

FEDERAL STATE BUDGETARY EDUCATIONAL INSTITUTION OF HIGHER
EDUCATION

ST. PETERSBURG STATE UNIVERSITY

VETERINARY MEDICINE

APPROVING



_____, Rector of the SPbGUVM

_____, K.V. Plemyashov

_____ " 10 June 2026

Additional educational

professional development program

«Fundamentals of conducting various types of genetic analyses on

NANOPHORE-5»

Considered and adopted
at the Department meeting

29 June 2026

protocol No. 14

Head of the Department of
genetic and reproductive
biotechnology

Dr. of Veterinary Sciences, Prof.,

_____, E.A. Korochkina

Saint Petersburg
2026

1. OBJECTIVE

The objective of the advanced training program "Fundamentals of Conducting Various Types of Genetic Analysis on NANOPHORE-5" (hereinafter referred to as the program) is to enhance the professional skills of faculty within the framework of their existing qualifications.

The program's objectives are aimed at exploring the capabilities of modern molecular genetic methods for studying biological objects using domestically produced Nanoform 5 and Nanoform SPS devices.

These objectives are relevant to the domestic livestock industry, taking into account modern data on the genetics and selection of productive animals, for identifying mutations associated with diseases and economically significant indicators, and preventing the spread of anomalies using available genetic methods and Russian-made equipment.

PLANNED LEARNING OUTCOMES

Planned learning outcomes, taking into account the qualification requirements for the relevant faculty positions. Upon completion of the program, the student, within the framework of their existing qualifications, improves and expands:

- knowledge of cattle genetics and breeding, becoming familiar with the capabilities of modern technologies, the necessary equipment, and its use;
- information on domestic developments in DNA sequencing, an introduction to capillary electrophoresis, and sequencing principles;
- information on Nanoform-5 software, instrument calibration features, and data analysis;
- application of MetaGen-MPS technology for assessing bacterial diversity, quality control of genomic libraries, metagenomic sequencing, the operating principle of Nanoform SPS, and sequencing by synthesis.

3. CURRICULUM

Total Program Scope

Type of Academic Work	Total Hours
Classroom Classes	37
Independent Work	4
Type of Final Assessment (Credit)	1
Total Workload	42

3.2 Curriculum

No.	Name of Academic Discipline	Types of Academic Work, Including Independent Work and Workload (in Hours) Credit	Test
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		Lectures	Practical Classes	Independent Work	
1	Fundamentals of conducting various types of genetic analyses on NANOPHORE-5»	15	22	4	-
2	Final Assessment	-	-	-	1
TOTAL: 42 Hours		15	22	4	1

4. CURRICULUM SCHEDULE

Credential Schedule

Periods of Study	6 days
1 day	L - 3 hours, Pr – 4 hours
2 day	L – 3 hours, Pr – 4 hours, Wed – 1 hour
3 day	L – 3 hours, Pr – 4 hours Wed – 1 hour
4 day	L – 2 hours, Pr – 4 hours Wed – 1 hour
5 day	L – 2 hours, Pr – 3 hours, Wed – 1 hour
6 day	L – 2 hours, Pr – 3 hours, IA – 1 hour
Total:	42

L – lectures; Pr – practical classes, IA – final assessment;
IW – independent work.

5. WORK PROGRAM OF THE DISCIPLINE

5.1. Objective

The objective of the advanced training course "Fundamentals of Conducting Various Types of Genetic Analyses on NANOPHORE-5" (hereinafter referred to as the course) is to improve the professional level of the faculty within the framework of their existing qualifications.

The objectives of this course are aimed at exploring current methods of genetic research of biological objects using domestic developments and Russian-made equipment. These methods allow for the study of the laws of heredity in a modern interpretation, based on modern concepts of gene structure, regulation of gene activity at different levels, the significance and structure of

mutations, genome editing methods, genetic databases, DNA fingerprinting, and marker-assisted and genomic selection in productive animals.

