INTERNATIONAL HIGHER SCHOOL OF MEDICINE

Department of Natural Sciences Disciplines

SYLLABUS
Molecular Biology

2025-2026 academic years for
students of medical faculty
2nd course 4th semester, for 1st& 4th groups
2 credits (60 hours, including Auditory 36 hours, independent work: 24 hours)

Lecturer: **Associate professor, Ph.D. Kostritsyna Tatiana Vladimirovna**
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Venue:

Practical lessons: **Associate professor, Ph.D. Kostritsyna Tatiana Vladimirovna**
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Venue: № 419 of Administrative building IHSM, 4th floor

The Syllabus is considered
at the meeting of the department of Natural Sciences Disciplines
Protocol №2 dated 15.09.25
Head of the Department _____ Ch. S. Ismailova

Course Objective: It consists in mastering knowledge:

a) the subject of molecular biology,

b) basic methods of molecular biological and molecular genetic analysis,

c) the fundamentals of the biological realization of the human genotype at the molecular level. Also demonstrate knowledge of the principles of structural and functional organization of biological objects and mechanisms of homeostatic regulation;

d) to demonstrate basic concepts about the basic laws and modern advances in genetics, genomics, proteomics, and other new areas of molecular biology.

After study of the discipline the student must:

Knowledge:

- molecular basis of cell activity, organism, knowledge in the field of the mutations origins and mechanisms of genome stability.
- understanding of possible mechanisms of gene regulation in eukaryotes.
- modern methods and technologies of molecular biology used in medicine.

Skill:

- to be oriented by modern achievements of molecular biology and molecular genetics for the diagnosis and treatment of diseases, as well as the role of science in the development of biomedicine.
- to integrate modern achievements in molecular biology, cell and gene technology into the clinical thinking of future doctors.

Attitude:

- to apply knowledge of basic molecular biological mechanisms in professional activities
- to demonstrate knowledge of the principles of structural and functional organization of biological objects and mechanisms of homeostatic regulation;
- to demonstrate basic concepts of the basic laws and modern advances in genetics, genomics, proteomics, and other new areas of molecular biology.

Pre-requisites. For successful study of this discipline, the student must know the basic disciplines, such as: School General Biology, Medical Biology, Biochemistry, Histology, Microbiology, Virology, Immunology, Pathology.

Post-requisites: Systemic pathology, Internal diseases, Childhood illnesses, Surgical diseases, Obstetrics and Gynecology, Oncology, Evidence-based medicine, Family medicine.

THEMATIC PLAN OF LECTURES

№	Themes of lectures	Hours	Date
	1st UNIT		
1.	Introduction to Molecular biology. Perspectives and update trends. Central Dogma of Molecular biology.	2	1.09.25
2.	Structure & functions of nucleic acids. DNA Replication.	2	2.09.25
3.	Central dogma of molecular biology, expression of biological information: Transcription, Translation.	2	5.09.25
4.	Controlling of Gene Expression. Model of Operon. Regulation of An Expression Of Genes. Gene Regulation – Operon Concept, Gene Regulation - Repression	2	6.09.25
5.	Genetic Controll of Cell Cycle, Cyclins & Cyclin-dependent kinases. General mechanism of Cyclin-CDKs regulation.	2	6.09.25
	2nd UNIT		
6.	Molecular biology of Cancer. Classification of oncogenes, Warburg effect, Human oncogenic viruses.	2	8.09.25
7.	General Principles of Gene Technology. Molecular Tools for Studying Genes and Gene Activity.	2	12.09.25
8.	Applications DNA Technology: Recombinant DNA technology, Genetically modified organisms, use in basic and applied research.	2	13.09.25
9.	Methods of Cell & Gene therapy and genetic screening in Medicine. Embryo Cloning & Nuclear Transfer	2	13.09.25

