Methodological instructions for independent work of students

Module: «Structural organization of human physiological processes»

Discipline: «Molecular biology»

Code of Discipline: SOFPCH 1203

Name of the EP: 6B10115 «Medicine»

Volume of training hours/credits: 24 hours/1.5 credit

Course and semester of study: 1-I

Independent work: 9 hrs.

Shymkent – 2023 y.

Methodical instructions for independent work of students developed in accordance with the working curriculum of the EP «Structural organization of human physiological processes», the discipline "Molecular biology of the cell" and discussed at the meeting of the department

Protocol № 17 of «26» 05 2023 y.

Head of the Department, Professor _____ Yessirkepov M.M.

IWLT №1
1. Topic: Molecular structure of cells and diseases arising from their malfunctioning.
2. Objective: To study the molecular structure of cells and diseases arising from their malfunctioning.
3. Assignments:
Molecular structure and functions of the major components of the cell:
1. Diseases associated with pathology of the nucleus: reduction of genetic material atypical mitoses pathology of synthesis of ribosome subunits and tRNAs in the nucleolus
2. Diseases associated with disorder of functioning and structure of EPS: enlargement of EPS cisterns, fragmentation of EPS, hyper and hypotrophy of EPS, blockade of synthetic and/or transport processes in the cell.
3. Diseases associated with disorder of functioning and structure of the Golgi apparatus:
Diseases associated with disruption of intracellular transport signaling
4. Diseases associated with malfunction and structure of mitochondria: mitochondrial diseases associated with nuclear DNA defects mitochondrial diseases caused by mtDNA defects.
5. Diseases associated with disorder of functioning and structure of lysosomes:
Mucopolysaccharide accumulation diseases or genetic accumulation diseases; diseases associated with disorders of sorting and transport of lysosomal enzymes - hydrolases. Diseases associated with damage to lysosomal membranes. Diseases associated with extracellular releaserole of lysosomes in the development of inflammatory processes
6. Diseases associated with disruption of the function and structure of peroxisomes:
Diseases due to almost complete loss of peroxisomal function;
Diseases arising due to excess of peroxisomal enzymes;
Diseases caused by the disorder of functioning of only one peroxisomal enzyme.
7. Diseases associated with membrane dysfunction.
Diseases associated with changes in the structure and number of cytoskeleton elements.
4. Form of performance/assessment: presentation, abstract, glossary
5. Criteria and performance: Appendix 2.
6. Due date - 1-2 weeks
7. Literature: see appendix 1
8. Control:
1. Answers to test questions.
2. Solving situational tasks.
3. Filling in cards on the topic.
4. Answers to the questions indicated in the tasks.
Optional: oral answers to questions on the topic.

IWLT № 2
1. Topic: Molecular structure and functions of cell membrane organelles
2. Objective: to study the structure and function of cell membrane organelles
3. Assignments:
1. Structure and functions of the EPR
2. Structure and functions of the Golgi apparatus
3. Structure and functions of the lysosome
4. Structure and functions of the mitochondrion
5. Structure and function of the plastid
6. Structure and functions of the nucleus
4. Form of performance/assessment: presentation, abstract, glossary
5. Criteria and performance: Appendix 2.

6. Due date - 1-2 weeks
7. Literature: see appendix 1
8. Control:
1. Answers to test questions.
2. Solving situational tasks.
3. Filling in cards on the topic.
4. Answers to the questions indicated in the tasks.
Optional: oral answers to questions on the topic.

IWLT №3
1.Topic: Molecular structure and functions of cell membrane organelles
2. Objective: to study the structure and function of cell membrane organelles
3. Assignments:
1. Membrane organelles of the cell.
2. Structure and functions: mitochondria, Golgi complex.
3. Three-dimensional model of the Golgi complex dictyosome. endoplasmic reticulum
4.Form of performance/assessment: presentation, abstract, glossary
5.Criteria and performance: appendix 2
6. Due date - 2 weeks
7. Literature: see appendix 1
8. Control:
1. Answers to test questions.
2. Solving situational tasks.
3. Filling in cards on the topic.
4. Answers to the questions indicated in the tasks.
Optional: oral answers to questions on the topic.

