Postgraduate track Program: Biology and Biotechnology

1. Olympiad winner's skill set

To succeed in the Olympics, you must:

- Have a strong understanding of the key objects, methods, and products of biotechnology.
- Be skilled in analyzing data and identifying the primary characteristics of biological objects.
- Be able to explain the causes and variations of various biological processes using knowledge in molecular biology, biochemistry, cytology, genetics, and ecology.
- Demonstrate logical thinking, focus on tasks, and a commitment to achieving the best results.

2. List of degree programs covered by the subject area

2.1. List of master's programs

19.04.01 Biotechnology
06.04.01 Biology

2.2. List of doctoral programs

1.5.3 Molecular biology
1.5.10 Virology
1.5.7 Genetics
1.5.11 Microbiology
1.5.22 Cell biology
1.5.15 Ecology
1.5.6 Biotechnology

3. Themes

Biotechnology & applied microbiology

1. Modern idea of biological objects of biotechnology.
2. Improvement of biological objects using mutagenesis and selection methods.
3. Variety of biotechnology products.
4. Genomics in biotechnology.
5. Structure and organization of biotechnological production in accordance with GMP principles.
6. Regulation of the biosynthesis of primary and secondary metabolites.
7. Cell and enzyme immobilization technology.
8. Isolation, purification and disposal of target products of biotechnological production.

Biology

1. Life (mitotic) cycle of a cell. Mitosis.
2. Meiosis. Gametogenesis, the concept of germ cells.
3. Asexual and sexual reproduction.
4. Direct and indirect development. Stages of embryogenesis. Types of cloning.

Genetics and heredity
1. Basic concepts of genetics.
2. Laws of G. Mendel and T. Morgan. Gene interaction.
3. The concept of karyotype. Sex-linked inheritance.
4. Types of variability. Mutagenic factors.
5. Types of mutations.
6. Inheritance of blood group and Rh factor.

Cell biology
1. Features of the organization and functioning of prokaryotic cells.
2. Features of the organization and functioning of eukaryotic cells.
3. Structure and functions of eukaryotic cell organelles.
4. Concept of tissue. Types of tissues.

Ecology
1. The diversity of life. The role of organisms in their communities.
2. The variety of habitats.
3. Environmental factors.
4. Supraorganismal systems. Interspecies relationships.

Microbiology
1. Microorganisms: classification and taxonomy.
2. Morphological forms of bacteria.
3. Structure and chemical composition of a bacterial cell. Features of the hereditary material of bacteria.
4. Cultivation and identification of bacteria.
5. Bacteria that cause human diseases. Immunobiological preparations.

Virology
1. Viruses and bacteriophages. Structure. Hereditary material of viruses. Viral vectors.
2. Cultivation and identification of viruses.
3. The development cycle of viruses and bacteriophages.
4. Viruses that cause human diseases. Immunobiological preparations.

Biochemistry & molecular biology
1. Low molecular weight bioregulators. Biopolymers. Non-polymeric biological macromolecules. Methods of detection of biomolecules.
2. Aerobes and anaerobes. Catabolism in living systems.
3. Matrix biosyntheses. Replication, transcription, translation. Regulation of gene expression.
4. Photosynthesis.
5. Chemosynthesis.
6. Cellular and humoral immunity.
7. Humoral regulation. The concept of hormones and their types.

