Министерство образования и науки Российской Федерации

ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ АВТОНОМНОЕ ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ ВЫСШЕГО ОБРАЗОВАНИЯ

"НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ УНИВЕРСИТЕТ ИТМО"

РАСПОРЯЖЕНИЕ

«<u>17</u>» января 2024 года

Nº3

О порядке проведения аттестационного испытания

Для осуществления переводов/восстановлений обучающихся ПРИКАЗЫВАЮ:

Утвердить порядок проведения аттестационного испытания в рамках осуществления переводов/восстановлений обучающихся в подразделение Химико-биологический кластер по направлениям подготовки магистратуры 19.04.01 Биотехнология и 06.04.01 Биология.

ПРИЛОЖЕНИЕ. Банк тестовых заданий с критериями оценивания, система перевода показателей академической успеваемости и учебно-научной активности студентов в балльно-рейтинговую систему.

Директор ХБК

(подпись)

<u>Виноградов В.В.</u> (ФИО)

Банк тестовых заданий

по образовательной программе 06.04.01, 19.04.01 «Прикладная геномика / Applied Genomics»

- 1. Write Unix commands to create a folder, to move it, and delete it.
- 2. Select the extension of the file with reads (sequencing data) information.
 - a) gff
 - b) faa
 - c) fastq
 - d) gbk
- 3. What program can be used to filter reads from adapters?
 - a) Prokka
 - b) TOGA
 - c) QUAST
 - d) Trimmomatic
- 4. Which scale is used to record information about nucleotide quality in the read? This scale is used to plot "Per base quality" in the FastQC program.
- 5. Which of the following parameters are related to the assessment of read quality?
 - a) adapter content
 - b) GC content
 - c) quality of bases (nucleotides) in the sequence
 - d) the length of the largest contig
- 6. Arrange the following sequences in ascending order of length (from minimal to maximum): contig, read, scaffold.
- 7. Arrange the steps of the genome assembly algorithm. In your answer, write a sequence of letters without commas and spaces (for example: abcde).
 - a) scaffold assembly,
 - b) quality control of the assembly,
 - c) library preparation,
 - d) quality control of reads,
 - e) assembly of contigs,
 - f) sequencing
- 8. Write at least three metrics for assessing the quality of genome assembly (for instance, from the QUAST report).
- 9. Do you think this assembly can be considered of high quality? Explain your viewpoint.

```
contigs (>= 0 bp)
 contigs (>= 1000 bp)
 contigs (>= 5000 bp)
 contigs (>= 10000 bp)
 contigs (>= 25000 bp)
 contigs (>= 50000 bp) 1
Total length (>= 0 bp) 4646332
Total length (>= 1000 bp)
                                4646332
Total length (>= 5000 bp)
                                4646332
Total length (>= 10000 bp)
                                4646332
Total length (>= 25000 bp)
                                4646332
Total length (>= 50000 bp)
                                4646332
* contigs
Largest contig 4646332
Total length
                4646332
GC (%) 50.80
       4646332
       4646332
N75
L50
       1
# N's per 100 kbp
```

- 10. Name at least one tool to assess the quality of genome assembly.
- 11. Write a Python command that outputs the string "Hello, World!"
- 12. What is x after x = 10; x += 1; x = x * 2 (Python)?
- 13. What types of RNA do you know?
- 14. How many genes are in the human genome?
 - a) 10.000 15.000
 - b) 20.000 25.000
 - c) 30.000 35.000
 - d) 40.000 45.000
- 15. The bat and ball together cost \$110. The price of the bat is \$100 more than the ball. How much is the ball price?
- 16. If the chance of getting sick is 20 out of 100, what is the percentage chance of getting sick?
- 17. What are polyT primers used for? What are polyA primers for?
- 18. Select the process of RNA synthesis from the DNA matrix?
 - a) replication
 - b) transcription
 - c) translation
 - d) duplication
- 19. Which statement is used to interrupt an infinite loop in Python?
 - a) stop
 - b) continue
 - c) false
 - d) break
- 20. Which of these commands creates the file?
 - a) touch file.txt
 - b) less file.txt
 - c) update file.txt
 - d) rm file.txt
- 21. What happens if a T > AG insertion occurs in the sequence (replacing one nucleotide with two)? How might this affect transcription and data processing?
- 22. How are unknown nucleotides labeled in the sequence?
 - a) A
 - b) T
 - c) N
 - d) C
- 23. Which of two parts has the nucleotide fasta file?

- a) header and sequence
- b) gene name and its length
- c) protein sequence and its function
- d) start and stop codons
- 24. Which of the following is not a stop code?
 - a) UAA
 - b) UGG
 - c) UAG
 - d) UGA
- 25. Which organelle carries out protein synthesis by the RNA matrix?
- 26. What is the difference between prokaryotes and eukaryotes?
- 27. Which area of bioinformatics studies the totality of an organism's genes?
 - a) Metagenomics
 - b) Genomics
 - c) Proteomics
 - d) Transcriptomics
- 28. Which instruction is used to declare functions in Python?
 - a) for
 - b) def
 - c) func
 - d) function
- 29. Specify the name of the document that describes the rules for writing code in Python.
- 30. The combination of three consecutive nucleotides in a nucleic acid molecule is called:
 - a) duplex
 - b) trypanosoma
 - c) triplet
- 31. Expand the parentheses in the expression according to the order in which the expression is evaluated (priority of operations):

a and b or not a and not b

- 32. Specify the result of the expression "354" + "67" (Python).
- 33. What is the resulting value of 1 + "ab"?
 - a) "1ab"
 - b) 1ab
 - c) 1"ab"
 - d) TypeError
- 34. Which Python function turns a list into a set?
- 35. Which of the following is not a variable name according to PEP8?
 - a) 123name
 - b) my-name
 - c) my name
 - d) my name

Формат проведения: опрос посредством Гугл-формы

Количество вариантов: вариант тестового задания формируется в случайном порядке из

банка вопросов

Количество вопросов/заданий в одном варианте: 15

Время выполнения: 45 минут

Полнота ответа на вопрос/задание	Количество баллов
полный правильный ответ	4 балла
частично правильный ответ	2 балл
полностью неверный (или отсутствующий)	0 баллов
ответ	

Минимальное количество баллов за выполнение варианта тестового задания -0. Максимальное количество баллов за выполнение варианта тестового задания -60.

Студент, набравший 50 % и более баллов (30 и более баллов из 60 возможных), успешно проходит аттестационное испытание.

Студент, набравший менее 50 % баллов (менее 30 баллов из 60 возможных), считается не прошедшим аттестационное испытание и не готовым к освоению образовательной программы.