IWLT / IWL №4
Consultation on the implementation of the MC.
Midterm control №1.
2. Purpose: Control of assimilation of theoretical knowledge and practical skills on the passed topics of lectures, practical classes
3. Learning objectives: the student must know the material on the topic; be able to answer oral questions, tests, solve situational tasks
4. The main questions of the topic:
1. Genetic material of prokaryotic cell
2. Genetic material of eukaryotic cell
3. Levels of organization of the genetic material of the cell
4. Levels of compactization of the genetic material of the cell
5. What is included in the composition of chromatin?
6. Which of the cell structures contain chromatin?
7. The structural and functional state of chromosomes in a non-dividing cell
8. Structural and functional state of chromosomes in a dividing cell
9. Determine the chemical composition of a chromosome?
10. What is the genetic material in a eukaryotic cell?
11. What is the genetic material in prokaryotes?
12. Forms of structural organization of chromosomes in the cell cycle
13. Cellular components involved in the transmission of external signals into the cell

14. Intercellular signaling substances
15. Stages of signal transduction into the cell
16. Enzymes involved in cell signaling processes
17. Signaling mechanisms not associated with surface receptors
18. Name the components of the cell that have a membrane structure, give a characterization
19. What are the components of the biomembrane?
20. What proteins are distinguished in the biomembrane?
21. Membrane lipids have what ends?
22. Functions of the plasma membrane
23. Selective permeability of the membrane
24. Protein and ATP synthesis occurs in which organoids?
25. Active and passive transport
26. Vesicular transport
27. Ion channels and pumps
28. Intercellular interactions. Contacts.
29. Adhesive proteins.
30. Basic principles of cellular theory
31. Structure and function of the nucleus
32. Structure and functions of the EPR
33. Structure and function of the Golgi complex
34. Structure and function of the lysosome
35. Structure and function of the peroxisome
36. Structure and function of the ribosome
37. Structure and function of the cytoskeleton
38. Structure and functions of mitochondria

4. Form of assessment: Testing, solving situational tasks, oral questioning. Evaluation of the results of the test, situational tasks.

5. Criteria and fulfillment: Appendix 2.

6. Due date - 7th week

7. Literature: see appendix 1

8. Control:

1. Answers to test questions.
2. Solving situational tasks.
3. Filling in cards on the topic.
4. Answers to the questions indicated in the tasks.

Optional: oral answers to questions on the topic.

IWLT №5

1. Topic. Molecular mechanisms of cell cycle regulation

2. Objective: To study the cell cycle, the content of its periods; cell types depending on their ability to divide. Familiarization with the process of cell division as a process providing reproduction, growth, repairs mechanisms. Study of the process of mitosis, its phases, importance and role in the vital activity of the organism

3. Assignments:

1. Define the concept of cell cycle and its contents.
2. Periods of the cell cycle G1, S, G2, M, G0, characterization and content of the periods.
3. Types of cells depending on their ability to divide: mitotic, irreversibly-postmitotic, and reversibly-postmitotic.

4. Definition of the concept of mitosis.
5. Characterization of the phases of mitosis, their content.
6. Biological significance of mitosis.
7. Atypical mitosis and its causes.
8. Consequences of atypical mitosis for the organism.

4. Form of performance/assessment: presentation, abstract, glossary
5. Criteria and performance: Appendix 2.
6. Due date - 5th week
7. Literature: see appendix 1
8. Control:
1. Answers to test questions.
2. Solving situational tasks.
3. Filling in cards on the topic.
4. Answers to the questions indicated in the tasks.

Optional: oral answers to questions on the topic.