8. Biochemistry of the nerve impulse. Neurotransmitters.
9. Digestive enzymes.
10. Vitamins.

4. List of recommended references

4.1. Recommended sources

Biotechnology & applied microbiology

Reading list in Russian	Corresponding topic
Глик Б., Пастернак Д. Молекулярная биотехнология: принципы и применение. – Мир, 2002. – Т. 589. URL: https://djvu.online/file/GCkU1UEIG2HLo?ysclid=lxkctvivwx117803393 – free access	Modern idea of biological objects of biotechnology. Enhancing biological objects through the application of mutagenesis and selection techniques. Variety of biotechnology products. Genomics in biotechnology. Structure and organization of biotechnological production in accordance with GMP principles. Regulation of the biosynthesis of primary and secondary metabolites. Cell and enzyme immobilization technology. Isolation, purification and utilization of target products of biotechnological production.
Колодязная В. А., Самотруева М.А. Биотехнология: учебник для использования в образовательных учреждениях, реализующих основные профессиональные образовательные программы высшего образования уровня специалитета, содержащих учебную дисциплину "Биотехнология"- М.: ГЭОТАР-Медиа, 2020. – 382 с. URL: https://www.studentlibrary.ru/ru/book/ISBN9785970454367.html - limited access	Modern idea of biological objects of biotechnology. Enhancing biological objects through the application of mutagenesis and selection techniques. Variety of biotechnology products. Genomics in biotechnology. Structure and organization of biotechnological production in accordance with GMP principles. Regulation of the biosynthesis of primary and secondary metabolites. Cell and enzyme immobilization technology. Isolation, purification and utilization of target products of biotechnological production.
Орехов С. Н. Фармацевтическая биотехнология – М.: ГЭОТАР-Медиа, 2013. - 384 с. URL: https://www.studentlibrary.ru/book/ISBN9785970424995.html- limited access	Modern idea of biological objects of biotechnology. Improving biological objects using mutagenesis and selection methods. Variety of biotechnology products. Genomics in biotechnology.

	Structure and organization of biotechnological production in accordance with GMP principles. Regulation of the biosynthesis of primary and secondary metabolites. Cell and enzyme immobilization technology. Isolation, purification and utilization of target products of biotechnological production.
Станишевский Я. М. Промышленная биотехнология лекарственных средств: учебное пособие. – М.: ГЭОТАР-Медиа, 2021. - 144 с. URL: https://www.studentlibrary.ru/book/ISBN9785970458457.html- limited access	Modern idea of biological objects of biotechnology. Enhancing biological objects through the application of mutagenesis and selection techniques. Variety of biotechnology products. Genomics in biotechnology. Structure and organization of biotechnological production in accordance with GMP principles. Regulation of the biosynthesis of primary and secondary metabolites. Cell and enzyme immobilization technology. Isolation, purification and utilization of target products of biotechnological production.
Тейлор. Д, Грин Н., Стаут У., Сопер Р. Биология. В 3 т. – М.: Лаборатория знаний, 2020. – Т. 2. - 495 с. URL : https://www.studentlibrary.ru/book/ISBN9785001016663.html- limited access	Modern idea of biological objects of biotechnology. Enhancing biological objects through the application of mutagenesis and selection techniques. Variety of biotechnology products. Genomics in biotechnology. Structure and organization of biotechnological production in accordance with GMP principles. Regulation of the biosynthesis of primary and secondary metabolites. Cell and enzyme immobilization technology. Isolation, purification and utilization of target products of biotechnological production.

Reading list in English	**Corresponding topic**
Glick, Bernard R., Pasternak Jack J., Patten Cheryl L. Molecular Biotechnology: principles and applications of recombinant DNA: ASM Press, 2010. 1000 p. URL: https://djvu.online/file/BNsYFjTApTDtn?yscli	Modern idea of biological objects of biotechnology. Enhancing biological objects through the application of mutagenesis and selection techniques. Variety of biotechnology products.

d=lxkd0nrzgp527607128– free access	Genomics in biotechnology. Structure and organization of biotechnological production in accordance with GMP principles. Regulation of the biosynthesis of primary and secondary metabolites.
Green N. P. O. (Nigel P. O.), Stout G. W., Taylor D. J., Soper R. Biological science. – Cambridge: Cambridge University Press, 1995. 972 p. URL: https://archive.org/details/biologicalscienc02edgree/page/n5/mode/2up - free access	Modern idea of biological objects of biotechnology. Enhancing biological objects through the application of mutagenesis and selection techniques. Variety of biotechnology products. Genomics in biotechnology. Structure and organization of biotechnological production in accordance with GMP principles. Regulation of the biosynthesis of primary and secondary metabolites. Cell and enzyme immobilization technology. Isolation, purification and utilization of target products of biotechnological production.
Ryabkova G. V. Biotechnology (Биотехнология) – Kazan.: KNITU, 2012. - 152 c. URL: https://www.studentlibrary.ru/ru/book/ISBN9785788213279.html- limited access	Modern idea of biological objects of biotechnology. Enhancing biological objects through the application of mutagenesis and selection techniques. Variety of biotechnology products. Genomics in biotechnology. Structure and organization of biotechnological production in accordance with GMP principles. Regulation of the biosynthesis of primary and secondary metabolites. Cell and enzyme immobilization technology. Isolation, purification and utilization of target products of biotechnological production.

