


ОҢТҮСТІК-ҚАЗАҚСТАН MEDISINA AKADEMIASY «Оңтүстік Қазақстан медицина академиясы» АҚ		SOUTH KAZAKHSTAN MEDICAL ACADEMY АО «Южно-Казахстанская медицинская академия»
Department of biology and biochemistry	46/	
Methodical recommendations for practical lesson	p. 1 of 16	

Methodical recommendations for practical lesson

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

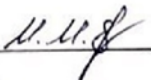
Practical (seminar) classes: 12 h.

ОҢТҮСТІК-ҚАЗАҚСТАН MEDISINA AKADEMIASY «Оңтүстік Қазақстан медицина академиясы» АҚ		SOUTH KAZAKHSTAN MEDICAL ACADEMY АО «Южно-Казахстанская медицинская академия»
Department of biology and biochemistry	46/	
Methodical recommendations for practical lesson	p. 1 of 16	


Methodological instructions for practical classes are developed in accordance with the working curriculum of the EP "Structural organisation of human physiological processes", the discipline "Molecular Biology of the Cell" and discussed at the meeting of the department.

Protocol No17 dated 26 05 2023 y.

Head of the department, professor



Yessirkeпов M.M.

ОҢТҮСТІК-ҚАЗАҚСТАН MEDISINA AKADEMIASY «Оңтүстік Қазақстан медицина академиясы» АҚ	 SKMA -1979-	SOUTH KAZAKHSTAN MEDICAL ACADEMY АО «Южно-Казахстанская медицинская академия»
Department of biology and biochemistry	46/	
Methodical recommendations for practical lesson	p. 1 of 16	

Practical class №1

1. Topic. Molecular biology of the cell. Structure and function main components of cell.

2. Objective: Study of the structure of prokaryotic and eukaryotic cell. Structure, functions.

3. Learning Objectives:

learner should know:

- Structure and functions of the prokaryotic and eukaryotic cell
- Structure and functions of the main components of the cell.
- Structure of the prokaryotic and eukaryotic cell
- Structure of the main components of the cell

learner should be able to:

- identify prokaryotic and eukaryotic cells;
- species of the major components of a cell;
- organoids;

4. The main questions of the topic:

1. Structure of biomembranes
2. Function of biomembranes
3. Adhesive function of biomembranes
4. Active transport.
5. Passive transport.
6. Structure and function of cell organoids
7. Structure and functions of the nucleus
8. Structure and functions of the cell membrane
9. Structure and functions of the Golgi apparatus
10. Structure and Functions of Mitochondria
11. Structure and functions of the lysosome
12. Role of the nucleus in the cell
13. Structure of the mitochondrion
14. Structure of the lysosome
15. Structure of the Golgi apparatus
16. Structure of cell membrane
17. Structure of ribosome
18. Structure of ER
19. Structure of the nucleus
20. Formation of lysosomes and their types

5. Learning and teaching methods/techniques: Small group work, discussion of key issues, presentation

https://www.youtube.com/watch?v=j0sEi_Dscd8&feature=youtu.be The cell

<https://www.youtube.com/watch?v=QSfntmjVtpQ&feature=youtu.be> eukaryotes


<https://www.youtube.com/watch?v=V6YC97Dj5E0&feature=youtu.be> Organelles

6. Assessment methods/techniques: Testing Oral and written questioning

7. Literature: see appendix 1

8. Control:

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

ОҢТҮСТІК-ҚАЗАҚСТАН MEDISINA AKADEMIASY «Оңтүстік Қазақстан медицина академиясы» АҚ	 SKMA -1979-	SOUTH KAZAKHSTAN MEDICAL ACADEMY АО «Южно-Казахстанская медицинская академия»
Department of biology and biochemistry	46/	
Methodical recommendations for practical lesson	p. 1 of 16	

Practical class №2

1. Topic: Eukaryotic cell. Cell surface apparatus. Plasma membrane.

2. Objective: To give an introduction to the eukaryotic cell. Surface apparatus of the cell. Plasma membrane

3. Learning Objectives: To study the mechanisms of eukaryotic cell, cell surface apparatus, supramembrane apparatus and submembrane layer of supporting and contractile structures. Membrane lipids.