THEMATIC PLAN OF PRACTICAL LESSONS

№	Theme of practical lessons	Hours	Date
	1st UNIT		
1.	Cellular Basis of Inheritance. Chromosome structure. Steps of cytogenetic analysis.	2	20.09.25 27.09.25
2.	DNA Repairing, Mutations, Classification & Problems of Mutagenesis	2	4.10.25 11.10.25
3.	Inborn Errors of Metabolism. Genetic errors of metabolism: main types, principles of detection of abnormalities.	2	18.10.25 25.10.25
4.	Problems of Cell Death and Apoptosis. Hayflick Limit.	2	1.11.25 8.11.25
5.	Summary of Cellular and Molecular basis of inheritance. Formative assessment & Questioning.	2	15.11.25 22.11.25
	2nd UNIT		
6.	Human Cytogenetics, Modern Trends of Molecular Cytogenetics.	2	29.11.25 06.12.25
7.	Gel Electrophoresis, Northern and Southern Blotting.	2	13.12.25 20.12.25
8.	Medical implications of Gene Technology Stem cell therapy	2	27.12.25 3.01.26.
9.	Small group discussion/assignment of projects, Group Presentation. Formative assessment & Questioning.	2	10.01.26 17.01.26

THEMATIC PLAN OF STUDENTS' INDEPENDENT WORKS

№	Themes of independent works	Hours	Date
	1st UNIT		
1.	Disorders of carbohydrate metabolism	12	20.09.25 22.11.25
2.	Disorders of amino acid metabolism		20.09.25 22.11.25
3.	Disorders of organic acid metabolism (organic acidurias)		20.09.25 22.11.25
4.	Disorders of fatty acid oxidation and mitochondrial metabolism		20.09.25 22.11.25
5.	Disorders of porphyrin metabolism		20.09.25 22.11.25
6.	Disorders of purine or pyrimidine metabolism		20.09.25 22.11.25
7.	Disorders of steroid metabolism		20.09.25 22.11.25
8.	Disorders of mitochondrial function		20.09.25 22.11.25
9.	Disorders of peroxisomal function		20.09.25 22.11.25
10.	**2nd UNIT**		
11.	Molecular biology and cancer nature.	12	29.11.25 17.01.26
12.	Modern theories of cancer origin.		29.11.25 17.01.26
13.	Cancer as point mutation and clonal evolution of cell.		29.11.25 17.01.26
14.	Diagnostic methods for mutations detection.		29.11.25 17.01.26
15.	Application of the molecularly-cytogenetic analysis for diagnosis and the prognosis of hereditary diseases.		29.11.25 17.01.26
16.	Application of modern methods of the molecularly-cytogenetic analysis (FISH) for prognosis and the therapy of cancer diseases.		29.11.25 17.01.26

17.	Major developments in gene therapy: Problems and ethics, In popular culture.		29.11.25 17.01.26
18.	The gene therapy and therapeutic cell cloning in medicine.		29.11.25 17.01.26
19.	Methods of somatic cell hybridization in biomedicine.		29.11.25 17.01.26
20.	The embryo cloning, embryonic steam & tissue steam cell therapy and ethical problems in biomedicine.		29.11.25 17.01.26
21.	Application of the molecularly-cytogenetic analysis to newborn screening tests and prenatal diagnosis**.**		29.11.25 17.01.26
22.	Polymerase Chain Reaction (PCR)-analysis in diagnostics of various infectious diseases.		29.11.25 17.01.26
23.	Application gel electrophoresis to diagnostics of hereditary diseases.		29.11.25 17.01.26
24.	Development and approaches of gene therapy of cardiovascular diseases and pathologies.		29.11.25 17.01.26
25.	Possible risks of usage of genetically modified organisms for human health, the agriculture, the forestry and the Nature.		29.11.25 17.01.26
26.	The gene technologies, the farm animals and medicine.		29.11.25 17.01.26
27.	The International Scientific Project «Human Genome»: main approaches and achievements . Formations of DNA & genomic libraries of the human and other species.		29.11.25 17.01.26
28.	Molecular diagnostics of the human hereditary mitochondrial diseases.		29.11.25 17.01.26
29.	Possible risks of usage of genetically modified organisms for human health, the agriculture, the forestry and the Nature.		29.11.25 17.01.26

Recommended reading for the discipline:

