxypyrimidine
E. 4-amino-2-hydroxypyrimidine

**29.5. 0,1,1,1,0**
**The structural components of DNA are:**
A. dihydroxyuracil
B. deoxyribose
C. phosphoric acid
D. thymine
E. ribosylthymine

**30.5. 0,1,0,0,1**
**The structural components of RNA are:**
A. inosine
B. pseudouridine
C. thymine

D. deoxyribose
E. adenine

**31.5. 0,1,1,1,1**
**The following chemical bonds are in the nucleic acids:**
A. peptide bond
B. 3',5'-phosphodiester
C. N-glycoside
D. hydrophobic
E. hydrogen

**32.5. 0,1,1,0,1**
**The DNA structure is:**
A. polyribonucleotide
B. polydeoxyribonucleotide
C. chain of dAMP, dGMP, dCMP, dTMP
D. chain of AMP, CMP, UMP, GMP
E. 5'-end is combined with phosphate

**33.5. 0,0,1,1,0**
**The confirmations for adenosine are correct:**
A. it has the lactam-lactim tautomerism
B. it has the $N_1$-$C_1$-glycosidic bond
C. it has the $N_9$-$C_1$-glycosidic bond
D. it has the free amino groups
E. it doesn't contain OH-group at $C_2$-atom of pentose

**34.5. 0,1,1,0,0**
**The confirmations about cytosine are correct:**
A. it doesn't contain the OH-group at $C_2$-atom
B. it has only the lactam form
C. it has the molecular structure $C_9H_{11}O_5N_3$
D. it is a ribonucleotide
E. it is a deoxyribonucleoside

**35.5. 1,0,1,0,0**

**The properties of nucleic acids components are:**

A. the nitrogenous bases (NB) are dissolved badly in water
B. the NB don't have the lactam-lactim tautomerizm
C. the nucleosides are more soluble than the corresponding bases
D. purine nucleotides are more stable to heating in acidic medium
E. the purine nucleotides are more stable to hydrolysis

**36.5. 0,1,1,0,0**

**Thymine:**

A. is a purine nitrogenous base
B. is a pyrimidine nitrogenous base
C. has the lactam-lactim tautomerism
D. has optic isomers
E. is converted to hypoxanthine and xanthine

**37.5. 0,1,1,0,1**

**The quantitative determination of nucleic acids (NA) at 260-280 nm is based on the:**

A. pyrimidine bases
B. nitrogenous bases
C. increasing of NA content during DNA denaturation
D. phosphoric acid
E. increasing of NA during acidic hydrolysis

**38.5. 0,1,0,0,1**

**The final acidic hydrolysis of nucleic acids (NA):**

A. the phosphodiester bonds are hydrolyzed by pyrophosphorilase
B. the phosphodiester bonds are hydrolyzed by phosphodiesterases
C. the end product is cytidine
D. the end product is guanosine
E. the end product is phosphoric acid

**39.5. 0,0,0,1,0**

**How many hydrogen bonds are there between T-C-G-A-G site and its complementarity site of DNA?**

A. 10
B. 11
C. 15
D. 13
E. 17

**40.5. 1,0,0,0,1**

**According to the secondary structure of DNA, it is correct:**

A. it is a double helix
B. the DNA chains are parallel
C. it is a single chain
D. the chains are combined by phosphodiester bonds
E. the nitrogenous bases protrude into the interior of the helix

**41.5. 1,1,0,0,1**

**According to DNA, it is correct:**

A. the double-helix is a plectonemic one
B. the positions of nitrogenous bases are based on hydrophobic interactions
C. the nucleotides of DNA-chains are similar
D. the nucleotide sequence of DNA-chains are similar
E. the planes of nitrogenous bases are perpendicular to axis of helix

**42.5. 1,0,1,1,0**

**It is correct for DNA:**

A. the step (one full turn) of helix has 10 nucleotides and 34 A
B. the parallel chains are complementary
C. the antiparallel chains are complementary
D. the various types of DNA are conditioned by dehydrotation difference
E. the one full turn of DNA A-form contains 10 nucleotides

**43.5. 1,1,0,0,1**

**According to DNA, it is correct:**

A. one full turn of classic B-form contains 10 nucleotides
B. one full turn of A-form contains 11 nucleotides
C. the Z-form contains 12 nucleotides and is the left-spiraled
D. all types of DNA have the relation C+G/A+T=1
E. the complementary nitrogenous bases are: A-T and G-C

**44.5. 1,0,1,0,0**

**It is correct for DNA:**

A. the DNA of one species is independent on age, food and external environment
B. all DNA have G/C=1 and G/T=1
C. all DNA have A/T=1 and G/C=1
D. the double-helix has the 5,4 nucleotides for one turn
E. one turn of helix has 5,4 A

**45.5. 0,1,1,0,0**

**For DNA, it is correct:**

A. between adenine and uracil there are two hydrogen bonds
B. the DNA of procaryotes is the cyclic
C. DNA has structural and regulatory sites
D. the length of eucaryotes gene may be calculated according to the number of amino acids in protein
E. the length of nucleic DNA in a cell is 2 mm

**46.5 ,0,1,1,0,0**

**For DNA, it is correct:**

A. the double-helix is a stable structure
B. the double-helix has an essential mobility
C. the changes of the helix structure are dependent on the external environment of DNA
D. the main form of DNA is the relaxing form
E. the number of DNA cycles is constant and doesn't change

**47.5. 1,1,0,0,0**

**For DNA, it is correct:**

A. the double-helix is a high-cooperative structure
B. it is denaturated in acidic or basic solutions at high temperature
C. the DNA denaturation is a irreversible process
D. there is no dependence between $t^o$ for DNA melting and its nucleotide composition
E. the phosphodiester bonds breakdown during denaturation

**48.5. 1,0,1,1,1**

**For DNA, it is correct:**

A. the DNA is renatured at a $t^o$ lower than a $t^o$ for its melting
B. the DNA has the prevalence of the positive superspiralization
C. the DNA has the prevalence of negative superspiralization
D. the degree of DNA despiralization is defined by superspiralization
E. energy for DNA spiralization is proportional to square of cycles

**49.5. 1,0,0,1,1**

**Adenilic acid:**

A. consists of nitrogenous base, pentose and phosphate
B. is a deoxyribonucleotide
C. has an $\alpha$-glycoside bond
D. is AMP
E. is cAMP

**50.5. 1,1,1,0,0**

**For nucleosome, it is correct:**

A. it is a repeated structural subunit of chromatin
B. it is a superorganized structure of DNA
C. DNA has a bond with the basic proteins-histones
D. DNA has a hydrophobic bond with proteins
E. DNA has a covalent bond with proteins

**51.5. 1,1,1,0,0**

**For nucleosome, it is correct:**

A. nucleosome includes 8 histones: $H_4$, $H_3$,$H_{2a}$ and $H_{2b}$
B. the DNA helix from 146 nucleotide pairs has two cycles around octomer
C. the $H_1$-histones are bound with internucleosome site
D. it is a superorganized RNA structure
E. it is an extrachromosome DNA molecule

**52.5. 1,1,0,0,0**

**For nucleosome, it is correct:**

A. it is a disking hertone-containing unit
B. the bond between DNA and histones is ionic
C. it is formed as a result of mRNA and histones interaction
D. a chromatin is a composed prevalence of RNA (35%)
E. ia a synonyme of polyribosomes

**53.5. 1,1,0,1,0**

**Histones:**

A. are constant according to the amino acid composition and electrical charge
B. contain high amounts of lys and arg
C. contain high amounts of asp and gly
D. the phosphorilic histones promote the transcription
E. the histone $H_1$ prevails in a nucleosome

**54.5. 0,1,0,1,1**

**For RNA, it is correct:**

A. the cellular RNA content is constant
B. it is a single-stranded ribonucleotide
C. it is composed of AMP, GMP, TMP, CMP
D. the RNA-chain is polar
E. the nucleotides are combined by 3',5'-phospho-diester bond

**55.5. 1,1,1,0,0**
**For mRNA, it is correct:**
A. it is a geterogenic molecule
B. each gene has its mRNA molecule
C. it sintetizes and breaks very rapidly
D. contains minor bases
E. permanently it is combined with ribosome

**56.5. 1,0,0,1,0**
**For mRNA, it is correct:**
A. it has a temporary bond with ribosomes
B. it is an exact copy of the DNA chain
C. the 5'-end has the poly-A sequence
D. it has an information about protein synthesis
E. the relation U/A=1

**57.5. 1,0,0,1,0**
**For mRNA, it is correct:**
A. it transfers the genetic information from nucleus to ribosomes
B. it is a double-chain polynucleotide
C. the 5'-end contains the CCA sequence
D. it contains methyl-containing bases
E. it has a small molecular mass

**58.5. 0,1,1,0,0**
**For mRNA, it is correct:**
A. it transfers the amino acids to site for protein synthesis
B. mRNA molecules have the main structural peculiarities
C. are single-chain molecules
D. are double-chain polynucleotides
E. contains only the main nitrogenous bases

**59.5. 1,1,0,1,0**
**For mRNA, it is correct:**
A. it has a structure of the "clover leaf"

B. an amino acid is composed of 3'-OH of adenine nucleotide
C. an anticodon loop consists of 3 nucleotides
D. an anticodon loop consists of 7 nucleotides
E. it consists of 50-60% of RNA cell content

**60.5. 0,1,1,1,0**
**For rRNA, it is correct:**
A. it has the similar form and size
B. consists of 75% of RNA cell content
C. are macromolecules with lightly changed conformation
D. each type of rRNA has its space structure
E. in the cell is found in free state

**61.5. 1,0,0,1,1**
**The structure and functions of ribosomes:**
A. the ribosomes may be reverse dissotiated to subunits
B. there are 4 centers in the ribosomes
C. the subunits composition requires of extraribosome factors
D. the large subunit contains 23S and 5S rRNA, and L 1-3 proteins
E. the small subunit contains 16S rRNA and S 1-21 proteins

**62.5. 0,1,1,0,1**
**DNA replication, it is characterized by:**
A. a participation of corresponding nucleoside diphosphates
B. the presence of $Mg^{2+}$, $Mn^{2+}$, $Zn^{2+}$ iones
C. a participation of deoxyribonucleotide triphosphates
D. cytoplasm is the place for DNA synthesis
E. the growth chain has 5' to 3' direction

**63.5. 1,1,0,0,1**
**The typical characteristics of DNA biosynthesis:**
A. replication is a semiconservative process
B. it requires the presence of double-chain mDNA
C. a primer is not necessary

D. only the deoxyribonucleoside phosphates are required
E. the nucleus is the place for DNA synthesis

**64.5. 1,0,1,1,0**
**For replication, it is correct:**
A. it is based on the complementary interaction of nitrogenous bases
B. the daughter's and mother's chains have the identical nucleotide sequence
C. replication is accompanied by despiralization of DNA
D. replication goes in both directions with the same rate
E. replication goes only in one direction

**65.5. 1,0,1,0,1**
**For replication, it is correct:**
A. the initiation of replication is conditioned by specific proteins
B. the initiation of replication is conditioned by helicase and topoisomerase
C. hydrolysis of pyrophosphate is the motive force of this process
D. it does not need a stable proteins presence
E. the whole ribosome acts simultaneously

**66.5. 1,0,1,1,1**
**The complex of DNA-replicase of procariotes includes:**
A. DNA polymerases I,II,III
B. NAD dehydrogenases
C. helicases
D. topoisomerases
E. RNA polymerases

**67.5. 1,1,0,0,1**
**The Okazaki fragments:**
A. these are short DNA fragments
B. are sintetized in 5' to 3' direction

C. these are noninformative DNA sites
D. are sintetized in 3' to 5'direction
E. exist for a short time period

**68.5. 1,1,0,0,1**
**The Okazaki fragments:**
A. a primer is necessary for the each fragment
B. are connected by the action of DNA ligases
C. are produced by RNA polymerase II
D. are produced by the action of revertases
E. ATP is required for the connection of fragments

**69.5. 1,0,0,1,1**
**The DNA polymerase III:**
A. the template presence is necessary
B. may be the initiator of the DNA chains synthesis
C. the presence of nucleoside diphosphates is required
D. has a 3'-5'exonuclease activity
E. has an editorial function

**70.5. 1,1,1,0,0**
**The DNA polymerase III:**
A. this is a polyenzyme complex
B. it synthetizes of DNA chain
C. it has sites for connection of RNA, dRTP and catalysis
D. it forms of DNA chain in direction from 3' to 5'
E. the polymerization is provided by ATP hydrolysis

**71.5. 0,1,1,0,1**
**The DNA polymerase I:**
A. synthetizes the DNA chain *de novo*
B. has the 5'-3'-exonuclease activity for primer removal
C. has the polymerase activity for dRN addition

D. irreversible process is based on the pyrophosphotase action
E. catalyzes the synthesis of DNA which is similar with template

**72.5. 0,1,1,0,1**
**The RNA participates in replication as:**
A. a substrate of DNA ligase
B. forms the phosphodiester bonds between deoxyribonucleotides
C. forms hydrogen bonds with DNA template
D. is a substrate for RNA polymerase I
E. is necessary to slow the chain production

**73.5. 0,1,1,1,0**
**Transcription:**
A. simultaneously the whole chromosome works
B. is asymmetrical
C. only certain DNA sites work
D. the double-helix of DNA is template
E. template is the noncodogenic DNA chain (-)

**74.5. 0,1,1,0,0**
**For the RNA synthesis, it is correct:**
A. the substrates are ribonucleoside diphosphates
B. is reverse
C. the $Mg^{2+}$, $Mn^{2+}$ presence is required
D. both DNA chains are template
E. the cytoplasm is the site for biosynthesis

**75.5. 1,1,1,0,0**
**For the RNA synthesis, it is correct:**
A. the substrates are ribonucleoside diphosphates
B. the mechanism of synthesis is continuous
C. the motive power of transcription is pyrophosphate hydrolysis
D. the mechamisms of replication and transcription are different
E. the RNA-transcript has the equimolar quantity of A and T

**76.5. 1,0,0,1,0**
**The procaryotes RNA polymerase:**
A. is a holoenzyme
B. has nucleotidase properties
C. needs a primer for synthesis
D. doesn't have the editor property
E. translates information by a semiconservative mechanism

**77.5. 0,1,1,1,0**
**For procaryote RNA polymerase, it is correct:**
A. it is the pentamer of $alfa_2$-$beta_2$-H subunits
B. it is the pentamer of sigma-$alfa_2$-$beta_2$
C. holoenzyme is the initiator of synthesis
D. the active center has two sites for DNA and substrates
E. the tetramer – $alfa_2$-$beta_2$ of "cor"-enzyme is the initiator of the process

**78.5. 0,0,1,1,1**
**The common characteristics of DNA and RNA biosynthesis:**
A. a primer synthesis
B. using the deoxyribonucleoside triphosphates
C. using the ribonucleoside triphosphates
D. the motive power of elongation is pyrophosphate hydrolysis
E. the synthesis of chains goes in 5' to 3' direction

**79.5. 1,1,1,0,0**
**For eucaryote RNA polymerases, it is correct:**
A. RNAase I synthetyzes the rRNA (28S and 18S)
B. RNAase II synthetyzes the mRNA
C. RNAase III synthetyzes the tRNA, rRNA 5S and small molecules
D. dublicates the noncodogenic DNA chain in 3' to 5' direction
E. dublicates both DNA chains in 3' to 5' direction

**80.5. 1,1,1,0,0**

**For RNA polymerase, it is correct:**

A. sigma-subunit is activator for recognition of promotor by RNAase
B. sigma-subunit insreases the enzyme affinity to promotor
C. sigma-subunit participates in DNA double-helix despiralization
D. sigma-subunit is coordinator for elongation
E. sigma-subunit combines with DNA template strongly

**81.5. 1,1,1,0,0**

**The end of transcription is conditioned by the:**

A. symmetrical structure of RNA-transcript
B. "ro"-protein
C. specific nucleotide sequence of the DNA chain
D. RNAases activities as holoenzyme
E. presence of some proteins which are combined with promotor

**82.5. 0,1,1,1,0**

**The proteinic ("ro") ρ-factor:**

A. fixes weakly to promotor
B. participates in correct termination of transcription
C. uses the ATP for carrying out its function
D. breaks off the RNA polymerase action
E. moves with RNAase in 3' to 5' direction

**83.5. 0,1,0,1,1**

**The polynucleotide phosphorylase, correct answer:**

A. the ribonucleoside triphosphates are substrates
B. the ribonucleoside diphosphates are substrates
C. the DNA-template presence is needed
D. may be found in bacteria
E. the polymerization may only be possible in the presence of certain mononucleotides

**84.5. 0,1,0,0,1**
**The RNA processing is the:**
A. Okazaki fragments binding
B. 7'-methylguanine combines with 5'-end
C. addition of CCA-sequence
D. place for processing is cytosol
E. nucleus is place for processing

**85.5. 1,1,1,1,0**
**The RNA synthesis of eucaryotes:**
A. polyA sequence is formed by enzyme on the 3'-end of RNA
B. a removal of introns takes place during processing
C. the removal of introns is produced by means of nucleus RNA of a small mass
D. autosplicing takes place in guanosine and $Mg^{2+}$presence
E. the sinthetized RNA has genetic information on some proteins

**86.5. 0,1,1,0,0**
**Biogenesis of tRNA, correct answers:**
A. an active tRNA synthetizes at once
B. RNAase participates in tRNA processing
C. processing includes the modifications of pentoses and nitrogenous bases
D. the removal of exones is based on ribozome action
E. nonenzymic hydrolysis is the main in breaking of phosphodiester bond