4. The main questions of the topic are:

1. What is an essential component of the cell surface apparatus?
2. Chemical composition and structure of plasmolemma
3. Function of plasmolemma
4. Methods of transport of substances across the cytoplasmic membrane
5. The supramembrane complex
6. What functions the plasma membrane performs in the cell
7. What functions does the membrane perform

5. Learning and teaching methods/techniques: Small group work, discussion of key issues, presentation

6. Assessment methods/techniques: Testing oral and written

questioning <https://www.youtube.com/watch?v=BmAq-EoIVCc&feature=youtu.be> the cell

<https://www.youtube.com/watch?v=G7-hNjwCwaw&feature=youtu.be> membrane

7. Literature: see appendix 1

8. Control:

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

Practical class №3

1. Topic: Plasma membrane. Transport of substances across membranes: passive and active, vesicular.

2. Objective: To give the concept of transport of substances through membranes: passive and active, vesicular, monolayer, bilayer and vesicles (liposomes and vesicles). Membrane proteins: peripheral and integral. Transport of high molecular weight compounds across membranes endocytosis and exocytosis.

3. Learning objectives: study of mechanisms and factors of transport of substances across membranes: passive and active, vesicular **to be able to:** give a definition on the plasma membrane, transport of substances across membranes

4. Main questions of the topic:


1. Structure of biomembranes
2. Function of biomembranes
3. Adhesive function of biomembranes
4. Active transport.
5. Passive transport.

5. Learning and teaching methods/techniques: Small group work, discussion of key issues, presentation

<https://www.youtube.com/watch?v=iv-025Dx8LE&feature=youtu.be> transport

<https://www.youtube.com/watch?v=pNoXrbIKIDk&feature=youtu.be> membrane

6. Methods/techniques of assessment: Testing, oral and written questioning

ОҢТҮСТІК-ҚАЗАҚСТАН MEDISINA AKADEMIASY «Оңтүстік Қазақстан медицина академиясы» АҚ	 SKMA -1979-	SOUTH KAZAKHSTAN MEDICAL ACADEMY АО «Южно-Казахстанская медицинская академия»
Department of biology and biochemistry	46/	
Methodical recommendations for practical lesson	p. 1 of 16	

7. Literature: see appendix 1

8. Control:

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

Practical class №4

1. Topic: Строение и работа ионных каналов и насосов.

2. Objective: study the mechanisms of intracellular transport and its role in disease formation, the structure and operation of ion channels and pumps

3. Learning objectives: the learner should know the mechanisms of membrane and vesicular transport; **be able to:** describe the processes of exo- and endocytosis, identify different types of channels and pumps.

4. Main questions of the topic:

Mechanisms of intracellular transport of substances

Transport of low molecular weight compounds

- Simple diffusion
- Facilitated diffusion
- Active transport

2. Ion channels. Structure and functions.

3. Active transport. Translocases.

4. Direction of transport of substances: uniport, symporti antiport.

5. Ion pumps. Structure and functions.

Types of pumps:

Na⁺K⁺ - pump

Na⁺ - channels

K⁺ - channels

Cation channels and n-cholinoreceptors

Ca²⁺ ion transport

6. Transport of high molecular weight compounds across membranes

- Endocytosis
- Exocytosis

5. Learning and teaching methods/techniques: Small group work, discussion of key issues, presentation

<https://www.youtube.com/watch?v=de2z4I6R2VY&feature=youtu.be> ion channels

<https://www.youtube.com/watch?v=dEXMrONKVPk&feature=youtu.be> pumps

6. Assessment methods/techniques: Testing, oral and written questioning


7. Literature: see appendix 1

8. Control:

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

Practical class №5

Topic. Structure and function of cellular non-membrane organelles and the cell cytoskeleton.