Банк тестовых заданий

по образовательной программе 19.04.01 «Молекулярная биология и биотехнология / Molecular Biology and Biotechnology»

Part 1 - Molecular biology

- 1. The central dogma of molecular biology. Semi-conservative DNA replication. Experiments that confirmed semi-conservative DNA replication.
 - Definition of the central dogma
 - Exceptions of the central dogma
 - Relation of a gene and the central dogma
 - Definition of transcription and translation
 - Role of DNA for data storage
 - Role of RNA for information transition
 - Role of proteins as effectors
 - Schematic description of a replication process
 - Experiments of Meselson and Stahl
- 2. Nucleosides, nucleotides and their examples. Purines and pyrimidines nitrogenous bases. Biological roles of nucleotides in cells.
 - Nucleosides and nucleotides: definitions and difference
 - Nucleotide composition of DNA and RNA
 - Difference of sugars in DNA and RNA
 - Difference of the free nucleotides and associated into a string
 - Purines and pyrimidines: structure and difference in hydrogen bonds
 - Roles of nucleotides in cell
- 3. The principles of DNA packaging in eukaryotic and prokaryotic cells. The structure of nucleosomes.
 - Difference in nucleic acid location in pro and eukaryotic
 - Forms of DNA in the cell
 - DNA forms and stability, supercoiling
 - Histone types, nucleosome structure

- Regulation of expression through the nucleosomes and condensation
- Solenoid structure, chromosomal structure
- 4. The main types of RNA: structure and functions
 - Main types of RNA and their functions
 - mRNA: production and modification
 - tRNA: structure and basic features
 - rRNA in eukaryotic and prokaryotic organisms
 - Conservative regions of features of RNA: locations and functions
 - microRNA, snRNA, lnRNA, minRNA: types and functions
- 5. Genetic code. The essence of genetic coding. Basic properties and universality of the genetic code.
 - GenCode definition
 - Triplets in code
 - Degeneration of code
 - Universality of code
 - Polarity of code
 - Non-overlapping of code
 - Unambiguousity of code
 - ORF in code
 - Stop codons
 - Start codon
- 6. The structure of prokaryotic genes: coding sequence and promoter.
 - Operonic structure of prokaryotic genes, introns in prokaryotes
 - Polycistronic operon structure, role of RBS
 - Promoter-operator relationship, role of promoter
 - Start codon, genetic code modification
 - Enhancers and silencers
- 7. The mosaic structure of eukaryotic genes (introns and exons), organization of promoters.
 - Exon-intron structure, difference from prokaryotic organisms, alternative splicing, mechanisms of splicing
 - Gene clusters definition

- Transcription factors and its role
- Structural elements of the promoter
- 8. Replication stages in prokaryotes: initiation, elongation and termination. Replication enzymes of prokaryotes.
 - Start of the synthesis, role of proteins in the preparation of DNA
 - Leading and lagging strand, difference, additional enzymes on the lagging strands
 - DNA-dependent DNA polymerase 3 type: subunits and their functions
 - Theta and rolling circle replication, difference
- 9. Replication stages in eukaryotes: initiation, elongation and termination. Replication enzymes of eukaryotes: types and functions.
 - Replication start in eukaryotes
 - Telomeres role and structure
 - Leading and lagging strands
 - Initiation of replication
 - Initiation of replication, cell cycle S-phase
 - ε and δ polymerases
 - Differences between eu- and prokaryotic DNA
- 10. Transcription as an intermediate stage of gene expression. Stages of transcription (initiation, elongation and termination).
 - Definition of transcription
 - Role of promoter in the initiation of transcription, formation of the transcription bubble, abortive initiation
 - Formation of the transcription bubble, abortive initiation
 - Transcription regulation in eukaryotes: transcription factors, enhancers, silencers
 - Special DNA sequences involved in transcription
 - RNA polymerases involved in prokaryotic and eukaryotic transcription
 - Elongation of transcription
 - Termination of transcription
- 11. Translation of proteins. Protein as a product of gene expression.
 - Definitions of translation, genetic code, and triplets
 - Levels of protein structure
 - Role of ribosomes in translation

- Initiation of translation
- Start and stop codons
- Elongation of translation
- Termination of translation
- Post-translational modifications
- Protein folding

12. DNA repair mechanisms.

- Consequences of DNA damage for the cell
- Error-prone DNA polymerases (translation synthesis)
- Base excision repair, nucleotide excision repair
- Mismatch repair
- Non-homologous end joining
- Homologous recombination
- Microhomology-mediated end joining
- Accuracy of DNA repair mechanisms
- 13. Recombinant DNA technology: cloning vectors. Restriction enzymes and ligases.
 - Types of cloning vectors
 - Features of cloning vectors
 - Restriction endonucleases and ligases: definitions, usage for cloning vectors
 - Selection of transformed bacteria
 - Definition of cell competence
 - Confirmation of assembled vector structure
 - Expression vectors
 - Protein production via vectors
- 14. Polymerase chain reaction. Principle, variants, applications.
 - Definition of PCR
 - Stages of PCR
 - Description of PCR stages
 - Components needed for PCR
 - RT-PCR
 - PCR visualization, qPCR

- PCR for the detection of mutations
- PCR in practice
- 15. The chemical composition of proteins. Classification and properties of amino acids.
 - Chemical structure of proteins
 - Types of amino acid side chains
 - Zwitterions, charged states of amino acids
 - Influence of amino acids on protein structure
 - Motifs in proteins
 - Protein modifications

Part 2 - Microbiology

- 1. Bacterial taxonomy and nomenclature. Non-taxonomic groups: strains, serotypes. Describe taxonomy and identify non-taxonomic groups (if possible) for *Escherichia coli* O157:H7 and *Lactobacillus* sp. ATCC 15578.
 - Description of all taxonomic units
 - Definition of strain
 - Definition of serotype
 - Description of *E.coli* and *Lactobacillus* strain/serotype
- 2. Define main ecological groups of bacteria depending on oxygen presence. What techniques can be used for cultivation of anaerobes? What techniques can be used to increase oxygenation for aerobes? Provide examples of aerobic and anaerobic organisms.
 - Definitions of ecological groups of bacteria depending on oxygen presence
 - Examples of techniques for anaerobes cultivation
 - Examples of techniques for aerobic cultivation
- 3. Define main ecological groups of bacteria depending on temperature and pH. Adaptations to temperature: sigma factors, membrane fluidity, chaperones.
 - Definitions of ecological groups of bacteria depending on temperature
 - Definitions of ecological groups of bacteria depending on pH
 - Description of each mechanism of adaptation with examples of specific molecules, enzymes and systems
- 4. Define isolate, pure culture, strain. Describe purpose of use for following growth media: general nutrient media, minimal media, enrichment media, selective media, differential media. Describe steps of Gram staining and how it can be used for microorganism identification.
 - Definitions of isolate, pure culture, strain

- Description (purpose) for different types of growth media
- Description of Gram staining procedure and stains
- Application of Gram staining
- 5. Bacterial cell wall. Draw a scheme and describe the structure of Gram positive and Gram negative cell walls. Provide examples of two organisms for each group (different genera). On scheme, identify periplasmic space, proteins, lipopolysaccharide, teichoic acid. Identify features of *Mycoplasma* and *Mycobacteria* cell envelope. Do they stain by Gram staining? Provide at least one example of Gram positive and Gram negative organisms, *Mycoplasma*, *Mycobacteria*.
 - Composition of Gram negative cell wall and scheme
 - Composition of Gram positive cell wall and scheme
 - Description of *Mycoplasma* envelope and its composition
 - Description of *Mycobacteria* cell envelope and its composition
 - Examples of microorganisms for each group
- 6. What is a biofilm? Describe stages of biofilm formation. Name at least 3 components of the biofilm matrix. Define biofilm subpopulations: fast growing, slow growing, persisters, mutants.
 - Biofilm definition
 - Stages of biofilm formation
 - Matrix components
 - Definition of 4 subpopulations
- 7. Give definitions of fed-batch culture, repeated fed-batch culture, batch culture, continuous culture. Draw a standard bacterial growth curve. Identify stages of growth. Describe level of protein synthesis and number of live and dead cells on each stage. What is quorum sensing and how it affects culture growth?
 - Definitions of fed-batch culture, repeated fed-batch culture, batch culture, continuous culture
 - Scheme, names of each growth phase, analysis of each stage
 - Definition of quorum sensing, description of its effect on bacterial culture growth
- 8. Describe bacterial cell division. What is a Z ring? What is the difference between binary fission and budding? Provide examples of bacteria which have binary and budding types of division. What is a generation time?
 - Description of bacterial cell division
 - Z ring description
 - Binary fission of bacteria
 - Budding of bacteria
 - Examples of bacteria for each type of division

