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**Federal State Autonomous Educational Institution for Higher Education**  
**PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA**  
**(RUDN University)**  
**Institute of Medicine**  
(Educational Division)

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## **COURSE SYLLABUS**

**Genetics: Molecular Basis of Human Hereditary Diseases**  
(Course title)

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**1.5.7. Genetics**  
(Specialisation)

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**Discipline is carried out within the implementation of the PhD Programme:**

**1.5.7. Genetics: Molecular Basis of Human Hereditary Diseases**

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## 1. COURSE AIMS

- to train highly qualified researchers;
- to form and develop their competencies in the field of classical, molecular and medical genetics in accordance with professional standards;
- to form skills required to use the modern genetic techniques and procedures.

## 2. REQUIREMENTS TO LEARNING OUTCOMES

In consequence of studying the discipline, a postgraduate is due to:

### **Know:**

1. Methods used in modern genetics.
2. The concept of genetic, biochemical and structural unity of all life. The achievements of modern genetics which is one of the basic disciplines of modern biology.
3. The population as an elementary unit of evolution.
4. Concepts of the gene, penetrance and expressivity. Forms of gene interaction.
5. The control of the cell cycle.
6. The history of genetics. The laws of heredity. Patterns of inheritance.
7. Gene structure and gene expression.
8. Control of gene expression in prokaryotic and eukaryotic cells.
9. Organization of the genetic material of viruses, prokaryotes, eukaryotes.
10. Forms of variability. Classification of mutations. Molecular mechanisms of gene mutations. Mechanisms of DNA repair.
11. Methods of human genetics.
12. Hereditary diseases and their causes.
13. Principles of diagnosis, treatment and prevention of hereditary diseases. Genetic counseling.

### **Be able to:**

1. use the methods of modern genetics, taking into account their capabilities and limitations;
2. analyze the results of crosses and solve genetic problems;
3. analyze the human karyotype;
4. carry out the statistical processing of the data obtained in the research;
5. write scientific work at the level required to be published in peer-reviewed journals;
6. analyze study books and scientific articles.

### **Have the skills in:**

1. modern molecular genetic techniques and procedures;
2. analysis, summarizing and public presentation of the results of the performed research work.

### 3. COURSE WORKLOAD AND TYPES OF ACADEMIC ACTIVITIES

The course total workload is equal to 3 credits.

*Table 3.1. Types of academic activities during the period of the HE programme mastering*

<i>Types of academic activities</i>	Totally, hours	Semester(s)	
		3	
<i>Contact academic hours</i>	<b>60</b>	<b>60</b>	
Including:			
Lectures (LC)	30	30	
Lab work (LW)			
Seminars (workshops/tutorials, W)	30	30	
<i>Self-study, academic hours</i>	<b>48</b>	<b>48</b>	
<i>Evaluation and assessment (exam or pass/fail grading)</i>	<b>36</b>	<b>36</b>	
<b>Course workload</b>	academic hours	<b>144</b>	<b>144</b>
	credits	<b>4</b>	<b>4</b>

### 4. COURSE MODULES AND CONTENTS

*Table 4.1. Course contents and types of academic activities*

Course Modules	Contents (Topics)	Types of academic activities
Module 1. Introduction to Genetics	Topic 1.1. Subject and tasks of Genetics. Fields of Genetics. Genetics in Biology and Medicine. The history of Genetics.	LC
Module 2. Structure and functions of nucleic acids	Topic 2.1. Structure and functions of nucleic acids	LC
	Topic 2.2. DNA replication in prokaryotic and eukaryotic cells	LC, W
	Topic 2.3. Gene mutations and their causes. DNA repair mechanisms	LC, W
Module 3. Gene expression	Topic 3.1. Synthesis of RNA molecules in prokaryotic and eukaryotic cells. Processing of RNA molecules	LC, W
	Topic 3.2. Translation in prokaryotic and eukaryotic cells	LC, W
	Topic 3.3. Control of gene expression in	LC, W

	prokaryotes and eukaryotes	
Module 4. Genomes of viruses, prokaryotes and eukaryotes	Topic 4.1. Genetic material of viruses, prokaryotes and eukaryotes. Chromosomal and extrachromosomal DNA. Mobile genetic elements	LC, W
Module 5. Cell division	Topic 5.1. Mitotic and meiotic cell divisions.	W
	Topic 5.2. Control of the cell cycle	LC
Module 6. The laws of heredity	Topic 6.1. Genotype as a balanced system of interacting genes	LC
	Topic 6.2. Laws of heredity	W
	Topic 6.3. Genetic analysis	W
Module 7. Genetics of Populations	Topic 7.1. Genetic processes in populations. The population as an elementary unit of evolution.	LC, W
Module 8. Human Genetics and Medical Genetics	Topic 8.1. Introduction to Human genetics and Medical genetics. Man as an object of genetic research	LC
	Topic 8.2. Methods in Human Genetics	W
	Topic 8.3. Human hereditary diseases	LC
	Topic 8.4. Principles of diagnosis, prevention and treatment of human hereditary diseases. Genetic counseling	LC