ОҢТҮСТІК-ҚАЗАҚСТАН MEDISINA AKADEMIASY «Оңтүстік Қазақстан медицина академиясы» АҚ	 SKMA -1979-	SOUTH KAZAKHSTAN MEDICAL ACADEMY АО «Южно-Казахстанская медицинская академия»
Department of biology and biochemistry	46/	
Methodical recommendations for practical lesson	p. 1 of 16	

2. Objective: to familiarize with the molecular structure and functions of the cell surface apparatus and the structure of the cytoskeleton.

3. Learning objectives: the student should know the structure and functions of membrane lipids and proteins, functions of glycocalyx; **be able to** identify biomembranes on microphotographs and micro drugs; and distinguish the components of the cytoskeleton

4. Main topic questions:

1. Structural-functional and molecular organisation of eukaryotic cell.
2. Cell surface apparatus and its structure: biomembrane (plasmalemma), supramembrane apparatus and submembrane layer of supporting and contractile structures
3. Molecular structure and functions of biomembranes.
4. Types and functions of membrane lipids: phospholipids, sphingolipids and glycolipids
5. Multi-molecular configurations of lipids at the interface of media: monolayer, bilayer and vesicles (liposomes and vesicles).
6. Membrane proteins: peripheral and integral.
7. Properties of membranes: mobility, integrity and impermeability.
8. Structure of specialized membranes, using the erythrocyte membrane as an example.
9. Principles of structure, properties and functions of membranes.
10. Structure of glycocalyx function: carbohydrate and protein component.
11. Submembrane layer of contractile structures.
12. The concept of cytoceptors.
13. Cytoskeleton of the cell:
 1. Basic proteins of the cytoskeleton
 2. Auxiliary proteins or molecular motors
 3. Microtubules
 4. Microfilaments:
 - a. actin microfilaments
 - b. intermediate filaments

5. Learning and teaching methods/techniques: Small group work, discussion of key issues, presentation

<https://www.youtube.com/watch?v=hH01jOis9BA&feature=youtu.be> the cell

<https://www.youtube.com/watch?v=X7rMnoUb2sQ&feature=youtu.be> structure of membrane

<https://www.youtube.com/watch?v=X7rMnoUb2sQ&feature=youtu.be> cytoskeleton

6. Assessment methods/techniques: Testing, oral and written questioning

7. Literature: see appendix 1

8. Control:

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


Practical class №6

1. Topic. Molecular structure and function of cell membrane organelles and the nucleus.

2. Objective: to provide an understanding of the structure and function of cell membrane organelles and the nucleus

3. Learning objectives: to familiarize with the structure and function of cell membrane organelles and the nucleus

4. The main questions of the topic are:

ОҢТҮСТІК-ҚАЗАҚСТАН MEDISINA AKADEMIASY «Оңтүстік Қазақстан медицина академиясы» АҚ	 SKMA -1979-	SOUTH KAZAKHSTAN MEDICAL ACADEMY АО «Южно-Казахстанская медицинская академия»
Department of biology and biochemistry	46/	
Methodical recommendations for practical lesson	p. 1 of 16	

1. Structure and functions of mitochondrion
2. Structure and functions of lysosome
3. Role of the nucleus in the cell
4. Structure of the mitochondrion
5. Structure of the lysosome
6. Structure of the Golgi apparatus
7. Structure of the cell membrane
8. Structure of ribosome
9. Structure of the EPT
10. Structure of the nucleus
11. Formation of lysosomes and their types
12. Structure of biomembranes
13. Function of biomembranes
14. Adhesive function of biomembranes
15. Active transport.
16. Passive transport.
17. Structure and functions of cell organoids
18. Structure and functions of the nucleus
19. Structure and functions of the cell membrane
20. Structure and functions of the Golgi apparatus