**87.5. 0,1,0,1,1**
**rRNA biosynthesis includes:**
A. rRNA is synthetized in cytosol
B. rRNA of small molecular mass is synthetized by RNA polymerase II
C. RNA transcript goes out from cell nucleus
D. after processing RNAases go out from cell nucleus
E. the synthetized RNA is combined with protein (production of ribonucleoproteinic complex)

**88.5. 0,1,0,1,1**
**RNA-dependent RNA-polymerase:**
A. synthetizes in 3' to 5' direction
B. uses the nucleoside triphosphates as substrates
C. uses the RNA as template
D. present in viruses only
E. the synthetized RNA is analogous of RNA virus

**89.5. 1,0,1,1,0**
**RNA-dependent RNA-polymerase:**
A. call the revertase (reverse transcriptase)
B. mRNA presence is necessary
C. is synthetized of DNA on RNA template
D. uses for DNA synthesis in genetic engineering
E. promotes for RNA virus insertion to human genome

**90.5. 1,1,1,1,0**
**DNA reparation, it is correct:**
A. DNA-reparase (DNA-polymerase I) synthetizes the correct site
B. DNA-polymerase I uses the free 3'OH group of the interrupted chain as primer
C. repairing DNA-polymerase has the exonuclease activity
D. DNA-ligase splices of DNA-ends
E. DNA-glycosidases hydrolyze the 3'-5' phosphodiester bonds

**91.5. 1,1,1,0,0**
**The reparation of thymine-dimer is:**
A. the presence of photoreagent enzyme – photolysis
B. breakdown of covalent bonds
C. including the complementary cytosine by DNA-polymerase I
D. GTP energy is used
E. synthesis of a new primer

**92.5. 0,0,1,0,1**
**In DNA reparation do not participate:**
A. glycosidases
B. endonucleases
C. DNA-polymerase III
D. DNA-polymerase I
E. RNA-primase

**93.5. 1,1,1,1,1**
**The DNA damages may lead to:**
A. the amino groups loss
B. formation of nonpurinic zones
C. formation of thymine dimers
D. a replacement of DNA bases goes to produce mistakes during replication
E. insertion of normal bases

**94.5. 1,1,1,1,0**
**Peculiarities of DNA replication of eucaryotes:**
A. DNA primer includes about 10-20 nucleotides
B. replication and synthesis of corresponding proteins go simultaneously
C. the replication rate is lower than the one in procaryotes
D. has many starting points for replication (replicons)
E. is one-direction

**95.5. 1,0,0,0,1**
**Genetic code:**
A. is triplet
B. is one nucleotide
C. codons are read in 3' to 5' direction
D. on mRNA the codons are divided by nonsense codons
E. code is degenerate (redundant)

**96.5. 1,0,1,0,1**
**Genetic code: which is correct?**
A. is universal for procaryotes and eucaryotes
B. has 3 codons for initiation
C. certain amino acids have the some codons
D. has one codon for termination only
E. has colinearity

**97.5. 0,1,1,0,1**
**Genetic code, it is correct:**
A. codons for one amino acid are synonyms
B. codons-synonyms are nonsense triplets for amino acids
C. nonsense codons are signals for termination of protein synthesis
D. nonsense codons are noncorresponding diplets for amino acids
E. one codon can't be a sense codon for one amino acid

**98.5. 0,1,0,1,1**
**Codon AUG:**
A. is the codon for cysteine
B. is the initial codon for translation
C. is the initial codon for transcription
D. is the codon for methionine
E. is the codon for formyl-methionine

**99.5. 1,1,1,0,0**
**Genetic code, it is correct:**
A. the chemical peculiarities of certain amino acids are reflected by codon structure
B. for codons-synonyms which have the difference of first or second codons different tRNAs are required
C. anticodons with inosine on the first position for three codons are corresponded

D. anticodons which have A or C on the first position correspond for two codons
E. anticodons which have U or G on the first position correspond for one codon

**100.5. 0,1,1,0,1**
**Introns:**
A. they are on the mature mRNA
B. they are on the same sites of the related genes
C. their removal is regulated of mRNA transport from nucleus
D. their removal is a posttranscriptional process
E. are the result of a corresponding gene evolution

**101.5. 1,0,0,1,1**
**The effect of nitric acid ($HNO_2$) on genome is produced by:**
A. convertion of adenine to hypoxanthine
B. insertion of one base pair
C. deletion of one base pair
D. convertion of cytosine to uracil
E. replacement of the base pair G-C by A-T

**102.5. 1,0,0,0,1**
**The "point" mutations:**
A. are based on the chemical change of one base of one DNA chain
B. all codons of defective DNA are changed as a result of transition
C. all codons of defective DNA are changed as a result of transvertion
D. are based on the chemical changes of the both complementarity bases
E. are based on the change of one codon

**103.5. 0,1,0,0,1**
**The transversion mutation is:**
A. replacement of one base by another base
B. replacement of one stop-codon by the sense codon
C. replacement of sense codon by the nonsense codon
D. alterations of all codons as the result of mutations
E. replacement of pyrimidine base by purine base

**104.5. 0,1,0,0,1**
**Mutation is the result of deletion in case of:**
A. replacement of certain purine bases by pyrimidine bases
B. alteration of all codons as a result of mutation
C. is the result of building
D. is caused by structural analogs of nitrogenous bases
E. replacement of one sense codon by the nonsense codon

**105.5. 0,0,1,1,0**
**Mutations don't lead to disturbances:**
A. between exon-intron
B. "pointing" on introns
C. reverse to normal code
D. which are formed by codons-synonyms
E. the "pointing" for amino acids on a special side of protein

**106.5. 1,1,1,1,1**
**Consequences of mutations:**
A. cessation (stop) of polypeptide chain synthesis
B. synthesis of the additional polypeptide chain
C. synthesis of the changed DNA molecules
D. formation of the abnormal proteins
E. some mutations don't change the amino acids sequence

**107.5. 0,1,1,1,0**
**Enzymes for restriction:**
A. act on mRNA
B. they are in bacterial cells
C. breakdown the double helix of DNA with double-direction symmetry
D. are the endonucleases which recognize and restrict of polyndrome sequences
E. act on one chain of DNA

**108.5. 1,0,1,0,1**
**Enzymes for restriction:**
A. breakdown one phosphoester bond on both chains of DNA
B. can break the polydeoxy-RNA according to the scheme:
C-C-A-/-T-G-G-C-C-
C. they are in bacteria only
D. break the poly-RNA chain according to the scheme:
C-U-U-/-A-U-U-C-
E. participate in the formation of molecular clone in genetic engineering

**109.5. 1,1,0,0,1**
**Plasmids:**
A. are replicated autonomically and quickly
B. are used as vector for gene inculcation
C. have the template of DNA
D. are large molecules which can't penetrate the host cell membrane
E. are in bacterial cell only

**110.5. 0,1,1,0,1**
**This confirmation for plasmids is correct:**
A. don't have the quality of autoreplication
B. can be substrates for restriction's enzymes

C. are small molecules which can penetrate the host cell membrane
D. plasmid's DNA with specific proteins present in nucleosome
E. plasmid's DNA is in cytosol in most of bacteria

**111.5. 1,1,1,1,1**
**Genetic engineering includes the following manipulations:**
A. cloning DNA and plasmid breakdown by action of restriction's enzyme
B. selection of cells, which have plasmids
C. insertion of recombinant DNA in plasmids with help of DNA-ligases
D. multiplication of plasmids at the same time with bacteria reproduction (amplification of introduced genes)
E. introduction of vector to bacteria cell

**112.5. 0,0,1,0,0**
**Show the sequence of processes for genetic recombination, types and necessary enzymes: 1-lysogenya, end transferase; 2-transduction, restricting enzymes; 3-conjugation, transferase; 4- transformation, reverse transcriptase.**
A. 1-2-3-4
B. 2-1-4-3
C. 4-2-3-1
D. 4-1-2-3
E. 3-1-2-4

**113.5. 1,1,0,0,1**
**According to aminoacyl-mRNA synthetases, it is correct:**
A. specificity is defined by the t-RNA structure only
B. exactness is provided by ability for autocontrol
C. protein composition defines of enzyme specificity
D. exactness doesn't depend on enzymes
E. has free SH-groups

**114.5. 1,0,0,1,0**
**For activation of amino acids, it is correct:**
A. the place of amino acids activation is cytosol
B. process has 5 steps
C. for each of amino acids there is one specific tRNA
D. for activation of amino acids an energy of 2 macroergic bonds is necessary
E. a complex of amino acid-tRNA is formed at the level of ribosomes

**115.5. 1,1,0,0,1**
**Formation of amino acid-tRNA complex (AA-tRNA):**
A. the bond between AA-tRNA is macroergic
B. action of pyrophosphatases stipulate unreversible reactions
C. AA combines with tRNA by amid bond
D. activation of all AA is catalized by 64 AA-tRNA synthetases
E. activation of all AA is catalized by 20 AA-tRNA synthetases

**116.5. 1,1,0,1,0**
**Initiation of protein synthesis requires:**
A. the whole ribosome
B. m-RNA
C. peptidyl transferase
D. GTP
E. arginine

**117.5. 1,1,0,0,1**
**Complex for initiation of protein synthesis includes:**
A. functionaly active ribosome 70S
B. mRNA with codon AUG on the A-site
C. mRNA with codon AUG on the P-site
D. N-formylmethionyl-tRNA (fmet) on A-site
E. factors of initiation: $IF_1$, $IF_2$, $IF_3$

**118.5. 0,1,0,1,1**
**According translation is correct:**
A. synthesis of polypeptide chain starts on the C-end
B. synthesis of polypeptide chain starts on the N-end
C. initiative amino acid for procaryotes is methionine
D. donor of formyl is the $N_{10}$-formyl-$FH_4$
E. formation of formyl-tRNA is catalized by specific transformylase

**119.3. 0,0,1**
**Show the sequence of steps for initiation of protein synthesis: 1 - release of initiation factors and GTP hydrolysis; 2 – dissociation of 70S ribosome on the subunits; 3 - joining the $IF_3$ to 30S subunit; 4 - joining the tRNA to 30S subunit; 5 - joining the N-formylmet-tRNA (fmet)-$IF_2$-GTP to the previous complex; 6 - joining the end complex to 50S subunit.**
A. 1-3-6-4-5-2
B. 3-5-4-1-2-6
C. 2-3-4-5-6-1

**120.5. 1,0,0,1,1**
**Elongation of protein synthesis is needed:**
A. initiation complex
B. aminoacyl-tRNA synthetase
C. ATP
D. peptidyl transferase
E. Tu, Ts, G factors

**121.5. 1,0,1,0,1**
**During protein biosynthesis for elongation is characterized:**
A. formation of peptide bonds
B. connection of formylmet-tRNA on the P site
C. using the 2 GTP molecules
D. formation the peptide bond between amino group of the P-center and carboxylic group of the A-center
E. ribosome's moving on one codon of mRNA

**122.5. 1,1,0,0,0**

**Elongation of protein biosynthesis is included:**

A. connection of mRNA and the second amino acid on A center
B. formation of the peptide bond between COOH of the P-center and $NH_2$ of the A- center
C. dissociation of ribosome on subunits
D. separation of protein from ribosome
E. using the 2 ATP molecules and $Ca^{2+}$iones

**123.3. 0,1,0**

**Put the elongation steps of protein synthesis in succession: 1 - complex AA-tRNA-Tu-GTP combines to initiation complex; 2 - transference of dipeptide is needed Od TF-G and 1 GTP molecule; 3 – hydrolysis of GTP; 4 - Tu-GDP goes out the ribosome and composes the Ts-GTP ; 5 - transport of ribosome on one triplet of mRNA; 6 - transport of formylmethionine from P-site to A- site with production of dipeptide-mRNA; 7 - the free mRNA goes to cytosol after hydrolysis.**

A. 1-7-2-6-3-5-4
B. 1-3-4-6-5-7-2
C. 3-7-2-4-5-6-1

**124.3. 1,0,0**

**Put the transcription steps in succession: 1 - growth of RNA chain with help of corenzyme, with moves in 3' to 5' direction of DNA; 2 - joining of gene with RNA polymerase with help of sigma-subunit; 3 - processing of RNA; 4 - untwisting of the DNA duble helix, synthesis and formation of phosphodiester bonds; 5 - recognition of RNA polymerase one of the promotor's sequence; 6 - ρ-factor stops the RNA synthesis; 7 - sigma-subunit is dissotiated by action of holoenzyme.**

A. 5-2-4-7-1-6-3
B. 3-7-2-4-5-6-1
C. 1-3-2-4-7-5-6

**125.5. 1,0,1,1,0**
**During termination of protein synthesis takes place:**
A. Release on the end mRNA from the P-site
B. using of the 3 ATP molecules
C. release of the synthetized protein by hydrolysis
D. dissociation of ribosome on it's subunits
E. reading the all stop codons

**126.5. 1,1,0,1,0**
**According to the termination of protein biosynthesis the confirmations are correct:**
A. is needed of the factors $R_1$, $R_2$, S
B. mRNA is released
C. is needed the presence of factor F
D. is needed of GTP using
E. the last complex AA-mRNA is hydrolized by termination factor

**127.5. 1,0,1,1,0**
**Posttranslational modifications include:**
A. production of hydroxyproline from proline
B. splicing of introns
C. acetylation of N-end
D. methylation of lysine, arginine
E. production of polyadenilate

**128.5. 1,1,0,0,1**
**Posttranslation modifications include:**
A. release of some polypeptide sites
B. joining the nonproteinic groups (heme)
C. replacement of the purine bases by the pyrimidine ones
D. formation of the hydrogen bonds in the structure ($\alpha$-helix)
E. carboxylation of glutamate

**129.5. 1,0,1,0,1**

**The processes which are needed for the 1 GTP molecule using:**

A. combining of the arginine mRNA on the A-center of ribosome
B. activation of methionine by methionine-mRNA synthetase
C. transport of peptidyl-mRNA from A-center to P-center
D. joining the mRNA to the small of subunit
E. activation of the alongation Tu factor

**130.5. 1,0,0,1,1**

**Choose of the protein biosynthesis inhibitor for the replication:**

A. streptomycin
B. erythromycin
C. puromycin
D. mitomycin C
E. canamycin

**131.5. 1,0,0,1,0**

**Choose the inhibitors for transcription:**

A. amanitin
B. actinomycin
C. penicyllin
D. rifamycin
E. erythromycin

**132.5. 1,0,0,1,0**

**Choose the inhibitors for translation:**

A. tetracycline
B. aminicin
C. actinomycin
D. puromycin
E. streptomycin

**133.5. 1,0,0,1,1**
**Protein biosynthesis is regulated by:**
A. equilibrium between production and breakdown of mRNA
B. synthesis rate of mRNA
C. breakdown rate of mRNA
D. quantity of mRNA
E. expression of corresponding genes

**134.5. 1,1,0,1,0**
**mRNA stability:**
A. based on the complex structure
B. is increased without 5'-segment
C. is increased in the presence of 5'-segment
D. the presence on 3'-fragment of U and A is increased in its hydrolysis
E. stability is decreased by action of estrogenes, GTH

**135.5. 1,0,1,0,0**
**mRNA stability, correct:**
A. cell RNA is destroyed by viruses action
B. cortisol decreases the mRNA stability
C. estrogenes increase the mRNA stability
D. mRNA breakdown rate doesn't depend on its structure
E. mRNA breakdown rate is dependent on rRNA

**136.5. 0,1,0,0,1**
**Regulation of the anabolic vital cell processes is dependent on:**
A. presence of inductive enzymes
B. presence of repressory enzymes
C. presence of the constitutive enzymes
D. coordinative induction
E. coordinative repression

**137.5. 1,0,1,1,0**

**Protein biosynthesis regulation:**

A. is dependent on regulative nucleotidic sequences enhancers (E) and silancers (S)
B. activities of E and S don't depend on hormones
C. is dependent on symmetrical complex of proteins, E and S
D. among the combined DNA proteins is a different correlation
E. doesn't depend on rRNA proteins action

**138.5. 0,1,1,0,0**

**For lag-operon theory is correct:**

A. cAMP concentration is increased according to the glucose concentration rise
B. CAP has the two centers for connection of cAMP and DNA
C. repressor has two centers for connection of inductor and fixation on operator
D. LAC genes are transctipted in/or without presence of lactose
E. LAC genes are transcripted independently in connection with repressor and operator

**139.5. 1,1,0,0,1**

**For LAC operon theory is correct:**

A. activation of LAC operon goes without glucose
B. regulatory genes are codons for repressor, which fixes gene operator
C. glucose is the inductor
D. inductor fixes the promotor
E. repressor-inductor complex promotes for connection of pDNA with promotor

**140.5. 1,0,0,1,1**

**Regulation of the genetic expression:**

A. lactose decreases affinity of repressor to operator
B. lactose metabolism is regulated by CAP-cAMP complex only

C. lactose metabolism is regulated by repressor-inductor complex only
D. corepressor increases the repressor affinity to operator
E. lactose metabolism is regulated by two mechanisms (CAP-cAMP, repressor-inductor)

**141.5. 1,0,1,1,0**
**Regulation of genetic expression:**
A. enhancers-sites are positive regulators for protein synthesis
B. enhancers have the species specificity
C. the enhancers ends aren't correct and have conservative zones
D. enhancers have the expressed tissue specificity
E. the enhancers position according to the gene doesn't change

**142.5. 1,0,1,1,0**
**Induction and repression of enzymes:**
A. induction is determined the "de novo" synthesis of the enzymic molecules
B. repression is analog of retroinhibition
C. repression and induction are based on the economic principle in the cell
D. repression is the inhibition of enzyme synthesis
E. induction doesn't define the new synthesis of enzyme molecules

