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**Federal State Autonomous Educational Institution of Higher Education  
"Peoples' Friendship University of Russia named after Patrice Lumumba "**

**Agrarian and Technological Institute**

(name of the main educational unit (MEU) – developer of the program)

**Department of Agrobiotechnology**

(name of the basic educational unit (BEU) – developer of the program)

**WORKING PROGRAM OF THE DISCIPLINE**

**Plant Genetics**

(name of discipline/module)

Scientific specialty:

**1.5.7. Genetics**

(code and name of scientific specialty)

The discipline is mastered within the framework of the postgraduate program:

**Plant Genetics**

(name of the program for training scientific and scientific-pedagogical personnel)

### 1. THE GOAL OF MASTERING THE DISCIPLINE

The objectives of mastering the discipline "Plant Genetics" are to form a theoretical base necessary for carrying out research activities in the field of genetics, and to prepare for passing the candidate exam in specialty 1.5.7. Genetics.

### 2. REQUIREMENTS TO THE RESULTS OF MASTERING THE DISCIPLINE

As a result of mastering the discipline "Plant Genetics", the postgraduate student must:

**Know:**

fundamental principles, directions and achievements of modern genetics;

modern research methods in the field of genetics;

the main directions and prospects for the use of achievements of modern genetics in biomedicine, agriculture, and in the field of environmental protection.

**Be able to:**

explain the fundamental principles of genetics, modern achievements, problems and trends in the development of genetics, its relationship with other sciences;

explain the essence of genetic processes and their mechanisms;

critically analyze information about modern achievements in genetics and its applied use;

identify promising areas of scientific research.

**Own:**

genetic terminology and genetic concepts;

methods for solving genetic problems;

information on the prospects for the development of molecular genetic methods.

### 3. SCOPE OF THE DISCIPLINE AND TYPES OF STUDY WORK

The total workload of the discipline "Plant Genetics" is 4 credit units (144 academic hours).

Type of academic work		Total, academic hours	Semester
			2
<i>Contact work</i>		60	60
including:			
Lectures (LC)		30	30
Laboratory work (LW)		-	-
Practical/seminar classes (SZ)		30	30
<i>Independent work of students</i>		48	48
<i>Control (exam)</i>		36	36
General complexity of the discipline	ac. h.	144	144
	credit unit	4	4

### 4. CONTENT OF THE DISCIPLINE

Name of the discipline section	Section Contents (Topics)	Type of academic work
Section 1. Introduction to Plant Genetics	Genetics and its place in the system of biological sciences. The concept of heredity and variability. History of the development of genetics. The importance of genetics for solving problems in agriculture, medicine, biotechnology and ecology. Genes as determinants of species diversity. Genetic diversity.	LK, SZ
Section 2. Types of inheritance of traits	Methodologies in plant genetics. Genes and gene products. Relationships between alleles of one gene. Chi-square method for testing genetic interactions. Autosomal inheritance. Inheritance of traits during gene interaction. Complementary interaction of genes. Suppression. Dominant	LZ, SZ

	epistasis. Cryptomery (recessive epistasis). Polymerism. Features of inheritance of quantitative traits. Transgression. Pleiotropy. Modifier genes. Penetrance and expressivity of genes. Influence of external conditions on the manifestation of gene action. Norm of genotype reaction. Sex chromosomes and linked inheritance.	
Section 3. Chromosomal Theory of Heredity	Morgan's Chromosome Theory. History of the Chromosome Theory. The Nature of Chromosomes. Mitosis and Meiosis. Crossing Over. The Mechanism of Crossing Over. The Amount of Crossing Over and the Linear Arrangement of Genes in a Chromosome. Single and Multiple Crossing Over. Interference. Gene Localization. Linked Inheritance of Genes and Crossing Over. Linear Arrangement of Genes in a Chromosome. Genetic Maps of Chromosomes. Cytological Evidence of Crossing Over. Factors Affecting Chromosome Crossing Over. Somatic Crossing Over. Molecular Basis of Crossing Over.	LZ, SZ
Section 4. Molecular basis of heredity	Nucleic acids. Structure of nucleic acids. Chemical composition and species specificity of DNA. General features of DNA replication. DNA synthesis in eukaryotes. RNA as genetic material and its replication. Types of RNA in polypeptide synthesis. Matrix RNA. Ribosomal RNA. Transfer RNA. DNA transcription on RNA matrix (reverse transcription). Genetic code and its properties. Evidence of code triplettness. Code degeneracy. Code universality. Protein biosynthesis. Structure of eukaryotic gene: exons, introns. Post-transcriptional transformations of mRNA in eukaryotes (processing, splicing). Features of the organization of the promoter region of eukaryotes. Problems of genetic engineering	LZ, SZ
Section 5. Modification and mutational variability. Polyploidy	Induced and spontaneous mutagenesis. Mutation process. Mutagenic factors. Ionizing radiation and mutations. Chemical mutagenesis. Polyploidy and aneuploidy	LZ, SZ
Section 6. Genetics of Ontogenesis	Ontogenesis. Genome stability and differential gene activity during individual development. Gene expression effects during embryogenesis. Gene amplification. Tissue-specific gene activity. Pleiotropic effect of genes during ontogenesis. Gene interactions determining the development of traits during ontogenesis. Cell relationships during morphogenesis.	LZ, SZ
Section 7. Distant hybridization	The concept of distant hybridization. Types of hybrids obtained by distant hybridization of	LZ, SZ

