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Информация о владельце:

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MINISTRY OF SCIENCE AND HIGHER EDUCATION

RUSSIAN FEDERATION

Federal State Autonomous Educational Institution of Higher Education

NORTH-CAUCASUS FEDERAL UNIVERSITY

APPROVED

Assoc. Prof. Kubanov S.I.

PhD in Medical Sciences

Dean Faculty of Medicine and Biology

ASSESSMENT TOOLS FUND FOR THE DISCIPLINE

Biology: Introduction to Genetics

- Specialty: 31.05.01 General Medicine
- Mode of training: Full-time
- Year of commencement of studies: 2026
- Delivered in Semester 2

Introduction

1. Intended for carrying out current control of academic performance progress and intermediate attestation in the discipline of Biology: Introduction to Genetics for students of the specialty (majoring in) 31.05.01 General Medicine.
2. The ATF is an appendix to the program of the discipline (module) Biology: Introduction to Genetics
3. Developer(s): Kukharuk Maksim Yurievich, Docent of the Department of Genetics and Breeding
Denyak Andrey Konstantinovich Assistant of the Department of Genetics and Breeding
4. Expert examination of the ATF has been completed.

Expert group:

Chairperson: Pahomova Tatyana Aleksandrovna Docent of the Department of Anatomy and Histology

Committee members: Krivoruchko Aleksandr Yurievich, Head of of the Department of Genetics and Breeding

Zuev Roman Vladimirovich Docent of the Department of Genetics and Breeding

Employer organization representative: Vilensky I.L., Chief Physician of Independent CDL, LLC

Expert conclusion – the ATF allows evaluating the level of competency levels and is recommended to be employed in the educational process.

5. The validity period for the ATF shall be determined by the period of implementation of the educational program.

1. Description of Evaluation Criteria at Various Stages of Their Formation, Description of Evaluation Scales

Levels of formation of competence(s), indicator(s)	Descriptors			
	Minimum level not achieved (Unsatisfactory) 2 points	Minimum level (Satisfactory) 3 points	Intermediate level (Good) 4 points	High level (Excellent) 5 points
Competency GPC-5. Capable of assessing morphofunctional, physiological states and pathological processes in the human body to solve professional tasks.				
Learning outcomes for the discipline (module): Development of clinical thinking. <i>Indicator: ID-1</i> GPC-5 Assesses morphofunctional and physiological states and processes in the human body at individual, group, and population levels to solve professional tasks.	Does not assess morphofunctional and physiological states	Assesses morphofunctional and physiological states	Assesses morphofunctional and physiological states and processes in the human body at individual, group, and population levels	Assesses morphofunctional and physiological states and processes in the human body at individual, group, and population levels to solve professional tasks
Learning outcomes for the discipline (module): Development of clinical thinking. <i>Indicator: ID-2</i> GPC-5 Identifies pathological states and processes in the human body to solve professional tasks	Does not identify pathological states	Identifies pathological states	Identifies pathological states and processes in the human body	Identifies pathological states and processes in the human body to solve professional tasks

The evaluation of the competency formation level in the discipline is carried out on the basis of the Regulations on conducting current control of academic progress and intermediate

attestation of students in higher education educational programs – Bachelor’s programs, Specialist’s programs, Master’s programs – at the Federal State Autonomous Educational Institution of Higher Education NORTH-CAUCASUS FEDERAL UNIVERSITY in its current edition.

ASSESSMENT TOOLS FOR CHECKING THE LEVEL OF COMPETENCY DEVELOPMENT

Task Number	Correct Answer	Content of the Question	Competency
1	a,b	Select the correct statements: a) Some transposons carry drug resistance markers; b) The main transposition protein is transposase; c) Mobile elements – retrotransposons – are common in prokaryotes; d) A transposition event itself cannot cause deletions and/or inversions.	GPC-5
2	a, b, d	Incomplete dominance in crosses of various organisms is observed (multiple answers): a) in Snapdragon (<i>Antirrhinum majus</i>); b) in Marvel of Peru (<i>Mirabilis jalapa</i>); c) in oats (<i>Avena</i>); d) in strawberry (<i>Fragaria</i>).	GPC-5
3	a	The TATA box consists of: a) adenine and thymine; b) guanine and cytosine; c) adenine and guanine; d) adenine, cytosine and thymine.	GPC-5
4	b	The subject of the science of genomics is: a) the formation of linkage groups of genes controlling various hereditary traits; b) the structure of the genomes of humans and other living organisms; c) the identification of loci of hereditary diseases; d) the study of molecular mechanisms of diseases.	GPC-5
5	a	The phenomenon of transformation in bacteria was first observed by: a) Griffiths; b) Morgan; c) Kornberg; d) Muller.	GPC-5
6	d	Which karyotype is characteristic of patients with Down syndrome? a) 45, X0; b) 47, XY+13; c) 47, XY+18; d) 47, XX+21.	GPC-5
7	b	Which of the following is a non-coding nucleotide sequence? a) Exons; b) Introns; c) Promoter; d) Enhancer.	GPC-5
8	a, b	Select the correct statements:	GPC-5

