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ФИО: Ястребов Олег Александрович  
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**Federal State Autonomous Educational Institution of Higher Education  
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA  
RUDN University**

**Agrarian and Technological Institute**

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educational division (faculty/institute/academy) as higher education programme developer

**COURSE SYLLABUS**

Veterinary genetics

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course title

**Recommended by the Didactic Council for the Education Field of:**

36.05.01 Veterinary

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field of studies / speciality code and title

**The course instruction is implemented within the professional education programme of higher education:**

36.05.01 Veterinary

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higher education programme profile/specialisation title

## 1. GOALS AND OBJECTIVES OF THE COURSE

The aim of mastering the course "**Veterinary genetics**" is obtaining knowledge about the methods of genetics; patterns of heredity and variability of animals; methods of regulation of productivity and product quality; cytological, biochemical and molecular bases of heredity; patterns of inheritance of traits in genotypic and phenotypic variability; the basics of mutagenesis; population genetics; the role and characteristics of cytoplasmic heredity in various life forms; about hybridization, inbreeding and apomixis; hereditary causes of diseases; genetic foundations of breed creation technology; the basics of biotechnology at different levels of the organization; carrying out cytological and hybridological analysis of animals; drawing up crossing schemes for the practical use of linked inheritance and inheritance, sex-linked traits; the use of the foundations of mathematical analysis in the study of the phenomenon of variability and heredity; solving problems on all topics studied; getting the student an idea of the regulation and control of the action of genes in ontogenesis, the mechanism of gene, chromosomal and genomic mutations and the problems of ecological genetics, the genetics of the individual development of organisms; population genetics; tasks of genetic and genetic engineering, transgenesis and cloning, cytological and genetic maps of chromosomes.

## 2. REQUIREMENTS FOR LEARNING OUTCOMES

The implementation of the course "**Veterinary genetics**" is aimed at creating the following competencies (parts of competencies) for students:

*Table 2.1. List of competencies formed by students during the development of the course (results of the development of the course)*

<b>Competence code</b>	<b>Competence descriptor</b>	<b>Indicators of competence accomplishment (within the course)</b>
GPC-2	Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological state of the animal organism	GPC-2.1 Have knowledge of the influence of natural, socio-economic, genetic and economic factors on the animal body.
GPC-6	Capable of analyzing, identifying, and assessing the risk of disease emergence and spread	GPC-6.1 Have knowledge of etiology and pathogenesis of animal diseases of different species.
		GPC-6.2 Know the laws of the emergence and spread of diseases in animal populations, predisposing factors to diseases and the causes of possible complications.

## 3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The course "**Veterinary genetics**" refers to the mandatory part of block B1 of the Educational Program of Higher Education.

As part of the Educational Program of Higher Education, students also master other courses and /or practices that contribute to achieving the planned results of mastering the course "**Veterinary genetics**".

*Table 3.1. List of Higher Education Program components courses that contribute to expected learning outcomes*

<b>Competence code</b>	<b>Competence descriptor</b>	<b>Previous courses/modules, internships*</b>	<b>Subsequent courses/modules, internships*</b>
GPC-2	Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological state of the animal organism	Biology with the basics of ecology	Breeding with the basics of private animal husbandry Animal health and welfare Feeding animals with the basics of forage production General and Veterinary Ecology Study practice Clinical internship Industrial practice Academic research practice with the preparation of a scientific qualification project Preparation for and passing the state exam
GPC-6	Capable of analyzing, identifying, and assessing the risk of disease emergence and spread		Animal health and welfare Pathological physiology Epizootology and infectious diseases Clinical internship Industrial practice Academic research practice with the preparation of a scientific qualification project Preparation for and passing the state exam

#### **4. COURSE WORKLOAD AND TRAINING ACTIVITIES**

Course workload of the course "**Veterinary genetics**" is 2 credits.