5.2. Planned Learning Outcomes

Planned learning outcomes for this course, taking into account the qualification requirements for the relevant faculty positions.

Upon completion of this course, the student, within the framework of their existing qualifications, will improve:

- knowledge of cattle genetics and breeding;
- familiarize themselves with the capabilities of modern domestic developments in DNA sequencing (Nanofor 05, Nanofor SPS);
- information on mutations and anomalies in productive animals that affect the viability and productive performance of the livestock;
- competencies related to solving production problems in the domestic agro-industrial complex.

5.3. Course Scope

Type of Academic Work	Total Hours
Classroom Classes	37
Independent Work	4
Final Assessment	1
Total Time	42

5.4. Course Content and Types of Classes

Topics (42 hours):

1. Domestic Developments in the Field

DNA sequencing.

2. Introduction to capillary electrophoresis. Principle of the method. Design of the Nanofor 05 device.

3. Introduction to the chemistry of the sequencing reaction.

4. Overview of the most common problems in Sanger DNA sequencing.

5. DNA isolation.

6. Measuring DNA concentration.

7. The sequencing reaction.

8. Data Analysis Software
9. Nanofor 05 Control Program
10. Starting Analysis on the Nanofor 05 Genetic Analyzer
11. Instrument Calibration
12. Instrument Maintenance
13. Analysis of DNA Sequencing Results
14. Introduction to DNA Fragment Analysis Chemistry and Data Analysis Principles
15. PCR for DNA Fragment Analysis
16. Starting Analysis on the Nanofor 05 Genetic Analyzer
17. Data Analysis Software
18. Analysis of DNA Fragment Analysis Results
19. DNA Preparation
20. MetaGen-MPS Technology
21. Quality Control of Genomic Libraries
22. Metagenomic Sequencing
23. Operating Principle of Nanofor SPS. Sequencing by Synthesis
24. Principles of Genomic Library Preparation
25. Analysis of Obtained Data
26. Bioinformatic Aspects of Data Analysis

6. ORGANIZATIONAL AND PEDAGOGICAL CONDITIONS

The program is taught full-time. The full-time session consists of classroom classes at the university.

The program, regardless of the educational technologies used, lasts 36 academic hours. Various educational technologies, including distance learning and e-learning, may be used in the program's implementation.

For all types of classroom classes, an academic hour is set at 45 minutes.

6.1 Information on the staffing of the educational process

Full name	Academic degree	Academic title	Position	Length of service in the specialty
Yakov Alekseev	PhD in Biology	Professor	Director of Research	37

Anton Pushkin	PhD in Biology	Associate Professor	Senior Research Fellow	10
Konstantin Kosarev			Research and Methodological Support Fellow	5
Anastasia Gushchina			Junior Research Fellow	1

7. CERTIFICATION FORMS

Program completion culminates in a final assessment of students, which consists of a test based on assessment questions.

Individuals who successfully complete the program and pass the final assessment are awarded a certificate of advanced training.

8. ASSESSMENT MATERIALS

Standard assessment tasks or other materials required to assess knowledge, skills, abilities, and work experience, characterizing the stages of competency development during program completion.

8.1. Assessment questions for the final assessment:

1. Global and domestic developments in DNA sequencing.
2. Principles of capillary electrophoresis.
3. The principle of Sanger DNA sequencing.
4. DNA isolation methods.
5. PCR reaction.
6. PCR product purification considerations.
7. Determining the concentration and quality of the PCR product.
8. Storage considerations for reagents and sequencing reaction products.
9. Common problems with Sanger sequencing.
10. Examples of data analysis software.
11. NanoFor 05 calibration.
12. Possible errors during spatial and spectral calibration.

13. Data analysis and necessary software.
14. Fragment analysis principles.
15. MetaGen-MPS technology.
16. Metagenomic sequencing.
17. Targeted sequencing.
18. Genomic library creation principles.
19. Databases – examples and applications.
20. Bioinformatics data analysis.