I. Basic literature:

1. Campbell N.A., Lawrence G. Mitchell, Jane B.Reece.. Biology: Concepts and connections 2017 10th edition Hardcover ISBN 10: 013429601X ISBN 13: 9780134296012 Publisher: Pearson

2. Methods of molecular biology and genetics in Medicine. Colleges// complied by Kostritsyna T.V. 2015 /Basal reader for senior students of University Medical - Bishkek

3. Hopson Janet L., Wessells Norman K. - McGRAW Essentials of BIOLOGY. 6th Edition © 2021View newer edition ISBN10: 1260087328 | ISBN13: 9781260087321 By Sylvia Mader, Michael Windelspecht

4. Dennis L.Kasher, Eugene Braunwald, Anthony fauci, J.L. Jameson Harrison's. Principles of Internal Medicine. 19th Edition , 14 November 2017 and Harrison's Manual of Medicine 19th Edition VAL PAK Hardcover – Import

II Additional literature:

1. Cornel Mülhardt and E.W. Beese, M.D. Cell, Molecular Biology and Genomics the Experimenter Series April 1, 2007 Edited by: Julio E. Celis, 2007, 2006, ISBN: 978-0-12-088546-6. 272 pages https://epdf.tips/molecular-biology-and-genomics4af83953d77eaf4e83289d818029c00b97550.html

Grading policy and procedures for all types of work

Rating of scores (standards of judgement)

Total score is 100 marks as maximal score, and consists of three parts:

Independence or self-doing work: score is 20 marks, (individual work – 20 MCQs);

Current score - 40 marks **Control score** – 40 marks ***Reduction scores rating:***

✓ Missed lecture and/or practice lesson is decreasing minus 2 marks of attendance score for 2 hours irrespective of reason.

✓ Being late to class reduces on 1 mark of attendance for each case.

Request to appearance: clean accurate doctor's uniform cloth (lab coat), Student with inappropriate appearance **will not be admitted** to lesson.

To taking module MOLECULAR BIOLOGY student must have:

A. Attendance of lectures and practical lessons will be >70% of total number lessons of current unit.

B. Regular and Positive marks of class activity (>20).

Passing of missed class is mandatory Student will have to prepare of review of missed lessons topics in copybook or separate hard copy essay

Requirements for the implementation of the review:

- ✓ Given with hard copy review
- ✓ Recitation in according general each particular item of missed lessons

Grading system for student's achievements

Grading criteria per discipline				
Maximum score	**Intervals**			
	«unsatisfactory»	**«satisfactory»**	**«good»**	**«excellent»**
Independent work -20 marks	**0-11**	**12-15**	**16-17**	**18-20**
Interval description	The student failed to fully review any of the independent work assignment questions (primary and/or secondary). The student refused to prepare the independent work assignment.	The student has mastered the required course material within the program, but the answers to the questions are not sufficiently comprehensive and accurate; the answers are based solely on data from the primary literature on the subject.	The student has studied the basic literature and he is known with the additional literature related to the program and uses this knowledge in their answers; when answering additional questions, the material is presented correctly, but without sufficient logical sequence; when answering, the student uses the necessary, carefully executed graphic material (diagrams, drawings, etc.). the instructor sometimes requires additional requests for clarifying answers	The student has studied the basic and additional literature on the discipline and competently uses the knowledge gained when answering; in the answers he uses course materials from related disciplines, provides various examples as justification; During the preparation process, he performs the necessary diagrams at a high level and uses them when responding; does not need any help from a teacher; He strives to independently replenish and update the knowledge necessary in his professional activity.
Current control 40 mih– 40 marks	**0-23**	**24-30**	**31-35**	**36-40**