5. Learning and teaching methods/techniques: Small group work, discussion of key issues, presentation

<https://www.youtube.com/watch?v=vfZMYBGxxyQ&feature=youtu.be> membrane organelles
<https://www.youtube.com/watch?v=IBi-d6jAKxQ&feature=youtu.be> the cell

6. Assessment methods/techniques: Testing, oral and written questioning

7. Literature: see appendix 1

8. Control:

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

Practical class №7


1. Topic. Intercellular interactions. Contacts.

2. Objective: to give an idea of intercellular contacts and adhesion, processes that play an important role in the formation of inflammation and immune response of the organism

3. Learning objectives: students should know the types of intercellular contacts and the concept of adhesion; be able to identify types of contacts, classify adhesive proteins.

4. The main questions of the topic:


1. Definition of the concept of adhesion
2. Families of adhesive membrane proteins.
 - integrins;
 - selectins
 - adhesive immunoglobulins
 - cadherins
3. Adhesive function of membranes
 - Mechanism of T-lymphocyte homing
 - mechanism of T-cell migration

ОҢТҮСТІК-ҚАЗАҚСТАН MEDISINA AKADEMIASY «Оңтүстік Қазақстан медицина академиясы» АҚ	 SKMA -1979-	SOUTH KAZAKHSTAN MEDICAL ACADEMY АО «Южно-Казахстанская медицинская академия»
Department of biology and biochemistry	46/	
Methodical recommendations for practical lesson	p. 1 of 16	

- inflammatory response and adhesion
- immune reactions
- 4. Intercellular contacts
- 5. Types of contacts:
 - simple intercellular junctions
 - interdigitation
 - adhesive belt
 - tight junction
 - nexus or slit-like junctions
- 6. Extracellular matrix
- 7. Definition of the concept of cell signalling.
- 8. Intercellular signalling substances - primary mediators.
- 9. Membrane bound and intracellular receptors.
- 10. Secondary mediators.
- 11. Basic steps in signal transduction.
- 12. Medical significance.
- 5. Learning and teaching methods/techniques:** Small group work, discussion of key issues, presentation
<https://www.youtube.com/watch?v=XhKep9xHfH4&feature=youtu.be> the cell
<https://www.youtube.com/watch?v=q2M0d17waII&feature=youtu.be> contacts
- 6. Assessment methods/techniques:** Testing, oral and written questioning
- 7. Literature:** see appendix 1
- 8. Control:**
 1. Answers to test questions.
 2. Solving situational tasks.
 3. Filling in cards on the topic.
 4. Answering oral questions.

Practical class №8

- 1. Topic.** Adhesive function of membranes. Transmission of external signal to the cell.
- 2. Objective:** to give an idea of intercellular contacts and adhesion, processes that play an important role in the formation of inflammation and immune response of the organism.
- 3. Learning objectives:** students should know the types of intercellular contacts and the concept of adhesion; be able to identify types of contacts classify adhesive proteins.
- 4. The main questions of the topic are:**
 1. Definition of the concept of adhesion
 2. Families of adhesive membrane proteins.
 - integrins;
 - selectins
 - adhesive immunoglobulins
 - cadherins
 3. Adhesive function of membranes
 - Mechanism of T-lymphocyte homing
 - mechanism of T-cell migration
 - inflammatory response and adhesion
 - immune reactions
 4. Intercellular contacts
 5. Types of contacts:

ОҢТҮСТІК-ҚАЗАҚСТАН MEDISINA AKADEMIASY «Оңтүстік Қазақстан медицина академиясы» АҚ	 SKMA -1979-	SOUTH KAZAKHSTAN MEDICAL ACADEMY АО «Южно-Казахстанская медицинская академия»
Department of biology and biochemistry	46/	
Methodical recommendations for practical lesson	p. 1 of 16	

- simple intercellular junctions
- interdigitation
- adhesive belt
- tight junction
- nexus or slit-like junctions

6.Extracellular matrix

7.Definition of the concept of cell signalling.