Table 4.1. Types of academic activities during the period of the HE program mastering for *full-time* study

Types of academic activities		HOURS	Semesters				
			2	-	-	-	
Contact academic hours		54	54	-	-	-	
including							
Lectures		18	18	-	-	-	
Lab work		36	36			-	
Seminars (workshops/tutorials)		-	-	-	-	-	
Self-study		12	12	-	-	-	
Evaluation and assessment (exam/pass/fail grading)		6	6	-	-	-	
Course workload		Academic hour	72	72	-	-	-
		Credit unit	2	2	-	-	-

## 5. COURSE CONTENTS

Table 5.1 Content of the course (module) by type of academic work

Modules	Content of the modules (topics)	Types of academic activities
Module 1. Genetics and its place in the system of natural sciences.	Topic 1.1 The subject of genetics.	Lectures, Lab work.
	Topic 1.2 The concept of heredity and variability.	Lectures, Lab work.
	Topic 1.3 The history of the development of genetics.	Lectures, Lab work.
	Topic 1.4 The significance of G. Mendel's works in the development of genetics as a science.	Lectures, Lab work.
	Topic 1.5 Methods of genetics.	Lectures, Lab work.
	Topic 1.6 The importance of genetics in agronomy.	Lectures, Lab work.
Module 2. Patterns of inheritance of traits during sexual reproduction.	Topic 2.1 Mendel's laws.	Lectures, Lab work.
	Topic 2.2 Dominance types.	Lectures, Lab work.
	Topic 2.3 Alleles.	Lectures, Lab work.
	Topic 2.4 Analyzing crossing.	Lectures, Lab work.
	Topic 2.5 Regularities of inheritance of traits in mono-, di- and polyhybrid crossing	Lectures, Lab work.

Module 3. Fundamentals of cytogenetics.	Topic 3.1 Cellular structure of organisms.	Lectures, Lab work.
	Topic 3.2 Cell structure.	Lectures, Lab work.
	Topic 3.3 Chromosomes, their types and structure.	Lectures, Lab work.
	Topic 3.4 Cell division.	Lectures, Lab work.
	Topic 3.5 Mitosis.	Lectures, Lab work.
	Topic 3.6 The biological significance of mitosis.	Lectures, Lab work.
	Topic 3.7 Pathology of mitosis.	Lectures, Lab work.
	Topic 3.8 Meiosis.	Lectures, Lab work.
	Topic 3.9 Genetic control of meiosis.	Lectures, Lab work.
	Topic 3.10 The genetic significance of meiosis.	Lectures, Lab work.
	Topic 3.11 Pathology of meiosis.	Lectures, Lab work.
	Topic 3.12 Karyotypes.	Lectures, Lab work.
Module 4. Interaction of non-allelic genes	Topic 4.1 Complementary Gene Interaction.	Lectures, Lab work.
	Topic 4.2 Suppression.	Lectures, Lab work.
	Topic 4.3 Dominant epistasis.	Lectures, Lab work.
	Topic 4.4 Cryptomeria (recessive epistasis).	Lectures, Lab work.
	Topic 4.5 Polymerism.	Lectures, Lab work.
	Topic 4.6 Pleiotropy.	Lectures, Lab work.
	Topic 4.7 Modifier genes.	Lectures, Lab work.
	Topic 4.8 Multiple alleles.	Lectures, Lab work.
Module 5. Chromosomal theory of heredity	Topic 5.1 Grip and crossing over.	Lectures, Lab work.
	Topic 5.2 Chromosomal theory of T.H. Morgan.	Lectures, Lab work.
	Topic 5.3 Crossover mechanism.	Lectures, Lab work.

