1. The work program of the academic discipline

1.1. Explanatory note

• **The mission of ISM MUK** is to train competent specialists in the field of medicine that meet international standards and traditions of medical ethics, ready for continuous professional growth using modern achievements of science and practice, to solve public health problems.

• **Annotation of the discipline** - Teaching this subject is built on the systematic study of the laws and regulations of heredity and variability at the molecular level. "Molecular Biology" is a basic subject, preparing for the study of hereditary diseases in subsequent courses.
The program is designed for theoretical and practical training of qualified specialists The study of "Molecular Biology" at medical faculties is relevant in connection with the increase in recent years of hereditary diseases, as well as the relevance of the development of genetic engineering and biotechnology.

• Purpose and objectives of the discipline - The purpose of the course "Molecular Biology" is the formation of fundamental systemic knowledge, skills and abilities on general biological and genetic laws at the molecular level, which is of greatest interest for practical health care. Due to advances in molecular biology and breeding.

Discipline objectives:
To study the main approaches to the organization and functioning of living systems and the general properties of living things;

To acquaint with the experience of applying general patterns of transmission and changes in hereditary traits and properties in generations, their role in hereditary human pathology;

Form ideas about**;**
- the subject and tasks of genetics
- the role of genetic laws in the inheritance of traits.

To be able to apply the laws of inheritance to determine the likelihood of the appearance of normal and pathological traits in the genotype and their manifestation in the phenotype, to predict the likelihood of developing hereditary diseases in humans using examples of solving genetic problems: master development skills
Develop competencies, professional qualities
Master the skills of developing genetic problems:

• Place of discipline in the structure of the PLO

This discipline is studied by students of the specialty 560001 General Medicine and is included in the compulsory scope of the studied disciplines of the State Educational Institution of Higher Professional Education.

Prerequisites; Medical biology with the basics of ecology, antomy, chemistry, physiology, histology.

Post-requisites; pathological physiology, pathological anatomy, medical genetics, pediatrics, therapy, obstetrics and gynecology.

• Competencies of students, formed as a result of mastering the discipline, the planned results of mastering the discipline -

- A graduate in the specialty "General Medicine" with the qualification of a specialist (doctor) in accordance with the goals of the PLO and the tasks of professional activity, must have the following professional competencies: IK1, PK32, PK33

IK-1 - capable and ready to work with computer hardware and software for system and applied purposes for solving professional problems;

PK-32 - capable and ready to plan and conduct scientific research;

PC-33 - capable and ready to introduce new methods and techniques aimed at protecting public health.

After mastering this discipline, the student:

Will know;

• Basic biological terminology;

• Basics of cytology; Prokaryotic and non-cellular life forms

• Basics of genetics;

Will understand;

• Biological terminology to explain the meaning and significance of basic concepts, laws and patterns of molecular biology;

Will be able to use;

• Laws of genetics for solving genetic problems;

• Skills of calculating genetic patterns and solving problems;

• Skills of working with devices;

• Primary skills of scientific research, describing the results of the experiment and obtaining conclusions;

• skills of searching for scientific information in the library fund and via the Internet.

Will be able to exercise .;

• Experiment in accordance with the guidelines for laboratory work;

• Independent work;

Will be able to analyze;

• Questions, build your own statement on the studied topic, give a general description of the biological system or object;

Will be able to evaluate, structure, generalize and systematize the collected scientific material for writing an abstract, preparing a presentation and an oral report

1.2. Recommended educational technologies

For the development of students of the academic discipline "Molecular Biology", the acquisition of knowledge and the formation of professional competencies, the following educational technologies are used:

- lecture with elements of discussion, problem statement;
- lectures - electronic presentations;
- analysis of specific situations;
- role-playing game, etc.