8.Intercellular signalling substances - primary mediators.

9.Membrane bound and intracellular receptors.

10.Secondary mediators.

11.Basic steps in signal transduction.

12.Medical significance.

5. Learning and teaching methods/techniques: Small group work, discussion of key issues, presentation

<https://www.youtube.com/watch?v=U053VjkuFaY&feature=youtu.be> contacts

<https://www.youtube.com/watch?v=8iAYEF8dXmw&feature=youtu.be> membrane

6. Assessment methods/techniques: Testing, oral and written questioning

7. Literature: see appendix 1

8. Control:

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

Practical class №9


1. Topic: Cell cycle. Mitosis. Meiosis.

2. Objective: to study the concept and main stages and mechanisms of the cell cycle, mitosis and meiosis.

3. Learning objectives: the student should know the periodisation of the cell cycle and the mechanisms of mitosis, meiosis and its molecular regulation; the phenomenon of apoptosis - programmed cell death and the role of protein p53 in its regulation; be able to give a clear and complete description of the processes occurring in each period of the cell cycle and explain the mechanisms of its regulation.

4. Main questions of the topic:


1. Definition of the concept of cell and mitotic cycles.
2. Periods of cell cycle: G₁, S, G₂, M, G₀; processes occurring during these periods.
3. Types of cells with different abilities to divide:
 - Mitotic,
 - Irreversible post mitotic cells
 - Irreversible post mitotic cells.
4. Cell division - mitosis. Biological significance.
5. Atypical mitoses. Causes of occurrence and significance for medicine.
6. Cell cycle regulation: cyclins and cyclin-dependent kinases, their role in mitotic cycle regulation.
7. Mitosis-stimulating factor.
8. Mechanism of action of cyclin-sck complexes:
 - in G₁-period;
 - in S and G₂-period;
 - cell cycle checkpoints.

ОҢТҮСТІК-ҚАЗАҚСТАН MEDISINA AKADEMIASY «Оңтүстік Қазақстан медицина академиясы» АҚ	 SKMA -1979-	SOUTH KAZAKHSTAN MEDICAL ACADEMY АО «Южно-Казахстанская медицинская академия»
Department of biology and biochemistry	46/	
Methodical recommendations for practical lesson	p. 1 of 16	

9. Regulatory role of p-53 protein;
 10. General idea of the mechanism of apoptosis.
 11. Types of apoptosis: "apoptosis from within" and "apoptosis on command".
 12. Mitochondrial factors of apoptosis and the role of p-53 protein.
 13. Apoptosis and necrosis.
 14. The role of apoptosis in immune system maturation and function;
 15. Definition of the concept of carcinogenesis.
 16. Genetic nature of carcinogenesis.
 17. Carcinogenic factors.
 18. Biological mechanisms of carcinogenesis.
- 5. Learning and teaching methods/techniques:** Small group work, discussion of key issues, presentation
<https://www.youtube.com/watch?v=Du5WillqBzQ&feature=youtu.be> mitosis
- 6. Assessment methods/techniques:** Testing, oral and written questioning
- 7. Literature:** see appendix 1
- 8. Control:**
1. Answers to test questions.
 2. Solving situational tasks.
 3. Filling in cards on the topic.
 4. Answering oral questions.

