Federal State Autonomous Educational Institution for Higher Education
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA

Agrarian and Technological Institute

WORKING COURSE SYLLABUS

Veterinary genetics

Recommended by the Methodological Council for the Education Field:

36.05.01 Veterinary medicine

2022 г.

1. GOALS AND OBJECTIVES OF THE DISCIPLINE

The aim of mastering the discipline "**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 THE RESULTS OF MASTERING THE DISCIPLINE

The development of the discipline "**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 discipline (results of the development of the discipline)

Code	**Competence**	**Indicators of competence accomplishment** (within the discipline)
GPC-2	The ability 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 Has knowledge of the influence of natural, socio-economic, genetic and economic factors on the animal body.
		GPC-2.2 He is able to establish the presence and reliability of cause-and-effect relationships between the effects of certain etiological factors on the animal's body and the development of diseases.
		GPC-2.3 Possesses methods of preventive and curative correction of the effects of adverse environmental factors that can cause deterioration of animal health.
GPC -5	The ability to draw up special documentation, analyze the results of professional activity and submit accounting documents using specialized databases.	GPC-5.1 Has the skills to search for the necessary forms of documentation on official websites and in specialized databases.
		GPC-5.2 Possesses professional terminology and skills in filling out

		analytical and reporting documents of a professional orientation.
		GPC-5.3 He is able to use specialized software to analyze the results of professional activity and compile accounting documentation.
PC -1	The ability to collect anamnesis of life and disease of animals to identify the causes of diseases and their nature.	PC -1.1 He is able to collect an anamnesis of the animal's life and reflect this in the relevant service documentation.
		PC-1.2 He is able to collect the anamnesis of the animal's disease and reflect it in the patient's medical history.
		PC-1.3 He is able to identify possible causes of the disease in an animal, factors predisposing to the disease and concomitant conditions affecting the nature of the course of the disease and use this information when making a diagnosis.
PC -5	The ability to make a diagnosis based on the analysis of anamnesis data, general, special (instrumental) and laboratory research methods.	PC-5.1 He is able to diagnose patients of various types based on the analysis of anamnesis data, general, special (instrumental) and laboratory research methods.
		PC -5.2 He is able to predict the risks of diseases based on anamnestic data, the results of general, special (instrumental) and laboratory studies.
PC -6	The ability to develop a treatment plan for animals based on the established diagnosis and individual characteristics of animals.	PC-6.1 Able to develop a treatment plan for animals based on the established diagnosis and individual characteristics of animals.
		PC-6.2 He is able to develop recommendations on therapeutic and preventive manipulations to prevent diseases, the high probability of which was revealed during the study of the patient.
		PC-6.3 He is able to develop recommendations for carrying out preventive and curative measures based on the results of the examination of animals carried out as part of the medical examination.
PC -10	The ability to determine the need for the use of surgical methods in the treatment of animals.	PC-10.1 Able to determine the need for the use of surgical methods in the treatment of animals;
		PC-10.2 Able to choose the optimal surgical method for the patient, taking into account the external conditions and the

		status of the patient's body, and if necessary, several manipulations - their order and time distribution;
		PC-10.3 He is able to take into account the risks and possible complications accompanying surgical interventions and take measures to prevent them.
PC -16	Ability to organize organizational, technical, zootechnical and veterinary measures aimed at the prevention of non-communicable diseases in accordance with the plan for the prevention of non-communicable animal diseases	PC-16.1 He is able to assess the impact of animal housing and feeding conditions on their health as part of the implementation of action plans for the prevention of animal diseases
		PC-16.2 He is able to carry out veterinary quality control and procurement of animal feed in order to ensure their veterinary and sanitary safety as part of the implementation of action plans for the prevention of animal diseases
		PC-16.3 He is able to detect deviations from the plan of timing, types, quality of measures to prevent the occurrence of non-infectious animals
		PC-16.4 Take corrective measures to implement measures to prevent the occurrence of non-infectious animal diseases based on the results of control
		PC-16.5 Conduct conversations, lectures, seminars for employees of the organization in order to explain the principles of work on the prevention of animal diseases
PC -18	The ability to draw up a plan for the medical examination of animals, taking into account their types and purpose, to conduct medical examinations, to develop recommendations for carrying out preventive and curative measures based on the results of the examination of animals conducted as part of the medical examination	PC-18.1 He is able to make a plan for the medical examination of animals, general or specialized, taking into account their types and purpose
		PC-18.2 He is able to organize and conduct medical examination according to the drawn up plan
		PC-18.3 He is able, based on the results of medical examination, to give recommendations on the implementation of therapeutic and preventive and curative measures aimed at improving the health of a group of animals

3. COURSE IN HIGHER EDUCATION

The discipline "**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 disciplines and /or practices that contribute to achieving the planned results of mastering the discipline "**Veterinary genetics**".