1.3. The scope of the discipline and types of educational work

Full-time form of education

According to the curriculum for 2021	**2 semes.**	**Total**	
		in hours	**in credits**
According to the curriculum for 2021, 2 semes. Total	**90**	**90**	**3**
Total labor intensity	54		
Classroom work	18		
Lectures	36		
Practical lessons	18		
Seminars	18		
Laboratory works	18		
Independent work	18		
IWSP			
Test papers			
Final control type	**exame**		

1.4. Структура дисциплины

1.4.1. Тематический план изучения дисциплины (по семестрам)

№	Name sections and topics disciplines (lectures and workshops	Classroom lessons				Classroom lessons Total hours per	SRSP	Student independent work	Formable Competencies	Used educational technologies, methods and methods of teaching	Forms of current and midterm control academic performance
		lectures	seminars	practical classes	laboratory works						
	Module 1										
1	*1 Topic 1 Cytology. Basic concepts*	*2*		2		4	2	4	*ИК-1 ПК-33.*	*lecture using video materials*	*test*
2	*Topic2 Eukaryotes and prokaryotes.*	2		2		4	2	4	*ИК-1 ПК-32, ПК-33*	*lecture-visualization*	*Test tasks*

3	*Topic 3 Cellular inclusions*	2		2		4	2	4	*ИК-1 ПК-32,*	*classes using simulators, simulators*	*Theoretical survey ....*
4	*Topic 4 Metabolism*	2		2		4	2	4	*ИК-1 ПК-32, ПК-33*	*Lecture-debate.*	*Interview on th situation. tasks*
	Module 2										
5	*Topic 5 History of the development of genetics. Mendel's laws*	2		2		4	2	4	*ПК-32, ПК-33*	*Lecture - "round table"*	*test*
6	*Topic 6 Variability. Patterns of inheritance of traits at the molecular level.*	2		2		4	2	4	*ИК-1 ПК-32,*	*lecture-visualization*	*Test tasks*
7	*Topic 7 Chromosomal and genomic levels of organization of hereditary material*	2		2		4	2	4	*ИК-1 ПК-32, ПК-33*	*Lecture-discussion of the forum type*	*Theoretical survey ..*
8	*Topic 8 Methods for studying the inheritance of traits*	2		2		4	2	4	*ИК-1 ПК-33*	*традиционная лекция traditional.*	*lecture Intervie on the situatio tasks*
9	*Topic 9 Types of transmission of hereditary traits. Hereditary diseases*	2		2		4	2	4	*ПК-32, ПК-33*	*Lecture with an analysis of clinical cases*	*Test tasks ..*
	Total hours by discipline	18		18			18	36			

1.4.2Organization of students' independent work

№	Topics of students' independent work	Assignment for IWS	Recommended blown	Liter Deadline (week)	Max ball
1	Basics of cytology. Eukaryotes, prokaryotes	Abstract	PDF Lectures 1.Med.biology Navigator for information resources. http: //www.spsl.nsc. 2.ru/win/nelbib/biolog/pricl.biology.htm 3. Educational resource of the Internet. Med Biology. http://www.alleng.ru./edu/biolog 2.htm	**1,2**	**10**
2	Organelles. Structure.	Essay function. Laboratory work.	PDF Lectures 1.Med.biology Navigator for information resources. http:	**3,4**	**10**

			//www.spsl.nsc. 2.ru/win/nelbib/biolog/pricl.biology.htm 3. Educational resource of the Internet. Med Biology. http://www.alleng.ru./edu/biolog 2.htm		
3	Microelements. Macronutrients	Abstract	Lab PDF Lectures 1.Med.biology Navigator for information resources. http: //www.spsl.nsc. 2.ru/win/nelbib/biolog/pricl.biology.htm 3. Educational resource of the Internet. Med Biology. http://www.alleng.ru./edu/biolog 2.htm	**5,6**	**10**
4	Metabolism and energy	Abstract	PDF Lectures 1.Med.biology Navigator for information resources. http: //www.spsl.nsc. 2.ru/win/nelbib/biolog/pricl.biology.htm 3. Educational resource of the Internet. Med Biology. http://www.alleng.ru./edu/biolog 2.htm	**7,8**	**10**
5	History of the development of medical genetics and molecular biology Chromosomal and genomic level of heredity	Essay. Laboratory work	PDF Lectures 1.Med.biology Navigator for information resources. http: //www.spsl.nsc. 2.ru/win/nelbib/biolog/pricl.biology.htm 3. Educational resource of the Internet. Med Biology. http://www.alleng.ru./edu/biolog 2.htm	**9,10**	**10**
6	Laws of heredity	Essays. Laboratory work	PDF Lectures 1.Med.biology Navigator for information resources. http: //www.spsl.nsc. 2.ru/win/nelbib/biolog/pricl.biology.htm 3. Educational resource of the Internet. Med Biology. http://www.alleng.ru./edu/biolog 2.htm	**11,12**	**10**
7	Molecular genetic level of heredity	Essays. Laboratory work	PDF Lectures	**13,14**	**10**
8	Mendel's laws	Essays.	PDF Lectures	**15,16**	**10**