Interval description	The student does not know a significant part of the program material, makes significant blunders; the main content of the material is not disclosed; poor knowledge of terminology; there is no necessary theoretical knowledge and the ability to apply them to solve practical problems. It will be also marked "unsatisfactory" if the student refuses to answer.	The student has mastered only the basic program material, but does not know individual features and details; admits inaccuracies; violates the sequence in the presentation of the program material; the material is not systematized, incorrectly formulated; speech is mostly literate, but poor; has a minimum sufficient level of competence; solves professional practical problems with errors, mainly justifies the decisions made	The student has demonstrated the formation of competencies, has a sufficient level of professional terminology; correctly, logically and essentially sets out the answer, doesn't allow significant errors and inaccuracies when answering questions, but the presentation is sufficiently systematic and consistent; when solving a practical problem, basically justifies the decisions made correctly.	The student has demonstrated the formation of competencies and can apply them in professional activities; exhaustively, consistently, competently and logically harmoniously presents the answer, without errors; the answer does not require additional questions; good speech, fluency in professional terminology; does not have difficulties in answering when changing assignments; knows how to solve professional practical tasks; correctly justifies the decisions, is able to summarize and present the material independently
Control score -40 marks	0-23	24-30	31-35	36-40
Interval descript	The student has identified gaps in his knowledge of the educational material provided by the program and cannot give clear answers to basic, additional, and leading questions.	The student has the necessary educational (study) knowledge within the framework of the program, but the answers to the questions are not complete and accurate enough; only data from the basic literature on the discipline is used in the answer.	The student fully discloses the educational (study) material provided by the program, small mistakes are made, inaccuracies that do not distort the content of the answers to the essence of the questions	The student presents the program material in a deep and complete manner at a high scientific level, answers all questions and additional queries with full understanding and without errors.

Conduct Policy: (lateness, absence, behavior in the auditorium, late submission of work).

Punctuality and completion of tasks.

- Mandatory attendance of classes.
- Attending class in a clean medical uniform.
- Eliminating conversations on a cell phone in the classroom.
- Active participation in the learning process.
- Doing homework on time.
- Academic detention at the time specified by the teacher.

For violations of the Conduct Policy, the total points for discipline might be reduced to 1-10 points.

Academic Ethics Policy.

- Be tolerant, respect the opinions of others.
- Formulate objections in the correct form.
- Constructively support feedback in all classes.
- Plagiarism and other forms of dishonest work are unacceptable. Plagiarism includes the following: the absence of references when using printed and electronic materials, quotes, thoughts and works of other authors or students.
- Prompting and cheating during tests, exams, classes is unacceptable as well as passing an exam for another student, unauthorized copying of materials.

For violations of the Academic Ethics Policy, the total points for the discipline may be reduced to 1-10 points.

GUIDELINES FOR THE LESSONS OF THE DISCIPLINE

THEME 1. INTRODUCTION TO MOLECULAR BIOLOGY. PERSPECTIVES AND UPDATE TRENDS. CENTRAL DOGMA OF MOLECULAR BIOLOGY.

Key questions covered in lesson № 1 (*Lecture)*

1. History of basis and development of science – Molecular biology.
2. The role of molecular biology in interdisciplinary scientific research. Recommended reading for the discipline:

[2] Methods of molecular biology and genetics in Medicine. Colleges// complied by Kostritsyna T.V. 2015// P.7-10

[3] Hopson Janet L., Wessells Norman K. - McGRAW Essentials of BIOLOGY. P. 63-89

[4] Dennis L.Kasher, Eugene Braunwald, Anthony fauci, J.L. Jameson Harrison's. Principles of Internal Medicine. P. 54- 56

Key questions covered in lesson №2 (*Practice)*

1. Cellular Basis of Inheritance. Cell divisions: Binary Fission, Mitosis, Meiosis.
2. Chromosome structure & morphology.
3. Steps of cytogenetic analysis. Romanovsky-Giemsa staining. Recommended reading for the discipline:

[2] Methods of molecular biology and genetics in Medicine. Colleges// complied by Kostritsyna T.V. 2015//P.7-10

[3] Hopson Janet L., Wessells Norman K. - McGRAW Essentials of BIOLOGY. P. 63-89

[4] Dennis L.Kasher, Eugene Braunwald, Anthony fauci, J.L. Jameson Harrison's. Principles of Internal Medicine. P. 54-56

THEME 2. STRUCTURE AND FUNCTION OF NUCLEIC ACIDS. DNA REPLICATION.