Practical class №10

- 1. Topic.** Molecular mechanisms of apoptosis and oncogenesis. Carcinogenesis.
- 2. Objective:** to study the concept and main stages of the cell cycle and mechanisms of its molecular regulation, apoptosis and carcinogenesis.
- 3. Learning objectives:** students should know the periodisation of the cell cycle and mechanisms of its molecular regulation; the phenomenon of apoptosis - programmed cell death and the role of protein p53 in its regulation; be able to give a clear and complete description of the processes occurring in each period of the cell cycle and explain the mechanisms of its regulation.
- 4. Main questions of the topic:**
 1. Definition of the concept of cell and mitotic cycles.
 2. Periods of cell cycle: G1, S, G2, M, G0; processes occurring during these periods.
 3. Types of cells with different abilities to divide:
 - Mitotic,
 - Irreversible postmitotic cells
 - Irreversible postmitotic cells.
 4. Cell division - mitosis. Biological significance.
 5. Atypical mitoses. Causes of occurrence and significance for medicine.
 6. Cell cycle regulation: cyclins and cyclin dependent kinases, their role in mitotic cycle regulation.
 7. Mitosis-stimulating factor.
 8. Mechanism of action of cyclin-sdc complexes:
 - in G₁-period;
 - in S and G₂-period;
 - cell cycle checkpoints.
 9. Regulatory role of p-53 protein;
 10. General idea of the mechanism of apoptosis.
 11. Types of apoptosis: "apoptosis from within" and "apoptosis on command".
 12. Mitochondrial factors of apoptosis and the role of p-53 protein.

ОҢТҮСТІК-ҚАЗАҚСТАН MEDISINA AKADEMIASY «Оңтүстік Қазақстан медицина академиясы» АҚ	 SOUTH KAZAKHSTAN MEDICAL ACADEMY АО «Южно-Казахстанская медицинская академия»
Department of biology and biochemistry	46/
Methodical recommendations for practical lesson	p. 1 of 16

13. Apoptosis and necrosis.
14. The role of apoptosis in immune system maturation and function;
15. Definition of the concept of carcinogenesis.
16. Genetic nature of carcinogenesis.
17. Carcinogenic factors.
18. Biological mechanisms of carcinogenesis.

5. Learning and teaching methods/techniques: Small group work, discussion of key issues, presentation

<https://www.youtube.com/watch?v=YIAaodoNGs&feature=youtu.be> apoptosis

<https://www.youtube.com/watch?v=YIAaodoNGs&feature=youtu.be> necrosis

<https://www.youtube.com/watch?v=YIAaodoNGs&feature=youtu.be> cancer

6. Assessment methods/techniques: Testing, oral and written questioning

7. Literature: see appendix 1

8. Control:

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

Practical class №11


1. Topic. Cell cycle and molecular mechanisms of its regulation.

2. Objective: to study the concept and main stages of the cell cycle and mechanisms of its molecular regulation, apoptosis and carcinogenesis.

3. Learning objectives: the student should know the periodisation of the cell cycle and the mechanisms of its molecular regulation; the phenomenon of apoptosis - programmed cell death and the role of protein p53 in its regulation; be able to give a clear and complete description of the processes occurring in each period of the cell cycle and explain the mechanisms of its regulation.

4. The main questions of the topic:

1. Periods of the cell cycle: G₁, S, G₂, M, G₀; processes occurring during these periods. Definition of the concept of cell cycle and mitotic cycle.
2. Types of cells with different abilities to divide:
 - mitotic,
 - irreversible postmitotic cells
 - irreversible postmitotic cells.
4. Cell division - mitosis. Biological significance.
5. Atypical mitoses. Causes of occurrence and significance for medicine.
6. Cell cycle regulation: cyclins and cyclin-dependent kinases, their role in mitotic cycle regulation.
7. Mitosis-stimulating factor.
8. Mechanism of action of cyclin-sdk complexes:
 - in G₁-period;
 - in S and G₂-period;
 - cell cycle checkpoints.
9. Regulatory role of p-53 protein;
10. General idea of the mechanism of apoptosis.
11. Types of apoptosis: "apoptosis-internal" and "apoptosis-on-command".
12. Mitochondrial factors of apoptosis and the role of p-53 protein.
13. Apoptosis and necrosis.
14. The role of apoptosis in immune system maturation and function;

ОҢТҮСТІК-ҚАЗАҚСТАН MEDISINA AKADEMIASY «Оңтүстік Қазақстан медицина академиясы» АҚ	 SKMA -1979-	SOUTH KAZAKHSTAN MEDICAL ACADEMY АО «Южно-Казахстанская медицинская академия»
Department of biology and biochemistry	46/	
Methodical recommendations for practical lesson	p. 1 of 16	