		Laboratory work.	1.Med.biology Navigator for information resources. http: //www.spsl.nsc. 2.ru/win/nelbib/biolog/pricl.biology.htm 3. Educational resource of the Internet. Med Biology. http://www.alleng.ru./edu/biolog 2.htm		
9	Типы наследования признаков. Types of inheritance of traits	Essays. Laboratory work.	PDF Lectures 1.Med.biology Navigator for information resources. http: //www.spsl.nsc. 2.ru/win/nelbib/biolog/pricl.biology.htm 3. Educational resource of the Internet. Med Biology. http://www.alleng.ru./edu/biolog 2.htm	**17,18**	**10**

1.4.3. Evaluative Assessment Tools

• Current and milestone (modular) control

The current control of students' knowledge can be:

- oral questioning;
- solving situational tasks;
- assessment of the development of practical skills on dummies;
- control task; test;
- checking the completion of written homework;
- checking abstracts, reports, presentations.

Topics of abstracts (reports, presentations):

Section "Cytology"

1. Medical biology as a science.
2. Definition of the concept of life at the present level of development of biological science. Forms and basic properties of living things.
3. Levels of life organization, their importance for medicine.
4. Cell theory, its current state and importance for medicine. General plan of the structure of the cell.
5. A cell is an elementary structural and functional unit of living things. Pro - and eukaryotic cells.
6. Methods for studying the structure and functioning of cells.
7. The chemical composition of the cell.
8. Cytoplasm. cell organelles
9. Organelles of movement. Inclusions.
10. Cell membranes: chemical composition, structure and function.

11. Membrane transport, its medical significance.
12. The cell as an open system. Organization of flows of substances and energy in the cell. Energy supply of the cell.
13. The structure and functions of the kernel.
14. Chromatin: levels of organization (packaging) of hereditary material. Sex chromatin.
15 The place and tasks of biology in the training of a doctor

Section "Molecular Biology"
1. Chemical composition, features of chromosome morphology. The dynamics of their structure in the cell cycle (interphase and metaphase chromosomes).
2. Polytene chromosomes.
3. Human karyotype.
4. Morpho-functional characteristics and classification of human chromosomes.
5. The importance of studying the karyotype in medicine.
6. Molecular level of organization of hereditary information.
7. Organization of the genome of pro - and eukaryotes.
8. Organization of the flow of information in the cell.
9. Genetic code, its properties.
10. The main stages of protein biosynthesis in the cell. Transcription.
11. Broadcast: initiation, elongation, termination.
12 Realization of genetic information in pro - and eukaryotes. Exon-intron organization of genes in eukaryotes ..
13. Features of the regulation of gene expression in pro - and eukaryotes.
14. Nucleic acids, their structure and function.
15. Genes structural, regulatory, synthesis of tRNA and rRNA. 16. Mobile genetic elements.
17. DNA replication, its meaning.
18. Self-correction and DNA repair.
19.Post-translational transformations of proteins - the basis of their functioning.
20.Processing, splicing

• Final (formative) control

Control questions;

1. Biology: definition, the current stage of development of biology, the place and tasks of biology in the system of training a doctor.
2. Definition of the concept of "life and properties of living things." Levels of organization of the living.
3. Creation of cell theory and its main provisions.
4. Pro - and eukaryotes. The main features of their structure (examples).
5. Cytoplasm. Chemical composition, physical and chemical properties, structural organization. Cytoskeleton.