Key questions covered in lesson № 3 (*Lecture).*

1. Structure and function of nucleic acids.
2. Process of DNA replication. Recommended reading for the discipline:

[1] Campbell N.A. , Lawrence G. Mitchell, Jane B.Reece.. Biology: Concepts and connections. P. 360-361.

23] Methods of molecular biology and genetics in Medicine. Colleges// complied by Kostritsyna T.V. 2015 //P.10-11

[3] Hopson Janet L., Wessells Norman K. - McGRAW Essentials of BIOLOGY. P. 83-89, 281-293

45] Dennis L.Kasher, Eugene Braunwald, Anthony fauci, J.L. Jameson Harrison's. Principles of Internal Medicine. P. 200-213

Key questions covered in lesson № 4 (*Practice)*–

1. Classification of mutations: point mutations, frameshift mutations.
2. Classification of mutagens.
3. DNA mistakes. Mechanisms of DNA reparation. Recommended reading for the discipline:

[1] Campbell N.A. , Lawrence G. Mitchell, Jane B.Reece.. Biology: Concepts and connections //P. 368-369

[2] Methods of molecular biology and genetics in Medicine. Colleges// complied by Kostritsyna T.V. 2015//P. 14- 16

[3] Hopson Janet L., Wessells Norman K. - McGRAW Essentials of BIOLOGY. //P. 281-297

[4] Dennis L.Kasher, Eugene Braunwald, Anthony fauci, J.L. Jameson Harrison's. Principles of Internal Medicine. P. 209-213

THEME 3. THE CENTRAL DOGMA OF MOLECULAR BIOLOGY. TRANSCRIPTION - TRANSLATION – SYNTHESIS OF PROTEIN. POSTTRANSLATIONAL MODIFICATION OF PROTEIN PRODUCTS

Key questions covered in lesson № 5 (*Lecture)*

1. RNA transcription. Protein factors in pro- and eukaryotes. Splicing of eukaryotes
2. Genetic code. Translation of proteins
3. Posttranslational modification of protein

products. Recommended reading for the discipline:
[1] Campbell N.A. , Lawrence G. Mitchell, Jane B.Reece.. Biology: Concepts and connections//P. 361-362.
[3] Hopson Janet L., Wessells Norman K. - McGRAW Essentials of BIOLOGY. //P. 297-314
[4] Dennis L.Kasher, Eugene Braunwald, Anthony fauci, J.L. Jameson Harrison's. Principles of Internal Medicine. // P. 215-227

Key questions covered in lesson № 6 (*Practice)*

1. Inborn Errors of Metabolism. Historical review, explanation of terminology.
2. Basic principles of hereditary monogenic diseases classification.
3. A scientific understanding of the molecular mechanisms of the hereditary diseases development and occurrence. DNA repair disorders. Mitochondrial dysfunction.

Recommended reading for the discipline:
[2] Campbell N.A. , Lawrence G. Mitchell, Jane B.Reece.. Biology: Concepts and connections //P. 364, 374-375.
[3] Hopson Janet L., Wessells Norman K. - McGRAW Essentials of BIOLOGY. // P. 314-323
[4] Dennis L.Kasher, Eugene Braunwald, Anthony fauci, J.L. Jameson Harrison's. Principles of Internal Medicine. //P. 264-267

THEME 4. CONTROLLING OF GENE EXPRESSION. MODEL OF OPERON. REGULATION OF AN EXPRESSION OF GENES.