- Definition of generation time
- 9. Bacteriophages. Describe lytic and lysogenic life cycle. What is a prophage? Examples of dsDNA and ssDNA bacteriophages. How bacteriophages P1 and T7 are used in genetic engineering?
 - Definition of bacteriophages
 - Description of lytic life cycle
 - Lysogenic life cycle
 - Definition of a prophage
 - Example of dsDNA and ssDNA bacteriophages
 - Bacteriophage P1 for temperature-dependent cell lysis
 - T7 bacteriophage promoter for increased rate of gene expression
- 10. Describe and draw schemes of 3 main types of horizontal gene transfer in prokaryotes. Describe conditions of chemical transformation and electroporation. What are the features of competent cells in comparison to other strains?
 - Description and scheme for transformation
 - Conjugation
 - Transduction
 - Description of principle for chemical transformation
 - Description of principle for electroporation
 - Features of competent cells
- 11. Regulation of gene expression in bacteria. DNA folding, examples of histone-like proteins. Sigma factors. Regulator operons: *lac* operon, tryptophan operon.
 - Description of DNA, nucleoid and histone-like proteins (HU, HNS, SMC)
 - Definitions of sigma factors, their functioning with examples
 - Description of *lac* operon functioning
 - Description of *trp* operon functioning
- 12. Antibiotics targets. Mechanisms of antibiotics resistance (at least 3). Definition of multidrug antibiotics resistance. R plasmids.
 - Antibiotics targets
 - Corresponding mechanisms of resistance
 - Definition of multidrug resistance
 - Definition of R plasmid

- 13. Examples of antibiotics and their targets (at least 5). Bacteriocins: source, function. Antimicrobial peptides: source, function. Quorum quenchers: source, function.
 - Examples of antibiotics and their targets
 - Sources and mechanisms of bacteriocins
 - Sources and mechanism of AMP
 - Sources and mechanism of QQ
- 14. Bacterial antigens (O-, H-, Vi-antigen). Pathogenicity, virulence, attenuation. Virulence factors, pathogenicity islands. Colonization and invasion.
 - Definition of O-, H-, Vi-antigen
 - Definition of pathogenicity, virulence, attenuation
 - Definition of virulence factors, pathogenicity islands
 - Colonization and invasion
- 15. Definition and difference between microbiota and microbiome. Dysbiosis. Probiotics and prebiotics. Commensal and conditionally pathogenic bacteria. Mechanisms of regulation of intestinal microbiota composition (at least 3).
 - Definition of microbiota and microbiome
 - Definition of dysbiosis, probiotics and prebiotics
 - Definition of commensal and conditionally pathogenic bacteria
 - Mechanisms of regulation of intestinal microbiota composition

Part 3 – Cell biology

- 1. Provide the structure of a eukaryotic cell. Name non-membrane, single-membrane and double layered organelles. Briefly describe their main functions.
 - Mitochondria: structure and functions
 - Endoplasmic reticulum: structure and functions
 - Golgi complex: structure and functions
 - Cytoplasmic membrane: structure and functions
 - Nucleus: structure and functions
 - Centriole, purinosome, etc: structure and functions
- 2. Describe the structure of a eukaryotic nucleus and its membrane.
 - Nuclear envelope, lamina: structure and functions
 - Nuclear transport description

- Karyoplasm, nucleolus: structure and functions
- 3. Provide a scheme of human cell cycle. What are the main phases and regulators of the cell cycle?
 - Definition of interphase and mitosis
 - Main phases of cell cycle and their features
 - Regulation of cell cycle progression by CDK complexes
- 4. Describe stages of mitotic cell division of a eukaryotic cell. What are the main phases and their characteristics?
 - Definition of karyokinesis and cytokinesis
 - Phases of karyokinesis and their features
- 5. Describe an anaerobic glucose oxidation process. How glucose is transported to the cell? What are the steps and products of glycolysis?
 - Constant and insulin-dependent glucose transporters
 - Hexokinase, aldolase, GAPDH and their reactions in glycolysis
 - Other participating enzymes and their reactions
- 6. Provide a scheme of tricarboxylic acid cycle with its stages and compounds. Describe main functions of the cycle in the cell.
 - Sequence of a cycle stages
 - Formula of citrate, α-ketoglutarate, succinate, oxaloacetate
 - Formula of *cis*-aconitate, isocitrate, succinyl-CoA, fumarate, malate
 - Role of a compound in cell metabolism
- 7. Describe oxidative phosphorylation and its main stages. What are the complexes of the electron transport chain and what are their functions?
 - Full name, function and features of Complex I
 - Full name, function and features of Complex II
 - Full name, function and features of Complex III
 - Full name, function and features of Complex IV
 - Full name, function and features of Complex V
- 8. Provide names and structures of non-essential and conditionally essential amino acids. Where does the biosynthesis of them take part inside the cell?
 - Name and structure of amino acid

- Location and enzymatic process of biosynthesis
- 9. Describe types and mechanisms of membrane transport. Provide examples of compounds transported by each type.
 - Description of membrane transport mechanism
 - Examples of compounds transported by each listed mechanism
- 10. Draw a scheme of a typical optical microscope. What are the main parts of it? What is the principle of image production in brightfield, darkfield and phase-contrast microscopes?
 - Components of a conventional microscope and their functions
 - Principle of brightfield microscopy
 - Principle of darkfield microscopy
 - Principle of phase-contrast microscopy
- 11. What is the principle of enzymatic reaction? Provide a formula of Michaelis–Menten equation. How is this equation obtained, what is the Michaelis–Menten constant?
 - Scheme of a typical enzymatic reaction
 - Michaelis–Menten equation for enzymatic reaction
 - Plot of reaction rate vs substrate concentration dependence
 - Michaelis constant definition
 - Differential representation of enzymatic reaction rate and its derivation
- 12. Signal transduction in human cells. What are primary transducers, receptors and secondary transducers? Provide examples.
 - Definition of signal transduction
 - Features of primary transducers
 - Features of receptors
 - Features of secondary transducers
 - Examples of transducers and receptors, their cascades
- 13. Provide the main principle of optical absorbance and fluorescence in terms of applications in molecular biology.
 - Definition of optical absorbance, Beer-Lambert law and its formulation
 - Additivity (linear combination) of optical absorbance in mixtures
 - The use of optical absorbance in molecular biology studies
 - Definition of fluorescence in terms of energy during nonradiative transition

- Stokes shift illustration on a wavelength vs intensity plot
- The use of fluorescence in molecular biology studies
- 14. Name B vitamins and their role in human cellular metabolism.
 - Name of vitamin B
 - Role in human cellular metabolism

Формат проведения: тестирование проводится в очной форме в присутствии наблюдателя Количество вариантов: вариант тестового задания формируется в случайном порядке из банка заданий

Количество вопросов/заданий в одном варианте: 6 (по 2 вопроса из каждого блока – Молекулярная биология, Микробиология, Клеточная биология)

Время выполнения: 120 минут

Система оценивания

Полнота ответа / Результат	Количество баллов
за вопрос	//задание
полный правильный ответ	10
частично правильный ответ	1-9*
полностью неверный (или отсутствующий) ответ	0
* в зависимости от вопроса/задания	

Минимальное количество баллов за выполнение варианта тестового задания -0. Максимальное количество баллов за выполнение варианта тестового задания -60.