	Topic 5.4 The size of the cross and the linear arrangement of genes in the chromosome.	Lectures, Lab work.
	Topic 5.5 Single and multiple crossover.	Lectures, Lab work.
	Topic 5.6 Interference.	Lectures, Lab work.
	Topic 5.7 Localization of genes.	Lectures, Lab work.
	Topic 5.8 The linear arrangement of genes in the chromosome.	Lectures, Lab work.
	Topic 5.9 Genetic maps of chromosomes.	Lectures, Lab work.
	Topic 5.10 Cytological evidence of crossing over.	Lectures, Lab work.
	Topic 5.11 Factors Affecting Chromosome Crossing.	Lectures, Lab work.
Module 6. Genetics of sex.	Topic 6.1 Inheritance of sex-linked traits.	Lectures, Lab work.
	Topic 6.2 Determination of sex.	Lectures, Lab work.
	Topic 6.3 Disorders in the development of sex.	Lectures, Lab work.
Module 7. Variability and methods of studying it	Topic 7.1 Types of variability and methods of study.	Lectures, Lab work.
	Topic 7.2 The statistical nature of the splitting.	Lectures, Lab work.
	Topic 7.3 Chi-square test.	Lectures, Lab work.
	Topic 7.4 Study of the relationship between signs.	Lectures, Lab work.
Module 8. Molecular basis of heredity	Topic 8.1 Evidence for a genetic role for DNA.	Lectures, Lab work.
	Topic 8.2 Chemical composition and structure of nucleic acids.	Lectures, Lab work.
	Topic 8.3 Types and structure of RNA.	Lectures, Lab work.
	Topic 8.4 Genetic code and its properties.	Lectures, Lab work.
	Topic 8.5 Protein biosynthesis.	Lectures, Lab work.
Module 9. Mutational variability. Types of mutations and mutagenic factors	Topic 9.1 Classification of mutations.	Lectures, Lab work.
	Topic 9.2 Induced and spontaneous mutagenesis.	Lectures, Lab work.
	Topic 9.3 Mutational process.	Lectures, Lab work.

	Topic 9.4 Mutagenic factors.	Lectures, Lab work.
	Topic 9.5 Ionizing radiation and mutations.	Lectures, Lab work.
	Topic 9.6 Chemical mutagenesis.	Lectures, Lab work.
	Topic 9.7 Polyploidy and aneuploidy.	Lectures, Lab work.
Module 10. Population genetics.	Topic 10.1 The concept of populations.	Lectures, Lab work.
	Topic 10.2 Determination of gene frequencies and genotype ratios in populations.	Lectures, Lab work.
	Topic 10.3 Hardy-Weinberger's Law.	Lectures, Lab work.
	Topic 10.4 Population dynamics factors.	Lectures, Lab work.
Module 11. Genetic abnormalities. Diseases with a hereditary predisposition	Topic 11.1 Genetic, hereditary-environmental and exogenous anomalies	Lectures, Lab work.
	Topic 11.2 Autosomal and sex-linked inheritance patterns of anomalies	Lectures, Lab work.
Module 12. Blood groups in humans and animals and biochemical polymorphism	Topic 12.1 Inheritance of blood groups.	Lectures, Lab work.
	Topic 12.2 The importance of blood groups for practice.	Lectures, Lab work.
	Topic 12.3 Biochemical polymorphism and its significance.	Lectures, Lab work.
Module 13. Biotechnology	Topic 13.1 Genetic and cell engineering, cloning, transgenic plants and animals	Lectures, Lab work.

## 6. COURSE EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

Table 6.1. Material and technical support of the course

<i>Classroom for Academic Activity Type</i>	<i>Equipping the classroom</i>	<b>Specialized educational/laboratory equipment, software and materials for the development of the course (if necessary)</b>
Lecture	An auditorium for conducting lecture-type classes, equipped with a set of specialized furniture; a board (screen) and technical means of multimedia presentations.	<ul style="list-style-type: none"> <li>- <i>Personal Computer.</i></li> <li>- <i>Multimedia equipment.</i></li> <li>- <i>Microscopes Mikmed-5.</i></li> <li>- <i>Sets of fixed biomaterials</i></li> <li>- <i>illustrative material, handouts</i></li> </ul>

Laboratory	An auditorium for laboratory work, individual consultations, routine monitoring and interim certification, equipped with a set of specialized furniture and equipment.	- <i>Personal Computer.</i> - <i>Multimedia equipment.</i> - <i>Microscopes Mikmed-5.</i> - <i>Sets of fixed biomaterials</i> - <i>illustrative material, handouts</i>
Self-studies	An auditorium for independent work of students (can be used for seminars and consultations), equipped with a set of specialized furniture and computers with access to an electronic information and educational environment.	