## 5. CLASSROOM EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

Table 5.1. Classroom Equipment and Technology Support Requirements

Classroom for Academic Activity Type	Classroom Equipment	Specialized Equipment
Specialized classroom	Lecture/Seminars/ Lab Classroom, equipped with a set of specialized furniture (328)	A set of specialized furniture; whiteboard; a set of devices includes multimedia projector, laptop, projection screen, stable wireless Internet connection. Software: Microsoft Windows, MS Office / Office 365, MS Teams, Chrome (latest stable release), Microscopes
Laboratory	Laboratory of Biomolecular research (332, 332A)	PCR laboratory equipment

Classroom for Academic Activity Type	Classroom Equipment	Specialized Equipment
Self-studies classroom	Self-studies classroom, equipped with a set of specialized furniture (аудитория 342)	A set of specialized furniture; whiteboard; a set of devices includes multimedia projector, laptop, projection screen, stable wireless Internet connection. Software: Microsoft Windows, MS Office / Office 365, MS Teams, Chrome (latest stable release)

## 7. RECOMMENDED SOURCES FOR COURSE STUDIES

### *Main reading:*

1. Concepts of genetics / W.S. Klug; Pearson new international edition. - 3th ed. - England : Pearson, 2014. - 885 p.

### *Additional reading:*

1. Общая генетика [Текст/электронный ресурс] = General Genetics. Manual for Graduate Students : Учебное пособие / Е.В. Романова, П. Кезимана. - Книга на английском языке; Электронные текстовые данные. - М. : Изд-во РУДН, 2018. - 104 с.
2. Fletcher H., Hickey I. Genetics. – Garland Science. – 2013.
3. Lewin B. Genes. – Oxford University Press. – 2012.
4. Color Atlas of Genetics / Passarge Eberhard. - 4th edition, revised and update. - Stuttgart ; New York : Thieme, 2013.
5. Vogel and Motulsky's Human Genetics: Problems and Approaches / M. Speicher, Antonarakis S.E., Motulsky A.G. – Springer. – 2010.
1. Gardner A., Davies T. Human Genetics. – Scion Publishing Ltd. – 2009.
6. Storry B., Wong E., Walker R.A., Gillaspay G., Sible J., Lederman M. – Working with Molecular Cell Biology (Fifth Edition). – W.H. Freeman and Company, New York. – 2004.
7. Gangane S.D. Human Genetics (Second edition). - Elsevier. Reed Elsevier India Private Limited. – 2004.

### *Internet sources:*

1. Electronic libraries with access for RUDN students:
  - RUDN online library <http://lib.rudn.ru/MegaPro/Web>
  - Royal Society of Chemistry <http://pubs.rsc.org/>
  - Scientific electronic library: - <http://elibrary.ru>
  - Nature - <http://www.nature.com/siteindex/index.html>
  - OxfordJournals - <https://academic.oup.com/journals/>

- <http://www.biblioclub.ru>
- <http://www.biblio-online.ru>
- [www.studentlibrary.ru](http://www.studentlibrary.ru)
- <http://e.lanbook.com/>

2. Databases and search engines:

- National Center for Biotechnology Information (NCBI) - [www.ncbi.nlm.nih.gov](http://www.ncbi.nlm.nih.gov)
- ScienceDirect - <http://www.sciencedirect.com>
- Google Academy - <http://scholar.google.ru/>
- SCOPUS <http://www.scopus.com/>

*Learning toolkits for self- studies in the RUDN LMS TUIS:*

Methodological recommendations on discipline study.

### 8. ASSESSMENT AND EVALUATION TOOLKIT

Assessment and evaluation toolkit as well as the grading system are presented in the Supplement to the Course Syllabus.

#### DEVELOPERS:

Associate professor,  
Department of Biology and  
General Genetics



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Head of the Department,  
Department of Biology and  
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M.M. Azova

#### HEAD OF THE DEPARTMENT:

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