**143.5. 1,1,1,1,0**
**Replication, the correct confirmations:**
A. DNA polymerase combines the nucleotides to 3'-growth chain only
B. 3'-end of the mature chain isn't replicated
C. 5'-end of the daughter chain is short
D. 3'-end of the mature chain is free
E. it is the incomplete replication of growth chain

**144.5. 1,1,1,1,0**

**According to the telomerase, it is correct:**

A. takes place the DNA shortening for the majority of somatic cells
B. the DNA shortening doesn't meet in the sexual and tumor cells
C. the DNA shortening is prevented by telomerase
D. enzyme which is prevented by DNA shortening is transferase
E. isn't reverse transcriptase (revertase)

**145.5. 0,1,1,0,1**

**Telomerase:**

A. ribonucleotide
B. ribonucleoprotein
C. enzyme for compensation of replication end
D. enzyme, which uses the ribonucleotides
E. enzyme, which uses the deoxyribonucleotides

**146.5. 1,1,1,0,1**

**Telomerase:**

A. has the proteic component TPT
B. TPT is universal for eukaryotes
C. enzyme acts as the stable nucleoproteinic complex
D. hasn't the distinctive properties with reverse transcriptases (revertases)
E. the small proteins participate in regulation of enzyme action

**147.5. 0,1,0,1,0**

**Chromosome elongation of eucaryotes:**

A. combines the hexonucleotide TTAGGG
B. 3'-end of DNA is extended of hexonucleotide TTAGGG
C. 5'-end of DNA is extended that nucleotide
D. in succession goes: fixation, elongation and translocation of telomerase
E. at first is extended by the opposite daughter chain (C)

**148.5. 0,1,1,0,1**

**Enzymic characteristics for telomerases:**

A. enzyme has the small activity “in vitro”
B. the human enzyme has high activity
C. process is dependent on the length primer
D. the primers are smaller than 10 nucleotides
E. when the primer is more than 10 nucleotides the DNA can have the thousands of nucleotides

**149.5. 1,1,0,0,1**

**Enzymic characteristics of telomerases:**

A. they use deoxynucleotides for chain synthesis
B. RNA-RNA as substrate may be used
C. they use dideoxynucleotide TP for elongation
D. $K^+$ and $Na^+$ are needed for their function
E. they have exonuclease activity

**150.5. 0,1,1,1,0**

**Structure and functions of RNA telomerase:**

A. RNA structure of the related organisms is very conservative
B. the primary structure has difference of sequence and nucleotide’s number
C. messenger site is on 50N of the 5’-end
D. secondary structure includes 4 parts and one chain fragment
E. RNA telomerase isn’t used for enzyme catalysis

**151.5. 1,1,1,0,1**

**Proteins of telomerase complex:**

A. haven’t homologic primary structure
B. are similar with RNA polymerases
C. the functional spectrum of these proteins is very variable
D. RNA telomerase hasn’t equimolar quantity of p80 and p95
E. polyproteinic complexes at the action with DNA are genes repressors

**152.5. 1,1,1,0,0**

**Regulation of telomerase activity in somatic cells:**

A. cytokines are activators of telomerase
B. takes place in the autoinduction of proliferation, autorestoration
C. in endometric cells of uterus is depended on mensus cycle
D. after menopause activity of telomerase is increased
E. estrogenes are inhibitors of it's activity

**153.5. 1,0,1,1,0**

**Activators and inhibitors of telomerase:**

A. azidothymine is its inhibitor
B. dideoxyguanosine is modern activator
C. as inhibitor isn't DNA corresponding telo-RNA
D. may be used as regulators of reverse transcriptases
E. the complementary for matrix telo-RNA olygonucleotides are activators

**154.5. 1,1,0,0,1**

**The correct confirmations:**

A. a loss of telomerase's properties is a reason for ageing
B. the telomerase length is biological age for growing old
C. replicative folk is into cell cytosol
D. problem of incomplete replication is specific for cyclic DNA
E. telomerase has thousands of TTAGGG sequences

**155.5. 1,1,0,1,1**

**The correct confirmations:**

A. with age the oxygen active forms (OAF) are deposited
B. the old age is the phenomen of phenoptosis
C. OAF have the ptotective function for living systems (cell, mytochondria)
D. superoxide anion radical ($:O^{2-}$) is initiator of OAF production
E. mytochondria have the special role for OAF generation

**156.5. 1,1,1,1,1**
**Mechanisms of the growing old organism:**
A. production of anomalic chromosome is increased
B. chromosomes loss are predominated
C. takes place the gene extraction near telomerase
D. after extraction of this gene the growing old repressor is inactivated
E. the telomer binding proteins (TBP) are included in process

**157.5. 1,1,0,1,1**
**The cell growing old is based on:**
A. activity of cGMP dependent protease is increased
B. activation of genes for protein phosphorylation
C. loss of the proteins-repressors for telomerase gene
D. presence of the prohimbitine gene
E. activation of methylguanine transferase

**158.5. 1,1,1,1,1**
**It is correct:**
A. 5'-methylcytosine number is needed for immortal fenotype
B. the mortalin present in the cytoplasm of normal human cells
C. a quarter of all immortal cells are telomer-negative
D. the telomerase length may be constant by recombination and retrotransposition
E. the cells have an alternative mechanisms for telomer lengthening

## METABOLISM. BIOLOGICAL OXIDATION. RESPIRATORY CHAIN

**1.5. 1,1,0,1,1**
**The functions of metabolism are the following:**
A. to supply the cells with chemical energy
B. transformation of nutritious substances into building blocks

C. synthesis only specific biomolecules
D. catabolism of specific biomolecules
E. assembling of polysaccharides and other cell components

**2.5. 0,1,1,0,1**
**The following statements are correct:**
A. catabolism is a stage of degradation of only exogenous substances
B. catabolism is a stage of degradation of various substances to more simple ones
C. catabolic processes are accompanied by release of free energy
D. the energy is collected only as ATP
E. the energy may be collected both as ATP and GTP

**3.5. 1,1,0,1,0**
**The following statements are correct:**
A. anabolism is a stage of synthesis of various organic compounds
B. anabolism consumes free energy (ATP)
C. anabolism requires hydrogen atoms delivered by NADH
D. anabolism has 3 stages
E. for anabolism is characteristic a convergence of metabolic pathways

**4.5. 0,0,1,1,1**
**The following statements are correct:**
A. catabolic and anabolic pathways have the same direction
B. the speed of catabolic and anabolic pathways is regulated by common enzymes
C. catabolic and anabolic pathways differ in localization
D. catabolic and anabolic pathways have a common third stage
E. reactions of catabolic and anabolic pathways should be regulated separately

**5.5. 0,1,1,0,1**
**Cycle ATP:**
A. ATP – is the main form of chemical energy storage
B. in all living cells carries out identical functions
C. it is the universal and main carrier of energy
D. ATP is presented only in mitochondria
E. in some biosynthetic reactions is used such as CTP, GTP, UTP

**6.5. 0,0,1,1,1**
**The regulation of cell metabolism:**
A. ADP and AMP serve as allosteric inhibitors
B. ATP serves as an activator
C. the rate of the metabolism depends on the cell needs for ATP
D. the rate of the metabolism depends on the ratio NADPH/NADP
E. depends on hormones

**7.5. 1,1,1,0,0**
**Which compounds are macroergic?**
A. ADP
B. ATP
C. creatine phosphate
D. diacylglycerol phosphate
E. glucose-6-phosphate

**8.5. 1,1,0,0,1**
**The regulation of pyruvate dehydrogenase complex:**
A. is carried out by retroinhibition
B. acetyl-ScoA and NADH serve as inhibitors
C. NADH is inhibitor for $E_2$
D. acetyl-ScoA is inhibitor for $E_3$
E. the allosteric inhibition is amplified by macromolecular fatty acids

**9.5. 1,0,1,0,0**

**The Krebs cycle:**

A. is a general final pathway of substances' oxidation in living cells

B. all compounds include in the Krebs cycle through acetyl-coA

C. in the Krebs cycle $H^+$ and $CO_2$ form from acetyl-coA

D. for reactions of the Krebs cycle are needed the anaerobic conditions

E. oxygen participates directly in the reactions of the Krebs cycle

**10.5. 1,0,0,0,0**

**Properties of α-ketoglutarate dehydrogenase complex (α-KGDH complex):**

A. derivatives of vitamins $B_1$, $B_2$, PP, HS-coA, lipoic acid are includeed as coenzyme

B. α-KGDH complex is regulated by both covalent modification and allosterically

C. it has a completely different action in comparison with pyruvate dehydrogenase complex

D. NADH and succinyl-coA intensify the activity of the α-KGDH complex

E. the activity of α-KGDH complex is reduced by the low level of cell energetic status

**11.5. 1,0,1,1,0**

**Oxidation of succinate (the $6^{th}$ reaction of the Krebs cycle):**

A. succinate oxidizes to fumarate by dehydrogenation

B. the reaction is catalyzed by NAD-dependent succinate dehydrogenase (SDH)

C. SDH is an integrated membrane protein

D. FAD is connected by a covalent bond with histidine in the active center of SDH

E. $FADH_2$ dissociates from SDH and the electrons are transferred to $Fe^{3+}$

**12.5. 0,1,0,0,1**

**The Krebs cycle:**

A. in one turn of the Krebs cycle is accompanied by formation of 3 molecules of $CO_2$

B. in one turn of the Krebs cycle only one acetyl radical is included

C. oxygen participates directly in the Krebs cycle

D. for the Krebs cycle are needed only the anaerobic conditions

E. the Krebs cycle provides regeneration of 1 molecule of oxaloacetate

**13.5. 0,0,0,1,0**

**The transformation of 1 molecule of isocitrate to succinate in the Krebs cycle provides the synthesis of ATP:**

A. 10 molecules

B. 12 molecules

C. 8 molecules

D. 7 molecules

E. 9 molecules

**14.5. 0,1,1,1,0**

**Pyruvate carboxylase reaction:**

A. the reaction takes place in cytosol

B. it is an anaplerotic reaction

C. the reaction takes place in mitochondria

D. it is a reaction of gluconeogenesis (from alanine to glucose)

E. does not require ions $Mg^{2+}$ or ATP

**15.5. 1,0,0,1,1**

**Biological oxidation – the essence of process:**

A. it is the totality of oxidative and reductive processes that take place in the cells

B. occurs by addition of oxygen

C. the transfer of electrons is realized directly to oxygen

D. the oxidation is carried out by dehydrogenation

E. the H-atoms are transferred as protons and electrons

**16.5. 1,1,0,1,0,**

**The correct statements about the acceptors of $H^+$ and ē:**

A. the acceptors of $H^+$ and ē are coenzymes of dehydrogenases
B. the electrons are the main source of energy in ATP synthesis
C. NADH serves as an acceptor of electrons in reactions of biosynthesis
D. NADPH serves as a donor of electrons in reaction of biosynthesis
E. $FADH_2$ is a donor of electrons in biosynthesis

**17.5. 1,1,0,0,1**

**Oxidative phosphorylation:**

A. the transfer of electrons through respiratory chain is connected with the ATP synthesis
B. delta G of two electrons is equal to 52,6 kcal
C. delta G of two electrons is enough to synthesize 5 molecules of ATP
D. delta G of two electrons is enough to synthesize 1 molecule of ATP
E. the synthesis of one molecule of ATP is required a Eo = 0,224v

**18.5. 1,1,1,0,1**

**The final products of electron transfer are:**

A. the addition to $O_2$ of 2 electrons forms $H_2O_2$
B. the addition to $O_2$ of 4 electrons forms 2 $H_2O$
C. the addition to $O_2$ of 1 electron forms superoxid radical ($:O_2$ -)
D. the transfer of 2 electrons through the complex II can form 3 molecules of ATP
E. the transfer of 2 electrons through the complex IV can form 1 molecule of ATP

**19.5. 1,1,1,0,0**

**Mechanisms of oxidative phosphorylation:**

A. the H-ions come back to mitochondria through the special ion channels

B. the flow of protons is driving force, which promotes synthesis of ATP

C. ATP- syntase consists of the factors $F_0$ and $F_1$

D. both factors are components of the inner mitochondrial membrane

E. ATP- syntase consists of 9 units of 5 different kinds

**20.5. 1,1,1,0,1**

**The control of oxidative phosphorylation:**

A. the P/O ratio is characteristics of the oxidative phosphorylation

B. P/O ratio represents the number of inorganic phosphate moles, transformed in the organic form at the utilization of 1 atom of oxygen

C. P/O for malate oxidation is equal to 3/1

D. P/O for succinate oxidation is equal to 4/1

E. as uncouplers can serve hydrazones, isothiocyanates

**21.5. 1,1,0,1,1**

**The functions of metabolism are the following:**

A. to supply the cells with chemical energy

B. transformation of nutritious substances into building blocks

C. synthesis of only specific biomolecules

D. catabolism of specific biomolecules

E. assembling of polysaccharides and others cell components

**22.5. 0,1,1,0,0**

**The following confirmations are correct:**

A. catabolism is process only of exogenic substances breakdown

B. catabolism is process of different substances breakdown to more simple products

C. a free energy releases during catabolism
D. released energy uses only for ATP production
E. catabolism has 2 stages

**23.5. 1,0,1,0,0**
**The following statements are correct:**
A. intracellular anabolism and catabolism go in time
B. dosn't release a free energy on the first stage of catabolism
C. pyruvate is the end product of the 2-nd stage of catabolism
D. lactate is the end product of the 2-nd stage of catabolism
E. the 2-nd stage of catabolism includes the Krebs cycle

**24.5. 1,1,0,1,0**
**Characteristics for metabolism are:**
A. anabolic pathways are needed in additional energy
B. anabolism and catabolism have common sites
C. anabolism and catabolism don't have common sites
D. the great portion of energy is produsedon the 3-rd stage of catabolism
E. pyruvate is the end product of metabolism

**25.5. 0,1,0,1,0**
**ATP:**
A. is nucleotide with one macroergic (energy-rich) chemical bond
B. is purinic nucleotide
C. is pyrimidinic nucleotide
D. has 2 macroergic bonds
E. has 3 macroergic bonds

**26.5. 1,0,0,0,1**
**Which substances are more energy-rich than ATP?**
A. creatinphosphate
B. glucose-5-phosphate
C. AMP
D. pyrophosphate
E. phosphoenolpyruvate

**27.5. 0,0,1,1,0**
**Pyruvate dehydrogenase complex:**
A. includes 48 polypeptidic chains
B. includes enzymes: $E_1$, $E_2$, $E_3$, $E_4$
C. includes enzymes: $E_1$, $E_2$, $E_3$
D. includes coenzymes: NAD, FAD, TDP (TPP)
E. includes active forms of vitamines: $B_1$, $B_2$, PP, $B_6$

**28.5. 0,0,1,1,0**
**Pyruvate dehydrogenase (PDH) complex functions are:**
A. pyruvate is oxidized by $O_2$
B. oxidative decarboxylation of $CH_3$-COOH
C. oxidative decarboxylation of $CH_3$-CO-COOH
D. production of $NADH_2$ for respiratory chain
E. production of $NADPH_2$ for respiratory chain

**29.5. 1,0,1,1,0**
**The 3-rd chemical reaction of PDH complex is:**
A. acyl-radical transfers on HS-coA with production acyl-ScoA
B. $E_1$ is catalyst of this reaction
C. $E_2$ is catalyst of this reaction
D. acyl-coA is macroergic complex
E. $E_3$ is catalyst of this chemical reaction

**30.5. 1,1,1,0,0**
**Pyruvate dehydrogenase complex regulation:**
A. nucleotides are regulators
B. ATP and GTP are inhibitors
C. AMP is activator
D. only allosteric regulation
E. only covalent modification

**31.5. 1,0,1,1,0**
**The Krebs cycle, its regulative reactions and enzymes:**
A. citrate synthesis citrate synthetase
B. citrate isomerization aconitase
C. oxaloacetate production MDH
D. succinate oxidation SDH
E. malate production MDH

**32.5. 1,1,1,0,0**
**Correct statements about oxidation of succinate to fumarate:**
A. is needed of FAD
B. is needed of the active form (coenzyme) of vitamine $B_2$
C. is reaction of dehydrogenation
D. is reaction of isomerization
E. is reaction of hydrotation

**33.5. 0,0,0,1,0**
**Substrate phosphorylation in the Krebs cycle:**
A. citrate→ isocitrate
B. isocitrate→ α-ketoglutarate
C. α-ketoglutarate→ succinyl-ScoA
D. succinyl-ScoA→ succinate
E. succinate→ fumarate

**34.5. 1,0,0,0,1**
**Respiratory chain (RC):**
A. its components are donors and acceptors of electrons
B. this is chain only of coenzymes
C. this is chain only of proteins
D. RC has 4 points for phosphorylation
E. RC has 3 cites for phosphorylation

**35.5. 1,1,1,1,0**
**Reactions of electron transport:**
A. $Fe^{2+} + Cu^{2+} \leftrightarrow Fe^{3+} + Cu^{+}$

B. $AH_2 + B \rightarrow A + BH_2$
C. donor $\rightarrow \bar{e} + A$
D. donor and acceptor are redox-pair
E. donor is oxidant, acceptor is reductant

**36.5. 1,0,1,1,0**
**Complex II (succinate-coQ-reductase):**
A. glycerol-3-phosphate is donor of $H^+$ and $\bar{e}$
B. includes FMN
C. has FeS-centers
D. transports of $H^+$ and $\bar{e}$ to ubiqunon
E. transports of $H^+$ and $\bar{e}$ to cytochrom c