## 7. RESOURCES RECOMMENDED FOR COURSE STUDIES

### *Main readings:*

1. Guzhov Yu.L. A.A. Zhuchenko Puhalskiy V.A., Genetics: Textbook for universities.-M.: KolosS, 2003.
2. Petukhov V.L. and other Veterinary genetics. - M.: Kolos, 1996.
3. Bakai A.V., Kochish I.I., Skripnichenko G.G. Genetics. - M.: KolosS, 2006.
4. Romanova E.V., Vatnikov Yu.A., Kezimana P. Veterinary genetics: Workshop.-M.: RUDN, 2020.
5. Romanova E.V. General genetics: a workbook for laboratory and practical studies, independent work of students and remote control of knowledge / E.V. Romanova. - M.: RUDN, 2015.
6. Romanova E.V. Collection of problems and tests on general genetics. - M.: RUDN, 2021.

### *Additional Readings:*

1. Singer M., Berg P. Genes and genomes: In 2 volumes - M.: Mir, 1998.
2. Ayala F., Keiger J. Modern genetics: In 3 volumes - M.: Mir, 1988.
3. Romanova E. V., P. Kezimana. General Genetics: study guide, English. lang. -M: RUDN, 2018.
4. Orlova N.N., Glazer V.M. and others. Collection of problems in general genetics (textbook). - M.: Moscow State University, 2001
5. Human genetics (Workshop for universities). - M.: VLADOS, 2001.
6. Questions and tasks in general biology and medical genetics (textbook) / Ed. prof. A.V. Itkesa. - M.: GEOTAR-MED, 2004.

### *Internet sources*

1. Electronic libraries (EL) of RUDN University and other institutions, to which university students have access on the basis of concluded agreements:

- RUDN Electronic Library System (RUDN ELS) <http://lib.rudn.ru/MegaPro/Web>
- EL "University Library Online" <http://www.biblioclub.ru>
- EL "Yurayt" <http://www.biblio-online.ru>
- EL "Student Consultant" [www.studentlibrary.ru](http://www.studentlibrary.ru)
- EL "Lan" <http://e.lanbook.com/>
- EL "Trinity Bridge"



## 2. Databases and search engines:

- electronic foundation of legal and normative-technical documentation  
<http://docs.cntd.ru/>
- Yandex search engine [https:// www .yandex.ru/](https://www.yandex.ru/)
- Google search engine <https://www.google.ru/>
- Scopus abstract database <http://www.elsevierscience.ru/products/scopus/>

Educational and methodological materials for independent work of students during the development of the course/ module\*:

1. A course of lectures on the course "**Veterinary genetics**".
2. Laboratory workshop on the course "**Veterinary genetics**".

\* - The training toolkit and guidelines for the internship are placed on the internship page in the university telecommunication training and information system under the set procedure.

## 8. ASSESSMENT TOOLKIT AND GRADING SYSTEM\* FOR EVALUATION OF STUDENTS' COMPETENCES LEVEL AS COURSE RESULTS

The assessment toolkit and the grading system\* to evaluate the level of competences (competences in part) formation as the course results are specified in the Appendix to the course syllabus.

\* The assessment toolkit and the grading system are formed on the basis of the requirements of the relevant local normative act of RUDN University (regulations / order).

### DEVELOPER:

Associate Professor of the Agrobiotechnology  
Department

Position, Basic curriculum

Signature

Romanova E.V.

Full name.

### HEAD OF EDUCATIONAL DEPARTMENT:

Agrobiotechnology Department

Name Basic Curriculum

Signature

Pakina E.N.

Full name.

### H HEAD OF HIGHER EDUCATION PROGRAMME:

Director of the Department of Veterinary Medicine

Position, Basic curriculum

Signature

Vatnikov Yu.A.

Full name