Biology

Reading list in Russian	**Corresponding topic**
Биология. Т. 1. / под ред. Ярыгина В.Н. - М.: ГЭОТАР-Медиа, 2023. 736 с. URL: https://www.studentlibrary.ru/ru/book/ISBN9785970474945.html - limited access	Life (mitotic) cycle of a cell. Mitosis. Meiosis. Gametogenesis, the concept of germ cells. Asexual and sexual reproduction. Direct and indirect development. Stages of embryogenesis. Types of cloning.
Биология. Т. 2. / под ред. Ярыгина В.Н. -	Life (mitotic) cycle of a cell. Mitosis.

М.: ГЭОТАР-Медиа, 2023. 560 с. URL: https://www.studentlibrary.ru/ru/book/ISBN9785970474952.html - limited access	Meiosis. Gametogenesis, the concept of germ cells. Asexual and sexual reproduction. Direct and indirect development. Stages of embryogenesis. Types of cloning.
Рис Дж., Урри Л., Кейн М., Вассерман С., Минорски П., Джексон Р. Биология в трёх томах, том 1. Химия жизни. Клетка. Генетика. Пер. с англ. – СПб: «Диалектика», 2021. – 672 с. URL: https://djvu.online/file/99M6ieTI1yWjq?ysclid=lxko47l5cv945893515– free access	Life (mitotic) cycle of a cell. Mitosis. Meiosis. Gametogenesis, the concept of germ cells. Asexual and sexual reproduction. Direct and indirect development. Stages of embryogenesis. Types of cloning.

Reading list in English	**Corresponding topic**
Biology: textbook / G. N. Solovykh, G. F. Kolchugina, E. A. Kanunikova, S. A. Donskova. - Moscow: GEOTAR-Media, 2024. — 384 p. URL: https://www.studentlibrary.ru/book/ISBN9785970484135.html- limited access	Life (mitotic) cycle of a cell. Mitosis. Meiosis. Gametogenesis, the concept of germ cells. Asexual and sexual reproduction. Direct and indirect development. Stages of embryogenesis. Types of cloning.
Green N. P. O. (Nigel P. O.), Stout G. W., Taylor D. J., Soper R. Biological science. – Cambridge: Cambridge University Press, 1995. 972 p. URL: https://archive.org/details/biologicalscienc02edgree/page/n5/mode/2up- free access	Life (mitotic) cycle of a cell. Mitosis. Meiosis. Gametogenesis, the concept of germ cells. Asexual and sexual reproduction. Direct and indirect development. Stages of embryogenesis. Types of cloning.
Urry L.A., Cain M.L., Wasserman S.A., Minorsky P.V., Orr R. Campbell Biology. – New York: Pearson; 2020. 1488 p. URL: https://www.pearson.com/en-us/subject-catalog/p/campbell-biology/P200000007019/9780135988046?tab=accessibility- limited access	Life (mitotic) cycle of a cell. Mitosis. Meiosis. Gametogenesis, the concept of germ cells. Asexual and sexual reproduction. Direct and indirect development. Stages of embryogenesis. Types of cloning.