IWLT №6

1. Topic: Transport of substances through membranes: transmembrane transfer of low molecular weight substances

2. Objective: to reveal the concept and essence of transport of substances through membranes, to study the mechanisms of transport of high molecular weight compounds - low molecular weight substances through membranes.

3. Assignments:
1. Definition of the concept of transport of substances through membranes.
2. Transmembrane transport of low molecular weight substances and ions. 3.
3. Membrane transport of substances according to the direction of their movement: uniport, symport and antiport.
4. Mechanisms of transport of low molecular weight compounds across membranes during passive transport of substances and ions.
5. Types of ion channels.
6. Types of ion pumps.
7. Mechanisms of transport of low molecular weight compounds through membranes: - active transport of substances and ions:
- primary-active transport,
- secondary-active transport.
8. Transporters of substances - translocases.

4. Form of performance/assessment: presentation, essay, glossary
5. Criteria and fulfilment: appendix 2
6. Due date - 6th week
7. Literature: see appendix 1
8. Control:
1. Answers to test questions.
2. Solving situational tasks.
3. Filling in cards on the topic.
4. Answers to the questions indicated in the tasks.

Optional: oral answers to questions on the topic.

IWLT №7

1. Topic: Cell cycle. Mitosis. Atypical mitosis and its causes.

2. Objective: To study the cell cycle, the content of its periods; types of cells depending on their ability to divide. Familiarization with the process of cell division as a process providing reproduction, growth, repairs mechanisms. Study of the process of mitosis, its phases, significance and role in the vital activity of the organism.

3. Assignments:

1. Define the concept of cell cycle and its content.
2. Periods of the cell cycle G1, S, G2, M, G0, characterisation and content of the periods.
3. Types of cells depending on their ability to divide: mitotic, irreversibly-postmitotic, reversibly-postmitotic.
4.Definition of the concept of mitosis.
5.Characteristics of the phases of mitosis, their content.
6.Biological significance of mitosis.
7.Atypical mitosis and its causes.
8.Consequences of atypical mitosis for an organism.

4.Form of performance: presentation, essay, glossary

5.Criteria and performance: appendix 2

6. Due date: week 7

7. Literature: see appendix 1

8. Control:

1. Answers to test questions.
2. Solving situational tasks.
3. Filling in cards on the topic.
4. Answers to the questions indicated in the tasks.

Optional: oral answers to questions on the topic.

IWLT №8

1. Topic: Cell cytoskeleton and motor organelles of the cell

2. Purpose: Description of the structure and function of cell organoids; Study of the structure and function of the cytoskeleton of motor organelles of the cell.

3. Assignments on the topic:

1. Definition of the concept of organoids and their classification
2. Non-membrane organoids: molecular structure and functions. 3.
3. Definition of cytoskeleton and motor organelles of the cell. 3.
4. Structure and functions of microtubules
5. Structure and functions of microfilaments
6. Structure and functions of cilia
7. Structure and functions of flagella
8. Conclusions

4. Form of performance/assessment: presentation, abstract, glossary

5. Criteria and fulfillment: Appendix 2

6. Due date - 8th week

7. Literature: see appendix 1

8. Control:

1. Answers to test questions.
2. Solving situational tasks.
3. Filling in cards on the topic.

4. Answers to the questions indicated in the tasks.
Optional: oral answers to questions on the topic.

IWLT / IWL №9
Consultation on the implementation of the MC
1. Topic: Midterm Control No. 2.
2. Objective: To control the assimilation of theoretical knowledge and practical skills on the passed topics of lectures and practical classes.
3. Assignments:
1.Protein biosynthesis involves ... amino acids.
А. 20
Б. 100
В. 50
Г. 10
Д. 30
2.Amino acids are monomers of ...
A. proteins.
B. lipids.
C. fats.
D. carbohydrates.
D. nucleic acids.
3.Amino acids have similar ...
A. amino groups.
B. radicals.
C. sulfide groups .
D. nitro groups .
D. oxide groups.
4.When cell proteins are heated, their .
A. denaturation .
B. sticking together .
C. fragmentation.
D. transformation.
D. lysis.
5. The primary structure of a protein is formed by..... bonds
A. hydrogen
B. peptide
C. ionic
D. disulfide
D. hydrophobic
6. A peptide bond is formed between.....
A. a carboxyl group and an amino group.
B. carboxyl group and hydrogen.
C. a radical and an amino group.
D. carboxyl group and radical.
D. radical and hydrogen.
7. A ... bond is involved in the formation of the secondary structure of a protein.
A. hydrogen
B. peptide

