**al-Farabi Kazakh National University**

**Faculty of Biology and Biotechnology**

**Department of Biodiversity and Bioresources**

**The program of final exam by discipline**

**КММ4310 «Cellular mechanisms of morphogenesis»**

**5B060700 – Biology**

2021

**The program of final exam by discipline КММ4310 «Cellular mechanisms of morphogenesis» in specialty 5B060700 – Biology was** **compiled by senior lecturer Faleyev D.G.**

Considered and recommended at the meeting of the department of Biodiversity and Bioresources from 15.06.2021. year, protocol № 32

Head of department \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Kurmanbayeva M.S.

**FORM OF FINAL EXAM IN DISCIPLINE - WRITTEN EXAM:**

**TRADITIONAL - ANSWERS TO QUESTIONS**

It is conducted on the external resource of IS Univer. The exam format is synchronous**.**

The exam paper will be created automatically, a student should form a written answer by directly entering the text into the system.

**EXAM PROCEDURE**

**IMPORTANT** - the exam is held on a schedule that must be known in advance as the students as the teachers.

**STUDENT**

1. The student receives the login and password in the IS Univer.

2. Generation of a ticket for each student is made automatically.

3. The exam begins with obligatory proctoring: a laptop or home computer with a webcam is required. If it is not available, you can use the smartphone camera, for example, with the "DroidCam client" application.

4. Upon completion of the exam, the student clicks the "Finish" button.

**TEACHER**

1. At the end of the exam, the teacher in his personal account in the "Exams" section will be able to receive feedback from students with the answers entered, as well as proctoring data.

2. All answers will be checked for plagiarism.

2. In the same section, the teacher evaluates the answers of each student.

Exam questions will be divided on the three blocks.

Exam paper will contain three questions, by one from each block.

The grades will be:

Questions from the first block - 35

Questions from the second block - 35

Questions from the third block - 30

**PROGRAM
final exam in the discipline
«Cellular mechanisms of morphogenesis»**

1. Morphogenesis: definition, history of study, examples.
2. Morphogenesis - Genetic and molecular basis: Transcription factor.
3. Morphogenesis - Genetic and molecular basis: Cell junction.
4. Cell migration.
5. Cell adhesion.
6. Hedgehog signaling pathway. Gastrulation.
7. Epithelial–mesenchymal transition.
8. Morphogenesis - Cellular basis: cell-to-cell adhesion.
9. Morphogenesis - Cellular basis: extracellular matrix.
10. Morphogenesis - Cellular basis: cell contractility.
11. Cellular differentiation. Tissue growth.
12. Differential adhesion hypothesis.
13. Embryonic differentiation waves.
14. Cancer morphogenesis.
15. Virus morphogenesis.
16. Morphogenetic Cell Movements: Diversity from Modular, Mechanical Properties.
17. Plant morphogenesis and expression of the main regulatory genes on the example of flower development.

The main sources:

1 Bolsover S.R., Hyams J.S., Shephard E.A., White H.A., Wiedemann C.G. CELL BIOLOGY A Short Course. - Hoboken, New Jersey: A JOHN WILEY & SONS, INC., PUBLICATION, 2004. - 535 р.

2 Pollard T.D., William C.E., Schwartz J.L., Graham T.J. Cell biology - 3rd Edition. - Elsevier, 2017. - 900 p.

3 Верещагина В. А. Цитология: учеб. для студентов учреждений высш. проф. образования. - Москва: Академия, 2012. - 173 с.

4 Ченцов Ю.С. Общая цитология. Учебник.М., МГУ, 1995, 384 с.

5 Denise J. Montell Morphogenetic Cell Movements: Diversity from Modular, Mechanical Properties. / SCIENCE. - 2008. – Vol. 322 5. – P. 1502 - 1505.

Additional sources:

http://www.nature.com/scitable/ebooks/essentials-of-cell-biolog

https://upload.wikimedia.org/wikipedia/commons/1/17/Cell\_Biology.pdf

http://www.biologymad.com/resources/Ch%201%20-%20Cells.pdf

Additional literature:

1 Nabors, Murray W. (2004). Introduction to Botany. San Francisco, CA: Pearson Education, Inc. ISBN 978-0-8053-4416-5.

2 Dube H.C. An Introduction to Fungi. – New Delhi, Scientific Publishers (India), 2013. – 603 p. ISBN 978-81-7233-743-8

3 Мяделец, О. Д. Основы цитологии, эмбриологии и общей гистологии. - Москва : Медицинская книга, 2002. - 363 с.

4 Peterson R.L., Massicotte H.B., Melville L.H. Mycorrhizas: Anatomy and Cell Biology. - Ottawa, 2004. - P. 57-79. - 173 p.

5 Свенсон К.,Уэбстер П. Клетка.М.,Мир.1980. - 304 с.

6 Робертис Е., Новинский В., Саэс Ф. Биология клетки. М.,Мир,1973. - 487 с.