**37.5. 1,1,1,0,0**
**Complex IV of Respiratory chain:**
A. is called as cytochrom c oxidase
B. transfers of $H^+$ and $\bar{e}$ to $O_2$
C. is complex for both respiratory chains, a long and short ones
D. all cytochromes have a relative proteinic portion
E. all cytochromes have a relative prostethic portion

**38.5. 0,1,0,1,0**
**Respiratory chain:**
A. FeS-proteins are cariers of $H^+$
B. FeS-proteins are cariers of $H^+$ and $\bar{e}$
C. a long respiratory chain generates 4 ATP molecules
D. cytochromes are cariers only for electrons
E. cytochromes are cariers of $H^+$ and electrons

**39.5. 0,1,1,1,1**
**Respiratory chain:**
A. all cytochromes contain of copper (Cu)
B. all cytochromes are heme proteins
C. 4 electrons are needed for reduction of $O_2$
D. $E_o$ of ubiqinon is + 0,04 v
E. cytochromes contain Fe or Cu

**40.5. 0,1,1,1,1**

**Transport via the mitochondric membrane:**

A. mitochondric membrane is permiable for NAD and NADH
B. protons and electrons transfer via its membrane
C. malate is carier of protons and electrons
D. glycerol-3-phosphate is carier of $H^+$ and $\bar{e}$
E. shuttle mechanisms regulate $NAD^+$ concentration in cytosol

**41.5. 1,1,1,0,1**

**Coefficient P/O:**

A. for malate is 3
B. for succinate is 2
C. for ascorbate is 1
D. for isocitrate is 2
E. for isocitrate is 3

**42.5. 1,1,1,0,0**

**Cytochrom $P_{450}$:**

A. uses $O_2$ and CO
B. catalyzes reaction of substrate hydroxylation
C. uses NADH and NADPH
D. doesn't participate in steroids' synthesis
E. doesn't participate in drugs' biotransformation

## CARBOHYDRATES: CHEMICAL STRUCTURE AND METABOLISM

**1.5. 1,1,1,0,0**

**Name of the carbohydrate functions:**

A. energetic
B. they are the main components of cell membranes
C. genetic
D. stabilize an oncotic pressure
E. are emulgators

**2.5. 0,0,0,1,1**
**In the human organism present the following carbohydrates:**
A. starch
B. cellulose
C. amylase
D. glucose
E. glycogen

**3.5. 0,1,1,1,0**
**Lactose is:**
A. carborydrate which has the reduce property and 2 molecules of β-galactose
B. the mammalia milk
C. disaccharide with reduce property
D. both of its monosaccharides have the pyranose form
E. repeated structural subunit of glycogen

**4.5. 1,0,1,0, 1**
**Which of these confirmations according to glucose are correct?**
A. may be in α- and β-form of stereoisomers
B. the glucofuranose form is stable
C. glucuronic acid is the product of glucose oxidation
D. doesn't have the hiral carbon atoms
E. is the aldohexose with the 4 hiral carbon atoms

**5.5. 1,0,1,0,0**
**Deoxyribose:**
A. is the component of certain nucleotides
B. is the component of mRNA
C. is the modificated aldopentose
D. can't be as the furanose form
E. has the NH-group in the site of OH-group

**6.5. 0,1,1,0,0**
**Name the homopolysaccharides:**
A. heparin
B. starch
C. glycogen
D. chondroitin sulphate
E. heparan sulphate

**7.5. 0,1,0,1,1**
**Name the heteropolysaccharides:**
A. amylopectin
B. hyaluronic acid
C. maltose
D. keratan sulphate
E. heparin

**8.5. 1,0,1,1,1**
**For glucose absorbtion is needed:**
A. $Na^+$-ions for production complex with monosaccharides
B. abundance of $Ca^{2+}$-iones
C. participation of $Na^+$ ,$K^+$ -ATP-ase
D. a coupling of oxidative phosphorylation in enterocytes
E. presence of ATP and corresponding transport mechanism

**9.5. 0,1,1,1,0**
**Breakdown of glucose into two trioses is correct:**
A. the end reaction is production of two aldoses
B. equilibrium of this reaction goes to C=O production
C. one aldose and one ketose produce in these reactions
D. 2 molecules of ATP are as the result of the five reactions
E. all reactions of this step are indirect

**10.5. 1,0,1,1,0**
**Oxidation of glyceraldehyde-3-phosphate:**
A. is catalyzed by corresponding dehydrogenase
B. is irreversible

C. is reversible
D. produces energy (ATP)
E. goes in mitochondria

**11.5. 0,0,1,1,0**
**The end products of anaerobic glycolysis are:**
A. pyruvate
B. glucose
C. 2 ATP
D. 2 $H_2O$
E. 2 $CO_2$

**12.5. 1,1,1,0,0**
**According to pentose-phosphate oxidation of glucose the confirmations are correct:**
A. glucose-6-phosphate + $NADP^+$ → 6-phosphogluconate lacton + NADP + $H^+$
B. reaction is catalyzed by NADP-dependent dehydrogenase
C. lactonase catalyzes 6-phosphogluconate production
D. lactonase is oxidoreductase
E. 6-phosphogluconate + $NADP^+$ → ribose-5-phosphate + $CO_2$ + NADP + $H^+$

**13.5. 1,0,1,0,0**
**End products of one glucose molecule oxidation are:**
A. 38 ATP
B. 54 $H_2O$
C. 6 $CO_2$
D. 22 $H_2O$
E. 44 ATP

**14.5. 1,0,1,0,1**
**Substrate for gluconeogenesis is:**
A. glycerol
B. acetyl-coA

C. glutamate
D. acetoacetate
E. asparagine

**15.5. 1,1,1,0,0**
**Hyperglycemia may be in:**
A. diabetes mellitus
B. pathology of cortex of medulla glands
C. using the β-blockator
D. hypothyrosis
E. Addison's disease

**16.5. 1,1,0,1,0**
**Confirmations for maltose are correct:**
A. it is product of enzymic hydrolysis of starch
B. it is product of enzymic hydrolysis of glycogen
C. it is cellulose monomer
D. it is composed of two α-glucose molecules
E. it doesn't have mutorotation property

**17.5. 1,0,0,1,0**
**Galactose is:**
A. lactose monomer
B. the main carbohydrate of blood
C. keto-pentose
D. epimer of glucose
E. α-anomer in the structure of lactose

**18.5. 0,0,1,0,0**
**Fructose is:**
A. reduced only to D-sorbitol
B. ketose with L-stereoform
C. galactose isomer
D. the main carbohydrate of blood
E. the main component of lactose

**19.5. 1,0,1,0,0**

**Homopolysaccharides:**

A. are cellulose, starch and hitin
B. maltose is structural subunit of cellulose
C. cellulose is polysaccharide of plant
D. cellobiose has 2 molecules of α-glucose
E. cellobiose has α-glycoside bond

**20.5. 0,1,0,0,1**

**Statements about glycogenolysis are correct:**

A. this is hydrolysis of glycogen
B. phosphorolysis of glycogen is the main process in organism
C. α-1,6-glycoside bonds of glycogen are broken by o-phosphate (orto-phosphate)
D. only glycogen phosphorylase is needed
E. α-1,6-bonds are broken by hydrolytic enzyme

**21.5. 0,1,0,0,1**

**According to glycogenesis the following confirmations are correct:**

A. it is active process in the cardiac muscle and nerve (brain) tissue
B. it is more active in the liver and skeletal muscle
C. in glycogenesis the "*a*" and "*b*" glycogen synthetases participate
D. glycogen synthesis is needed of enzymic complex
E. 3 of macroergic molecules are necessary for glycogen synthesis

**22.5. 1,1,0,1,0**

**For Girke disease the following confirmations are correct:**

A. deficiency of glucose-6-phosphatase is the reason of this pathology
B. lactate and pyruvate are increased in the blood
C. glycogen structure is anomalic
D. the metabolic disturbances takes place in the liver, kidney and intestine
E. the reserve of glycogen is minimum

**23.5. 0,0,1,1,1**

**Enzyme for regulation of glycolysis is:**

A. triose-phosphate isomerase
B. phospho-glucose isomerase
C. hexokinase
D. phosphofructokinase
E. pyruvate kinase

**24.5. 0,0,1,1,1**

**Glycolysis activator is:**

A. NADH
B. ATP
C. adrenalin
D. fructose-1,6-biphosphate
E. AMP or ADP

**25.5. 0,0,0,1,1**

**Inhibitor of glycolysis is:**

A. NAD
B. citrate
C. glucose
D. ATP
E. lactate

**26.5. 0,1,0,1,1**

**NADH is:**

A. the main factor of catecholamines production
B. inhibitor of $Fe^{2+}$ oxidation in erythrocytes
C. its hydrogen is used in the gluconeogenesis
D. necessary for synthesis and secretion of HCl in the stomach
E. donor of $H^{+}$ for Respiratory chain

**27.5. 1,0,1,0,1**

**Which component is common for production of glucose from alanine and lactate?**

A. pyruvate
B. lactate dehydrogenase
C. $Mg^{2+}$-ions
D. alanine aminotransferase (glutamic oxaloacetic transaminase, GOT)
E. pyruvate kinase

**28.5. 1,0,0,1,1**

**Confirmations are correct:**

A. monosaccharide has aldehyde-form or keto-form
B. monosaccharide has disulfer chemical bond
C. monosaccharide includes the peptide chemical bond
D. certain carbohydrates have N, P or S-atoms in their structure
E. lactose is disaccharide

**29.5. 1,1,0,0,0**

**The following statements are correct:**

A. during reduction monosaccharide is converted into an alcohol
B. NAD-dependent enzyme is needed for the reduction of monosaccharide
C. glucose doesn't have a reducing property
D. D-glucose is converted into D-fructose during reduction
E. glycosidic bond may be formed with each C-atom

**30.5. 1,0,0,1,0**

**The correct statements according to sucrose:**

A. it is a disaccharide
B. it is a heteropolysaccharide
C. ribose is a monosaccharide of sucrose
D. it is an oligosaccharide
E. it is transport form of carbohydrates in plants

**31.5. 1,1,0,0,0**

**Which statements about ribose are correct?**

A. it can't be in pyranose-form
B. it is a component of certain nucleotides
C. it is a keto-form
D. its cyclic form has 5 asymmetric C-atoms
E. it has SH-group

**32.5. 0,1,1,1,0**

**Which confirmations about lactose and monose are correct?**

A. they have a β-glycosidic bond
B. they have reducing properties
C. they have the 1,4-glycosidic bond
D. they include hexo-aldoses as pyranose-form
E. they don't have reducing properties

**33.5. 0,1,0,1,1**

**Digestive mechanism of carbohydrates:**

A. stomach is the site of carbohydrates hydrolysis
B. α-amylase hydrolyzes the α-1,4-glycosidic bonds of homopoly-saccharides
C. disaccharidases don't have substrate specificity
D. disaccharidases have substrate specificity
E. disaccharidases are synthetized into enterocytes

**34.5. 0,1,1,1,0**

**Synthesis of glycogen:**

A. glycogen synthetase "*a*" forms the α-1,6-glycosidic bond
B. glycogen synthetase produces the α-1,4-bond in glycogen
C. reaction of glucose activation with UTP is a key one
D. glycogen synthetase "*a*" is active form after dephosphorylation
E. insulin decreases the content of glycogen in the liver

**35.5. 1,1,1,1,0**

**Reaction glucose → glucose-6-phosphate:**

A. is irreversible in the cell
B. (ATP + $Mg^{2+}$) complex is needed for this reaction
C. product of this reaction is its allosteric inhibitor in the skeletal muscles
D. hexokinase is the enzyme of this reaction
E. GTP is a substrate for glucose phosphorylation

**36.5. 0,1,0,0,1**

**Phosphofructokinase regulation:**

A. only ATP and fatty acids are inhibitors of this reaction
B. AMP and fructose-1,6-diphosphate are positive modulators
C. NADPH is the main activator of this reaction
D. FMN is the main activator of this reaction
E. it is an allosteric enzyme

**37.5. 0,1,1,1,0**

**Glycerol phosphate dehydrogenase:**

A. OH-radical of serine presents in its active center
B. I-$CH_2$-COOH is its inhibitor
C. SH-group of cysteine presents in its active center
D. it is enzyme of oxidoreduction
E. ATP is a substrate for phosphorylation

**38.5. 1,1,0,1,0**

**Production of pyruvate in glycolysis:**

A. pyruvate kinase is the enzyme of this reaction
B. phosphorylation takes place on the substrate level
C. dehydrogenase is the enzyme of this reaction
D. 1 ATP molecule is the product of this reaction
E. it is a reversible reaction

**39.5. 1,1,1,1,0**
**Substances of glycolysis are:**
A. lactate
B. 2 ATP
C. 4 ATP
D. 2 NAD
E. 2 $H_2O$

**40.5. 1,0,0,0,1**
**Common enzyme of glycolysis and alcohol oxidation is:**
A. pyruvate kinase
B. alcohol dehydrogenase
C. lactate dehydrogenase
D. pyruvate decarboxylase
E. hexokinase

**41.5. 0,0,0,1,1**
**Common product of glycolysis and alcohol oxidation is:**
A. acetaldehyde
B. lactate
C. $FADH_2$
D. TPP (TDP)
E. pyruvate

**42.5. 0,0,1,1,1**
**Pentose phosphate pathway:**
A. presents only in erythrocytes and hepatocytes
B. presents only in the fat tissue and medulla glands
C. is an anabolic pathway
D. produces NADPH and ribose-5-phosphate
E. presents in the mitochondria

**43.5. 0,0,0,1,1**
**The end product of pentose phosphate pathway is:**
A. ribulose-5-phosphate
B. glucose-6-phosphate

C. ATP
D. ribose-5-phosphate
E. 2 $NADPH_2$

**44.5. 0,1,1,1,0**
**The end products (before $H_2O$ and $CO_2$) of 2 pyruvate molecules oxidation are:**
A. 2 NADH
B. 8 NADH
C. 2 $FADH_2$
D. 30 ATP
E. 38 ATP

**45.5. 1,0,0,1,1**
**Enzyme of galactose (Gal) metabolism is:**
A. galactokinase
B. aldolase
C. phosphotase
D. UDP-Gal-pyrophosphorylase
E. UDP-Gal-epimerase

**46.5. 0,0,1,1,1**
**Activator of gluconeogenesis is:**
A. AMP
B. insulin
C. corticosterone
D. citrate
E. ATP

**47.5. 0,1,1,1,1**
**Common enzyme of glycolysis and gluconeogenesis is:**
A. hexokinase
B. enolase (enoylhydratase)
C. phosphoglycerate mutase

D. triose-phosphate isomerase
E. phosphoglycerate kinase

**48.5. 1,0,0,1,1**
**Insulin is:**
A. activator of glucose transport to tissues
B. activator of glycerol convertion into glucose
C. activator of lypolysis
D. activator of lipids synthesis in the liver
E. activator of glycolysis

## LIPIDS: CHEMICAL STRUCTURE AND METABOLISM

**1.5. 1,0,0,0,1**
**The main function of lipids is:**
A. transport
B. catalytic
C. contraction
D. genetic
E. energetic

**2.5. 0,1,1,0,0**
**Lipids as the components of the cell membrane are:**
A. triglicerides
B. cholesterol
C. phosphodiglyceride
D. phosphatidyl ethanol
E. free fat acids

**3.5. 0,0,0,1,0**
**Neutral lipids are esters of the following components:**
A. ethanolamine and amino acids
B. sphingosine and fat acids
C. ethylenglycol and fat acids
D. glycerol and fat acids
E. cholesterol and fat acids

**4.5. 0,0,0,1,0**

**The biological role of phosphatidyl choline and phosphatidyl ethanolamine is:**

A. the main components of the fat tissue
B. substrates of cholesterol production
C. energetic role
D. the main components of the cell membrane
E. the main components of the nerve cell membranes

**5.5. 0,0,1,0,0**

**Component of phospholipids is the following amino acid:**

A. methionine
B. cysteine
C. serine
D. tyrosine
E. α-alanine

**6.5. 0,0,0,0,1**

**What is a ceramide?**

A. triacylglycerol
B. phospholipids
C. plasmalogen
D. sterid
E. sphingomyelin

**7.5. 1,0,1,0,0**

**Galactose is the component of:**

A. cerebrosides
B. gangliosides
C. sulpholipids
D. acetalphosphatides
E. sterids

**8.5. 0,0,1,0,0**
**Sites and enzymes of triglycerides hydrolysis (digestion) are:**
A. intestinal lipase, the small intestine
B. gastric lipase, stomach
C. pancreatic and intestinal lipases, the small intestine
D. lipoproteinlipase, intestine
E. phospholipase, the large intestine

**9.5. 0,0,1,1,0**
**The bile acids are products of conjugation with the following component:**
A. cholesterol
B. serine
C. taurine
D. glycine
E. bilirubin

**10.5. 0,0,1,0,0**
**Glycerophospholipids are hydrolyzed by:**
A. pancreatic lipase
B. intestinal lipase
C. phospholipase
D. coupled (conjugates) bile acids
E. cholesterol esterase

**11.5. 0,0,1,0,0**
**Production of lysophosphatidyl choline and lysophosphatidyl ethanolamine is catalyzed by:**
A. lipase (intestinal, pancreatic)
B. phospholipase $A_1$
C. phosphjlipase $A_2$
D. phospholipase C
E. phospholipase D