C. ionic
D. disulfide
D. hydrophobic
8. The tertiary structure of a protein is formed by the bonding between....
A. radicals
B. amino groups
C. carboxyl groups
D. hydrogen and nitrogen
D. radical and carboxyl group
9. The process of forming the correct spatial three-dimensional structure of a protein is called....
A. folding.
B. splicing.
C. processing.
D. clearing.
D. screening.
10.Amino acids can exhibit properties.....
A. acids.
B. bases.
C. acids and bases.
D. salts.
D. vitamins.
11. Complex protein structures are formed ....
A. in the channels of the endoplasmic reticulum and Golgi apparatus.
B. ribosomes.
C. in the matrix of the cytoplasm.
D. in the cell nucleus.
D. in lysosomes.
12. A polypeptide is formed by....
A. the interaction of the amino group of one amino acid and the carboxyl group of another amino acid.
B. the interaction of the carboxyl groups of two neighbouring amino acids.
C. interactions between the amino groups of two neighbouring amino acids.
D. interactions of the nucleotides of two neighbouring amino acids.
E. interactions of radicals of two neighbouring amino acids.
13. The degree of spiralisation of a protein characterises.....
A. the secondary structure of the protein.
B. the primary structure of a protein.
C. the tertiary structure of a protein.
D. the superspiralisation of a protein.
D. the quaternary structure of a protein.
14. The quaternary structure of a protein is characteristic of....
A. globular proteins.
B. oligomeric proteins.
C. fibrillar proteins.
D. oligopeptides.
D. dipeptides.
15. The proteins actin and myosin have ..... function.
A. protective

B. transport
B. Receptor
D. energetic
D. contractile
16. Prion diseases include the disease.....
A. Creutzfeldt-Jakob disease.
B. accumulation of lysosomes
B. Wilson's disease
Г. Down's
Д. Edwards
17. Immunoglobulins perform..... function.
A. protective
B. transport
C. receptor
D. hereditary
D. contractile
18. Haemoglobins perform ..... function.
A. protective
B. transport
C. receptor
D. hereditary
D. contractile
19. Neurotransmitters perform .....functions.
A. protective
B. transport
C. receptor
D. hereditary
D. contractile
20. Globular proteins are ....
A. haemoglobins.
B. carotenes.
C. actions.
D. myosins
D. collagens.
21. Fibrillar proteins are.
A. keratins.
B. haemoglobins.
C. immunoglobulins.
D. antibodies.
D. enzymes.
22. Structural proteins include _____.
A. collagens.
B. haemoglobins.
C. immunoglobulins.
D. antibodies.
D. enzymes.
23. Simple proteins include ...
A. histones.