6. Structure and function of general purpose organelles: endoplasmic reticulum, Golgi complex, lysosomes, peroxisomes, mitochondria, plastids, ribosomes, cell center, microtubules. Organoids for special purposes.
7. The structure and functions of the kernel.
8. Composition, structure, properties and functions of cell membranes.
9. Types of passive and active membrane transport. Osmosis, osmotic properties of cells, dialysis.
10. The concept of the life, cellular and mitotic cycles of a cell. Interphase, types of interphases. Periods of autosynthetic interphase.
11. Mitosis. Its essence, phases, biological significance. Amitosis.
12. Meiosis. Stages, biological significance.
13. Gametogenesis: ovo - and spermatogenesis.
14. Chromosomes. Their chemical composition, supramolecular organization (levels of DNA packing).
15. Features of the structure of interphase chromosomes. Their function. The concept of chromatin, types of chromatin. Sex chromatin.
16. Polytene chromosomes. Endomitosis.
17. Features of the structure of metaphase chromosomes. Types of chromosomes. Chromosome set. Chromosome rules.
18. Human karyotype. Its definition. Karyogram, the principle of compilation. The idiogram, its content.
19. Denver classification of chromosomes and their Paris nomenclature.
20. Protein biosynthesis. Transcription, processing, broadcasting.
21. DNA. Structure, properties, code system.
22. Genetics as a science. Basic concepts of genetics: heredity, variability; allelic genes, homo- and heterozygotes; signs - dominant, recessive, alternative; genotype, phenotype; Mendelian signs.
23. Hybridological method, its essence. Crossing types - mono- and polyhybrid, analyzing. Their essence.
24. Mendel's laws based on monohybrid crossing. Schedule the experiment.
25. The hypothesis of gamete purity, its cytological substantiation.
26. Mendel's law based on dihybrid crossing. Schedule the experiment.
27. Chromosomal mechanism of sex determination.
28. Linked inheritance, crossing over, determination of the distance between genes in an experiment with fruit flies. Linkage groups, chromosome maps.
29. Sex-linked inheritance. Describe examples.
30. The main provisions of the chromosomal theory of T. Morgan.

31. Interaction of allelic genes: complete and incomplete dominance, overdominance, codominance, allelic exclusion. Examples.
32. The specificity of the manifestation of genes in a trait - expressiveness, penetrance, pleiotropy, genocopy.
33. Multiple allelism. Human blood groups according to the ABO system (genotypes, phenotypes, inheritance, transfusion rules)

34. Interaction of non-allelic genes - complementarity, epistasis, polymerization. Examples.
35. Rh factor. Its phenotypic manifestation, patterns of inheritance, the effect of the position of genes. Blood transfusion rules, taking into account Rh-affiliation. The essence of the Rh-conflict between the body of the mother and the fetus.
36. Variability. Definition, forms of variability.
37. Mutations. Their classification.
38. Gene mutations. Chromosomal mutations: aberrations, genomic mutations.
39. Mutagens of the environment. The consequences of mutations for humans. Anti-mutational barriers.
40. Combinative variability. Its sources, meaning. Marriage systems in human populations.
41. Modification variability. Reaction rate. Phenocopies.
42. Definition of the concept of "gene". Gene classification. The current state of gene theory.
43. Regulation of gene activity (gene expression) in pro- and eukaryotes.
44. Reparation of genetic material - types of reparations. Cytoplasmic inheritance.
45. Reproduction is a universal property of living things. Asexual and sexual reproduction, their forms. Parthenogenesis.
46. Phylogenesis of the circulatory system in invertebrates, lower and higher chordates (vertebrates)

47. Phylogenesis of arterial arches and development of the heart in vertebrates and some phylogenetically determined malformations of the cardiovascular system.
48. Phylogenesis of the excretory system in vertebrates, some phylogenetically determined defects of its development.
49. Characteristics of the types of the nervous system in animals that have developed in the process of evolution. Phylogenesis of the brain in vertebrates.
50. Phylogenetically developed types and forms of the immune response. Characteristics of the features of the immune system of vertebrates.
51. Ontogenesis, its types and periodization.
52. General characteristics of the prezygous period, the stage of embryonic development. Critical periods. Teratogenic factors.
53. The main mechanisms of embryogenesis.
54. Postembryonic periods of ontogenesis in humans (juvenile, pubertal, adolescent, mature, elderly, senile). Their morphological and functional features. The concept of acceleration.
55. Morphological characteristics of aging processes. Aging theories. The concept of gerontology and geriatrics.
56. Human genetics. Definition. Section of medical genetics. Man as a specific object of genetic analysis.
57. Medical genetic counseling. The main stages of medical genetic counseling.
58. Methods of human genetics: genealogical, twin, cytogenetic, population-statistical, biochemical, dermatoglyphics, ultrasound diagnostics and amniocentesis.

