**Al-Farabi Kazakh National University**

**Faculty of Biology and Biotechnology**

**Department of Biotechnology**

**Final exam program by discipline**

**MBMUR 6308, MBMYRB 6308 «****Molecular biochemical markers to plants disease resistance “7M05109, Биотехнология” 2 course**

2021

The program of the final exam of the discipline " Molecular biochemical markers to plants disease resistance " 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 Molecular biochemical markers to plants disease resistance" is writing offline.**

The exam in the discipline "Molecular biochemical markers to plants disease resistance" 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.

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

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 should cover lectures, seminars, as well as tasks submitted to the IWS (IWS, IWS).

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

Classification of plants diseases

What is a Disease

How Pathogens affect Plants?

Biochemical markers as a useful tool to identify the plants resistance to pahogen

How Pathogens affect Plants?

Methods of extraction and determination of phenols as biochemical markers related to disease resistance

Gene for Gene Concept

Genetic and physiological evidences elicitor-receptor models

What is a Elicitors of pathogens

Recognition of pathogen

The perception of pathogen”s signals

Steps of Signal Transduction

Cyclic adenosine monophosphate (cAMP)

 Mitogen-activated protein kinases (MAPKs)

Secondary messengers in plants to transmit the primary elicitation signal of pathogen and/or host.

Ethylene as the secondary messengers in plants of transmition of signal pathogens

Methyl Jasmonic and Jasmonic Acid as the Secondary Messengers in plants of transmition of dignal pathogens

The quality of resistance gene in the host

The protein for protein hypothesis of gene for gene Concept

 The practical use of gene to gene relationships

 Biochemical relationship in resistant and susceptible cultivars

Sugars act as precursor for synthesis of: phenolics,

Sugars act as precursor phytoalexins,

 Sugars act as precursor lignin and

Sugars act as precursor cellulose .

Role of lignification in plant defense

The examples of enzymes used as Biochemical markers

Marker-assisted Selection for Disease Resistance: Applications in Breeding

**Information resources**

**Main:**

Amer F. Mahmoud, Bahaa E. S. Abd El-Fatah. Genetic Diversity Studies and Identification of Molecular and Biochemical Markers Associated with Fusarium Wilt Resistance in Cultivated Faba Bean (Vicia faba). Plant Pathol. J. 36(1): 11-28 (2020) https://doi.org/10.5423/PPJ.OA.04.2019.0119

Muhammad Azhar Nadeem, Muhammad Amjad Nawaz, Muhammad Qasim

Shahid, Y.ld.z Dogan, Gonul Comertpay, Mehtap Y.ld.z, Rüstü Hatipoglu, Fiaz Ahmad, Ahmad

Alsaleh, Nitin Labhane, Hakan Özkan, Gyuhwa Chung & Faheem Shehzad Baloch (2018)

DNA molecular markers in plant breeding: current status and recent advancements in genomic

selection and genome editing, Biotechnology & Biotechnological Equipment, 32:2, 261-285, DOI:

10.1080/13102818.2017.1400401

3. Costa, R., Pereira, G., Garrido, I., Tavares-de-Sousa, M. M. and Espinosa, F. 2016. Comparison of RAPD, ISSR, and AFLP molecular markers to reveal and classify Orchard grass (Dactylis glomerata L.) germplasm variations. PLoS ONE 11:e0152972

4. Reuven Reuveni. Biochemical Markers for Disease Resistance. In book Edited ByRudra P. Singh, Uma S. Singh. Molecular Methods in Plant Pathology, 2017.

5. Charles Stuber. Biochemical and Molecular Markers in Plant Breeding. lant Breeding Reviews 2010. 9:37 – 61.

6. Mandeep S. Randhawa, , Navtej S. Bains , Virinder S. Sohu, Parveen Chhuneja , Richard M. Trethowan, Harbans S. Bariana and Urmil Bansal. Marker Assisted Transfer of Stripe Rust and Stem Rust Resistance Genes into Four Wheat Cultivars. Agronomy 2019, 9, 497; doi:10.3390/agronomy9090497

**Additional:**

Ayman M.H. Esh Molecular Markers and Phytopathology. 2014.

R R Khan[1](https://pubmed.ncbi.nlm.nih.gov/16025305/#affiliation-1), H S Bariana, B B Dholakia, S V Naik, M D Lagu, A J Rathjen, S Bhavani, V S Gupta. Molecular mapping of stem and leaf rust resistance in wheat. Theor Appl Genet . 2005 Sep;111(5):846-50.

Yang LiuHui ChenChunxin LiLirong ZhangMingqin ShaoYuhui PangXiangyang XuGuihua Bai. Development of diagnostic markers for a wheat leaf rust resistance geneLr42using RNA-sequencing. J Crop science. 2021.

Gultyaeva, E.; Shaydayuk, E.; Gannibal, P. Leaf Rust Resistance Genes in Wheat Cultivars Registered in Russia and Their Influence on Adaptation Processes in Pathogen Populations. Agriculture 2021, 11, 319.

Goutam U, Kukreja S, Yadav R, Salaria N, Thakur K and Goyal AK (2015) Recent trends and perspectives of molecular markers against fungal diseases in wheat. Front. Microbiol. 6:861. doi: 10.3389/fmicb.2015.00861

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

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

https://www.researchgate.net/publication/227596399\_Biochemical\_and\_Molecular\_Markers\_in\_Plant\_Breeding

https://onlinelibrary.wiley.com/doi/abs/10.1002/9781118533024.ch15 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://pubmed.ncbi.nlm.nih.gov/16025305/