Студент, набравший 60 % и более баллов (36 и более баллов из 60 возможных), успешно проходит аттестационное испытание.

Студент, набравший менее 60 % (менее 36 баллов из 60 возможных) баллов, считается не прошедшим аттестационное испытание и не готовым к освоению образовательной программы.

Ответы на вопросы/задания сдаются в письменном виде на английском языке. Оценивание проводится в соответствии с представленными ниже критериями.

Критерии оценивания

Вопрос/задание	Критерий*	Количество баллон	3**
		промежуточное	итоговое
	Part 1 - Molecular biolo	ogy	
1. The central dogma of	Definition of the central dogma	-	1
molecular biology.	Exceptions of the central dogma	-	1
Semi-conservative DNA replication. Experiments that	Relation of a gene and the central	-	1
confirmed semi-conservative	dogma		
DNA replication.	Definition of transcription and	0,5	1
	translation	за каждое определение	
	Role of DNA for data storage	-	1
	Role of RNA for information	-	1
	transition		
	Role of proteins as effectors	-	1
	Schematic description of a	-	1
	replication process		
	Experiments of Meselson and	-	2
	Stahl		
2. Nucleosides, nucleotides	Nucleosides and nucleotides:	0,67	2
and their examples. Purines	definitions and difference	за каждое определение	
and pyrimidines nitrogenous		0,67	
bases. Biological roles of		за название отличий	
nucleotides in cells.	Nucleotide composition of DNA	-	1
	and RNA		
	Difference of sugars in DNA and	-	1
	RNA		1
	Difference of the free nucleotides	-	1
	and associated into a string	1.5	3
	Purines and pyrimidines: structure	1,5	3
	and difference in hydrogen bonds	за каждый пункт (структура / название отличий)	
	Roles of nucleotides in cell	/ название отличии)	2
3. The principles of DNA	Difference in nucleic acid location	-	1
packaging in eukaryotic and	in pro and eukaryotic	-	1
prokaryotic cells. The	Forms of DNA in the cell	_	1
structure of nucleosomes.	DNA forms and stability,	1	2
structure of nucleosomics.	supercoiling	за каждый пункт (формы и	2
	Superconnig	стабильность ДНК /	
		суперскручивание)	
	Histone types, nucleosome	1	2
	structure	за каждый пункт (типы	_
		гистонов / структура	
		нуклеосом)	
	Regulation of expression through	- 1	2
	the nucleosomes and condensation		
	Solenoid structure, chromosomal	1	2
	structure	за каждый пункт (структура	
		соленоида / структура	
		хромосом)	

4. The main types of RNA:	Main types of RNA, their	1	2
structure and functions.	functions	за каждый пункт (основные	2
	Tunctions	типы РНК / их функции)	
	DNIA	типы РПК / их функции)	2
	mRNA: production and		2
	modification	за каждый пункт	
		(получение мРНК /	
		модификация)	
	tRNA: structure and basic features	0,5	1
		за каждый пункт (структура	
		тРНК / основные	
		характеристики)	
	rRNA in eukaryotic and	1	2
	prokaryotic organisms	за каждый пункт (рРНК в	
		эукариотических клетках /	
		рРНК в прокариотических	
		клетках	
	Conservative regions of features	0,5	1
	of RNA: locations and functions	за каждый пункт	1
	of KNA. locations and functions	I	
		(расположение	
		консервативных областей /	
		их функции)	
	microRNA, snRNA, lnRNA,	-	2
	minRNA: types and functions		
5. Genetic code. The essence	GenCode definition	-	1
of genetic coding. Basic	Triplets in code	-	1
properties and universality of	Degeneration of code	-	1
the genetic code.	Universality of code	-	1
	Polarity of code	-	1
	Non-overlapping of code	-	1
	Unambiguousity of code	-	1
	ORF in code	_	1
	Stop codons	_	1
	Start codon	<u> </u>	1
6. The structure of	Operonic structure of prokaryotic	_	1
prokaryotic genes: coding	genes, introns in prokaryotes	- I	1
		1	
sequence and promoter.	Polycistronic operon structure,	1	2
	role of RBS	за каждый пункт (структура	
		полицистронного оперона /	
		роль	
		рибосомосвязывающего	
		центра)	
	Promoter-operator relationship,	1,5	3
	role of promoter	за каждый пункт (связь	
		промоутер-оператор / роль	
		промоутера)	
	Start codon, genetic code	1	2
	modification	за каждый пункт	
		(стартовый кодон /	
		модификация генетического	
		кода)	
	Enhancers and silencers	1	2
		за каждый пункт	-
		(усилители / глушители)	
	1	(yenamiean)	

7. The mosaic structure of	Exon-intron structure, difference	1,25	5
eukaryotic genes (introns and	from prokaryotic organisms,	за каждый пункт (структура	
exons), organization of	alternative splicing, mechanisms	экзон-интрона / отличие от	
promoters.	of splicing	прокариотических	
		организмов /	
		альтернативный сплайсинг /	
		механизмы сплайсинга)	
	Gene clusters definition	-	1
	Transcription factors and its role	1	2
		за каждый пункт (факторы	
		транскрипции / их роль)	
	Structural elements of the	-	2
	promoter		
8. Replication stages in	Start of the synthesis, role of	1	2
prokaryotes: initiation,	proteins in the preparation of	за каждый пункт (начало	
elongation and termination.	DNA	синтеза / роль белков в	
Replication enzymes of		получении ДНК)	
prokaryotes.	Leading and lagging strand,	1	3
1 J	difference, additional enzymes on	за каждый пункт (ведущая	5
	the lagging strands	и отстающая нити / их	
	the ragging straines	разница / дополнительные	
		ферменты на отстающих	
		нитях)	
	DNA-dependent DNA	1,5	3
	polymerase 3 type: subunits and	за каждый пункт	5
	their functions	(субъединицы фермента /	
	then functions	их функции)	
	Thata and rolling airele	0,67	2
	Theta and rolling circle replication, difference	· · · · · · · · · · · · · · · · · · ·	2
	replication, difference	за определение каждого	
		вида репликации 0,67	
O Parlication stages in	Danliagtion start in sulramates	за название отличий	1
9. Replication stages in	Replication start in eukaryotes	-	1
eukaryotes: initiation, elongation and termination.	Telomeres: role and structure	1	2
		за каждый пункт (роль	
Replication enzymes of		теломеров / их структура)	
eukaryotes: types and functions.	Leading and lagging strands	0,5	1
functions.		за каждое определение	
	Initiation of replication	-	1
	Initiation of replication, cell cycle	1	2
	S-phase	за каждый пункт	
		(инициация репликации /	
		S-фаза клеточного цикла)	
	ε and δ polymerases	1	2
		за каждое определение	
	Differences between eu- and	- 1	1
	prokaryotic DNA		
10. Transcription as an	Definition of transcription	-	1
intermediate stage of gene	Role of promoter in the initiation	0,67	2
	of transcription, formation of the	за каждый пункт (роль	
expression. Stages of	of transcription, formation of the	3 1 (F 3	
= =	transcription bubble, abortive	промоутера / формирование	
expression. Stages of transcription (initiation, elongation and termination).	1 .		