59. Hereditary diseases, their classification. Chromosomal diseases. Reasons, classification.
60. Hereditary diseases associated with a change in the number of autosomes: Down's disease, Edwards syndrome, Patau. Reasons, clinic, diagnostics.
61. Hereditary diseases caused by a change in the number of sex chromosomes: Klinefelter, Shereshevsky-Turner syndromes, trisomy on the X chromosome, polysomy on the Y chromosome; UO karyotype. Reasons, clinic, diagnostics.
62. Diseases caused by chromosomal aberrations: the "cry of a cat" syndrome, "Philadelphia" chromosomes, a translocation form of Down's disease, Martin-Bell syndrome. Reasons, clinic, diagnostics.
63. The concept of molecular diseases, their causes, diagnostic methods and screening.
64. The main human gene diseases.
65. The main provisions of the evolutionary teachings of Charles Darwin. Evidence for evolution (comparative anatomical, embryological).
66. The value of genetics for the development of evolutionary teaching: genetics and Darwinism; synthetic theory of evolution - basic provisions.
67. Elementary evolutionary factors: mutation process, population waves, gene drift, isolation, natural selection.
68. The concept of the species. Population structure of the species. Ecological and genetic characteristics of populations. The concept of the gene pool of populations. Polymorphism of natural populations.
69. Population is an elementary unit of microevolution. Genetic processes in populations. Hardy-Weinberg's law.
70. Methods of speciation.
71. Population structure of humanity. Man as an object of the action of evolutionary factors.
72. Genetic polymorphism of humanity. Genetic load in human populations.

1.4.4. Course policy and assessment criteria

• Course policy

The control of students' knowledge is carried out according to a point-rating system in accordance with the standard "Regulations on a modular point-rating system for assessing knowledge
students at the NOU UNPK "International University of Kyrgyzstan".
The discipline "Molecular Biology" includes 3 modules (sections), each module is assessed on a 100 point system:
Maximum score -100, of which:
- attendance - 20 points;
- current control - 40 points (20 points - for classroom work, 20 points - for independent work),
- midterm control (delivery of the module) - 40 points.

The results of the 2 modules are added up and the average score is displayed.

Scoring policy	**Module 1**	**Module 2**
Attendance	20 points	20 points
Classroom work (activity in discussions, during oral questioning, work in groups, etc.)	20 points	20 points
Independent work: essay, report	20 points	20 points
Total for the module (testing)	40 points	40 points
Total for the discipline:	100 points	
Exam		

Final control in the form of offset is carried out based on the results of attendance, current and midterm (modular) control.
Final control form - offset.

To assess the student's progress, the following scale of correspondence between grades and points is used

Шкала соответствия оценок и балловScale of correspondence of grades and points				
Maximum Score	Maximum Score Intervals			
	"Unsatisfactory"	"satisfactory	"good"	"excellent
20	0-11	12-15	16-17	18-20
40	0-23	24-30	31-35	36-40
60	0-35	36-45	46-53	54-60
100	0-59	60-75	76-89	90-100