B. glycoproteins.
C. chromatin.
D. proteoglycans.
D. flavoproteins.
24. The primary structure of a protein is determined by ...
A. the nucleotide sequence of a gene.
B. the sequence of amino acids in the gene.
C. the physicochemical properties of the protein's primary structure.
D. physicochemical properties of the radicals of the primary structure of the protein.
E. physicochemical properties of the contact surfaces of the tertiary structure.
25. The secondary structure of a protein is determined by ...
A. the nucleotide sequence of a gene.
B. the sequence of amino acids in the gene.
C. physicochemical properties of the primary structure of a protein.
D. physicochemical properties of the radicals of the primary structure of the protein.
E. physicochemical properties of the contact surfaces of the tertiary structure.
26. The tertiary structure of a protein is determined by ....
A. the nucleotide sequence of a gene.
B. the sequence of amino acids in the gene.
C. physicochemical properties of the primary structure of the protein.
D. physicochemical properties of the radicals of the primary structure of the protein.
E. physicochemical properties of the contact surfaces of the tertiary structure.
27. The termination of a polypeptide containing an amino group is called an....
A. the N-terminus.
B. the peptide bond.
B. C-terminus.
Г. 3'-end.
Д. 5'-end.
28. The termination of a polypeptide containing a carboxy group is called the
A. C-terminus.
B.N-terminus.
C.the peptide bond.
Г. 3'-end.
Д. 5'-end.
29. Hydrogen bonds between CO- and NH-groups in a protein molecule give it a helix shape characteristic of ..... structure
A. primary
B. secondary
C. tertiary
D. quaternary
30. The helix-shaped secondary structure of a protein is held together by ..... bonds.
A. peptide
B. ionic
C. hydrogen
D. covalent
31. Proteins produced in the body when bacteria or viruses enter the body perform ..... function.
A. regulatory
B. signalling

C. defence
D. enzymatic
32. Proteins that accelerate chemical reactions in the cell perform ..... function.
A. hormonal
B. signalling
C. enzymatic
D. informational
33. When proteins are heated in solutions of acids and alkalis, they undergo:
A. denaturation
B. hydrolysis
C. dissolution
D. precipitation of proteins
34. Tertiary structure of a protein:
A. the configuration of the polypeptide helix in space
B. the main characteristic of a protein
C. position of a protein molecule in a living cell of an organism
D. position of a protein molecule in a ternary coordinate system
35. The quaternary structure of a protein is:
A.an aggregate or complex of several protein macromolecules
B.the aggregate of all proteins in a living cell
C.the fourth level of protein organisation
D.four proteins connected by donor-acceptor bonds
36. Which organic matter in the cell is first in mass?
А. Carbohydrates.
Б. Lipids.
В. Proteins.
Г. Nucleic acids.
37. How many amino acids make up the entire variety of proteins?
А. 170.
Б. 26.
В. 20.
Г. 10.
Д. 15
38. Which bonds stabilise the secondary structure of proteins?
А. Covalent.
Б. Ionic.
В. Hydrogen.
Г. Disulfide.
39. What structure does the haemoglobin molecule have?
А. Primary.
Б. Tertiary.
В. Secondary.
Г. Quaternary.
40. An amino acid is a monomer of ....
A. proteins.
B. nucleic acids.
C. fats.
D. carbohydrates.

D. vitamins.
41.Simple proteins are made up of ....
A. only nucleotides.
B. of amino acids only.
C. of amino acids and non-protein compounds.
D. of phosphoric acid residues.
D. of deoxyribose.
42.Proteins that are soluble in both water and salt solution are called:
A. albumin
B. globulins
C. fibrillar proteins
D. immunoglobulins
D. repressor proteins
43.In the structure of proteins, there are ....
A. two levels of organisation of the molecule.
B. three levels of organisation of the molecule.
C. four levels of organisation of the molecule.
D. one level of organisation of the molecule.
D. five levels of organisation of the molecule.
44.A polypeptide is formed by _____.
A. the interaction of the amino groups of two neighbouring amino acids.
B. interaction between the amino group of one amino acid and the carboxyl group of another amino acid.
C. interactions between the carboxyl groups of two neighbouring amino acids.
D. interactions between the nucleotides of two neighbouring amino acids.
D. interactions between the radicals of two neighbouring amino acids.
45. Folding enzymes are ....
A. foldases.
B. nucleases.
C. hydrolases.
D. polymerases.
D. catalases.
46. Folding enzymes are ....
A. chaperones
B. nucleases.
C. hydrolases.
D. polymerases.
D. catalases.
47.Foldase is an enzyme of ....
A. TFIID.
B.TFIID.
C.PCNA.
D.SSB.
D.MAP.
48.Molecules involved in protein folding are called ....
A. folding regulators.
B. enhancers of folding.
B. Repressors of folding.