Genetics and heredity

Reading list in Russian	**Corresponding topic**
Атлас по генетике. Под редакцией Н.В.Чебышева. – М.: Русь-Олимп, 2009. 318 с. URL: https://djvu.online/file/JPCsd0aZZs1ZH?yscli	Basic concepts of genetics. Laws of G. Mendel and T. Morgan. Gene interaction. The concept of karyotype. Sex-linked inheritance.

d=lxizv7wtm2927687786– free access	Types of variability. Mutagenic factors. Types of mutations. Inheritance of blood group and Rh factor.
Биология: Учебник для студентов высших учебных заведений/ Под ред. акад. РАО Н.В. Чебышева. — М.: ООО «Издательство «Медицинское информационное агентство», 2016. 640 с. URL: https://vk.com/doc303206085_575372204?hash=c91E38R6A2glMzOCB0H7aFraPHoHUssD8ZYAsU9hmJw&dl=d06SleZabtZKZnYHAKgmaMEqCiI9wJtGUQ6lDnYVrBg – free access	Basic concepts of genetics. Laws of G. Mendel and T. Morgan. Gene interaction. The concept of karyotype. Sex-linked inheritance. Types of variability. Mutagenic factors. Types of mutations. Inheritance of blood group and Rh factor.
Бочков Н.П., Пузырев В.П., Смирнихина С.А. Клиническая генетика: учебник. – М.: ГЭОТАР-Медиа, 2023. 592 с. URL: https://www.studentlibrary.ru/ru/book/ISBN9785970479346.html- limited access	Basic concepts of genetics. Laws of G. Mendel and T. Morgan. Gene interaction. The concept of karyotype. Sex-linked inheritance. Types of variability. Mutagenic factors. Types of mutations. Inheritance of blood group and Rh factor.
Кребс Д., Голдшейн Э., Килпатрик С. Гены по Льюину. – М.: Лаборатория знаний, 2017. 919 с. URL: https://djvu.online/file/NoQdE8qCabamX– free access	Basic concepts of genetics. Laws of G. Mendel and T. Morgan. Gene interaction. The concept of karyotype. Sex-linked inheritance. Types of variability. Mutagenic factors. Types of mutations. Inheritance of blood group and Rh factor.
Пассарг Э. Наглядная генетика. – М.: Лаборатория знаний, 2020. 508 с. URL: https://vk.com/doc50476217_636628581?hash=rtQgsGxIZvEvPeMMN0J1hHdc09rJPlUZy7GzwzqYjH8- free access	Basic concepts of genetics. Laws of G. Mendel and T. Morgan. Gene interaction. The concept of karyotype. Sex-linked inheritance. Types of variability. Mutagenic factors. Types of mutations. Inheritance of blood group and Rh factor.
Хандогина, Е. К. Генетика человека с основами медицинской генетики: учебник. – М.: ГЭОТАР-Медиа, 2021. 192 с. URL: https://www.studentlibrary.ru/ru/book/ISBN97	Basic concepts of genetics. Laws of G. Mendel and T. Morgan. Gene interaction. The concept of karyotype. Sex-linked inheritance.

85970461815.html- limited access	Types of variability. Mutagenic factors. Types of mutations. Inheritance of blood group and Rh factor.

Reading list in English	**Corresponding topic**
Bochkov N.P., Puzyrev V.P., Smirnikhina S.A. Clinical genetics: textbook. – Moscow: GEOTAR-Media, 2023. 504 p. URL: https://www.studentlibrary.ru/book/ISBN9785970475454.html - limited access	Basic concepts of genetics. Laws of G. Mendel and T. Morgan. Gene interaction. The concept of karyotype. Sex-linked inheritance. Types of variability. Mutagenic factors. Types of mutations. Inheritance of blood group and Rh factor.
Krebs J., Goldstein E., Kilpatrick S. Lewin's genes XI. – Burlington, MA: Jones and Bartlett Publishers, 2013. 940 p. URL: https://ms2016asab.wordpress.com/wp-content/uploads/2016/09/lewins-genes-xi.pdf– free access	Basic concepts of genetics. Laws of G. Mendel and T. Morgan. Gene interaction. The concept of karyotype. Sex-linked inheritance. Types of variability. Mutagenic factors. Types of mutations. Inheritance of blood group and Rh factor.
Passarg E. Color Atlas of Genetics. – New York: Thieme, 2013. 475 p. URL: https://shop.thieme.de/Color-Atlas-of-Genetics/9783132414419- limited access	Basic concepts of genetics. Laws of G. Mendel and T. Morgan. Gene interaction. The concept of karyotype. Sex-linked inheritance. Types of variability. Mutagenic factors. Types of mutations. Inheritance of blood group and Rh factor.

