**al-Farabi Kazakh National University**

**Faculty of Biology and Biotechnology**

**Department of Molecular Biology and Genetics**

**Final Exam Program on discipline**

**(OBZh 2222) Basics of Animal Biotechnology**

**«6В05103 – Biotechnology» (NISch), course 2**

2021

Final Exam Program on discipline (OBZh 2416) **«**Basics of Animal Biotechnology» for specialty «6B05103-Biotechnology» (NISch) is created by Djansugurova Leyla, PhD, professor, senior lecturer.

Observed and accepted at the meeting of the Department of Molecular Biology and Genetics

 « » \_\_\_\_\_\_\_\_\_\_\_ 2021, protocol №

Head of Department \_\_\_\_\_\_\_\_\_\_\_\_\_ PhD, Zhunusbayeva Zh.K.

Introduction

Final exam will be held in test manner online. It is totally prohibited to use any electronic devices during the exam, and cheat. More details will be given asap. The 100 point system will be used for estimation of the final exam results.

Final exam theoretical questions:

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| **№** | **Questions** |
| **1** | The subject and methods of Animal Biotechnology. Place of animal biotechnology in the system of Biological Sciences. |
| **2** | Bioethics issues in Animal biotechnology. |
| **3** | The main stages in the development of Animal biotechnology. Embryological basis of Animal biotechnology. Genetic basis of Animal biotechnology.  |
| **4** | Allofennic animals (genetic chimera). Microsurgery of embryonic cells (morula, blastocyst) to create allofennic animals. |
| **5** | Genetic cloning. Development of methods for cloning using nuclear transfer. (experiments on amphibians). Microsurgery of germ cells for cloning mammals. |
| **6** | Research on Animal cloning, achievements and prospects. |
| **7** | Using cultures of somatic animal cells in biotechnology. |
| **8** | Embryo transfer to recipient animals. |
| **9** | Agricultural application of Animal biotechnology. |
| **10** | Methods for determining the viability of eggs, sperm and embryos. Methods of in vitro zygotes culturing. Methods of embryo transplantation. |
| **11** | Peculiarities in the prokaryotes and eukaryotes organization of genetic information and expression. |
| **12** | The modern concept of "gene" as a transcription unit. The phenomenon of genetic transformation. The notion of transformation and transfection. The history of the animal cells genetic transformation research. |
| **13** | Transformation in individual cells. |
| **14** | Genetic transformation on the organism level. Infection of embryos on the preimplantion stage by the recombinant retroviruses.line cells). |
| **15** | Manipulation with embryonic stem cells. |
| **16** | Microinjection of DNA into a fertilized egg. |
| **17** | The genetic engineering principles in Animal biotechnology. |
| **18** | The main approaches to the genes cloning (creating a cDNAs libraries, cloning by the "shotgun" and "chromosome walking” methods). |
| **19** | Two-directional system of selection. HAT selective medium. |
| **20** | Usage of genes encoding enzymes of nucleotide synthesis (tk, gfrt, dhfr) as a markers. |
| **21** | Cell markers. Types of selectable markers used in systems for genetic transformation of cells. |
| **22** | General principles for design of genes expressed in mammalian cells. Specific sequences - enhancers and silencers. |
| **23** | Vector systems used in Animal biotechnology. |
| **24** | Methods for introducing of foreign DNAs into animal cells. DEAE-dextran method. Calcium phosphate method. Method of cultured cells PEG-based fusion with bacterium protoplasts containing recombinant plasmid. Method of microinjection of foreign DNAs into the animals germ cells. Usage of liposomes for the genetic transformation of animal cells. Electroporation and the use of "gene guns". |
| **25** | Requirements for the promoters used to create gene constructions for the animal cells transformation. |
| **26** | Efficiency and stability of genetic transformation. |
| **27** | Identification of the foreign DNAs in transformed cells.  |
| **28** | Analysis of transgenic animals of the integration of exogenous DNA sequences. |
| **29** | Methods for determining the expression of foreign DNA. |
| **30** | Transgenic animals. Basic principles and of production.  |
| **31** | The main problems of transgenic animals generating and ways to overcome them. Transgenic mice. Productions technologies. Successes and challenges. Positive-negative selection. Production of transgenic animals by the nuclear transfer method. |
| **32** | Production of antibodies by transgenic technologies. |
| **33** | Transgenic cattle, transgenic sheep, goats and pigs. Transgenic birds. Transgenic fish. |
| **34** | Cryopreservation of sex and germ line cells of animals and humans. Creating of gametes and embryos banks. |
| **35** | Main stages of the artificial insemination of animals and humans. Technical equipment of experiments on artificial insemination. |
| **36** | Modern methods of artificial insemination in humans (AIHS - artificial insemination by the husband sperm, AIDS – artificial insemination by the donor sperm, GIFT – gamete insemination of fallopian tubes, ZIFT - zygote insemination of fallopian tubes, IVF –in vitro fertilization, ICSI – intracytoplasmic injection of sperm).  |
| **37** | Complications of IVF procedures. |
| **38** | Gene therapy ex vivo. |
| **39** | Gene therapy in vivo.  |
| **40** | Preclinical testing: Experiments carried out in vitro and in laboratory animals.  |

**Literature for preparation:**

1. Animal Biotechnology. Technologies, Markets & Companies – Edited by Prof. K.K. Jain. Jain PharmaBiotech. A Jain Pharma Biotech Report. 2013. 215 p.

2. Щелкунов С.Н. Генная инженерия. Новосибирск. Изд-во Новосибирского государственного университета. 2004.

3. Biotechnology. Medtec. Ellyn Daugherty, 2015. 439 p.

4. Турашева С. К. Заядан Б.К., Джансугурова Л.Б. Basics of Biotechnology: textbook Qazaq universitety 2019 - г. ISBN 978-601-04-4230-6 428 стр.

5. A.Verma, A. Singh. Animal Biotechnology. Models in Discovery and Translation. 1st Edition. Academic Press. 2013. 668 p.