**12.5. 0,0,0,1,0**

**Phospholipids may be modified into phosphatidyc acid by action of:**

A. phospholipase $A_1$
B. phospholipase $A_2$
C. phospholipase C
D. phospholipase D
E. all these enzymes

**13.5. 0,0,0,1,0**

**The common intermediate of the triglycerides and phospholipids synthesis is:**

A. diacylglycerol
B. triacylglycerol
C. phosphoglycerinic acid
D. phosphatidyc acid
E. monoacylglycerol

**14.5. 0,0,0,1,0**

**Chylomicrons are broken down by the action of:**

A. triglyceridlipase
B. diglyceridlipase
C. monoglyceridlipase
D. lipoproteinlipase
E. phospholipase

**15.5. 0,1,0,0,0**

**The hormone-sensitive enzyme and hormones of fat acids mobilization are:**

| | |
|---|---|
| A. digliceridlipase | insulin |
| B. triglyceridlipase | glucagon, catecholamines |
| C. monoglyceridlipase | catecholamines |
| D. triglyceridlipase | steroid hormones |
| E. diglyceridlipase | catecholamines, glucagon |

**16.5. 0,0,1,0,0**

**Triglyceridlipase is activated by adrenalin and glucagon via the second messenger:**

A. inosytol mechanism
B. cTMP
C. cAMP
D. $Ca^{2+}$-ions
E. production of enzymes by genome activation

**17.5. 0,0,1,0,0**

**The common intermediate of the carbohydrates and glycerol catabolism is:**

A. glyceraldehyde-3-phosphate
B. 3-phosphoglycerinic acid
C. dihydroxyacetone phosphate
D. 2-phosphoglycerinic acid
E. 1,3-diphosphoglycerinic acid

**18.5. 0,0,0,1,0**

**Transport of fatty acids from cytosol into mitochondria takes place in the form of:**

A. free fat acid
B. acyl-coA
C. acyl-coQ
D. acylcarnetine
E. acyl-coA and acylcarnetine

**19.5. 0,1,0,0,0**

**Number of acetyl-coA and cycles which are as the result of β-oxidation of the fat acid with 14 carbon atoms:**

A. 7 and 7
B. 7 and 6
C. 6 and 7
D. 6 and 6
E. 7 and 5

**20.5. 0,0,0,1,0**

**The ketone bodies are:**

A. acetone, β-ketobutiric acid, valerianic acid
B. acetoacetic acid, α-hydroxybutiric acid, aceton
C. β-hydroxybutiric acid, α-ketobutiric acid, aceton
D. acetoacetic acid, β-hydroxybutiric acid, aceton
E. acetic acid, butiric acid, aceton

**21.5. 0,0,0,1,0**

**Aceton is produced during the following process:**

A. β-oxidation of fatty acids
B. glycolysis
C. glycerol catabolism
D. decarboxylation of acetoacetic acid
E. reduction of glyceraldehyde-3-phosphate

**22.5. 0,1,0,0,0**

**Which substance is the donor of methyl-group for phosphatidylcholine production?**

A. methionine
B. S-adenosylmethionine
C. S-adenosylhomocysteine
D. methilcobalamine
E. tetrahydrofolic acid

**23.5. 0,0,1,0,0**

**Which type of acid-base disorders does take place in the blood in patients with diabetes mellitus?**

A. metabolic alkalosis
B. gaseous (respiratory) acidosis
C. metabolic acidosis
D. gaseous (respiratory) alkalosis
E. mixed acidosis

**24.5. 0,0,0,1,0**
**For phosphatidylcholine production is needed:**
A. ADP
B. TTP
C. GTP
D. CTP
E. UTP

**25.5. 0,0,1,0,0**
**For synthesis of conjugated bile acids are needed:**
A. taurine and cholesterol
B. cysteine and uronic acids
C. glycocoll and cholic acid
D. methionine and deoxycholic acid
E. taurine and chenodeoxycholic acid

**26.5. 0,1,0,1,0**
**Phospholipids of the membranes:**
A. soluble in water
B. are polar molecules
C. are nonpolar molecules
D. have electric charge
E. don't have electric charge

**27.5. 1,1,1,0,0**
**Functions of the cell membranes are:**
A. receptoric
B. permeability
C. compartmentalization
D. glycolytical enzymes present in the cell membrane
E. prodaction of oxyhemoglobine ($HbO_2$)

**28.5. 0,1,1,0,0**
**Principal protein of the cell membranes is:**
A. albumin
B. glycophorin

C. spectrin
D. collagen
E. calmodulin

**29.5. 0,1,0,0,0**
**Glycerol is:**
A. dihydroxyalcohol
B. trihydroxyalcohol
C. cyclic alcohol
D. aldehyde
E. ketone

**30.5. 0,0,1,1,0**
**Unsaturated fatty acid is:**
A. palmitic
B. lauric
C. linolenic
D. arachidonic
E. stearic

**31.5. 1,0,0,1,1**
**Saturated fatty acid is:**
A. capronic
B. oleic
C. linolenic
D. stearic
E. palmitic

**32.5. 0,1,0,1,1**
**The structural component (alcohol) of phospholipids is:**
A. cholesterol
B. inositol
C. hydroxychinol
D. glycerol
E. glycerolphosphate

**33.5. 0,0,1,0,0**
**Which lipid is ceramide?**
A. triacylglycerol
B. phosphatidylcholine
C. sphingomielin
D. ganglioside
E. plasmalogen

**34.5. 0,0,1,0,0**
**Sphingosin presents in the following lipids:**
A. glycerophospholipids
B. lysophosphatidylcholines
C. glycolipids
D. α-lipoproteins
E. β-lipoproteins

**35.5. 0,0,1,0,0**
**Oligosaccharide of galactose presents in the following lipids:**
A. sulpholipids
B. cerebrosides
C. gangliosides
D. sphingomielins
E. plasmalogenes

**36.5. 0,1,0,1,1**
**Cholesterol is substrate for synthesis of:**
A. vitamin K
B. vitamin D
C. vitamin E
D. bile acids
E. testosteron

**37.5. 0,1,1,0,1**
**Bile acids are:**
A. lignoceric

B. cholic
C. glycocholic
D. phosphocholic
E. deoxycholic

**38.5. 0,0,0,0,1**
**The main functions of triacylglycerins:**
A. permeability of the cell membrane
B. transport of substances via membrane
C. transfer of the nerve impulse
D. intercellular interrelations
E. energetic storage

**39.5. 0,0,0,1,0**
**Lysophosphatidylcholin is product of phospholipid hydrolysis by:**
A. phospholipase C
B. phospholipase D
C. pancreatic lipase
D. phospholipase $A_2$
E. intestinal lipase

**40.5. 0,0,1,0,0**
**The main components of chylomicrons are:**
A. proteins
B. phospholipids
C. triglycerides
D. cholesterol
E. cholesterides

**41.5. 0,1,0,0,0**
**The enzyme for mobilization of the neutral lipids is:**
A. diglyceride lipase
B. triglyceride lipase
C. monoglyceride lipase
D. all these enzymes
E. intracellular phospholipase

**42.5. 0,0,1,0,0**
**The secondary messenger of adrenalin action for lipids mobilization is:**
A. inositol
B. 3',5'-cCMP
C. 3',5'-cAMP
D. $Ca^{2+}$-ions
E. oligonucleotide

**43.5. 0,0,1,0,0**
**The product of first reaction of glycerol oxidation is:**
A. glyceraldehyde-3-phosphate
B. dihydroxyacetone phosphate
C. glycerol-3-phosphate
D. phosphoglycerinic acid
E. diglycerophosphate

**44.5. 0,0,1,0,0**
**The product of glycerolphosphate oxidation is:**
A. phosphoglycerinic acid
B. 3-glycerinic acid
C. dihydroxyacetone phosphate
D. phosphoenolpyruvate
E. glyceraldehyde-3-phosphate

**45.5. 1,0,1,1,0**
**The mechanism activation of fatty acids is needed of:**
A. carnetine + ATP
B. ATP + coQ
C. HS-coA + ATP
D. biotin + ATP
E. carnosine + ATP

**46.5. 0,1,1,0,0**
**Enzyme of fatty acids activation is:**
A. carnetine-acyl-ScoA synthetase

B. tiokinase
C. acyl-ScoA synthetase
D. acyl-ScoQ synthetase
E. acyl-ScoA transferase

**47.5. 0,0,0,1,0**
**The transport form of fatty acid in mitochondria is:**
A. free fatty acid
B. acyl-ScoA
C. acyl-ScoQ
D. acyl-carnetine
E. acyl-ScoA and carnetine

**48.5. 0,0,1,0,0**
**The products of the first reaction of β-oxidation of fatty acid are:**
A. acyl-ScoA + $FADH_2$
B. enoyl-ScoA + NADH
C. trans-enoyl-ScoA + $FADH_2$
D. cetoacyl-ScoA + FMN
E. hydroxyacyl-ScoA + $FADH_2$

**49.5. 0,0,0,01**
**What are the products of thiolyzation of fatty acid?**
A. acyl-ScoA + HS-coA
B. acyl-scoA
C. acetoacetyl-ScoA + HS-coA
D. acyl + acetyl-ScoA
E. acyl-ScoA + acetyl-ScoA

**50.5. 0,0,1,0,0**
**Number of acetyl-ScoA for synthesis of acetoacetic acid is:**
A. 1
B. 2
C. 3
D. 4
E. 6

**51.5. 0,0,0,1,0**
**Aceton is produced in:**
A. β-oxidation of fatty acids
B. glycolysis
C. glycerol metabolism
D. acetoacetic acid decarboxylation
E. in glycerol-3-phosphate oxidation

**52.5. 0,0,1,0,0**
**The major portion of fatty acids synthetizes in:**
A. nucleus
B. mitochondria
C. cytoplasm
D. chromosome
E. endoplasmic reticulum

**53.5. 0,0,1,0,0**
**Acetyl-ScoA moves from mitochondria to cytoplasm as:**
A. acyl-carnetine
B. its free form
C. citrate
D. acetoacetyl-ScoA
E. acetoacetate

**54.5. 0,0,0,1,0**
**Which components are needed for breakdown of citrate in cytosol?**
A. ATP + kinase
B. GTP + kinase
C. HS-coA + thiolase
D. ATP + HS-coA + ATP-citrate lyase
E. ATP + citrate lyase

**55.5. 0,0,0,1,0**
**The activator and inhibitor of acetyl-ScoA carboxylase are:**
A. malonate ADP
B. succinate citrate
C. acetoacetate NADH
D. citrate palmitoyl-ScoA
E. ATP $FADH_2$

**56.5. 0,0,0,1,0**
**The reaction for transformation of acetoacetyl-ScoA in fatty synthesis is:**
A. dehydrogenation
B. decarboxylation
C. hydrolysis
D. hydrotation
E. dehydrotation

**57.5. 0,0,1,0,0**
**Hydrogen ($H^+$) donor of acetoacetyl-ScoA reduction is:**
A. NADH
B. $FADH_2$
C. $NADPH_2$
D. $FMNH_2$
E. TDP

**58.5. 0,0,0,1,0**
**The product of the first cycle of fatty synthesis and number of NADPH are:**
A. crotonyl-SACP 2 NADPH
B. acetoacetyl-SACP 3 NADPH
C. β-hydroxibutiryl-SACP 2 NADPH
D. butiryl-SACP 2 NADPH
E. butiryl-SACP 4 NADPH

**59.5. 0,0,1,1,0**
**The site for elongation of fatty acid chain is:**
A. hialoplasm
B. mitochondria
C. endoplasmic reticulum (EPR)
D. mitochondria and endoplasmic reticulum
E. microsomes

**60.5. 1,0,0,0,0**
**The enzyme of production of mono- and polyenic fatty acids is:**
A. monooxygenase
B. dehydrogenase
C. dioxygenase
D. hydrotase
E. dehydrotase

**61.5. 1,1,1,1,1**
**Isopren-group presents in the chemical structure of the follo-wing biological active substances:**
A. vitamin A
B. vitamin E
C. vitamin K
D. cholesterol
E. side-radical of chlorophyls

**62.5. 0,0,1,0,0**
**The common intermediate of TAG and phospholipids byosyn-thesis is:**
A. monoglyceride
B. diglyceride
C. diacylglycerol-3-phosphate
D. glycerol-3-phosphate
E. monoacylglycerol phosphate

**63.5. 0,0,1,0,0**
**Which substance is specific for the lipids synthesis?**
A. ADP
B. TTP
C. CTP
D. GTP
E. UTP

**64.5. 0,0,1,0,0**
**The initial reaction of the phospholipids synthesis is:**
A. phosphatidic acid + ATP
B. phosphatidic acid + GTP
C. phosphatidic acid + CTP
D. phosphatidic acid + TTP
E. phosphatidic acid + UTP

**65.5. 0,0,0,1,0**
**Convertion of phosphatidyl ethanolamine into phosphatidyl choline requires:**
A. 2 $CH_3$-groups
B. 1 $CH_3$-group
C. 4 $CH_3$-groups
D. 3 $CH_3$-groups
E. carboxylation

**66.5. 0,1,0,0,0**
**The role of adrenalin and glucagon in the lipid metabolism regulation is:**
A. activation of adenylate cyclase production
B. activation of adenylate cyclase activity
C. activation of phosphodiesterase
D. inhibition of adenylate cyclase
E. inhibition of triglyceride lipase

**67.5. 0,1,0,0,0**
**In the lipid metabolism regulation insulin is:**
A. activator of adenylate cyclase
B. activator of phosphodiesterase synthesis
C. activator of phosphodiesterase
D. inhibitor of adenylate cyclase
E. activator of triglyceride lipase

**68.5. 0,0,1,0,0**
**The metabolic disturbance in patients with diabetes mellitus is:**
A. metabolic alkalosis
B. respiratory acidosis
C. metabolic acidosis
D. gaseous alkalosis
E. metabolic and gaseous acidosis

**69.5. 0,0,0,1,0**
**Hyposecretion of bile in patient dues to hypovitaminoses:**
A. A, $B_6$, $B_{12}$
B. E, $B_{12}$, PP
C. D, $B_1$, $B_6$
D. K, E
E. $B_5$, H, PP

**70.5. 0,1,0,0,0**
**Lipotropic substances are:**
A. vitamins $B_1$, $B_2$, $B_6$
B. methionine, S-adenosylmethionine
C. cystein, S-adenosylhomocystein
D. adrenalin, noradrenalin
E. insulin, glucagon

**71.5. 0,0,0,0,1**
**Which atoms of glucose aren't used for fatty acids synthesis?**
A. 1 and 5
B. 2 and 4
C. 3 and 6
D. 1 and 4
E. 3 and 4

**72.5. 0,0,1,1,1**
**Bile acid is:**
A. arachidonic acid
B. glyco-arachidonic acid
C. choleic acid
D. glycocholic acid
E. taurocholic acid

## CATABOLISM OF SIMPLE PROTEINS. METABOLISM OF NUCLEOPROTEINS AND CHROMOPROTEINS

**1.5. 0,1,1,1,0**
**Biological functions of proteins are:**
A. coenzymic
B. catalytical
C. plastic
D. transport
E. energetic

**2.5. 0,1,0,1,0**
**The essential amino acids are:**
A. arginine
B. tryptophan
C. glutamic acid
D. phenylalanine
E. tyrosine

**3.5. 0,1,1,0,1**
**HCl functions are:**
A. activation of trypsinogen
B. activation of pepsinogen
C. optimum pH for pepsin activity
D. optimum pH for lipase activity
E. denaturation of food proteins

**4.5. 1,0,1,0,1**
**Characteristics of pepsin are:**
A. it secretes from the main mucosal cells of the stomach
B. it secretes from additional mucosal cells of the stomach
C. it is activated by HCl in the stomach cavity
D. its optimum pH is 3,0-4,0
E. its optimum pH is 1,5-2,5

**5.5. 1,0,1,0,1**
**Characteristics of trypsin are:**
A. it secretes in the nonactive form as trypsinogen
A. it is an exopeptidase
B. enterokinase is an activator of trypsinogen
C. intestine is the site of trypsinogen secretion
D. mechanism of the trypsinogen activation is a partial proteolysis

**6.5. 0,1,0,1,0**
**Characteristics of trypsin and enterokinase are:**
A. trypsin hydrolyzes the peptide bonds between *lys* and *arg* at N-position
B. trypsin hydrolyzes the peptide bonds between *lys* and *arg* at C-position
C. optimum pH of trypsin is 7,2-7,8
D. optimum pH of trypsin is 8,2-8,8
E. active enterokinase is glycoprotein

**7.5. 0,1,0,1,0**
**Chymotrypsin:**
A. secretes of the intestinal mucosal cells
B. secretes of the pancreatic gland
C. is an exopeptidase
D. is an endopeptidase
E. is an activator of trypsinogen

**8.5. 0,0,1,0,1**
**Carboxypeptidases:**
A. secret in active forms
B. are the endopeptidases
C. carboxypeptidase A is a Zn-containing enzyme
D. are nucleoproteins
E. are metaloproteins

**9.5. 0,1,1,0,0**
**Aminopeptidases:**
A. are endopeptidases
B. are exopeptidases
C. break a N-end amino acids
D. have an absolute specific activity
E. $Mg^{2+}$ is an activator of aminopeptidase

**10.5. 0,1,1,0,0**
**Dipeptidases:**
A. are endopeptidases
B. are exopeptidases
C. hydrolyze the dipeptides
D. are elastases
E. secret of the mucosal cells of the stomach

**11.5. 0,1,0,1,0**
**Absorption of amino acids:**
A. is a simple diffusion

B. is an active diffusion
C. uses the $Ca^{+}$-ATP-ase
D. uses the $Na^{+}$,$K^{+}$-ATP-ase
E. is antiport of $Na^{+}$-ions diffusion