eukaryotes: transcription factors, enhancers, silencers Special DNA sequences involved in transcription RNA polymerases involved in prokaryotic and eukaryotic transcription RNA polymerases involved in prokaryotic and eukaryotic transcription Elongation of transcription Termination of transcription Definitions of translation, genetic code, and triplets Eversion. Elongation of translation genetic code, and triplets Eversion. Elongation of translation genetic code, and triplets Eversion. Elongation of translation Post-translation of translation Start and stop codons Elongation of translation Frotian and stop codons Elongation of translation Start and stop codons Elongation of translation Frotian for translation of translation Post-translational modifications Protein folding 12. DNA repair mechanisms. Consequences of DNA damage for the cell Error-prone DNA polymerases (translation synthesis) Base excision repair, nucleotide excision repair, nucleotide excision repair Mismatch repair Non-homologous end joining Homologous recombination Accuracy of DNA repair mechanisms 13. Recombinant DNA Rechnology: cloning vectors Restriction enzymes and ligases. Protein for deal competence Confirmation of cell competence Confirmation of cell competence Confirmation of cell competence Expression vectors Elongation of active situation in postation in post		Tanananiation moneletion in	0.22	1
enhancers, silencers транскриншии, усилители, плушители) Special DNA sequences involved in transcription - RNA polymerases involved in prokaryotic and eukaryotic transcription 1 Elongation of transcription - Termination of proteins. Protein as a product of gene expression. Definitions of translation, genetic code, and triplets 0,33 1 Elongation of translation of translation initiation of translation of translation of translation initiation of translation initiation of translation - 1 Every for photonic structure - 2 2 Role of ribosomes in translation - 1 1 Initiation of translation - 1 1 Elongation of translation - 1 1 Every for photonic structure - 2 2 Role of ribosomes in translation - 1 1 Initiation of translation - 1 1 Elongation of translation - 1 1 Protein folding - 1 1 12. On A repair mechanisms - 1 1		Transcription regulation in	0,33	1
Special DNA sequences involved in transcription				
Special DNA sequences involved in transcription		ennancers, silencers		
In transcription RNA polymerases involved in prokaryotic and eukaryotic transcription 1 3а каждый пункт (PHK полимераза, участвующая в транскуппции пуокариот / в транскуппци		C : IDNIA : 1 1	глушители)	
RNA polymerases involved in prokaryotic and eukaryotic transcription		_ =	-	2
Prokaryotic and eukaryotic transcription		_		
transcription			1	2
Elongation of transcription 1 1 1 1 1 1 1 1 1				
Elongation of transcription - 1		transcription		
Elongation of transcription - 1 1 1 1 1 1 1 1 1				
Termination of transcription			транскрипции эукариот)	
11. Translation of proteins. Protein as a product of gene expression. Definitions of translation, genetic code, and triplets Sa каждое определение Code, and triplets Cevels of protein structure Cevels of			-	
Protein as a product of gene expression. code, and triplets 3а каждое определение Levels of protein structure - 2 Role of ribosomes in translation - 1 Initiation of translation - 1 Elongation of translation - 1 Termination of translation - 1 Protein folding - 1 Protein folding - 1 12. DNA repair mechanisms. Consequences of DNA damage for the cell - 1 Error-prone DNA polymerases (translation synthesis) 1 2 Base excision repair, nucleotide excision repair, nucleotide excision repair - 1 Mismatch repair - 1 Non-homologous end joining - 1 Homologous recombination - 1 Microhomology-mediated end joining - 1 Homologous recombination - 1 Technology: cloning vectors. Features of cloning vectors - 1 Restriction endonucleases and ligases: definitions, usage for cloning vectors - <td></td> <td></td> <td>-</td> <td>1</td>			-	1
Expression. Levels of protein structure	11. Translation of proteins.	Definitions of translation, genetic	0,33	1
Role of ribosomes in translation	Protein as a product of gene	code, and triplets	за каждое определение	
Initiation of translation - 1	expression.	Levels of protein structure	-	2
Start and stop codons		Role of ribosomes in translation	-	1
Elongation of translation		Initiation of translation	-	1
Termination of translation		Start and stop codons	-	1
Post-translational modifications		Elongation of translation	-	1
Protein folding - 1 12. DNA repair mechanisms. Consequences of DNA damage for the cell		Termination of translation	-	1
12. DNA repair mechanisms. Consequences of DNA damage for the cell		Post-translational modifications	-	1
12. DNA repair mechanisms. Consequences of DNA damage for the cell		Protein folding	-	1
for the cell	12. DNA repair mechanisms.		-	1
(translation synthesis)Base excision repair12за каждый пункт (эксцизионная репарация оснований ДНК / нуклеотидов)1Mismatch repair-1Non-homologous end joining-1Homologous recombination-1Microhomology-mediated end joining-1Accuracy of DNA repair mechanisms-2Technology: cloning vectors1Restriction enzymes and ligases1Restriction enzymes and ligases.3a каждое определение cloning vectors2Selection of transformed bacteria-1Definition of cell competence-1Confirmation of assembled vector-1Expression vectors-1	•	_		
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Mismatch repair Non-homologous end joining Homologous recombination ————————————————————————————————————			1	
Mismatch гераіг - 1 Non-homologous end joining - 1 Homologous recombination - 1 Microhomology-mediated end joining - 1 Accuracy of DNA repair mechanisms - 2 Accuracy of DNA repair mechanisms - 1 Types of cloning vectors - 1 Restriction enzymes and ligases: Features of cloning vectors - 1 Restriction endonucleases and ligases: definitions, usage for cloning vectors 3a каждое определение 2 Selection of transformed bacteria - 1 Definition of cell competence - 1 Confirmation of assembled vector structure - 1 Expression vectors - 1				
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Homologous recombination-1Microhomology-mediated end joining-1Accuracy of DNA repair mechanisms-213. Recombinant DNA Technology: cloning vectors. Restriction enzymes and ligases.Types of cloning vectors Features of cloning vectors-1Restriction enzymes and ligases: definitions, usage for cloning vectorsRestriction endonucleases and ligases: definitions, usage for cloning vectors3a каждое определениеSelection of transformed bacteria Definition of cell competence-1Confirmation of assembled vector structure-1Expression vectors-1		±	-	1
Microhomology-mediated end joining Accuracy of DNA repair mechanisms 13. Recombinant DNA Technology: cloning vectors. Restriction enzymes and ligases. Restriction endonucleases and ligases: definitions, usage for cloning vectors Selection of transformed bacteria Definition of cell competence Confirmation of assembled vector structure Expression vectors 1 1 2 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1			-	1
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13. Recombinant DNA Technology: cloning vectors. Restriction enzymes and ligases.Types of cloning vectors-1Restriction enzymes and ligases.Restriction endonucleases and ligases: definitions, usage for cloning vectors0,67 3а каждое определение2Selection of transformed bacteria-1Definition of cell competence-1Confirmation of assembled vector structure-1Expression vectors-1			_	2
13. Recombinant DNA Technology: cloning vectors. Restriction enzymes and ligases. Restriction enzymes and ligases: definitions, usage for cloning vectors Selection of transformed bacteria Definition of cell competence Confirmation of assembled vector Expression vectors - 1 0,67 2 3а каждое определение 0,67 3а описание использования 1 Definition of cell competence - 1 Expression vectors - 1				
Тесhnology: cloning vectors.Restriction enzymes and ligases.Features of cloning vectors-1Restriction endonucleases and ligases: definitions, usage for cloning vectors3a каждое определение ользованияSelection of transformed bacteria-1Definition of cell competence-1Confirmation of assembled vector structure-1Expression vectors-1	13. Recombinant DNA		-	1
Restriction enzymes and ligases.Restriction endonucleases and ligases: definitions, usage for cloning vectors0,67 3а каждое определение 0,67 3а описание использования2Selection of transformed bacteria Definition of cell competence-1Confirmation of assembled vector structure-1Expression vectors-1		<u> </u>	_	
ligases.ligases: definitions, usage for cloning vectorsза каждое определение0,67 за описание использования1Selection of transformed bacteria-1Definition of cell competence-1Confirmation of assembled vector structure-1Expression vectors-1			0.67	
cloning vectors0,67за описание использования1Selection of transformed bacteria-1Definition of cell competence-1Confirmation of assembled vector structure-1Expression vectors-1			1 '	_
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Selection of transformed bacteria - 1 Definition of cell competence - 1 Confirmation of assembled vector - 1 structure - 1 Expression vectors - 1			· · · · · · · · · · · · · · · · · · ·	
Definition of cell competence - 1 Confirmation of assembled vector - 1 structure Expression vectors - 1		Selection of transformed bacteria	-	1
Confirmation of assembled vector - 1 structure Expression vectors - 1			 	
structure Expression vectors - 1			 	
Expression vectors - 1				1
			_ +	1
		Protein production via vectors	 	2