Key questions covered in lesson № *7 (Lecture).*

1. Regulation of gene expression in prokaryotes.
2. Regulation of gene expression in eukaryotes.
3. Exon/intron structure of eukaryotic genes.
4. Splicing of eukaryotic genes. Multigene families. Recommended reading for the discipline:

[2] Campbell N.A. , Lawrence G. Mitchell, Jane B.Reece.. Biology: Concepts and connections //P. 363.
[3] Hopson Janet L., Wessells Norman K. - McGRAW Essentials of BIOLOGY. //P. 351-360
[4] Dennis L.Kasher, Eugene Braunwald, Anthony fauci, J.L. Jameson Harrison's. Principles of Internal Medicine. //P. 234-241

Key questions covered in lesson № *8 (Practice).*

1. Problems of Cell Death and Apoptosis.
2. Apoptosis and its role in the body. The role of p53.
3. Cell cycle. Regulation. Necrosis. Apoptosis. Oncogenesis.
4. The main theories of aging, their molecular and genetic mechanisms
5. Hayflick Limit. Mechanisms of cellular aging. Recommended reading for the discipline:

[1] Campbell N.A., Lawrence G. Mitchell, Jane B.Reece.. Biology: Concepts and connections //P.1907, 1023.
[3] Hopson Janet L., Wessells Norman K. - McGRAW Essentials of BIOLOGY.// P.978-986
[4] Dennis L.Kasher, Eugene Braunwald, Anthony fauci, J.L. Jameson Harrison's. Principles of Internal Medicine. // P. 295.

THEME 5. CELL CYCLE CONTROL SYSTEM. CYCLINS AND CYCLIN-DEPENDENT KINASES. GENERAL MECHANISM OF CYCLIN - CDK REGULATION.

Key questions covered in lesson № 9 (*Lecture)* .

1. Overview of the biological regulation of the cell cycle: Cell cycle control system.
2. Cyclins and Cyclin-dependent kinases.
3. General mechanism of cyclin - CDK interaction.

a) Cell cycle checkpoints:

- G2/S (restriction) control point
- point of control
- G2 checkpoint
- Metaphase as a control point during the cell cycle

4. Cancer and cell cycle regulation. Recommended reading for the discipline:

[1]. Campbell N.A. , Lawrence G. Mitchell, Jane B.Reece.. Biology: Concepts and connections //P.1924-1927
[3] Hopson Janet L., Wessells Norman K. - McGRAW Essentials of BIOLOGY // P.214-217, 980

Key questions covered in lesson № 10 (*Practice).*

1. Summary of Cellular and Molecular basis of inheritance.
2. Formative assessment & Questioning.

Testing Recommended reading for the discipline:
[1] Campbell N.A. , Lawrence G. Mitchell, Jane B.Reece.. Biology: Concepts and connections// P.1924-1927
[3] Hopson Janet L., Wessells Norman K. - McGRAW Essentials of BIOLOGY. //P.214-217, 980

THEME 6. MOLECULAR BIOLOGY OF CANCER.

Key questions covered in lesson № 11 (*Lecture)*

1. General overview: main groups of oncogenes. Oncogenes. It's role in Cancerogenesis.
2. Proto-oncogenes and Tumor suppressor genes. Genes, responsible for DNA repairing
3. Human viruses and cancer. Viral theory of cancer.
4. Some features of the cancer cells metabolism, the Warburg

effect Recommended reading for the discipline:

[1] Campbell N.A., Lawrence G. Mitchell, Jane B.Reece.. Biology: Concepts and connections //P.486-488, 447-453

[3] Hopson Janet L., Wessells Norman K. - McGRAW Essentials of BIOLOGY. // P. 217-218.

[4] Dennis L.Kasher, Eugene Braunwald, Anthony fauci, J.L. Jameson Harrison's. Principles of Internal Medicine. //P. 302-304, 355

Key questions covered in lesson № 12 (*Practice)* .

1. Review of modern methods of human molecular cytogenetics: (FISH method), its modifications

Molecular- cytogenetic analysis of human genome.

2. FISH method for chromosomes abnormalities analysis at metaphase and interphase stages.
3. Medical application Human genome project. Modifications of FISH hybridization methods.

Recommended reading for the discipline:

[1] Campbell N.A. , Lawrence G. Mitchell, Jane B.Reece.. Biology: Concepts and connections //P. 378-381.

[2] Methods of molecular biology and genetics in Medicine. Colleges// complied by Kostritsyna T.V. 2015 //P. 46- 53

[3] Hopson Janet L., Wessells Norman K. - McGRAW Essentials of BIOLOGY. //P. 384-385

[4] Dennis L.Kasher, Eugene Braunwald, Anthony fauci, J.L. Jameson Harrison's. Principles of Internal Medicine. //P. 247-249.