**12.5. 0,1,1,0,0**
**Absorption of amino acids:**
A. takes place in the stomach
B. takes place in the small intestine
C. is needed the $Na^{+}$-ions
D. is needed the $Ca^{2+}$-ions
E. takes place in the large intestine

**13.5. 1,0,0,1,0**
**γ-Glutamyl transferase:**
A. has the cofactor - glutathione
B. has the cofactor - cysteine
C. has the cofactor – glutamic acid
D. uses the energy of glutathione bonds
E. uses the energy of ATP

**14.5. 1,0,1,0,0**
**Putrefaction of amino acids in the intestine produces:**
A. toxic substances in large intestine
B. toxic substances in small intestine
C. indole
D. histamine
E. hippuric acid

**15.5. 1,0,0,1,1**
**Putrefaction of amino acids in intestine produces:**
A. cadaverine
B. indikan
C. indole as a toxic product of tyrosine degradation
D. indole as a toxic product of tryptophan degradation
E. phenol as a product of tyrosine degradation

**16.5. 0,1,0,0,1**
**Amino acids are used for production of:**
A. uric acid
B. urea
C. ATP
D. ketone bodies
E. creatinine

**17.5. 0,1,0,1,0**
**The main pathways of amino acids catabolism are:**
A. isomerization
B. transamination
C. epimerization
D. deamination
E. transmethylation

**18.5. 1,0,0,1,0**
**Types of amino acids deamination in the human tissues:**
A. direct oxidative deamination
B. hydrolytical deamination
C. intramolecular deamination
D. indirect oxidative deamination
E. reductive deamination of glutamic acid

**19.5. 1,0,0,0,0**
**Direct oxidative deamination is correct for:**
A. glutamic acid
B. aspartic acid
C. glycine
D. serine
E. alanine

**20.5. 0,0,1,0,1**
**Indirect deamination is correct for:**
A. glutamic acid
B. asparagine
C. aspartic acid
D. serotonin
E. alanine

**21.5. 0,1,0,1,1**
**Transamination is correct for:**
A. tryptamine
B. glutamic acid
C. serotonin
D. aspartic acid
E. alanine

**22.5. 1,0,0,1,0**
**Reaction: $HOOC\text{-}CH_2\text{-}CHNH_2\text{-}COOH + HOOC\text{-}(CH_2)\text{-}CO\text{-}COOH \rightarrow HOOC\text{-}CH_2 \text{–}CO\text{-}COOH + HOOC\text{-}(CH_2)_2\text{-}CHNH_2\text{-}COOH$**
A. is transamination
B. is decarboxylation
C. is the direct oxidative deamination
D. is the reaction of AsAT (GOT)
E. is the reaction of AlAT (GPT)

**23.5. 0,1,1,0,0**
**Transamination of alanine is:**
A. the production of oxaloacetate
B. the production of pyruvate
C. the reaction catalyzed by AlAT (GPT)
D. an indirect process
E. synthesis of biogenic amine

**24.5. 0,1,1,0,0**
**Decarboxylation of amino acids:**
A. is production of ketone bodies
B. is production of biogenic amines
C. vitamin $B_6$ is necessary as coenzyme
D. vitamin $B_1$ is necessary as coenzyme
E. produces ammonia ($NH_3$)

**25.5. 1,0,1,0,0**
**Decarboxylation of histidine:**
A. is production of histamine
B. is production of GABA
C. pyridoxal phosphate is necessary as coenzyme
D. NAD is necessary as coenzyme
E. is production of serotonin

**26.5. 0,1,1,0,0**
**Decarboxylation of hydroxytryptophan:**
A. is production of histamine
B. is production of serotonin
C. is synthesis of hydroxytryptamine
D. NAD is necessary as coenzyme
E. is catalyzed by AlAT (GPT)

**27.5. 1,0,0,1,0**
**Amino acids as precursors (substrates) of catecholamines production are:**
A. phenylalanine
B. glutamic acid
C. arginine
D. tyrosine
E. glycine

**28.5. 1,0,0,1,0**
**Production of ammonia ($NH_3$) in the cells:**
A. direct oxidative deamination
B. transamination of amino acids
C. decarboxylation of histidine
D. indirect oxidative deamination of alanine
E. reductive amination of glutamic acid

**29.5. 1,0,1,0,0**
**Urea production:**
A. takes place in the hepatocytes
B. takes place in the kidneys
C. is ornithine cycle
D. is needed for vitamin $B_1$
E. is needed for arginine

**30.5. 1,0,1,0,0**
**Final products of ammonia detoxication are:**
A. urea
B. uric acid
C. ammonia salts
D. carbamoylphosphate
E. glutamine

**31.5. 1,0,0,1,0**
**Methionine is:**
A. an essential amino acid
B. a nonessential amino acid
C. a basic amino acid
D. a donor of $CH_3$ group
E. a donor of disulphide (S-S) bonds in the proteins structure

**32.5. 0,1,1,0,0**
**For purine nucleotide production is necessary:**
A. carbomoylphosphate
B. glycine
C. inosine acid
D. adenosine phosphate
E. vitamin $B_1$

**33.5. 1,0,0,1,1**
**For pyrimidine nucleotide production is necessary:**
A. carbomoyl-phosphate
B. inosine acid
C. vitamine $B_6$ as coenzyme
D. aspartic acid
E. glutamine as a donor of amino group for CMP

**34.5. 0,1,1,0,0**
**Monoaminooxidase is enzyme:**
A. for the biogenic amines production
B. for the biogenic amines inactivation
C. of histamine inactivation
D. catalyzes the production of serotonin
E. as the TDP-dependent one

**35.5. 1,0,1,0,0**
**Allopurinol:**
A. is the inhibitor of the uric acid production
B. is the activator of the uric acid production
C. decreases the uric acid concentration in the blood
D. increases the uric acid concentration in the blood
E. is the substrate of xantine oxidase

**36.5. 0,1,0,1,0**

**HOOC-$CH_2$-$CH_2$-CH-COOH**

**|**

**$NH_2$**

**This substance is:**

A. aspartic acid
B. glutamic acid
C. essential amino acid
D. nonessential amino acid
E. asparagine

**37.5. 0,1,0,1,0**

**Hyppuric acid is:**

A. complex of acetyl-ScoA and glycine
B. complex of benzoic acid and glycine
C. conjugate of phenol and glycine
D. conjugate of benzoic acid and glycine
E. complex of indol and glycine

**38.5. 0,1,0,1,1**

**HOOC-CH-$CH_2$-$CH_2$-COOH→E→$H_2N$-$CH_2$-$CH_2$-$CH_2$COOH + $CO_2$**

**|**

**$NH_2$**

**This reaction:**

A. is carboxylation
B. is decarboxylation
C. vitamin $B_2$ is necessary for it
D. vitamin $B_6$ is necessary for it
E. is production of GABA

**39.5. 1,0,1,1,0**

**R-$CH_2$-$NH_2$ + $H_2O$→ E→ R-COH + $NH_3$ + $H_2O_2$**

**This reaction:**

A. is inactivation of the biogenic amines

B. is production of the hormonoides
C. is inactivation of histamine
D. is oxidative deamination of amines
E. is hydrolysis of the biogenic amines

**40.5. 0,1,0,0,1**
**Amino acids as precursors of the catecholamines production are:**
A. glutamic acid
B. phenylalanine
C. histidin
D. aspartic acid
E. tyrosine

**41.5. 0,1,0,0,0**
**Amino acid as precursor of histamine synthesis is:**
A. glutamic acid
B. histidin
C. glutamine
D. aspartic acid
E. methionine

**42.5. 0,0,1,1,0**
**Amino acid needed for serotonin synthesis is:**
A. phenylalanine
B. tyrosine
C. tryptophan
D. hydroxytryptophan
E. tryptamine

**43.5. 1,0,1,1,0**
**Final products of the simple proteins catabolism are:**
A. ammonia
B. glutamine

C. urea
D. $CO_2$
E. uric acid

**44.5. 0,1,1,0,0**

**$HOOC\text{-}CH(NH_2)\text{-}CH_2\text{-}CH_2\text{-}COOH + NH_3 \rightarrow E \rightarrow HOOC\text{-}CH(NH_2)\text{-}CH_2\text{-}CH_2\text{-}CONH_2$**

**This reaction:**

A. is amination of aspartic acid
B. catalyzes by glutamine synthetase
C. is production of glutamine
D. is production of asparagine
E. catalyzes by asparagine synthetase

**45.5. 1,0,1,1,0**

**Choose the correct reactions of urea production:**

A. carbamoylphosphate + ornithine → citrulline + $H_3PO_4$
B. carbamoylphosphate + ornithine + ATP→ citrulline + ADP + $H_3PO_4$
C. citrulline + aspartate + ATP→ argininosuccinate + AMP + PP
D. argininosuccinate → arginine + fumarate
E. argininosuccinate + $H_2O$ → arginine + fumarate

**46.5. 1,1,0,1,0**

**Amino acids and derivatives which are used in urea production are:**

A. glutamine
B. aspartic acid
C. threonine
D. arginine
E. glutamic acid

**47.5. 0,0,1,0,0**
**The number of ATP which produced during a full degradation of alanine is:**
A. 4
B. 18
C. 15
D. 22
E. 12

**48.5. 0,1,0,1,0**
**Substances for ammonia salts synthesis are:**
A. glutamic acid
B. glutamine
C. urea
D. $CO_2$
E. aspartic acid

**49.5. 0,0,1,0,1**
**Amino acids which may be synthetized from intermediates of the Krebs cycle are:**
A. alanine
B. serine
C. aspartic acid
D. tyrosine
E. glutamic acid

**50.5. 0,0,0,1,0**
**The site of the direct deamination of amino acid is:**
A. nucleus
B. cytoplasm
C. ribosome
D. mitochondria
E. lyzosome

**51.5. 0,1,0,1,1**
**Sources of $NH_3$ in the human organism are:**
A. α-ketoglutarate
B. adenine
C. pyruvate
D. glutamine
E. asparagine

**52.5. 0,1,1,1,0**
**For detoxication and transport of $NH_3$ are needed:**
A. citrulline
B. glutamate
C. glutamine
D. aspartic acid
E. ornithine

**53.5. 1,0,0,1,0**
**Glutamate dehydrogenase is:**
A. oxido-reductase
B. hydrolase
C. isomerase
D. hydrogenase
E. transferase

**54.5. 0,0,1,0,1**
**End products of ammonia detoxication are:**
A. glutamine
B. asparagines
C. urea
D. uric acid
E. ammonia salts

**55.5. 0,0,1,0,1**
**Transport form of ammonia in the blood is:**
A. carbamoylphosphate

B. uric acid
C. glutamine
D. glutamic acid
E. asparagine

**56.5. 0,1,1,0,1**
**Interrelations between the Krebs cycle and urea production cycle:**
A. $NADH_2$ produced in the Krebs cycle is used in the urea production
B. $CO_2$ produced in the Krebs cycle is used into in the urea cycle
C. fumarate produced in the urea cycle is used in the Krebs cycle
D. fumarate produced in the Krebs cycle is used in the urea cycle
E. the Krebs cycle generates the ATP for the urea cycle

**57.5. 0,1,0,1,1**
**Glycine is needed for synthesis:**
A. pyrimidine nucleotides
B. heme
C. indican
D. hippuric acid
E. glutathione

**58.5. 1,1,0,1,1**
**Glutathione:**
A. is a tripeptide
B. is a coenzyme
C. has only reduced form
D. is an antioxidant
E. includes glutamic acid

**59.5. 1,0,1,1,0**
**Characteristics of glutathione reductase (GR) and glutathione peroxidase (GP):**
A. glutathione is a substrate for GR

B. glutathione is a coenzyme for GR
C. glutathione is a substrate for GP
D. GP uses of the reduced form of glutathione (GSH)
E. GR uses of the reduced form of glutathione (GSH)

**60.5. 0,1,1,0,1**
**Cysteine:**
A. is a nonessential amino acid
B. is an essential amino acid
C. is a thioamino acid
D. is a hydroxyamino acid
E. presents in the active centers of enzymes

**61.5. 1,0,0,1,1**
**Phenylalanine:**
A. is an essential amino acid
B. is a nonessential amino acid
C. in the human organism it may be synthetized from fenolic acid and alanine
D. is used in the synthesis of catecholamines
E. is used in the synthesis of thyroxine

**62.5. 0,1,0,0,1**
**Tryptophan is:**
A. a nonessential amino acid
B. an essential amino acid
C. used in the synthesis of catecholamines
D. used in the synthesis of adrenalin
E. used in the synthesis of serotonin

**63.5. 1,0,1,0,1**
**Histidine:**
A. is an essential amino acid
B. is a nonessential amino acid
C. is used in the histamine production

D. is used in the GABA production
E. vitamin $B_6$ is necessary for its decarboxylation

**64.5. 1,1,0,1,1**
**Glutamic amino acid is:**
A. a nonessential amino acid
B. an acidic amino acid
C. an intermediate of urea production
D. an acceptor of $NH_3$
E. a substrate for purine nucleotides synthesis

**65.5. 1,0,1,1,1**
**Glutamic acid is used for synthesis of:**
A. glutamine
B. asparagine
C. purine nucleotides
D. glutathione
E. carbamoylphosphate

**66.5. 0,1,1,0,0**
**Characteristics of digestive mechanism of nucleoproteins (NP) in the gastro-intestinal tract are:**
A. breakdown of nucleic acids takes place in the stomach
B. stomach is the site of NP hydrolysis
C. hydrolases are necessary for breakdown of NP
D. only trypsin is an enzyme for breakdown of NP
E. only pepsin is needed for breakdown of NP

**67.5. 0,0,1,1,1**
**Final products of purine nucleotides degradation are:**
A. xantin
B. β-alanine
C. $CO_2$
D. uric acid
E. $H_2O$

**68.5. 1,0,0,1,1**
**Final products of pyrimidine nucleotides degradation are:**
A. urea
B. uric acid
C. xantin
D. β-alanine
E. $CO_2$

**69.5. 1,1,0,1,0**
**For heme synthesis the following compounds are necessary:**
A. glycine
B. succinyl-ScoA
C. aspartate
D. key enzymes, δ-aminolevulinate synthetase and ferrohelatase
E. only a key enzyme, δ-aminolevulinate synthetase

**70.5. 1,0,0,1,1**
**Name the substances needed for heme synthesis:**
A. vitamin $B_{12}$
B. vitamins $B_1$ and H
C. vitamin H and S-adenosyl-methionine
D. pyridoxal phosphate
E. δ-aminolevulinate synthetase as an allosteric enzyme

**71.5. 0,1,1,0,1**
**Hemoglobin degradation:**
A. takes place in all human organs
B. sites for breakdown of Hb are liver, spleen, marrow cells
C. NADP-oxidase is an enzyme for verdoglobin production
D. NAD-oxidase is enzyme of verdoglobin production
E. verdoglobin breaks down to Fe, globin and biliverdin

**72.5. 0,0,1,1,1**
**Bilirubin conjugation, name the correct characteristics:**
A. its enzyme is bilirubin reductase

B. site for this process is mitochondria
C. its enzyme is bilirubin glucoronyltransferase
D. its enzyme is bilirubin UDP-GA-transferase
E. indirect bilirubin + UDP-GA→ direct bilirubin + UDP

**73.5. 0,1,1,0,1**
**Direct bilirubin:**
A. is hydrophylic substance
B. is hydrophobic substance
C. is nontoxic substance
D. is toxic substance
E. penetrates the cell membranes

**74.5. 1,0,0,1,1**
**Indirect bilirubin:**
A. penetrates the cell membranes
B. doesn't penetrate the cell membranes
C. is nontoxic substance
D. is toxic substance
E. combines with albumine in the blood

## HORMONES: CHEMICAL STRUCTURE, MECHANISM ACTION, METABOLIC ROLE

**1.5. 1,0,1,0,1**
**Hormones are:**
A. simple proteins
B. carbohydrates
C. complex proteins
D. glucose derivatives
E. steroids

**2.5. 0,1,0,1,1**
**Mechanism of hormonal action:**
A. γ-peptidase

B. membrane (membranous)
C. local
D. membrane intracellular or indirect
E. cytosolic or direct

**3.5. 1,0,0,1,0**
**Hormone mechanism of action is:**
A. central
B. NAD-dependent
C. local
D. peripheral
E. TDP-dependent

**4.5. 0,1,0,0,0**
**Membrane mechanism is:**
A. specific for glucagon
B. specific for insulin
C. 2,3-cAMP-dependent
D. characteristic for steroid hormones
E. characteristic for thyroxine

**5.5. 1,0,0,1,0**
**Name the correct statements of adenylate cyclase:**
A. 3,5-cAMP is its product
B. 2,3-cAMP is its product
C. 3,5-cGMP is its product
D. ATP is its substrate
E. ADP is its substrate

**6.5. 0,0,1,1,0**
**3,5-cAMP is a:**
A. substrate of guanylate cyclase
B. cyclic dinucleotide
C. cyclic mononucleotide
D. secondary messenger
E. primary mediator

**7.5. 0,1,0,1,0**
**3,5-cGMP is a:**
A. substrate of adenylate cyclase
B. substrate of guanylate cyclase
C. product of ATP
D. product of GTP
E. primary mediator