14. Polymerase chain	Definition of PCR	-	1
reaction. Principle, variants,	Stages of PCR	-	1
applications.	Description of PCR stages	0,33	1
		за описание каждого этапа	
	Components needed for PCR	-	1
	RT-PCR	-	1
	PCR visualization, qPCR	1	2
	, 1	за каждый пункт	
		(визуализация ПЦР /	
		количественная ПЦР)	
	PCR for the detection of	-	2
	mutations		
	PCR in practice	-	1
15. The chemical	Chemical structure of proteins	_	1
composition of proteins.	Types of amino acid side chains	_	3
Classification and properties	Zwitterions, charged states of	_	1
of amino acids.	amino acids		1
	Influence of amino acids on	_	1
	protein structure	<u> </u>	1
	Motifs in proteins	_	2
	Protein modifications	-	2
	Part 2 - Microbiology	<u>-</u>	
1. Dootomic Ltouromanner and	Description of all taxonomic units	1	(
Bacterial taxonomy and nomenclature.	Description of all taxonomic units	_	6
		за описание каждой	
Non-taxonomic groups: strains, serotypes. Describe	Definition of studio	таксономической единицы	1.5
taxonomy and identify	Definition of strain	-	1,5
non-taxonomic groups (if	Definition of serotype	-	1,5
possible) for Escherichia coli	Description of <i>E.coli</i> and	0,5	1
O157:H7 and Lactobacillus	Lactobacillus strain/serotype	за описание каждого вида	
sp. ATCC 15578.		бактерий	
2. Define main ecological	Definitions of ecological groups	1	5
groups of bacteria depending	of bacteria depending on oxygen	за описание каждой группы	3
on oxygen presence. What	presence	за описание каждон группы	
techniques can be used for	Examples of techniques for	0,22	2
cultivation of anaerobes?	anaerobes cultivation	за каждый пример	-
What techniques can be used	Examples of techniques for	1	3
to increase oxygenation for	aerobic cultivation	за каждый пример	J
aerobes? Provide examples	deroore curry attorn	за каждый пример	
of aerobic and anaerobic			
organisms.			
3. Define main ecological	Definitions of ecological groups	0,43	3
groups of bacteria depending	of bacteria depending on	за описание каждой группы	
on temperature and pH.	temperature		
Adaptations to temperature:	Definitions of ecological groups	0,5	4
sigma factors, membrane	of bacteria depending on pH	за описание каждой группы	-
fluidity, chaperones.	Description of each mechanism of	1	3
J / 1	<u> </u>	<u> </u>	2
	l adaptation with examples of	за описание кажлого	
	adaptation with examples of specific molecules, enzymes and	за описание каждого механизма	

4. Define isolate, pure	Definitions of isolate, pure	1	3
culture, strain. Describe	culture, strain	за каждое определение	3
purpose of use for following	Description (purpose) for different	1	5
growth media: general	types of growth media	за каждое описание	3
nutrient media, minimal	Description of Gram staining	за каждое описание	1,5
media, enrichment media,	procedure and stains	-	1,3
selective media, differential	Application of Gram staining		0,5
media. Describe steps of	Application of Grain staining	-	0,3
Gram staining and how it can			
be used for microorganism			
identification.			
5. Bacterial cell wall. Draw a	Composition of Gram negative	0,25	2
scheme and describe the	cell wall and scheme	за название каждого	2
structure of Gram positive	cen wan and seneme		
and Gram negative cell		компонента 0,25	
walls. Provide examples of		· · · · · · · · · · · · · · · · · · ·	
two organisms for each		за схематичное	
group (different genera). On		изображение каждого	
		компонента	2
scheme, identify periplasmic space, proteins,	Composition of Gram positive	0,25	2
1 1 1 1	cell wall and scheme	за название каждого	
lipopolysaccharide, teichoic		компонента	
acid. Identify features of		0,25	
Mycoplasma and		за схематичное	
Mycobacteria cell envelope.		изображение каждого	
Do they stain by Gram		компонента	
staining? Provide at least one	Description of Mycoplasma	-	2
example of Gram positive	envelope and its composition		
and Gram negative	Description of Mycobacteria cell	-	2
organisms, Mycoplasma,	envelope and its composition		
Mycobacteria.	Examples of microorganisms for	0,5	2
	each group	за каждый пример	
6. What is a biofilm?	Biofilm definition	1	1
Describe stages of biofilm	Stages of biofilm formation	0,8	4
formation. Name at least 3		за описание каждой стадии	
components of the biofilm	Matrix components	0,6	3
matrix. Define biofilm		за название каждого	
subpopulations: fast		компонента	
growing, slow growing,	Definition of 4 subpopulations	0,5	2
persisters, mutants.		за каждое определение	
7. Give definitions of	Definitions of fed-batch culture,	1 за каждое определение	4
fed-batch culture, repeated	repeated fed-batch culture, batch		
fed-batch culture, batch	culture, continuous culture		
culture, continuous culture.	Scheme, names of each growth	1	4
Draw a standard bacterial	phase, analysis of each stage	за описание каждой фазы	•
growth curve. Identify stages	Definition of quorum sensing,	1	2
of growth. Describe level of	description of its effect on	за каждый пункт	2
protein synthesis and number	bacterial culture growth	(определение чувства	
of live and dead cells on each	ouctorial culture growth	кворума / описание его	
stage. What is quorum		l l	
sensing and how it affects		влияния на рост	
culture growth?		бактериальной культуры)	
Culture growin:			