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

Competence code	**Competence**	**Previous Disciplines (Modules)**	**Subsequent Disciplines (Modules)**
GPC-2	The ability 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	Veterinary Microbiology and Mycology Virology and biotechnology Physiology and ethology of animals Breeding with the basics of private animal husbandry Animal health and welfare Pathological physiology Veterinary radiobiology Pathological anatomy Instrumental diagnostic methods Toxicology Obstetrics, gynecology and andrology Internal diseases General surgery Private Veterinary Surgery Parasitology and invasive diseases Epizootology and infectious diseases Forensic veterinary examination and dissection of animals Immunology General and Veterinary Ecology Veterinary sanitation Fodder plants Zoopsychology

			Здоровье и благополучие животных Horse diseases Diseases of Productive Animals Diseases of small pets Болезни мелких домашних животных Diseases of bees and entomophages Fish pathology and aquaculture Diseases of exotic animals Anesthesiology, resuscitation and intensive care Dermatology Cardiology Endocrinology Nephrology Veterinary ophthalmology Animal Dentistry
GPC -5	The ability to draw up special documentation, analyze the results of professional activity and submit accounting documents using specialized databases.	-	Computer science Breeding with the basics of private animal husbandry Clinical diagnostics Pathological anatomy Operative surgery with topographic anatomy Instrumental diagnostic methods Obstetrics, gynecology and andrology Internal diseases Parasitology and invasive diseases Epizootology and infectious diseases Veterinary and sanitary examination Organization of veterinary affairs

			Forensic veterinary examination and dissection of animals Veterinary deontology Economics and organization of agricultural production Clinical laboratory diagnostics Laboratory diagnostics of infectious and invasive diseases Organization of state veterinary supervision Veterinary and industrial laboratories with design basics Anesthesiology, resuscitation and intensive care Dermatology Cardiology Endocrinology Nephrology
PC -1	The ability to collect anamnesis of life and disease of animals to identify the causes of diseases and their nature.	-	Physiology and ethology of animals Breeding with the basics of private animal husbandry Animal health and welfare Feeding animals with the basics of forage production Clinical diagnostics Toxicology Obstetrics, gynecology and andrology Internal diseases General surgery Private Veterinary Surgery Parasitology and invasive diseases Epizootology and infectious diseases Basics of Rhetoric and Communication

			Veterinary deontology Zoopsychology Здоровье и благополучие животных Personality psychology and professional self-determination Horse diseases Diseases of Productive Animals Diseases of small pets Болезни мелких домашних животных Diseases of exotic animals Anesthesiology, resuscitation and intensive care Dermatology Cardiology Endocrinology Nephrology Reconstructive surgery Veterinary ophthalmology Animal Dentistry
PC-5	The ability to make a diagnosis based on the analysis of anamnesis data, general, special (instrumental) and laboratory research methods.	-	Cytology, Histology and Embryology Physiology and ethology of animals Breeding with the basics of private animal husbandry Feeding animals with the basics of forage production Pathological physiology Clinical diagnostics Pathological anatomy Toxicology Obstetrics, gynecology and andrology Internal diseases General surgery Private Veterinary Surgery

			Parasitology and invasive diseases Epizootology and infectious diseases Forensic veterinary examination and dissection of animals Zoopsychology Horse diseases Diseases of Productive Animals Diseases of small pets Болезни мелких домашних животных Diseases of bees and entomophages Fish pathology and aquaculture Diseases of exotic animals Anesthesiology, resuscitation and intensive care Dermatology Cardiology Endocrinology Nephrology Reconstructive surgery Veterinary ophthalmology Animal Dentistry
PC -6	The ability to develop a treatment plan for animals based on the established diagnosis and individual characteristics of animals.	-	Veterinary Microbiology and Mycology Virology and biotechnology Pathological physiology Veterinary pharmacology Toxicology Obstetrics, gynecology and andrology Internal diseases General surgery Private Veterinary Surgery Parasitology and invasive diseases Epizootology and infectious diseases

			Maths Immunology Zoopsychology Horse diseases Diseases of Productive Animals Diseases of small pets Болезни мелких домашних животных Diseases of bees and entomophages Fish pathology and aquaculture Diseases of exotic animals Anesthesiology, resuscitation and intensive care Dermatology Cardiology Endocrinology Nephrology Reconstructive surgery Veterinary ophthalmology Animal Dentistry
PC -10	The ability to determine the need for the use of surgical methods in the treatment of animals.	-	Cytology, Histology and Embryology Veterinary Microbiology and Mycology Physiology and ethology of animals Pathological physiology Clinical diagnostics Pathological anatomy Obstetrics, gynecology and andrology General surgery Private Veterinary Surgery Horse diseases Diseases of Productive Animals Diseases of small pets Болезни мелких домашних животных Diseases of exotic animals

			Dermatology Cardiology Endocrinology Nephrology Reconstructive surgery Veterinary ophthalmology Animal Dentistry
PC -16	Ability to organize organizational, technical, zootechnical and veterinary measures aimed at the prevention of non-communicable diseases in accordance with the plan for the prevention of non-communicable animal diseases.	-	Life safety Physiology and ethology of animals Breeding with the basics of private animal husbandry Animal health and welfare Feeding animals with the basics of forage production Obstetrics, gynecology and andrology Internal diseases General surgery Private Veterinary Surgery Organization of veterinary affairs Fundamentals of Economics and Management Economics and organization of agricultural production Medicinal and poisonous plants Fodder plants Zoopsychology Здоровье и благополучие животных Horse diseases Diseases of Productive Animals Diseases of small pets Болезни мелких домашних животных Diseases of bees and entomophages