		a) Some transposons carry drug resistance markers; b) The main transposition protein is transposase; c) Mobile elements – retrotransposons – are common in prokaryotes; d) A transposition event itself cannot cause deletions and/or inversions.	
9	L1R2; L2BR3; L3R1.	Establish correspondence: Match the scientist and their work. L1: "Experiments on Plant Hybridization" L2: "What is Life from the Point of View of Physics?" L3: "On the Nature of Gene Mutations and Gene Structure" R1: Timofeev-Resovsky, Zimmer, Delbrück R2: Mendel R3: Schrödinger	GPC-5
10	L1R2; L2R1; L3R3.	Match the types of transduction with their characteristics: L1: Non-specific L2: Specific L3: Abortive R1: Characterized by the ability of the phage to transfer specific genes from the donor bacterium to the recipient bacterium. R2: Transducing phages act only as carriers of genetic material from one bacterium to another. R3: The fragment of donor bacterial DNA brought by the phage is not incorporated into the recipient bacterium's chromosome but resides in the cytoplasm.	GPC-5
11	L1R3; L2R1; L3R4; L4R2.	Match the concepts and their terms: L1: Telomeres L2: Hayflick limit L3: Amplification L4: Telomerase R1: limitation on the number of cell divisions R2: a ribonucleoprotein complex whose RNA contains a nucleotide sequence that serves as a template for the synthesis of the TTAGGG repeat R3: terminal regions of chromosomes that do not carry genetic information but serve to protect chromosomal material from loss during replication and from attacks by endonucleases R4: multiple replication of individual groups of genes	GPC-5
12	L1R4; L2R1; L3R2; L4R3.	Match the scientist and the fact about him: L1: W. Bateson L2: G. Mendel L3: T. Morgan L4: F. Crick R1: Identified discrete traits from the continuous characteristics of plants R2: Formulated the chromosomal theory of heredity R3: Is one of the people who established the structure of DNA	GPC-5

		R4: Introduced the concepts of "homozygosity" and "heterozygosity"	
13	L1R4; L2R3; L3R1; L4R2.	Match the types of blot hybridization with their definitions: L1: Southern blot L2: Dot and slot blot hybridization L3: Northern blot L4: Western blot R1: a method of hybridizing DNA probes with electrophoretically separated RNA molecules R2: binding of electrophoretically separated proteins fixed on filters to labeled antibodies R3: DNA or RNA molecules hybridize with a labeled DNA probe without prior restriction enzyme treatment and electrophoresis R4: genomic DNA is treated with restriction enzymes, and the resulting fragments are separated by relative molecular mass in agarose or acrylamide gel	GPC-5
14	L1-R2; L2-R1; L3-R4; L4-R3; L5-R5.	Match each biotechnological tool/method with its primary application. L1. Restriction enzymes L2. PCR (Polymerase Chain Reaction) L3. CRISPR/Cas9 L4. Gel electrophoresis L5. DNA ligase R1. Amplification of specific DNA sequences R2. Cutting DNA at specific recognition sites R3. Separation of DNA fragments by size R4. Targeted genome editing (gene knockouts, insertions) R5. Joining DNA fragments (e.g., vector and insert)	GPC-5
15	L1-R2; L2-R1; L3-R5; L4-R4; L5-R3.	Match each condition with its violation that leads to changes in allele frequencies. L1. Random mating L2. No mutation L3. No migration L4. No natural selection L5. Large population size R1. Mutation introduces new alleles R2. Non-random mating (assortative mating, inbreeding) R3. Genetic drift due to small population size R4. Differential survival and reproduction of genotypes R5. Gene flow (immigration/emigration)	GPC-5
16	L1-R2; L2-R1; L3-R4; L4-R5; L5-R3.	Match each type of inheritance with its correct description. L1. Autosomal dominant L2. Autosomal recessive L3. X-linked recessive L4. X-linked dominant L5. Y-linked (holandric) R1. Trait appears only in homozygous recessive individuals; both sexes affected equally	GPC-5