8. Describe bacterial cell	Description of bacterial cell	-	1
division. What is a Z ring?	division		
What is the difference	Z ring description	-	2
between binary fission and	Binary fission of bacteria	-	2
budding? Provide examples	Budding of bacteria	-	2
of bacteria which have	Examples of bacteria for each	0,5	2
binary and budding types of	type of division	за каждый пример	
division. What is a	Definition of generation time	-	1
generation time?			_
9. Bacteriophages. Describe	Definition of bacteriophages	-	1
lytic and lysogenic life cycle.	Description of lytic life cycle	-	2
What is a prophage?	Lysogenic life cycle	-	2
Examples of dsDNA and	Definition of a prophage	-	1
ssDNA bacteriophages. How	Example of dsDNA and ssDNA	0,5	2
bacteriophages P1 and T7 are	bacteriophages	за каждый пример	_
used in genetic engineering?	Bacteriophage P1 for	-	1
	temperature-dependent cell lysis	_	1
	T7 bacteriophage promoter for		1
		-	1
10 D	increased rate of gene expression		2
10. Describe and draw	Description and scheme for	-	2
schemes of 3 main types of	transformation		
horizontal gene transfer in	Conjugation	-	2
prokaryotes. Describe	Transduction	-	2
conditions of chemical	Description of principle for	-	1
transformation and	chemical transformation		
electroporation. What are the	Description of principle for	-	1
features of competent cells in	electroporation		
comparison to other strains?	Features of competent cells	0,4	2
		за каждую особенность	
11. Regulation of gene	Description of DNA, nucleoid and	0,67	2
expression in bacteria. DNA	histone-like proteins (HU, HNS,	за описание каждого	
folding, examples of	SMC)	объекта	
histone-like proteins. Sigma	Definitions of sigma factors, their	1	2
factors. Regulator operons:	functioning with examples	за каждый пункт	
lac operon, tryptophan		(определение	
operon.		сигма-факторов / их	
		функционирование с	
		примерами)	
	Description of <i>lac</i> operon	<u> </u>	4
	functioning		
	Description of <i>trp</i> operon	-	2
	functioning		
12. Antibiotics targets.	Antibiotics targets	1	5
Mechanisms of antibiotics	1 milotottes targets	за каждый пример	
resistance (at least 3).	Corresponding mechanisms of	1	3
Definition of multidrug	resistance	за описание каждого	,
antibiotics resistance. R	Tesistanee		
plasmids.	Definition of multidrug resistance	механизма	1
praoritiao.		<u> </u>	
	Definition of R plasmid	-	1

	1		
13. Examples of antibiotics	Examples of antibiotics and their	0,5	5
and their targets (at least 5).	targets	за каждый пример	
Bacteriocins: source,		антибиотика	
function. Antimicrobial		0,5	
peptides: source, function.		за название мишеней	
Quorum quenchers: source,		каждого антибиотика	
function.	Bacteriocins: sources and	1	2
	mechanisms	за каждый пункт	
		(источники бактериоцинов /	
		механизмы их действия)	
	AMP: sources and mechanisms	1	2
	And Sources and meenanisms	за каждый пункт	2
		(источники антимикробных	
		пептидов / механизмы их	
		I ''	
		действия)	
	QQ: sources and mechanisms	0,5	1
		за каждый пункт	
		(источники средств для	
		подавления кворума /	
		механизмы их действия)	
14. Bacterial antigens (O-,	Definition of O-, H-, Vi-antigen	1	3
H-, Vi-antigen).		за каждое определение	
Pathogenicity, virulence,	Definition of pathogenicity,	1	3
attenuation. Virulence	virulence, attenuation	за каждое определение	
factors, pathogenicity	Definition of virulence factors,	1	2
islands. Colonization and	pathogenicity islands	за каждое определение	_
invasion.	Colonization, invasion	1	2
	Colonization, invasion	i -	2
15. Definition and difference	Definition of microbiota and	за каждое определение	2
		i -	2
between microbiota and	microbiome	за каждое определение	
microbiome. Dysbiosis.	Definition of dysbiosis, probiotics	1	3
Probiotics and prebiotics.	and prebiotics	за каждое определение	
Commensal and	Definition of commensal and	1	2
conditionally pathogenic	conditionally pathogenic bacteria	за каждое определение	
bacteria. Mechanisms of	Mechanisms of regulation of	1	3
regulation of intestinal	intestinal microbiota composition	за описание каждого	
microbiota composition (at		механизма	
least 3).			
	Part 3 – Cell biology	7	
1. Provide the structure of a	Mitochondria: structure and	1	2
eukaryotic cell. Name	functions	за каждый пункт (структура	
non-membrane,		митохондрий / их функции)	
single-membrane and double	Endoplasmic reticulum: structure	0,75	1,5
layered organelles. Briefly	and functions	за каждый пункт (структура	,
describe their main		эндоплазматического	
functions.		ретикулума / его функции)	
	Golgi complex: structure and	0,75	1,5
	functions	/ / /	1,3
	Tunctions	за каждый пункт (структура	
		аппарата Гольджи / его	
		функции)	
	Cytoplasmic membrane: structure	0,75	1,5
	Cytoplasmic membrane: structure and functions	за каждый пункт (структура	1,5
	1	/ / /	1,5

	Nucleus structure and functions	0.75	1.5
	Nucleus: structure and functions	0,75	1,5
		за каждый пункт (структура	
		ядра / его функции)	
	Centriole, purinosome, etc:	0,5	2
	structure and functions	за описание структуры	
		каждого примера	
		0,5	
		за описание функций	
		каждого примера	
2. Describe the structure of a	Nuclear envelope, lamina:	1	4
eukaryotic nucleus and its	structure and functions	за описание структуры	•
membrane.	Structure and ranctions	каждого примера	
memorane.		1	
		за описание функций	
		каждого примера	
	Nuclear transport description	-	3
	Karyoplasm, nucleolus: structure	0,75	3
	and functions	за описание структуры	
		каждого примера	
		0,75	
		за описание функций	
		каждого примера	
3. Provide a scheme of	Definition of interphase and	0,5	1
human cell cycle. What are	mitosis	за каждое определение	
the main phases and	Main phases of cell cycle and	1	6
regulators of the cell cycle?	their features	за название каждой фазы	
		1	
		за описание особенностей	
		каждой фазы	
	Regulation of cell cycle	1	3
	progression by CDK complexes	за каждый пример	3
4 Describe et a confermitation	Definition of karyokinesis and	за каждый пример	
4. Describe stages of mitotic	3	1	2
cell division of a eukaryotic	cytokinesis	за каждое определение	
cell. What are the main	Phases of karyokinesis and their	1	8
phases and their	features	за название каждой фазы	
characteristics?		1	
		за описание особенностей	
		каждой фазы	
5. Describe an anaerobic	Constant and insulin-dependent	1	2
glucose oxidation process.	glucose transporters	за каждое определение	=
How is glucose transported	Hexokinase, aldolase, GAPDH	1	6
to the cell? What are the	and their reactions in glycolysis	· .	U
	and their reactions in grycorysis	за описание каждого	
steps and products of		фермента	
glycolysis?			
		за описание реакций в	
		гликолизе каждого	
		фермента	
	Other participating enzymes and	0,5	2
	their reactions	за описание каждого	
		фермента	
		0,5	
		· ·	
		I DO OTHODINA BAOMINI	
		за описание реакций каждого фермента	