**8.5. 1,1,0,1,0**
**Secondary messengers are:**
A. 3,5-cAMP
B. 3,5-cGMP
C. 2,3-cAMP
D. $Ca^{2+}$-ions
E. $Mg^{2+}$-ions

**9.5. 1,0,0,1,0**
**Specificity of hormone:**
A. 3,5-cAMP is secondary messenger of glucagon
B. glucagon is activator of gluconeogenesis
C. hydrocortisone is activator of gluconeogenesis
D. adrenalin is activator of glycogenolysis
E. adrenalin is activator of glycogen production

**10.5. 0,1,1,0,1**
**Adrenalin:**
A. is a hypoglycemic hormone
B. is a hyperglycemic hormone
C. 3,5-cAMP is a secondary messenger of adrenalin
D. 2,3-cAMP is a secondary messenger of adrenalin
E. has $\alpha$- and $\beta$-receptors on the cell membrane

**11.5. 1,0,0,1,1**
**Glucagon:**
A. is a hyperglycemic hormone

B. is a hypoglycemic hormone
C. 3,5-cGMP is a secondary messenger of glucagon
D. is activator of glycogenolysis
E. α-cells of the pancreatic gland secrete glucagon

**12.5. 1,0,1,0,1**
**Insulin is a:**
A. simple protein
B. complex protein
C. hormone with the membrane mechanism of action
D. hyperglycemic hormone
E. hypoglycemic hormone

**13.5. 1,0,0,1,0**
**Insulin is:**
A. an anabolic hormone
B. a catabolic hormone
C. amino acid derivatives
D. a dimer in active form
E. a trimer in active form

**14.5. 0,1,1,0,0**
**Hypothalamic hormones are:**
A. complex proteins
B. polypeptides
C. liberins and statins
D. somatotropins
E. corticotropins

**15.5. 1,0,1,0,1**
**Hypophyseal hormones are:**
A. somatotropin
B. somatoliberin
C. thyrotropin
D. thyroliberin
E. lutropin

**16.5. 1,0,0,1,1**
**Vasopressin is an:**
A. activator of water reabsorbtion in the distal tubes of the kidneys
B. diuretic hormone (increases of diures)
C. activator of cGMP protein kinases
D. activator of cAMP protein kinases
E. antidiuretic hormone

**17.5. 0,1,0,1,1**
**Somatotropin:**
A. is a catabolic hormone
B. acts via 3,5-cAMP secondary messenger
C. acts via 3,5-cGMP secondary messenger
D. is a growth hormone
E. is an anabolic hormone

**18.5. 1,1,0,0,1**
**Thyroidal hormones:**
A. are iodothyronines
B. thyroxine is tetraiodothyronine
C. thyroxine is a complex protein
D. thyroxine has the membrane mechanism of action
E. calcitonin is a hormone of thyroidal gland

**19.5. 1,1,0,1,0**
**Calcitonin and parathyrin:**
A. are hormones of parathyroid glands
B. calcitonin is a hormone of thyroid and parathyroid glands
C. calcitonin increases $Ca^{2+}$-ions concentration in the blood
D. calcitonin decreases $Ca^{2+}$-ions concentration in the blood
E. parathyrin decreases $Ca^{2+}$-ions concentration in the blood

**20.5. 1,0,0,1,0**
**Pancreas hormones:**
A. insulin is secreted of β-cells of the pancreas

B. insulin is secreted of α-cells of the pancreas
C. glucagon is secreted of β-cells of the pancreas
D. insulin is a hypoglycemic hormone
E. glucagon is a hypoglycemic hormone

**21.5. 1,1,0,0,1**
**Adrenal cortex hormones:**
A. are steroid hormones
B. are corticosteroids
C. have the membrane mechanism of action
D. are derivatives of amino acids
E. cholesterol is a substrate for production of aldosterone

**22.5. 0,0,1,0,1**
**Aldosterone is a:**
A. simple protein
B. regulator of $Ca^{2+}$-ions concentration in the blood
C. mineralocorticoid
D. glucocorticoid
E. regulator of $Na^{+}$ and $K^{+}$ concentration in the blood

**23.5. 1,0,1,0,0**
**Glucocorticoids:**
A. are steroid hormones
B. decrease the glucose concentration in the blood
C. increase the glucose concentration in the blood
D. have the the membrane mechanism of action
E. have the cytosolic (direct) mechanism of action

**24.5. 1,0,0,1,1**
**Sex hormones:**
A. are steroid hormones
B. are catabolic hormones
C. have the membrane-cytosolic mechanism of action
D. estradiol and testosterone are sex hormones
E. have the direct (cytosolic) mechanism of action

**25.5. 0,0,1,1,0**
**Prostaglandins:**
A. are steroid hormones
B. have the membrane-cytosolic mechanism of action via 3,5-cAMP
C. are the hormone-like compounds (hormonoids)
D. are compounds derived from $C_{20}$-polyene fatty acids
E. have an antihormonal action

**26.5. 0,1,1,1,0**
**Characteristics of hormones are:**
A. universal action
B. specific property
C. tropical action
D. systemic action
E. local action

**27.5. 0,1,1,0,0**
**Receptors of hormones are:**
A. lipoproteins
B. glycoproteins
C. specific for hormones
D. phospholipids
E. nucleoproteins

**28.5. 0,1,1,1,1**
**Mechanism of hormonal action:**
A. local
B. membrane
C. membrane cytosolic
D. cytosolic
E. indirect

**29.5. 0,1,1,0,1**
**Hormone classifications are:**
A. physico-chemical
B. biological
C. chemical
D. functional
E. based on the mechanism of action

**30.5. 0,1,1,1,0**
**The following hormones have the membrane cytosolic mechanism of action:**
A. thyroxine
B. adrenalin
C. glucagon
D. calcitonin
E. insulin

**31.5. 0,0,1,1,1**
**The following hormones have the cytosolic mechanism of action:**
A. adrenalin
B. insulin
C. thyroxine
D. cortisol
E. testosterone

**32.5. 0,1,1,1,0**
**3',5 -cAMP:**
A. is the primary mediator
B. is the secondary mediator
C. is the secondary messenger
D. phosphodiesterase decreases 3',5'-cAMP concentration in the cell
E. phosphodiesterase increases 3',5'-cAMP concentration in the cell

**33.5. 0,1,1,0,1**
**Protein kinase characteristics are:**
A. the 3',5'-cAMP is its inhibitor
B. the 3',5'-cAMP is its activator
C. it is the allosteric enzyme
D. dissociation of protein kinase is a irreversible process
E. dissociation of protein kinase is a reversible process

**34.5. 0,1,1,1,0**
**Hormones are:**
A. carbohydrates derivatives
B. simple proteins
C. complex proteins
D. amino acids derivatives
E. sphingosine derivatives

**35.5. 0,1,1,1,0**
**Liberins are:**
A. somatotropin
B. prolactoliberin
C. thyreoliberin
D. corticoliberin
E. oxytocin

**36.5. 0,1,1,0,1**
**Statins and their characteristics:**
A. it is cortisol
B. it is somatostatin
C. it is prolactostatin
D. 3',5'-cGMP is their secondary messenger
E. 3',5'-cAMP is their secondary messenger

**37.5. 0,1,1,0,0**
**Hormones of hypophysis and their characteristics:**
A. they are derivatives of amino acids

B. they are simple and complex proteins
C. vasopressin deposites in hypophysis
D. vasopressin synthetizes in hypophysis
E. antidiuretic hormone synthetizes in hypophysis

**38.5. 0,1,1,0,0**
**Vasopressin and oxytocin, the correct statements:**
A. can't be synthetized in laboratory
B. may be synthetized in laboratory
C. are nonapeptides
D. are octapeptides
E. are decapeptides

**39.5. 0,1,1,1,0**
**Vasopressin:**
A. is an octapeptide
B. increases absorption of $H_2O$
C. 3',5'-cAMP is its secondary messenger
D. its hyposecretion is due to diabetes insipidus
E. its hypersecretion is due to diabetes insipidus
?
**40.5. 1,0,0,0,1**
**Corticotropical hormone (Corticotropin, ACTH):**
A. is activator of corticosteroids secretion
B. is activator only of glucocorticoids
C. is activator only of mineralocorticoids
D. has a steroid nature
E. has a proteinic nature

**41.5. 1,0,1,0,1**
**Somatotropical hormone (somatotropin, STH) is:**
A. a simple protein
B. a complex protein
C. synthetized as prohormone

D. inhibitor of insulin secretion
E. inhibitor of lipolysis

**42.5. 1,0,0,1,1**
**Thyrotropical hormone (thyrotropin, TTH):**
A. is a glycoprotein
B. is a simple protein
C. 3',5'-cGMP is its effector
D. 3',5'-cAMP is its effector
E. has an indirect mechanism of action

**43.5. 1,0,1,0,1**
**Parathormone (parathyrin):**
A. has a proteinic nature
B. decreases Ca-ions concentration in the blood
C. increases Ca-ions concentration in the blood
D. is secreted of the thyroid glands
E. is secreted of the parathyroid glands

**44.5. 0,1,1,0,1**
**Parathormone (parathyrin):**
A. has a steroidal nature
B. is activator of hydroxylase in the liver
C. 1,25-dihydroxycalciferol is needed for its action
D. 1,15-dihydroxycalciferol is needed for its action
E. increases absorption of Ca-ions in the intestine and kidneys

**45.5. 0,1,1,1,0**
**Calcitonin:**
A. is a hormone only of the parathyroid glands
B. is hormone of the thyroid and parathyroid glands
C. has an indirect mechanism of action
D. decreases Ca-ions concentration in the blood
E. increases Ca-ions concentration in the blood

**46.5. 1,0,0,1,0**
**Hormones of the thyroid glands:**
A. are derivatives of amino acids
B. are derivatives of cholesterol
C. thyroxine is an anabolic hormone
D. thyroxine is a catabolic hormone
E. thyroxine is triiodothyronine ($T_3$)

**47.5. 0,1,1,1,1**
**Thyroxine and its characteristics:**
A. 3',5'-cAMP is its secondary messenger
B. albumins are its carriers in the blood
C. prealbumins are its carriers in the blood
D. α-globulins are its carriers in the blood
E. $T_4$ has a higher affinity with proteins than $T_3$

**48.5. 1,1,1,1,1**
**Metabolism of iodothyronines:**
A. aminotransferases use these hormones as substrates
B. thyronine cycle is broken down
C. they conjugate with UDP-glucuronic acid
D. they conjugate with PAPS
E. decarboxylases use thyronine-conjugates as substrates

**49.5. 1,0,1,0,1**
**Insulin:**
A. is secreted of β-cells of the Langerhans islands
B. is secreted of α-cells of the Langerhans islands
C. includes 51 amino acids
D. includes 84 amino acids
E. has 2 subunits

**50.5. 0,1,1,0,0**
**Insulin:**
A. contains 3 S-S-bonds in its molecule
B. 2 S-S-bonds stabilize its quarternary structure
C. quarternary structure includes α- and β-protomers
D. quarternary structure includes α- and γ-protomers
E. contains 3 polypeptidic chains

**51.5. 0,1,1,1,0**
**Diabetes mellitus characteristics are:**
A. hypoglycemia, glucosuria
B. hyperglycemia, glucosuria
C. hyperglycemia, cetonemia, cetonuria
D. increases lypolysis and cetone bodies production
E. decreases lypolysis and cetone bodies production

**52.5. 1,0,1,0,0**
**Insulin:**
A. increases lipids synthesis
B. decreases lipids synthesis
C. increases glycolysis
D. increases glycogen mobilization
E. decreases glycogen synthesis

**53.5. 0,1,1,0,1**
**Catecholamines are:**
A. synthetized in the cortex of medulla glands
B. synthetized in the medulla
C. tyrosine derivatives
D. tryptophan derivatives
E. adrenalin, noradrenalin, dopamin

**54.5. 0,1,0,1,1**
**Catecholamines:**
A. adrenalin via α-receptor activates production of 3',5'-cAMP
B. adrenalin via α-receptor activates production of 3',5'-cGMP
C. α-receptor is specific for adenylate cyclase system
D. α-receptor is specific for guanylate cyclase system
E. β-receptor is specific for adenylate cyclase system

**55.5. 0,1,1,0,1**
**Catecholamines:**
A. are vasodilatators
B. are vasoconstrictors
C. increase blood pressure
D. decrease blood pressure
E. are inactivated by methylation and deamination

**56.5. 1,0,1,1,1**
**Glucocorticoids:**
A. are secreted from the cortex of medulla glands
B. are secreted from the medulla
C. have cyclopenten-perhydrophenantren group
D. are pregnane derivatives
E. are cholesterol derivatives

**57.5. 1,0,1,1,0**
**Glucocorticoids:**
A. are cortisol and corticosterone
B. are cortisol, corticosterone, aldosterone
C. are derivatives of cholesterol
D. are pregnane derivatives
E. have the membrane-cytosolic mechanism of action

**58.5. 0,1,0,0,1**
**Glucocorticoids:**
A. decrease the glucose content in the blood
B. increase the glucose content in the blood
C. activate proteolysis
D. inhibit lypolysis
E. activate lypolysis

**59.5. 0,1,1,1,0**
**Glucocorticoids (GC):**
A. decrease the amino acids content in the blood
B. increase the amino acids content in the blood
C. transcortin is carrier of GC
D. transcortin is synthetized in the liver
E. transcortin is synthetized in the cortex of medulla glands

**60.5. 1,0,1,0,0**
**Glucocorticoids:**
A. increase proteins synthesis in the liver and kidneys
B. decrease proteins synthesis in the liver and kidneys
C. are activators of lympholysis
D. are inhibitors of lympholysis
E. are activators of urea synthesis and excretion

**61.5. 0,1,0,1,1**
**Characteristics of "steroid" diabetes (Icenko-Kushing disease):**
A. hypersecretion of glucocorticoids
B. hyposecretion of glucocorticoids
C. osteochondrosis
D. osteoporosis
E. blood pressure increases (hypertony)

**62.5. 1,0,1,0,1**
**Characteristics of "steroid" diabetes:**
A. hyperglycemia and glucosuria
B. hypoglycemia
C. increases the amino acids content in the blood
D. the amino acids content in the blood decreases
E. aminoaciduria and ketonuria

**63.5. 0,1,0,1,1**
**Mineralocorticoids:**
A. are cortisol and corticosterone
B. are aldosterone and deoxycorticosterone
C. decrease Na-content in the blood
D. increase Na-content in the blood
E. increase Na and Cl content in the blood

**64.5. 0,1,1,1,0**
**Mineralocorticoids:**
A. are derivatives of tryptophan
B. are derivatives of cholesterol
C. have the cytosolic mechanism of action
D. increase reabsorption of NaCl
E. increase active transport (reabsorption) of $H_2O$

**65.5. 0,1,1,1,0**
**Characteristics of hyperaldosteronism (Konn disease):**
A. hypotonia (decrease of blood pressure)
B. hypertonia (increase of blood pressure)
C. Na-content in the blood increases
D. K-content in the blood decreases
E. protein synthesis in the bones decreases

**66.5. 1,0,0,1,1**
**Corticosteroids:**
A. cortisone is an effector of corticotropin (CTH)
B. corticosterone is an effector of corticotropin (CTH)
C. cytosol is a place for their synthesis
D. mitochondria is the site for their synthesis
E. pregnenolone is intermediate of corticosteroids synthesis

**67.5. 0,1,1,0,1**
**Sex hormones:**
A. are synthetized only in the sex glands
B. are synthetized in the sex glands and other tissues
C. have the cytosolic mechanism of action
D. have the membrane-cytosolic mechanism of action
E. are synthetized from cholesterol

**68.5. 1,0,1,0,1**
**Estrogens:**
A. contain 18 C-atoms in their structure
B. contain 21 C-atoms in their structure
C. are anabolic hormones
D. kidneys are the place of estrogens transformation
E. liver is the place of estrogens transformation

**69.5. 1,1,0,1,0**
**Estrogens:**
A. are activators of RNA and proteins synthesis
B. participate in phospholipids reconstruction
C. don't participate in phospholipids reconstruction
D. increase Ca and phosphate content in the blood
E. decrease Ca and phosphate content in the blood

**70.5. 0,0,1,1,0**
**Estrogens are:**
A. aldosterone
B. hydroxy-3-aldosterone
C. estradiol
D. progesterone
E. testosterone

**71.5. 1,0,1,0,1**
**Male sex hormones:**
A. are androgens
B. are estrogens
C. is testosterone
D. have catabolic action
E. have anabolic action

**72.5. 1,0,0,0,1**
**Androgens:**
A. contain 19 C-atoms in their structure
B. contain 21 C-atoms in their structure
C. 3',5'-cAMP is their secondary messenger
D. 3',5'-cGMP is their secondary messenger
E. have the cytosolic mechanism of action

**73.5. 0,0,1,0,1**
**Androgens:**
A. decrease protein synthesis
B. decrease DNA and RNA synthesis
C. 17-ketosteroids are the end products of androgens catabolism
D. 15-ketosteroids are the end products of androgens catabolism
E. are used in the breast cancer therapy

**74.5. 0,1,1,0,1**
**Prostaglandins:**
A. are hormones
B. are hormonoides
C. are used to decrease the blood pressure (hypertony therapy)
D. are used to increase the blood pressure (hypotony therapy)
E. arachidonic acid is a substrate of their synthesis

## BLOOD: METABOLISM OF BLOOD CELLS, CHEMICAL COMPOSITION OF BLOOD PLASMA. BUFFER SYSTEMS OF BLOOD. HEMOSTASIS

**1.5. 1,0,1,0,1**
**Blood functions are:**
A. transport
B. catabolic
C. buffering
D. catalytic
E. hemostatic

**2.5. 1,0,1,0,1**
**Proteins of the blood are:**
A. albumins
B. prolamins
C. globulins
D. histones
E. lipoproteins

**3.5. 1,0,1,1,0**
**Enzymes of the blood are:**
A. alanyl aminotransferase (AlAT or GPT)
B. hitinase
C. lactate dehydrogenase (LDH)
D. acetylcholine esterase
E. uricase