			Fish pathology and aquaculture Diseases of exotic animals Veterinary ophthalmology Animal Dentistry
PC -18	The ability to draw up a plan for the medical examination of animals, taking into account their types and purpose, to conduct medical examinations, to develop recommendations for carrying out preventive and curative measures based on the results of the examination of animals conducted as part of the medical examination	-	Physiology and ethology of animals Breeding with the basics of private animal husbandry Animal health and welfare Feeding animals with the basics of forage production Pathological physiology Veterinary pharmacology Clinical diagnostics Pathological anatomy Instrumental diagnostic methods Toxicology Obstetrics, gynecology and andrology Internal diseases General surgery Private Veterinary Surgery Здоровье и благополучие животных Clinical laboratory diagnostics Horse diseases Diseases of Productive Animals Diseases of small pets Болезни мелких домашних животных Diseases of exotic animals Dermatology Cardiology Endocrinology Nephrology

			Veterinary ophthalmology Animal Dentistry

4. COURSE WORKLOAD AND TRAINING ACTIVITIES

Course workload of the discipline "**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**	**-**	**-**	-

*Table 4.2. Types of academic activities during the period of the HE program mastering for **part-time** study*

Types of academic activities		**HOURS**	**Semesters**			
			2	**-**	**-**	**-**
Contact academic hours		18	18	-	-	-
including						
Lectures		-	-	-	-	-
Lab work		18	18	-	-	-
Seminars (workshops/tutorials)		-	-	-	-	-
Self-study		44	44	-	-	-
Evaluation and assessment (exam/pass/fail grading)		10	10	-	-	-
Course workload	Academic hour	**72**	**72**	**-**	**-**	-
	Credit unit	**2**	**2**	**-**	**-**	-

5. CONTENT OF THE DISCIPLINE

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

Name of the discipline section	Content of the section (topics)	Types of academic activities
Section 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.
Section 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.
Section 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.
Section 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.
Section 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.
Section 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.
Section 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.
Section 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.
Section 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.
Section 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.
Section 11. Genetic abnormalities. Diseases with a hereditary	Topic 11.1 Genetic, hereditary-environmental and exogenous anomalies	Lectures, Lab work.

predisposition	Topic 11.2 Autosomal and sex-linked inheritance patterns of anomalies	Lectures, Lab work.
Section 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.
Section 13. Biotechnology	Topic 13.1 Genetic and cell engineering, cloning, transgenic plants and animals	Lectures, Lab work.

6. CLASSROOM INFRASTRUCTURE AND TECHNOLOGY SUPPORT REQUIREMENTS

Table 6.1. Material and technical support of the discipline

Classroom for Academic Activity Type	***Equipping the classroom***	**Specialized educational/laboratory equipment, software and materials for the development of the discipline** (if necessary)
Lecture	An auditorium for conducting lecture-type classes, equipped with a set of specialized furniture; a board (screen) and technical means of multimedia presentations.	*- Personal Computer.* *- Multimedia equipment.* *-Microscopes Mikmed-5.* *- Sets of fixed biomaterials* *- illustrative material, handouts*
Laboratory	An auditorium for laboratory work, individual consultations, routine monitoring and interim certification, equipped with a set of specialized furniture and equipment.	*- Personal Computer.* *- Multimedia equipment.* *-Microscopes Mikmed-5.* *- Sets of fixed biomaterials* *- illustrative material, handouts*
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. RECOMMENDED SOURCES FOR COURSE STUDIES

Main reading:

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 Reading:

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.

Resources of the Internet information and telecommunication network:

1. Electronic library system of RUDN and third-party Electronic library systems to which university students have access on the basis of concluded contracts:
- Electronic library system of RUDN - ELS RUDN http://lib.rudn.ru/MegaPro/Web
- ELS "University Library online"http://www.biblioclub.ru
- ELS Yurayt http://www.biblio-online.ru
- ELS "Student Consultant"www.studentlibrary.ru
- ELS "Lan"http://eZlanbook.com/
- ELS "Trinity Bridge"http://www.trmost.com/

2. Databases and search engines:
- electronic fund of legal and regulatory and technical documentation http://docs.cntd.ru/
- search engine Yandex https://www.yandex.ru/
- search engine Google https://www.google.ru/
- abstract database SCOPUS http://www.elsevierscience.ru/products/scopus/

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

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

* - All educational and methodological materials for independent work of students are placed in accordance with the current procedure on the discipline page in the **Telecommunication educational and Information System!**

8. MID-TERM ASSESSMENT

Evaluation materials and a point-rating system* for assessing the level of competence formation (part of competencies) based on the results of mastering the discipline "**Veterinary genetics**" are presented in the Appendix to this Work Program of the discipline.

* - Assessment Materials and a Point Rating System are formed based on the requirements of the relevant local regulatory act of the RUDN.

DEVELOPER:

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Position, Basic curriculum	Signature	Full name.

HEAD OF THE DEPARTMENT:

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