(D : 1 1 C		· · · · · · · · · · · · · · · · · · ·	
6. Provide a scheme of	Sequence of a cycle stages	-	2
tricarboxylic acid cycle with	Formula of citrate,	0,75	3
its stages and compounds.	α-ketoglutarate, succinate,	за каждую формулу	
Describe main functions of	oxaloacetate		
the cycle in the cell.	Formula of cis-aconitate,	0,6	3
	isocitrate, succinyl-CoA,	за каждую формулу	
	fumarate, malate		
	Role of a compound in cell	0,5	2
	metabolism	за каждый пример	
7. Describe oxidative	Full name, function and features	0,67	2
phosphorylation and its main	of Complex I	за каждый пункт (название	
stages. What are the		комплекса / функции /	
complexes of the electron		особенности)	
transport chain and what are	Full name, function and features	0,33	1
their functions?	of Complex II	за каждый пункт (название	1
men functions:	of Complex II	- · · · · · · · · · · · · · · · · · · ·	
		комплекса / функции /	
		особенности)	
	Full name, function and features	0,67	2
	of Complex III	за каждый пункт (название	
		комплекса / функции /	
		особенности)	
	Full name, function and features	0,67	2
	of Complex IV	за каждый пункт (название	
		комплекса / функции /	
		особенности)	
	Full name, function and features	1	3
	of Complex V	за каждый пункт (название	
		комплекса / функции /	
		особенности)	
8. Provide names and	Name and structure of amino acid	0,25	7
structures of non-essential	Traine and structure of animo actu	за название каждой	,
and conditionally essential		аминокислоты	
amino acids. Where does the		0.25	
piosynthesis of them take		1	
part inside the cell?		за описание структуры	
part inside the cen?		каждой аминокислоты	
	Location and enzymatic process	1,5	3
	of biosynthesis	за каждый пункт	
		(местоположение	
		биосинтеза /	
		ферментативный процесс)	
		1 1	
	Description of membrane	1,5	6
mechanisms of membrane	Description of membrane transport mechanism	1 1	6
mechanisms of membrane	transport mechanism	1,5	6
mechanisms of membrane transport. Provide examples	_	1,5 за описание каждого	6
mechanisms of membrane transport. Provide examples of compounds transported by	transport mechanism	1,5 за описание каждого	
mechanisms of membrane transport. Provide examples of compounds transported by	transport mechanism Examples of compounds	1,5 за описание каждого механизма 1	
mechanisms of membrane transport. Provide examples of compounds transported by each type.	Examples of compounds transported by each listed	1,5 за описание каждого механизма 1	
mechanisms of membrane transport. Provide examples of compounds transported by each type.	Examples of compounds transported by each listed mechanism Components of a conventional	1,5 за описание каждого механизма 1 за каждый пример	4
mechanisms of membrane transport. Provide examples of compounds transported by each type. 10. Draw a scheme of a typical optical microscope.	Examples of compounds transported by each listed mechanism	1,5 за описание каждого механизма 1 за каждый пример 1 за каждый пункт	4
mechanisms of membrane transport. Provide examples of compounds transported by each type. 10. Draw a scheme of a typical optical microscope. What are the main parts of	Examples of compounds transported by each listed mechanism Components of a conventional	1,5 за описание каждого механизма 1 за каждый пример 1 за каждый пункт (составляющие микроскопа	4
mechanisms of membrane transport. Provide examples of compounds transported by each type. 10. Draw a scheme of a typical optical microscope. What are the main parts of it? What is the principle of	Examples of compounds transported by each listed mechanism Components of a conventional microscope and their functions	1,5 за описание каждого механизма 1 за каждый пример 1 за каждый пункт	2
9. Describe types and mechanisms of membrane transport. Provide examples of compounds transported by each type. 10. Draw a scheme of a typical optical microscope. What are the main parts of it? What is the principle of image production in brightfield, darkfield and	Examples of compounds transported by each listed mechanism Components of a conventional	1,5 за описание каждого механизма 1 за каждый пример 1 за каждый пункт (составляющие микроскопа	4

	1		1
	Principle of phase-contrast	-	4
	microscopy		
11. What is the principle of	Scheme of a typical enzymatic	-	1
enzymatic reaction? Provide	reaction		
a formula of	Michaelis-Menten equation for	-	1
Michaelis–Menten equation.	enzymatic reaction		
How is this equation	Plot of reaction rate vs substrate	-	2
obtained, what is the	concentration dependence		
Michaelis–Menten constant?	Michaelis constant definition	-	2
	Differential representation of	-	4
	enzymatic reaction rate and its		
	derivation		
12. Signal transduction in	Definition of signal transduction	-	1
human cells. What are	Features of primary transducers	-	1
primary transducers,	Features of receptors	-	1
receptors and secondary	Features of secondary transducers	-	1
transducers? Provide	Examples of transducers and	1,5	6
examples.	receptors, their cascades	за каждый пример	
13. Provide the main	Definition of optical absorbance,	-	1
principle of optical	Beer–Lambert law and its		
absorbance and fluorescence	formulation		
in terms of applications in	Additivity (linear combination) of	-	2
molecular biology.	optical absorbance in mixtures		
	The use of optical absorbance in	-	2
	molecular biology studies		
	Definition of fluorescence in	-	2
	terms of energy during		
	nonradiative transition		
	Stokes shift illustration on a	-	1
	wavelength vs intensity plot		
	The use of fluorescence in	-	2
	molecular biology studies		
14. Name B vitamins and	Name of vitamin B	0,5	2,5
their role in human cellular		за каждый пример	
metabolism.	Role in human cellular	1,5	7,5
	metabolism	за каждый пример	
		,, 1 1	

Примечание:

Сумма набранных баллов за тестирование оценивается по правилу округления до целого значения.

На аттестационном испытании запрещается использовать записи, конспекты лекций и иные материалы, а также электронные устройства.

При использовании данных материалов ответы студента аннулируются, аттестационное тестирование считается не пройденным.

^{*} часть вопроса/задания, которую необходимо раскрыть

^{**} если студент правильно раскрывает критерий (подпункт критерия), то получает указанное количество баллов, если критерий (подпункт критерия) не раскрыт или раскрыт неверно, то студент получает 0 баллов за критерий (подпункт критерия)

Система перевода показателей в балльно-рейтинговую систему

Показателями академической успеваемости и учебно-научной активности студентов, которые учитываются при проведении аттестационного собеседования, являются: академическая разница, наличие достижений по научной и учебной деятельности, средний балл по академической справке.

Данные показатели могут быть учтены для всех направлений подготовки, за которыми закреплены образовательные программы Химико-биологического кластера.

Для осуществления ранжирования студентов в общем списке в случае конкурса на вакантные бюджетные места все показатели переводятся в балльно-рейтинговую систему согласно таблице ниже.

В случае если студент не проходит аттестационное тестирование, он считается не прошедшим аттестационное испытание, и баллы по показателям не учитываются.

Система перевода показателей академической успеваемости и учебно-научной активности студентов в балльно-рейтинговую систему

N₂	Показатель	Критерий измерения	Балл
1	Академическая разница*	0-2 дисциплины/практики	5
		3-5 дисциплин/практик	3
		6-8 дисциплин/практик	1
		более 8 дисциплин/практик	0
2	Наличие достижений победитель или призер		3
		международных олимпиад /	за каждое
		соревнований	достижение
		наличие статьи в журнале,	3
		рецензируемом базой Scopus,	за каждое
		Web of Science	достижение
		участие в международной	3
		конференции/симпозиуме	за каждое
			достижение
		победитель или призер	2
		всероссийских олимпиад /	за каждое
		соревнований	достижение

		наличие статьи в журнале,	2
		рецензируемом ВАК	за каждое
		podononpy on on 21 21	достижение
		участие во всероссийской	2
		конференции/симпозиуме	за каждое
			достижение
		победитель или призер	1
		региональных или	за каждое
		внутривузовских олимпиад /	достижение
		соревнований	
		наличие статьи в журнале,	1
		рецензируемом РИНЦ	за каждое
			достижение
		участие в	1
		региональной/внутривузовской	за каждое
		конференции/симпозиуме	достижение
		прочие достижения	1
			за каждое
			достижение
		нет достижений	0
3	Средний балл**	4,7-5,0	5
		4,3-4,6	4
		3,9-4,2	3
		3,5-3,8	2
		3,0-3,4	1
		менее 3,0	0

^{*} Академическая разница подсчитывается на основании количества дисциплин/практик (не форм контроля)
** Средний балл учитывается согласно академической справке по правилу округления

значения до десятичного знака