THEME 7. GENERAL PRINCIPLES OF GENE TECHNOLOGY. MOLECULAR TOOLS FOR STUDYING GENES AND GENE ACTIVITY.

Key questions covered in lesson № 13 (*Lecture)* .

1. Genetic engineering: an overview. Main stages:
2. Enzymes, applied in molecular methods: DNA – polymerases, DNA – ligases, endonucleases,

restriction enzymes.

3. Isolation of DNA and mRNA (genes of interest) from the donor species (organisms).
4. Cloning of cDNA. Genome libraries. Vectors.
5. Application of genetic engineering

methods. Recommended reading for the discipline:

[1] Campbell N.A. , Lawrence G. Mitchell, Jane B.Reece.. Biology: Concepts and connections// P. 364-362, 451.

[2] Methods of molecular biology and genetics in Medicine. Colleges// complied by Kostritsyna T.V. 2015 //P. 23-29

[3] Hopson Janet L., Wessells Norman K. - McGRAW Essentials of BIOLOGY. //P. 369-375

Key questions covered in lesson № 14 (*Practice)*

1. Polymerase chain reaction. Steps and procedure. PCR analysis of Human genome.
2. Gel electrophoresis. Documentation of results.
3. DNA microarrays. Fingerprinting method. Southern and Northern

blotting. Recommended reading for the discipline:

[1]. Campbell N.A., Lawrence G. Mitchell, Jane B.Reece.. Biology: Concepts and connections //P.365, 378.

[2] Methods of molecular biology and genetics in Medicine. Colleges// complied by Kostritsyna T.V. 2015 //P.31- 36

[3] Hopson Janet L., Wessells Norman K. - McGRAW Essentials of BIOLOGY. //P. 376-396

[4] Dennis L.Kasher, Eugene Braunwald, Anthony fauci, J.L. Jameson Harrison's. Principles of Internal Medicine. //P. 708-710.

THEME 8. APPLICATIONS DNA TECHNOLOGY: RECOMBINANT DNA TECHNOLOGY, GENETICALLY MODIFIED ORGANISMS, USE IN BASIC AND APPLIED RESEARCH.

Key questions covered in lesson № 15 (*Lecture)*

1. DNA Technology: Medical implications of Gene Technology Stem cell therapy DNA Technology:

DNA Sequencing

2. Targeted gene transfer technologies: an overview.
3. Medicine and genetic engineering. Human Genome Project.
4. Gene therapy: main types. Gene therapy is like human genetic engineering.
5. Application of genetic engineering in industry and

agriculture. Recommended reading for the discipline:

[1] Campbell N.A. , Lawrence G. Mitchell, Jane B.Reece.. Biology: Concepts and connections// P.365, 378

[2] Methods of molecular biology and genetics in Medicine. Colleges// complied by Kostritsyna T.V. 2015 // P.39-43

[3] Hopson Janet L., Wessells Norman K. - McGRAW Essentials of BIOLOGY. //P. 376-396

Key questions covered in lesson № 16 (*Practice)*

1. Medical implications of Gene Technology Stem cell therapy.
2. Application of gene technologies and gene therapy in clinical medicine.
3. Vectors in gene therapy: virus and non-virus methods, hybridom method.
4. Gene therapy of hemophilia, kidney's diseases

and etc. Recommended reading for the discipline:

[1] Campbell N.A., Lawrence G. Mitchell, Jane B.Reece.. Biology: Concepts and connections //P.392, 482, 597, 1073.

[2] Methods of molecular biology and genetics in Medicine. Colleges// complied by Kostritsyna T.V. 2015// P. 23-26

[3] Hopson Janet L., Wessells Norman K. - McGRAW Essentials of BIOLOGY. //P. 384-388

[4] Dennis L.Kasher, Eugene Braunwald, Anthony fauci, J.L. Jameson Harrison's. Principles of Internal Medicine. //P. 248, 263-266

THEME 9. METHODS OF CELL & GENE THERAPY AND GENETIC SCREENING IN MEDICINE.