		R2. Trait appears in every generation; affected individuals have at least one affected parent; both sexes affected equally R3. Trait appears only in males; father transmits the trait to all sons R4. Trait appears more frequently in males; affected males inherit the allele from their mother R5. Both males and females are affected; affected males pass the trait to all daughters	
17	1-C, 2-A, 3-D, 4-B	Arrange the following steps of a single PCR cycle in the correct chronological order A. Primer annealing (primers bind to complementary template sequences) B. Final extension completes the synthesis of all products C. Denaturation (double-stranded DNA is separated into single strands) D. Elongation (DNA polymerase extends primers, synthesizing new DNA)	GPC-5
18	1-C, 2-D, 3-B, 4-E, 5-A	Arrange the following events of translation (protein synthesis) in the correct chronological order A. Ribosome reaches a stop codon (UAA, UAG, or UGA) B. Peptide bond forms between the amino acid in the A-site and the growing polypeptide chain C. Small ribosomal subunit binds to the mRNA (initiation) D. tRNA carrying an amino acid binds to the A-site (elongation) E. Ribosome translocates to the next codon (moves 3 nucleotides along the mRNA)	GPC-5
19	1-C, 2-D, 3-E, 4-A, 5-B	Arrange the following events of DNA replication in the correct chronological order A. DNA polymerase fills the gap with new nucleotides B. DNA ligase seals the nick in the sugar-phosphate backbone C. The MutS protein recognizes and binds to the mismatch D. The MutL protein recruits MutH, which nicks the newly synthesized strand E. Exonuclease excises the mismatched segment (from the nick to beyond the mismatch)	GPC-5
20	1-B, 2-E, 3-C, 4-D, 5-A	Arrange the following steps involved in performing and interpreting a dihybrid cross in the correct logical order A. Determine the phenotypes of the F₂ generation based on the genotype ratios B. Cross two true-breeding parents (P generation) differing in two traits (e.g., RRYy × rryy) C. Self-pollinate or cross the F₁ plants to produce the F₂ generation D. Use a Punnett square (16 cells) to predict the F₂ genotype and phenotype ratios E. Determine the genotype and phenotype of the F₁ generation (all heterozygous for both traits)	GPC-5

21	1-A, 2-C, 3-D, 4-E, 5-B	Arrange the following events of pre-mRNA processing and alternative splicing in the correct chronological order A. The primary transcript (pre-mRNA) is synthesized by RNA polymerase II B. Final mRNA is exported from the nucleus to the cytoplasm for translation C. A 5' cap is added and a 3' poly-A tail is added (co-transcriptional processing) D. Spliceosome assembles at the splice sites E. Introns are removed and exons are ligated; alternative splice patterns may produce different mRNA isoforms	GPC-5
22	1-C, 2-F, 3-A, 4-B, 5-E, 6-D	Arrange the following steps of a typical gene cloning experiment in the correct chronological order A. Insert the DNA fragment into the vector (ligation) B. Transform host cells (e.g., E. coli) with the recombinant plasmid C. Isolate and purify the target gene (e.g., by PCR or restriction digestion) D. Select and screen recombinant colonies (using antibiotics, blue-white screening, etc.) E. Amplify the recombinant plasmid in host cells (culture) F. Cut the vector and the target DNA with the same restriction enzyme(s)	GPC-5
23	bacteriophage	Transduction is the process of transferring bacterial DNA from one cell to another by a #####.	GPC-5
24	maternal effect	The phenomenon in which the phenotype of the offspring is determined exclusively by the maternal genome is called ###.	GPC-5
25	Helicase	The main DNA unwinding protein is ###.	GPC-5
26	gynandromorphism	The phenomenon in which different parts of an organism's body, by their characteristics, belong to different sexes is called ###.	GPC-5
27	test cross backcross	The backcrossing of a hybrid with the parental form is called a ###.	GPC-5
28	telomeres	The joining of chromosomes by their end regions is prevented by ###.	GPC-5
29	hypertranscription	As a result of dosage compensation in Drosophila, ### occurs, as well as the formation of a diffuse loosened structure and early completion of replication.	GPC-5
30	crossing over	Recombination in eukaryotes usually occurs during ###.	GPC-5

2. Description of the Evaluation Scale

Within the framework of the rating system, students' academic progress in each discipline is evaluated during current control and intermediate attestation. The rating system for assessing students' knowledge is based on the use of a combination of control activities to check the covered material (checkpoints), optimally located throughout the entire time interval of studying the discipline. The principles of the rating system for assessing students' knowledge are based on the requirements described in the Regulations on the organization of the educational process based on the rating system for assessing students' knowledge at NCFU.

3. Criteria for Evaluating Competencies

The grade **Excellent** shall be awarded to a student if the theoretical content of the course has been mastered completely, without gaps; the material is presented exhaustively, consistently, clearly, and logically; the student freely copes with tasks, questions, and other types of knowledge application; uses additional material in the answer; all tasks provided for by the program are completed, and the quality of their execution is evaluated by a number of points close to the maximum; analyzes the obtained results; demonstrates independence when performing tasks.

The grade **Good** is to be awarded to a student if the theoretical content of the course is mastered completely, the necessary practical competencies are mainly formed, all educational tasks provided for by the training program are completed, and the quality of their execution is sufficiently high. The student firmly knows the material, presents it competently and strictly on the merits of the matter, without allowing significant inaccuracies in answering the question.

The grade **Satisfactory** is awarded to a student in case the theoretical content of the course has been mastered in part only, but the gaps are not of a significant nature, most of the tasks provided for by the program are completed, but contain errors, the student allows inaccuracies and insufficiently correct wording when answering the question, and violations of logical sequence are observed in the presentation of the program material.

The grade **Unsatisfactory** is awarded to a student if they do not know a significant part of the program material, allow significant errors, perform practical works with great difficulty and uncertainty, the necessary practical competencies are not formed, most of the educational tasks provided for by the training program are not completed, and the quality of their execution is evaluated by a number of points close to the minimum.