1.4.5. Educational-methodical and informational support of the discipline

1.V N. Yarygina Biology [: textbook. for universities: in 2 volumes. Vol. 1 /. - M. GEOTAR-Media, 2012 .-- 736 p.
2. Biology: textbook. : in 2 volumes. Vol. 1 / ed. V.N. Yarygin. - M.: GEOTAR-Media, 2014 .-- 736 p. - Access mode
3 Slyusarev, A.A. Biology with General Genetics - 2nd ed., Stereotype. - M.: Alliance, 2015 .-- 472 p.
4. N.V. Cheby-Sheva Biology: hands. to the lab. classes. - M .: GEOTAR-Media, 2013 .-- 384 p.
5. V.V. Markin, Yu.D. O-rotists, N.G. Lisatova Biology: hands. to practical. classes M .: GEOTAR-Media, 2010 .-- 448 p.
Additional:
1. Slyusarev, A.A. Biology with general genetics [Text]: textbook. / A.A. Slyusarev. - 3rd ed., Stereotype. - M.: Alliance, 2011 .-- 472 p.
2. Chebyshev N.V. Biology .: GEOTAR-Media, 2010 .-- 416 p. 3. A. B. Khojayan, S. S. Kozlova, M. V. Medical parasitology and parasitic diseases GEOTAR-Media, 2014. - 448 p. - Access mode:
3. Khojayan, A.B. Fundamentals of General Ecology. - Stavropol: StGMA Publishing House, 2011 .-- 75 p.
4. A.B. Khodzhyan, A.K. Mikhailenko, N.N. Fedorenko. Collection of situational problems in genetics for 1st year students (updated) - Stavropol: Publishing house of StGMU, 2014. -52 p.
6. A. B. Khodzhayan, N. N. Fedorenko, M. G. Gevandova Structural and functional organization of cells - Stavropol: Publishing house of StGMA, 2012. - 67 p.

7. A. B. Khodzhayan, A. K. Mikhailenko, N. N. Fedorenko Human nematodoses Stavropol: Publishing house of the StSMA, 2012. - 44 p.
10. Protozoal human diseases: biological aspect - Stavropol: Publishing house of StGMU, 2013. - 75 p.
14. Khojayan, AB Ontogenesis: textbook. manual for stud. 1st year Publishing house of StSMU, 2014.-64 p.
15. Gevandova M.G. On some issues of general and medical genetics: textbook for 1st year students of StSMU Stavropol: Publishing house of StGMU, 2015-96 p.
16. Pekhov, A.P. Biology: medical biology, genetics and parasitology textbook. / Pehov A.P. 2010 .-- 664 p. -
6.2 Electronic educational resources (databases, reference and search systems, Internet resources). ...
1.BIOLOGY Navigator for information resources. http: //www.spsl.nsc. ru / win / nelbib / biolog / pricl.biology.htm
3. Educational resource of the Internet. BIOLOGY

1.4.6. Logistics of the discipline

№	Name of special premises and premises for independent work (indicating the address and area)	Equipping special rooms and premises for independent work with equipment
1.	- - scientific laboratory	-classrooms, room for independent work;
2.	-microtomes (rotary, freezing);	-microscopes and sets of preparations individually for each listener
3.	- thermostats (37 and 56 degrees)	-fund of drugs by structure and age characteristics;
4.	- dry oven;	-fund of preparations for the microscopic structure of human organs and tissues
5.	--museum with macro-preparations and dummies	- dummies;
6.	- distiller	- stand with wet macro-preparations for human embryology;
7.	- scales	- multimedia installations;
8.	video test Morpho 5.0;	- plasma panels
9.	classrooms, a room for independent work; -	- TVs;
10.	microscopes and sets of preparations individually for each student;	- laptops in each classroom;
11.	-und of drugs by structure and age features;	-kits of multimedia visual presentations for all lectures and practical classes in electronic form
12.	-fond of micropreparations - dummies;	
14	-stand with wet macro-preparations.	
15	. - multimedia installations	
16.	- plasma panels;	
17.	- телевизорыTVs	
18.	- laptops in each classroom;;	

19.	-sets of multimedia visual presentations for all lectures and practical exercises in electronic form.	

1.4.7. Student research work

Research work includes preparing students through their mastering in the learning process the methods, techniques and skills of performing research work, developing their creative abilities, independence, initiative in learning and future professional activity within the specialty.

The program of students' research work (SRWS), as a section of the development of practical skills, includes:

- study of special literature and other scientific and medical information, achievements of domestic and foreign science and technology in the field of medical knowledge, preparation of scientific abstracts (literature reviews);
- participation in scientific research or in the implementation of certain developments at the theoretical or clinical departments of MSM;
- collection, processing, analysis and systematization of scientific information on the topic or on the assignment;
- preparation of reports and presentation of a report at the conference, preparation of scientific work for publication;
- participation in mass events of the SRWS system (student scientific conferences, seminars, subject Olympiads, competitions, "Week of Science", exhibitions, discussions, disputes, etc.).