Г. С. folding cortexes.
D. folding suppressors.
49.The shape of a protein molecule is determined by....
A. amino acid sequence and folding factors.
B. amino acids and protein synthesis enzymes.
C. temperature and humidity.
D. amino acid sequence and temperature.
D. folding factors and humidity.
50.Molecules that accelerate folding are called ....
A. folding catalysts.
B. folding chaperones.
C. retention chaperones.
D. disaggregating chaperones.
D. secretory chaperones.

4. Form of performance/assessment: Testing, solving situational tasks, oral questioning. Evaluation of the results of the test, situational tasks.

5. Criteria and fulfillment: Appendix 2

6. Due date - 9th week

7. Literature: see appendix 1

8. Control:

1. Answers to test questions.
2. Solving situational tasks.
3. Filling in cards on the topic.
4. Answers to the questions indicated in the tasks.

Optional: oral answers to questions on the topic.

Appendix.

7. Literature: see App. 1

In English:

Basic:

1. Jorde L. B., Carey J.C., Bamshad M. J. Medical Genetics, Elsevier, 2015
2. Cooper G. M., Hausman R. E. The Cell: a Molecular Approach. - Sinauer Associates, 2015
3. Genetics [Текст] = Генетика : textbook / D. K. Aydarbaeva [and etc.]. - Almaty : Association of hiighereducational institutions of Kazakhstan, 2016. - 244 p
4. Alberts B. [et al.]. Molecular Biology of the CELL - 3th ed., 2014
5. Batyrova, K. I. Introduction to biology [Текст] = Введениевбиологию : textbook / K. I.Batyrova, D. K. Aydarbaeva.-Almaty :Association of hiighereducationalinstitutions of Kazakhstan, 2016. -316 p.

Additional:

1. Schumm, Dorothy E. Core Concepts in clinical Molecular biology [Текст] :монография / Dorothy E. Schumm. - First Edition. - New York : Lippincott - Raven Publichers Philadelphia, 1997. - 74 p.

Electronic resource:

1. Lodich, H. Molecularcell [Электронный ресурс]: научное издание / H. Lodich. - (10,4 Мб). - Б. м. : Б. и., 2003
2. PrimerofMolecularGenetics [Электронный ресурс]: учебник. - Электрон.текстовые дан. (10,5Мб). - М. :Б. и., 1992

3.Clote, P. Computational molecular biology FP. Clote, R. Backofen [Электронный ресурс] : научное издание / P. Clote, R. Backofen. - Электрон.текстовые дан. (13,2 Мб). - Б. м. : Б. и., 2000
4. Glossary, Lodish H. Molecular Cell biology [Электронныйресурс] :словарь / Lodish H. Glossary. - Электрон. текстовыедан. (11,1 Мб). - Б. м. : Б. и., 2003
5. Watson, J. D. Molecular Biology of the gene [Электронныйресурс]: научное издание / J. D. Watson. - Fifth edition. - Электрон. текстовыедан. (30,2 Мб). - Б. м. : Б. и., 2004

Electronic textbooks

№	Name	Link
1	Electronic library	http://lib.ukma.kz
2	Republican interuniversity electronic library	http://rmebrk.kz/
3	Electronic library of the Medical University "Student Advisor"	http://www.studmedlib.ru
4	"Paragraph" information system "Medicine" section	https://online.zakon.kz/Medicine
5	Scientific electronic library	https://elibrary.ru/
6	Electronic library "BooksMed"	http://www.booksmed.com
7	«Web of science» (Thomson Reuters)	http://apps.webofknowledge.com
	Science Direct» (Elsevier)	https://www.sciencedirect.com
9	«Scopus» (Elsevier)	www.scopus.com
10	PubMed	https://www.ncbi.nlm.nih.gov/pubmed