**Al-Farabi Kazakh National University**

**Faculty of Biology and Biotechnology**

**Department of Biotechnology**

**Final exam program by discipline**

**RMT 6209 «Risk management of transgenes»**

**“7M05109, Биотехнология” 2 course**

2021

The program of the final exam of the discipline " Risk management of transgenes " of the specialty “7M05109, Биотехнология” was compiled by Kenzhebaeva S.S. –Professor of the Department of Biotechnology

Reviewed and approved at a meeting of the Department of Biotechnology

From "15\_\_\_"11 \_\_\_ 2021, No. 5 \_\_

Head Department \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Kistaubaeva A.S.

**The final exam form for the discipline Risk management of transgenes" is writing offline.**

The exam in the discipline "Risk management of transgenes" will be held in writing offline, according to the schedule (exam duration - 120 minutes).

To successfully pass the exam, the student needs to know the following rules:

1. It is necessary to familiarize yourself with the rules for conducting final control in writing offline.

2. Bank of examination questions on the discipline "Risk management of transgenes" contains 45 questions. The database provides 3 types of examination questions:

3. The maximum mark for the exam is 100 points.

4. The exam takes place at a strictly specified time on schedule.

5. 30 minutes before the start, students must prepare for the exam in accordance with the requirements of the instructions.

 The bank of examination questions for the discipline is aimed at checking the achievement of learning outcomes and contains questions to test the cognitive (knowledge and understanding of the learning object), system (the ability to synthesize and evaluate information) and functional (the ability to apply and analyze information) competencies.

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**Topics for which assignments will be drawn up**

 The list of topics submitted for consideration in the final exam in accordance with the syllabus of the discipline. The list of topics cover lectures, seminars, as well as tasks submitted to the IWS (IWS, IWS).

**The exam will include the following sections of the course.**

The goals of creating GMOs. GM plants in agriculture. The use of GMOs in animal husbandry

The use of GMOs in scientific research. Selection and molecular genetic analysis of transgenic organisms.

Basic principles and methodology for risk assessment of genetic engineering activities

Subchronic experiments on laboratory belly. LD50 - half-lethal dose

Stages of preliminary assessment of the toxicity potential of pollutants

Methods used in genetic modification. Agrobacterial transformation.

Substantial equivalence concept for assessing the safety of GM products.

The main stages of assessing the safety of genetically modified food.

Potential risks to human health associated with the use of GMOs.

Methods for assessing the quality and safety of traditional food.

Potential risks to human health associated with the use of GMOs. Methods for assessing the quality and safety of traditional food.

Hazard Analysis and Critical Control Points.

Environmental risks associated with the release and spread of GMOs in the environment.

Food allergens of plant and animal origin.

The emergence of living organisms resistant or tolerant to transgenic products.

Principles of processing raw materials of plant, animal and microbiological origin

The influence of transgenic viral DNA (RNA) on the natural evolution of viruses.

The emergence of living organisms resistant or tolerant to transgenic products.

Estimates of the ecological risk of GMO impact on non-target organisms

Reduction of biological diversity as a result of changes in natural biocenoses during the cultivation of transgenic plants.

**Information resources**

**Main:**

**1**. Ed. Ermishina A.P. Plant biotechnology and safety. GEOTAR-Media, 2015.

2. Genome, cloning, human origins. - Century 2, 2004

3. Beeckman DSA and Rüdelsheim P (2020) Biosafety and Biosecurity in Containment: A Regulato-ry Overview. Front. Bioeng. Biotechnol. 8: 650. doi: 10.3389 / fbioe.2020.00650

4. Wilson K., Walker D. Principles and methods of biochemistry and molecular biology, Bean, 2015.

5. Nelson D., Cox M. Fundamentals of Leninger's biochemistry. In 3 volumes. M.: Binom, 2014.

6. Biochemistry (Chirkin A.A., Danchenko E.O.) 2010.

7. Severin E.S., Aleinikova T.L., Osipov E.V. Biochemistry. M. Medicine, 2010.

8. Biochemistry in schemes and tables (Semak V.I., Gubich O.I., Kukulyanskaya T.A.) 2011.

9. Seitov Z.S. Biochemistry. Almaty, 4th edition, 2011.

10. Severin E.S., Golenchenko V.A., Glukhov A.I. Biochemistry with exercises and tasks, GEOTAR-Med ia-2010

**Additional:**

1. Alisdair R Fernie[1](https://pubmed.ncbi.nlm.nih.gov/33872931/#affiliation-1), Uwe Sonnewald. Plant biotechnology for sustainable agriculture and food safety. J Plant Physiol. 2021 Jun;261:153416. doi: 10.1016/j.jplph.2021.153416.
2. GM Crops and Food: Biotechnology in Agriculture and the Food Chain. Editorial.
3. Moses V, Abdallah NA, Prakash CS.GM Crops Food. 2012 Jan-Mar;3(1):1-2. doi: 10.4161/gmr.19925. Epub 2012 Jan 1.

**Internet resources:** <https://www.goodreads.com/>

https://www.khanacademy.org/science/biology/cellular-molecular-biology/mitosis/a/cell-cycle-phases

http://plantphys.info/plant\_physiology/cellcycle.shtml

http://www.britannica.com/EBchecked/topic/623731/vascular-system

<http://www.britannica.com/UpBeat-37879-Basic-Plant-Physiology-Parts-Flowering-Functions-Roots-Types-phy-Education-ppt-powerpoint.htm>

<https://biologydictionary.net/photosynthesis/>

<https://www.nature.com/articles/nature02598>

<https://www.wyzant.com/resources/lessons/science/biology/photosynthesis/light-dark-reactions>

<https://eschooltoday.com/learn/light-and-dark-reactions/>