Cell biology

Reading list in Russian	**Corresponding topic**
Банин, В. В. Цитология. Функциональная ультраструктура клетки. Атлас. – М.: ГЭОТАР-Медиа, 2016. - 264 с. URL: https://www.studentlibrary.ru/ru/book/ISBN9785970438916.html- limited access	Features of the organization and life of prokaryotic cells. Features of the organization and life of eukaryotic cells. Structure and functions of eukaryotic cell organelles. Concept of tissue. Types of tissues.
Данилов, Р. К., Боровая Т. Г. Гистология, эмбриология, цитология: учебник. – М.: ГЭОТАР-Медиа, 2020. 528 с. URL: https://www.studentlibrary.ru/ru/book/ISBN97	Features of the organization and life of prokaryotic cells. Features of the organization and life of eukaryotic cells. Structure and functions of eukaryotic cell

85970453612.html- limited access	organelles. Concept of tissue. Types of tissues.
Кассимерис Л., Лингаппа В. Р., Плоппер Д. Клетки по Льюину. – М.: Лаборатория знаний, 2022. 1059 с. URL: https://znanium.ru/read?id=425257- limited access	Features of the organization and life of prokaryotic cells. Features of the organization and life of eukaryotic cells. Structure and functions of eukaryotic cell organelles. Concept of tissue. Types of tissues.
Ченцов Ю. С. Введение в клеточную биологию. – М.: ИКЦ «Академкнига», 2004. 495 с. URL: https://vk.com/doc424997169_562006630?hash=oZZRQ5cxfPaWzt7LI76NBoon9JZOmo0F0u3P3OJBekH- free access	Features of the organization and life of prokaryotic cells. Features of the organization and life of eukaryotic cells. Structure and functions of eukaryotic cell organelles. Concept of tissue. Types of tissues.

Reading list in English	**Corresponding topic**
Afanasyev Y.I., Yurina N.A. Histology, Embryology, Cytology. – Moscow: GEOTAR-Media, 2022. 768 p. URL: https://www.studentlibrary.ru/book/ISBN9785970470558.html - limited access	Features of the organization and life of prokaryotic cells. Features of the organization and life of eukaryotic cells. Structure and functions of eukaryotic cell organelles. Concept of tissue. Types of tissues.
Cassimeris L., Lingappa V.R., Plopper D. Cells according to Lewin. – Burlington, MA: Jones and Bartlett Publishers, 2013. 1056 p. URL: https://archive.org/details/bwb_p8-cue-596/mode/2up- free access	Features of the organization and life of prokaryotic cells. Features of the organization and life of eukaryotic cells. Structure and functions of eukaryotic cell organelles. Concept of tissue. Types of tissues.
Danilov R. K., Borovaya T.G. Histology, Embryology, Cytology. – Moscow: GEOTAR-Media, 2022. 480 p. URL: https://www.studentlibrary.ru/book/ISBN9785970463857.html - limited access	Features of the organization and life of prokaryotic cells. Features of the organization and life of eukaryotic cells. Structure and functions of eukaryotic cell organelles. Concept of tissue. Types of tissues.
Pollard T. D., Earnshaw W.C., Lippincott-Schwartz J., Johnson G. Cell Biology E-Book: Cell Biology E-Book. – Elsevier Health Sciences, 2022. 944 p. URL: https://shop.elsevier.com/books/cell-	Features of the organization and life of prokaryotic cells. Features of the organization and life of eukaryotic cells. Structure and functions of eukaryotic cell

biology/pollard/978-0-323-75800-0- limited access	organelles. Concept of tissue. Types of tissues.
Zimatkin S.M. Basics of Histology, Cytology, Embryology. – Minsk: Vysheyshaya Shkola, 2020. 240 p. URL: https://www.studentlibrary.ru/book/ISBN9789850632043.html - limited access	Features of the organization and life of prokaryotic cells. Features of the organization and life of eukaryotic cells. Structure and functions of eukaryotic cell organelles. Concept of tissue. Types of tissues.