9. OTHER COMPONENTS

Educational and methodological support for the program

1. Molecular research methods in genetics and veterinary medicine: a teaching aid / compiled by P. I. Ukolov, Yu. V. Mukii; Ministry of Agriculture of the Russian Federation, SPbGAVM. - St. Petersburg: SPbGAVM, 2017. - 29 p. – URL: Molecular research methods in genetics and veterinary medicine Ukolov (accessed: 21.04.2024). - Access mode: for authorized users of the SPbGAVM Electronic Library.
2. Animal genetics: a collection of problems: a teaching aid / A. G. Maksimov, V. V. Fedyuk, N. V. Ivanova, N. A. Maksimov. - Persianovsky: Donskoy SAU, 2021. - 142 p. — Text: electronic // Lan: electronic library system. — URL: <https://e.lanbook.com/book/216569> (date of access: 18.04.2024). — Access mode: for authorized users.
3. Genomic selection of animals: monograph / Weller J. I.; scientific ed. translated from English by K. V. Plemyashov. - St. Petersburg: Prospekt Nauki, 2018. - 207 p. URL: <http://prospektnauki.ru/ebooks/books/copypaste/genomsel3.php> (date of access: 18.04.2024). — Access mode: for authorized users.
4. Visual genetics: translated from English edited by D. V. Rebrikov; translated by N. S. Tikhomirov / Passarg Eberhard. - 3rd ed. - Moscow: Laboratory of Knowledge, 2022. - 508 p.: ill. - (Visual Medicine).
5. Yusipov I.I., Kalyakulina A.I., Ivanchenko M.V. Bioinformatics Algorithms: A Tutorial (Lecture Material). Novgorod: Nizhny Novgorod State University, 2018, 112 p.
6. Rebrikov D.V., Korostin D.O., Shubina E.S. "NGS: High-Throughput Sequencing". - Laboratory of Knowledge Publishing House, 2023, 232 p.
7. Nader Rifai - Tietz Textbook of Laboratory Medicine, 7th Edition, 2023.

Materials and Technology Program Support

To support the Program, the Department of Genetic and Reproductive Biotechnology has facilities and equipment, including classrooms, interactive screens, audiovisual equipment, office

equipment, and copy machines. The molecular genetics laboratory includes the necessary equipment for research: NanoFor 05, thermocyclers, a sequencer, a refrigerator, scales, a centrifuge, and reagent kits.

The facilities comply with current sanitary and technical standards and support all types of laboratory, practical, disciplinary, and interdisciplinary training for students as required by the program.

9.3 Methodological Materials

Methodological Recommendations for Faculty and Students

Classes are held in groups. The number of students in a group should not exceed 25.

The student can sufficiently acquire and successfully implement specific knowledge, abilities, skills, and competencies in their practical activities by fulfilling the following conditions:

- systematic work in classes under the guidance of the instructor and independent work to consolidate the acquired knowledge and skills;
- conscientiously completing the instructor's assignments during practical classes;
- clarifying and refining individual premises, inferences, and conclusions contained in the course; the interrelations between its individual sections, the methods used, and the nature of their application in practical activities;
- comparing the views of various authors on the topics covered in the course; identifying inaccuracies and incorrect presentation of material in periodicals and specialized literature;
- periodically familiarizing themselves with the latest theoretical and practical achievements;
- developing proposals for the instructor regarding the revision and improvement of the course.

Program Developers:

Director of Science at the SPC "Synthol",
PhD (Biology)



Ya. Alekseev

Senior Researcher at the SPC "Synthol",
PhD (Biology)



A. Pushkin

Scientific and Methodological Support Specialist,
DNA Identification and Sequencing Department,
SPC "Synthol",



K. Kosarev

Junior Researcher at the SPC "Synthol"