	plants and animals. Barriers to non-crossability in distant hybridization. Methods for overcoming non-crossability in distant hybridization.	
Section 8. Population genetics. Inbreeding and heterosis.	Elementary processes of evolution. Change in the genetic structure of a population as a result of selection. Change in gene frequencies with complete dominance. Change in gene frequencies in the absence of dominance. Change in gene frequencies with overdominance. Genetic-automatic processes in a population (random genetic drift). Migrations and their influence on the population structure. Factors of population isolation. The concept of genetic load. Genetic homeostasis of populations. Inbreeding in cross-pollinated crops. Inbred minimum. Inbreeding lines of plants. The hypothesis of overdominance and its genetic justification. Use of inbreeding and heterosis phenomena in agricultural practice.	LZ, SZ
Section 9. Plant Genomics	Plant genomics overview. Plant genome organization. Comparative genome mapping and model systems.	LZ, SZ

#### 5. LOGISTIC AND TECHNICAL SUPPORT OF DISCIPLINE

Audience type	Equipping the auditorium	Specialized educational/laboratory equipment, software and materials
Seminar	An auditorium for conducting seminar-type classes, group and individual consultations, ongoing monitoring and midterm assessment, equipped with a set of specialized furniture and technical means for multimedia presentations	No
For independent work of students	A classroom for independent work of students (can be used for conducting seminars and consultations), equipped with a set of specialized furniture and computers with access to the EIS	No

#### 6. EDUCATIONAL, METHODOLOGICAL AND INFORMATIONAL SUPPORT OF THE DISCIPLINE

##### *Main literature:*

Romanova, E. V. General genetics [Text/Electronic resource] = General genetics: a tutorial / E. V. Romanova, P. Kezimana. - Moscow: Peoples' Friendship University of Russia, 2018. - 102 p.: ill., table.; 20 cm; ISBN 978-5-209-08470-9 - URL: [http://lib.rudn.ru/MegaPro/UserEntry?Action=Rudn\\_FindDoc&id=467616](http://lib.rudn.ru/MegaPro/UserEntry?Action=Rudn_FindDoc&id=467616)

Nakhaeva, V. I. General Genetics. Practical Course [Electronic resource]: a textbook for universities / V. I. Nakhaeva. - 2nd ed., revised. and add. - Moscow: Publishing House Yurait, 2022. - 276 p. - (Higher education). - ISBN 978-5-534-06631-9. - URL: <https://urait.ru/bcode/493759>

##### *Further reading:*

Molecular-genetic and biochemical methods in modern plant biology [Text] / [G. N. Raldugin et al.]; edited by Vl. V. Kuznetsov, V. V. Kuznetsov, G. A. Romanov. - Moscow: Binom.

Lab. knowledge, 2012. - 487 p., [4] p. ill. : ill.; 25 cm. - (Methods in biology); ISBN 978-5-9963-0738-8

Genetics of Plant Development [Text]: a textbook for students of higher educational institutions / L. A. Lutova [et al.]; edited by S. G. Inge-Vechtomov. - 2nd ed., revised and enlarged. - St. Petersburg: N-L, 2010. - 431 p.: ill., table, color ill.; 22 cm + 1 CD-ROM.; ISBN 978-5-94869-104-6 (in translation)

Varshney, R. K. Plant Genetics and Molecular Biology [ Electronic resource ] / RK Varshney, MK Pandey, A. Chitikineni – Cham : Springer Cham, 2018. – 298 pp.; ISBN: 978-3-319-91313-1

*Resources of the information and telecommunications network "Internet":*

RUDN University Electronic Library System and third-party electronic library systems to which university students have access on the basis of concluded agreements:

- Electronic library system of RUDN: [site]. URL: <http://lib.rudn.ru/MegaPro/Web>
- Electronic library system "University Library Online": [website]. URL: <http://www.biblioclub.ru/>
- Educational platform "Urait": [site]. URL : <https://urait.ru/>
- Electronic Library System "Lan": [site]. URL : <https://e.lanbook.com/>
- Educational platform "Urait": [site]. URL : <https://urait.ru/>

Databases and search engines:

- Electronic fund of legal and normative-technical information: [site]. URL: <https://docs.cntd.ru/>
- Search engine "Yandex": [site]. URL : <https://yandex.ru/>
- Search engine « Google »: [site]. URL : <https://www.google.com/>

*Educational and methodological materials for independent work of students in mastering a discipline/module:*

A course of lectures on the subject of "Plant Genetics".

## **7. EVALUATION MATERIALS AND SCORE-RATING SYSTEM FOR ASSESSING THE LEVEL OF DEVELOPMENT OF COMPETENCES IN THE DISCIPLINE**

The assessment materials and the point-rating system for assessing the mastery of the discipline are presented in the appendix to this work program of the discipline.

### **DEVELOPERS:**

Associate  
the Department of Agrobiotechnology

Professor



of  
E. V. Romanova

### **HEAD OF THE BUP**

Director  
the Agrobiotechnological Department



of  
E. N. Pakina