**4.5. 1,0,0,1,1**
**Nonproteinic nitrogenous compounds of the blood are:**
A. urea
B. cholesterol
C. glucose
D. uric acid
E. creatinine

**5.5. 0,1,1,0,0**
**Carbohydrates of the blood are:**
A. maltose
B. glucose
C. fructose
D. lactose
E. glycogen

**6.5. 1,1,1,0,0**
**Lipids of the blood are:**
A. cholesterol
B. triacylglycerides
C. phospholipids
D. waxes
E. acetone

**7.5. 1,1,0,0,1**
**Mineral components of the blood plasma are:**
A. $Na^+$ (sodium)
B. $K^+$ (potassium)
C. acetone
D. glycerol
E. $Cl^-$ (chloride ions)

**8.5. 1,0,0,1,0**
**Macroelements of the blood plasma are:**
A. Na
B. Mn
C. Cr
D. K
E. Se

**9.5. 1,0,0,1,1**
**Buffer systems of the blood are:**
A. bicarbonate
B. arsenate
C. glutamate
D. phosphate
E. proteinic

**10.5. 1,0,0,1,1**
**The correct statements about metabolic acidosis are:**
A. concentration of acids in the blood increases
B. concentration of urea in the blood increases
C. concentration of $CO_2$ in the blood increases
D. concentration of ketone bodies in the blood increases
E. takes place in diabetes mellitus

**11.5. 0,0,1,1,0**
**Characteristics of gaseous alkalosis are:**
A. urea concentration in the blood increases
B. concentration of Ca-iones in the blood plasma increases
C. concentrations of Na and K-iones in the blood increases
D. concentration of $CO_2$ in the blood decreases
E. concentration of Cl-iones in the blood plasma increases

**12.5. 1,0,0,1,0**

**The correct statements about respyratory function of the blood:**

A. hemoglobin is the carrier of oxygen
B. gaptoglobin is the carrier of oxygen
C. oxyhemoglobin concentration in arteria blood is 67%
D. oxyhemoglobin concentration in arteria blood is 97%
E. carboxyhemoglobin is a complex of hemoglobin and $CO_2$

**13.5. 1,0,0,1,0**

**Characteristics of hemoglobin forms:**

A. oxyhemoglobin is $O_2$ transport form in the blood
B. carboxyhemoglobin is $CO_2$ transport form in the blood
C. methemoglobin includes $Fe^{2+}$
D. carbohemoglobin is a transport form of $CO_2$
E. oxyhemoglobin includes $Fe^{3+}$

**14.5. 0,0,1,1,0**

**Carboanhydrase:**

A. is an enzyme for production of anhydrases
B. is only a leukocytic enzyme
C. is an enzyme of $H_2CO_3$ decomposition
D. has a high activity in the lungs
E. is an enzyme of carbohemoglobin production

**15.5. 1,0,0,1,0**

**Characteristics of hemostatic function of the blood:**

A. fibrinogen is coagulating factor of the blood plasma
B. fibrinogen is the thrombocytic coagulating factor
C. vitamin K is the blood plasma coagulating factor
D. prothrombin (thrombinogen)is a nonactive factor
E. prothrombin (thrombinogen)is an active factor

**16.5. 0,0,1,1,1**
**Blood clotting factors are:**
A. fibrinolysin
B. heparin
C. fibrinogen
D. thrombin
E. Hageman

**17.5. 1,1,0,0,1**
**Natural anticoagulants are:**
A. fibrinolysin
B. antithrombin
C. pelentan
D. sincumar
E. heparin

**18.5. 0,0,1,1,0**
**Synthetic anticoagulants are:**
A. vikasol
B. heparin
C. pelentan
D. dicumarin
E. streptokinase

**19.5. 1,0,0,1,0**
**Procoagulants are:**
A. vitamin K
B. vitamin $B_1$
C. plasmin
D. vitamin $D_3$
E. convertin

**20.5. 1,1,0,0,1**
**Name pathology of the blood clotting:**
A. hemophilia
B. Christmas disease
C. Edisson disease
D. Hartnup disease
E. Willebrand disease

**21.5. 0,0,1,1,1**
**Coagulating factors are:**
A. plasmin
B. adrenalin
C. fibrinogen
D. Hageman
E. thrombin

**22.5. 0,1,0,0,0**
**Blood pH is:**
A. 7,38-7,48
B. 7,36-7,44
C. 7,42-7,49
D. 7,32-7,48
E. 7,30-7,45

**23.5. 0,1,1,0,1**
**Characteristics of metabolic acidosis:**
A. $H_2CO_3$ in the blood increases
B. pyruvate in the blood increases
C. hypercetonemia
D. urea content in the blood increases
E. lactate in the blood increases

**24.5. 0,0,1,0,1**

**Characteristics of metabolic alkalosis:**

A. urea content in the blood increases
B. glutamine content in the blood increases
C. Cl-ions concentration in the blood decreases
D. Cl-ions concentration in the blood increases
E. Cl-ions excretion with urine increases

**25.5. 0,1,0,0,0**

**$Ca^{2+}$ ions concentration in the blood plasma is:**

A. 2,12 - 3,45 mmol/L
B. 2,25 - 2,75 mmol/L
C. 3,25 - 3,75 mmol/L
D. 2,55 - 2,85 mmol/L
E. 3,65 - 4,35 mmol/L

**26.5. 0,0,1,0,0**

**$Cl^-$ ions concentration in the blood plasma is:**

A. 106 - 138 mmol/L
B. 128 - 146 mmol/L
C. 98 - 106 mmol/L
D. 86 - 116 mmol/L
E. 76 - 108 mmol/L

**27.5. 1,1,0,0,1**

**Factors of intrinsic mechanism of the blood coagulation (the $1^{st}$ stage) are:**

A. Hageman
B. VIII
C. proconvertin
D. VII
E. Stuart-Prauer

**28.5. 0,1,1,1,0**
**Factors of extrinsic mechanism of the blood coagulation (the 1st stage) are:**
A. XI
B. proconvertin
C. VII
D. Stuart-Prauer
E. Rozental

**29.5. 1,0,0,1,1**
**$CO_2$ transport forms in the blood:**
A. 3-5% in the blood plasma is a gas
B. 1-3% in the blood plasma is a gas
C. carboxyhemoglobin (10-15 %)
D. carbohemoglobin (10-15%)
E. $NaHCO_3$

**30.5. 0,1,0,1,0**
**$O_2$ transport forms in the blood:**
A. 3-5% in the blood plasma is a gas
B. 2-3% in the blood plasma is a gas
C. 1-2% in the blood plasma is a gas
D. oxyhemoglobin (97-98%)
E. oxyhemoglobin (87-89%)

**31.5. 0,1,1,0,1**
**Organospecific enzymes of the liver are:**
A. $LDH_3$ and $LDH_4$
B. $LDH_5$
C. fructose-1-phosphate aldolase
D. fructose-1,6-diphosphate aldolase
E. alanine aminotransferase (AlATor GPT)

**32.5. 0,0,1,1,0**
**Organospecific enzymes of the heart are:**
A. $LDH_2$ and $LDH_3$
B. $LDH_3$ and $LDH_4$
C. $LDH_1$ and $LDH_2$
D. aspartate aminotransferase (AsAT or GOT)
E. alanine aminotransferase (AlAT or GPT)

**33.5. 0,1,1,1,0**
**Organospecific enzymes of the heart are:**
A. MM isoenzyme of CPK (creatine phosphokinase)
B. MB isoenzyme of CPK
C. $LDH_1$
D. AsAT (GOT)
E. AlAT (GPT)

**34.5. 0,0,1,1,1**
**Organospecific enzymes of the liver are:**
A. creatine kinase
B. α-amylase
C. sorbitol dehydrogenase
D. ornithine carbamoyl transferase
E. histidase

**35.5. 0,1,1,0,0**
**Fe (ion) in the blood:**
A. Fe-content in the blood is 12-15 g
B. Fe-content in the blood is 4,5-5,0 g
C. the $Fe^{2+}$ form is absorbed only in the small intestine
D. the $Fe^{3+}$ form is absorbed only in the small intectine
E. hemoglobin contains about 50% of Fe

## BIOCHEMICAL INDICES

### Chemical composition of blood plasma

### I. Proteins

| | |
|---|---|
| 1. Total protein | 65-85 g/L |
| 2. Albumins | 35-50 g/L |
| 3. Globulins | 25-35 g/L |
| 4. Fibrinogen | 2.0-7.0 g/L |
| 5. Haptoglobin | 0.28-1.90 g/L |
| 6. Prothrombin | 10-15 mg/dL |
| 7. Plasminogen | 1.4-2.8 μmol/L (20-40 mg/dL) |
| 8. Transferrin | 19.3-45.4 μmol/L (170-400mg/dL) |
| 9. Ceruloplasmin | 1.52-3.31 μmol/L ( 23-50 mg/dL) |
| 10. β-Lipoproteins | 3.0-6.0 g/L (300-600 mg/dL) |
| HDL – high density lipoprotein (α-LP) | 1.063-1.210 mmol/L (80-400 mg/dL) |
| LDL – low density lipoprotein (β-LP) | 1.006-1.063 mmol/L (360-640 mg/dL) |

### II. Enzymes

| | |
|---|---|
| 1. Alanyl aminotransferase (ALT) (glutamate pyruvate transferase, GPT) | 0.16-0.68 mmol/h ·L or (15-75 IU/L) |
| 2. Aspartate aminotransferase (AST) (glutamate oxaloacetate transferase, GOT) | 0.10-0.45 mmol/h · L or (10-50 IU/L) |
| 3. Lactate dehydrogenase | 0.8-4.0 mmol/h · L |
| 4. Creatine kinase | < 1.2 mmol/h · L or (< 90 IU/L) |
| 5. Fructose-biphosphate aldolase (F-1,6-PA) | 3.6-21.8 mmol/h · L |
| 6. Acetylcholine esterase | 160-340 mmol/ h · L |

| | |
|---|---|
| 7. α-Amylase | 15-30 g/h · L or (< 300 IU/L) |
| 8. Alkaline phosphatase | 30-150 IU/L |
| 9. Acidic phosphatase | < 62 nkat/L |
| 10. γ-Glutamyl transferase | (γGT or GGT) < 60 IU/L |

### Nonproteinic nitrogenous compounds

| | |
|---|---|
| 1. Nitrogen residual (nonpr-oteinic) | 19.5-30.0 mmol/L |
| 2. Nitrogen of amino acids | 3.5-5.5. mmol/L |
| 3. Creatine | 15-70 mmol/L |
| 4. Creatinine | 60-150 μmol/L |
| 5. Urea | 3.3-6.7 mmol/L |
| 6. Uric acid | 0.1-0.4 mmol/L |
| 7. Bilirubin total | 8-20 μmol/L |
| 8. N-Acetylneiraminic acid | 1.8-2.2 mmol/L |
| 9. Histamine | 17.99-71.94 nmol/L(0.2-0.8 μg/dL) |
| 10. Adrenalin | 1.91-2.46 nmol/L (0.35-0.45 μg/L) |
| 11. Serotonine | 0.3-1.7 μmol/L (5.0-30.0 μg/dL) |
| 12. Thyroxine | 64.36-141.59 nmol/L (5-11μg/dL) |

## III. Carbohydrates and metabolites

| | |
|---|---|
| 1. Glucose | 2.8-6.0 mmol/L |
| 2. Lactate | 0.5-2.0 mmol/L |
| 3. Pyruvate | < 0.1 mmol/l |
| 4. Citric acid | 88.5-156.1 μmol/L (1.7-3.0 mg/dL) |

## IV. Lipids and metabolites

| | |
|---|---|
| 1. Total lipids | 4.0-8.0 g/L |
| 2. Triacylglycerides | 0.5-2.1 mmol/L |
| 3. Total phospholipids | 2.0-3.5 mmol/L |
| 4. Total cholesterol | 4.0-8.6 mmol/L |

| | |
|---|---|
| 5. Free fatty acids | 0.3-0.8 mmol/L |
| 6. Ketone bodies | 100-600 μmol/L |

## V. Mineral components

| | |
|---|---|
| 1. Sodium ($Na^+$) | 135-155 mmol/L |
| 2. Potassium ($K^+$) | 3.6-5.0 mmol/L |
| 3. Chlorides ($Cl^-$) | 97-108 mmol/L |
| 4. Calcium ($Ca^{2+}$) | 2.25-2.75 mmol/L |
| 5. Phosphate inorganic | 0.8-1.4 mmol/L |
| 6. Magnezium ($Mg^{2+}$) | 0.7-1.0 mmol/l |
| 7. Sulphates | 0.4-0.6 mmol/L |
| 8. Iron (Fe) | 14-32 μmol/L (65-175 μg/dL) |
| 9. Copper (Cu) | 12-19 μmol/L |
| 10. Zinc (Zn) | 12-20 μmol/L |
| 11. Ammonia | 10-47 μmol/L |

## Indices of blood

| | |
|---|---|
| 1. Hemoglobin: males | 130-180 g/L (13-18 g/dL) |
| females | 120-160 g/L (12-16 g/dL) |
| 2. Hydrogen ion: arterial blood | 35-46 nmol/L (pH= 7.36-7.44) ($38^oC$) |
| 3. Oxygen ($Po_2$) in arterial blood: | 11-15 kPa ( 85-105 mm Hg) |
| 4. Bicarbonate total ($CO_2$) | 22-30 mmol/L |
| 5. Carbon dioxide ($Pco_2$) in arterial blood: | 4.5-6.0 kPa (35-46 mm Hg) |

## Indices of urine

| | |
|---|---|
| Density (ρ) | 1.017-1.020 |
| pH | 5.7-6.5 |
| Urea | 220-609 mmol/24 h (20-35 g/24 h |
| Creatinine | 7.1-17.7 mmol/24 h ( 0.8-2.0 g/24 h |
| Uric acid | 1.60-3.54 mmol/24 h ( 270-600 mg/24 h) |

| | |
|---|---|
| Indican | 46.0-56.4 mmol/24 h |
| Calcium ($Ca^{2+}$) | 2.50-6.25 mmol/24 h ( 100-250 mg/24 h) |
| Cloride ion ($Cl^-$) | |
| Ketone bodies: acetone | 400-600 mg/L |
| acetoacetic acid | 100-200 mg/L |
| Chondroitine sulphates | 2.7-7.5 mg/24 h |
| Pyruvic acid | 113.7-283.9 μmol/24 h (10-25 mg/24 h) |
| Uropepsinogen | 150-300 IU/24 h (1.5-3.0 mg/24 h) |
| α-Amylase (diastase): | 1.0-2.0 IU/ml (100-200 IU/dL) |
| Volgemut's method: | 16-64 IU/L |
| Adrenalin | < 13.3 μg/24 h |
| Noradrenalin | < 79.8 μg/24 h |
| 17-ketosteroids: males | 42.48-46.75 μmol/24 h (12.83±0.8 mg/24 h) |
| female | 34.78-39.16 μmol/24 h (10.61±0.66 mg-/24 h) |

### Indices of saliva

| | |
|---|---|
| Daily volume (V) | 500-1500 ml (500-1500 ml/24 h) |
| pH | 6.07-7.9 |
| Density (ρ) | 1.08-1.32 |

### Nitrogen-contaning organic substances

| | |
|---|---|
| Proteins | 1.4-6.4 g/L |
| Mucine | 0.8-6.0 g/L |
| Ammonia | 0.01-0.12 g/L |
| Urea | 0.14-0.75 g/L |
| Uric acid | 0.005-0.029 g/L |
| Creatinine | 0.005-0.750 g/L |
| Choline | 0.005-0.036 g/L |

## Nitrogen-noncontaning organic substances

| | |
|---|---|
| Glucose | 0.10-0.30 g/L |
| Citric acid | < 0.020 g/L |
| Lactic acid | 0.01-0.05 g/L |
| Cholesterol | 0.025-0.500 g/L |

## Inorganic substances

| | |
|---|---|
| Sodium (Na) | 5.2-24.4 mmol/L |
| Potassium (K) | 14-41 mmol/L |
| Calcium (Ca) | 2.3-5.5 mmol/L |
| Chlorides ($Cl^-$) | 15.1-31.6 mmol/L |
| Phosphate inorganic | 0.080-0.217 g/L |
| Bicarbonate ($HCO_3^-$) | 2.13-13.00 mmol/L |
| Fluor ($F^-$) | 0.8-2.5 g/L |
| Brom ($Br^-$) | 0.2-7.1 mg/L |
| Tiocianate ($SCN^-$) | 0.12-0.33 g/L |
| Magnezium ($Mg^{2+}$) | 0.16-1.06 mmol/l |
| Sulphates | 0.04-0.2 g/L |
| Copper (Cu) | 0.5-7.6 mg/L |
| Zinc (Zn) | 0.06-0.80 g/L |
| Vitamines | |
| Thiamine ($B_1$) | 0.7 μg/dL |
| Riboflavin ($B_2$) | 5.0 μg/dL |
| Pyridoxine ($B_6$) | 60 μg/dL |
| Nicotinic acid (PP) | 3.0 μg/dL |
| Pantotenic acid | 8.0 μg/L |
| Ascorbic acid (C) | 0.58-3.78 mg/L |
| Biotin (H) | 0.08 μg/dL |
| Phyllochinon (K) | 1.5 μg/Dl |

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