15. Definition of the concept of carcinogenesis.

16. Genetic nature of carcinogenesis.

17. Carcinogenic factors.

18. Biological mechanisms of carcinogenesis.

5. Learning and teaching methods/techniques: Small group work, discussion of key issues, presentation

<https://www.youtube.com/watch?v=vfZMYBGxxyQ&feature=youtu.be> cell cycle

<https://www.youtube.com/watch?v=J6NY3R6K-6k&feature=youtu.be> regulation

6. Assessment methods/techniques: Testing, oral and written questioning

7. Literature: see appendix 1

8. Control:

1. Answers to test questions.

2. Solving situational tasks.

3. Filling in cards on the topic.

4. Answering oral questions.

Practical class №12

1.Topic. Cell cycle and molecular mechanisms of its regulation.

2.Objective: to study the concept and main stages of the cell cycle and mechanisms of its molecular regulation, apoptosis and carcinogenesis.

3.Learning objectives: the student should know the periodisation of the cell cycle and the mechanisms of its molecular regulation; the phenomenon of apoptosis - programmed cell death and the role of protein p53 in its regulation; be able to give a clear and complete description of the processes occurring in each period of the cell cycle and explain the mechanisms of its regulation.

4. The main questions of the topic:

1. Periods of the cell cycle: G1, S, G2, M, G0; processes occurring during these periods.

Definition of the concept of cell cycle and mitotic cycle.

2. Types of cells with different abilities to divide:

- mitotic,

- irreversible postmitotic cells

- irreversible postmitotic cells.

4. Cell division - mitosis. Biological significance.

5. Atypical mitoses. Causes of occurrence and significance for medicine.

6. Cell cycle regulation: cyclins and cyclin-dependent kinases, their role in mitotic cycle regulation.

7. Mitosis-stimulating factor.

8. Mechanism of action of cyclin-sdk complexes:

- in G₁-period;

- in S and G₂-period;

- cell cycle checkpoints.

9. Regulatory role of p-53 protein;

10. General idea of the mechanism of apoptosis.

11. Types of apoptosis: "apoptosis-internal" and "apoptosis-on-command".

12. Mitochondrial factors of apoptosis and the role of p-53 protein.


13. Apoptosis and necrosis.

14. The role of apoptosis in immune system maturation and function;

15. Definition of the concept of carcinogenesis.

16. Genetic nature of carcinogenesis.

17. Carcinogenic factors.

ОҢТҮСТІК-ҚАЗАҚСТАН MEDISINA АКАДЕМИАСЫ «Оңтүстік Қазақстан медицина академиясы» АҚ	 SKMA -1979-	SOUTH KAZAKHSTAN MEDICAL ACADEMY АО «Южно-Казахстанская медицинская академия»
Department of biology and biochemistry	46/	
Methodical recommendations for practical lesson	p. 1 of 16	

18. Biological mechanisms of carcinogenesis.

5. Learning and teaching methods/techniques: Small group work, discussion of key issues, presentation

https://www.youtube.com/watch?v=Xh_RpIAaNBQ&feature=youtu.be cell cycle

6. Assessment methods/techniques: Testing, oral and written questioning

7. Literature: see appendix 1

8. Control:

1. Answering test questions.
2. Solving situational tasks.
3. Filling in cards on the topic.
4. Answering oral questions.

7. Literature: see appendix 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 highereducationalinstitutions 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 highereducationalinstitutions 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

ОҢТҮСТІК-ҚАЗАҚСТАН MEDISINA AKADEMIASY «Оңтүстік Қазақстан медицина академиясы» АҚ		SOUTH KAZAKHSTAN MEDICAL ACADEMY АО «Южно-Казахстанская медицинская академия»
Department of biology and biochemistry	46/	
Methodical recommendations for practical lesson	p. 1 of 16	

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