Key questions covered in lesson №17 (*Lecture)*

1. General review about artificial genetic systems, methods of molecular cloning; methods of creating transgenic animals, knockout animals.
2. Basic methods of genetic engineering of cultured animal cells. Embryonic stem cells in genetic engineering.
3. Application of different types of stem cells in the cell therapy.

Recommended reading for the

[1] Campbell N.A. , Lawrence G. Mitchell, Jane B.Reece.. Biology: Concepts and connections //P. 393-395.

[2] Methods of molecular biology and genetics in Medicine. Colleges// complied by Kostritsyna T.V. 2015 //P. 54-56

[3] Hopson Janet L., Wessells Norman K. - McGRAW Essentials of BIOLOGY. //P. 981

[4] Dennis L.Kasher, Eugene Braunwald, Anthony fauci, J.L. Jameson Harrison's. Principles of Internal Medicine //P. 283, 528-529

Key questions covered in lesson № 18 (*Practice)*

1. Presentations of students' projects. Small group discussion/assignment of projects
2. Passing of Unit №2. General review: Methods of molecular genetic analysis, gene and cell therapy Recommended reading for the discipline:

[1] Campbell N.A., Lawrence G. Mitchell, Jane B.Reece.. Biology: Concepts and connections //P. 393-395.

[2] Methods of molecular biology and genetics in Medicine. Colleges// complied by Kostritsyna T.V. 2015 //P. 54-56

[3] Hopson Janet L., Wessells Norman K. - McGRAW Essentials of BIOLOGY. //P. 981

[4] Dennis L.Kasher, Eugene Braunwald, Anthony fauci, J.L. Jameson Harrison's. Principles of Internal Medicine. //P. 283, 528-529

METHODOLOGICAL INSTRUCTIONS FOR THE IMPLEMENTATION OF INDEPENDENT WORK on elective course MOLECULAR BIOLOGY

The basis of independent work of students is systematic, purposeful and thoughtful reading of recommended literature. It is necessary to read what is recommended for each topic by the curriculum, seminar plans, other teaching materials, as well as by teachers. The basic literature includes the minimum of sources that is necessary for the complete and solid development of educational material.

Additional literature is recommended for a more in-depth study of the program material, expanding the horizons of the student. It is necessary to read literature systematically, according to the plan, correctly allocating time. Working with sources requires to:

1) focus on what you are reading;
2) highlight the main thoughts;
3) "embrace the thought" of the author quite clearly and distinctly, which helps to develop clarity and distinctness of your own thoughts;
4) think consistently;
5) imagine vividly and distinctly, as if experiencing what you read in the source;
6) consult with the instructor if facing difficulties during fulfilling practical tasks or something is not clear.

How to prepare an ESSAY (abstract)? It is worth following the order of preparation, which consists of several stages:

1. Choose and formulate a topic.
2. Find information sources.
3. Work out the basic materials.
4. Systematize the data obtained.
5. Make a detailed work plan.

6. Think over the content of each part.
7. Clarify how to issue an ESSAY (abstract) according to **INSTRUCTIONS**.

The plan corresponds to the structure of the work and consists of the following points:

- **INTRODUCTION;**
- **THE MAIN PART;**
- **CONCLUSIONS;**
- **LIST OF REFERENCES;**
- **APPLICATIONS** (If Any).

What should be the design of the ESSAY (abstract)?

The ESSAY (abstract) is made out in typewritten form on A4 sheets, font 14 pt, line spacing – 1.5. The volume of the abstract is 8-10 pages. On the title page in the center is the topic of the abstract, department name, on the right under the topic is the surname and initials of the student (course and group number), surname and initials of supervisor, the on the bottom in the center is the place and year of writing the abstract.

In conclusion it may be said: Independent work of students is an integral part of training and aims to consolidate and deepen the acquired knowledge, skills and abilities, search for and acquire new knowledge, perform training tasks, prepare for upcoming classes, ongoing monitoring of academic performance and intermediate certification.