Ecology

Reading list in Russian	**Corresponding topic**
Архангельский В. И., Кириллов В. Ф. Гигиена и экология человека: учебник. – М.: ГЭОТАР-Медиа, 2013. 176 с. URL: https://www.studentlibrary.ru/book/ISBN9785970425305.html - limited access	Diversity of the organic world. The role of organisms in the community. Diversity of habitats. Environmental factors. Supraorganismal systems. Interspecies relationships.
Григорьев А. И. Экология человека: учебник. –М.: ГЭОТАР-Медиа, 2008. 240 с. URL: https://www.studentlibrary.ru/book/ISBN9785970407202.html- limited access	Diversity of the organic world. The role of organisms in the community. Diversity of habitats. Environmental factors. Supraorganismal systems. Interspecies relationships.
Николайкин Н. И., Николайкина Н. Е., Мелехова О. П. Экология. – М.: Дрофа, 2004. 624 с. URL: https://jasulib.org.kg/wp-content/uploads/2023/04/%D0%9D%D0%B8%D0%BA%D0%BE%D0%BB%D0%B0%D0%B9%D0%BA%D0%B8%D0%BD-%D0%9D.%D0%98.-%D0%AD%D0%BA%D0%BE%D0%BB%D0%BE%D0%B3%D0%B8%D1%8F.pdf – free access	Diversity of the organic world. The role of organisms in the community. Diversity of habitats. Environmental factors. Supraorganismal systems. Interspecies relationships.
Тулякова О.В. Экология: учебное пособие. – М., Берлин: Директ-Медиа, 2019. 183 с. URL: https://e-univers.ru/catalog/t0006766/- limited access	Diversity of the organic world. The role of organisms in the community. Diversity of habitats. Environmental factors. Supraorganismal systems. Interspecies relationships.
Хаскин, В.В., Акимова Т.А. Экология. Человек — Экономика — Биота — Среда: учебник. – М.: Юнити-Дана, 2017. 495 с.	Diversity of the organic world. The role of organisms in the community. Diversity of habitats.

URL: https://www.litres.ru/book/v-v-haskin/ekologiya-chelovek-ekonomika-biota-sreda-67581185/- limited access	Environmental factors. Supraorganismal systems. Interspecies relationships.

Reading list in English	**Corresponding topic**
Bowman W. D., Hacker S. D., Cain M. L. Ecology - 4th Edition. Oxford University Press – 2017, 744 p. URL: https://www.amazon.com/Ecology-William-D-Bowman/dp/1605356182- limited access	Diversity of the organic world. The role of organisms in the community. Diversity of habitats. Environmental factors. Supraorganismal systems. Interspecies relationships.
Campbell N. A., Urry L. A., Cain M. L., Wasserman S. A., Orr R. A., Minorsky P. V., Reece J.B.. Biology: A Global Approach. – Generic. 1510 p. URL: https://www.amazon.com/Biology-Global- Approach-12th-Latest/dp/B09Y93QQMJ - limited access	Diversity of the organic world. The role of organisms in the community. Diversity of habitats. Environmental factors. Supraorganismal systems. Interspecies relationships.
Green N. P. O. (Nigel P. O.), Stout G. W., Taylor D. J., Soper R. Biological science. – Cambridge: Cambridge University Press, 1995. 972 p. URL: https://archive.org/details/biologicalscienc02edgree/page/n5/mode/2up- free access	Diversity of the organic world. The role of organisms in the community. Diversity of habitats. Environmental factors. Supraorganismal systems. Interspecies relationships.

Microbiology

Reading list in Russian	**Corresponding topic**
Зверев В.В., Буданова Е.В. Основы микробиологии и иммунологии. – М.: Academia, 2024. 320 с. URL: https://academia-moscow.ru/catalogue/5538/816744/ – limited access	Microorganisms: classification and taxonomy. Morphological forms of bacteria. Structure and chemical composition of a bacterial cell. Features of the hereditary material of bacteria. Cultivation and identification of bacteria. Bacteria that cause human diseases. Immunobiological preparations.
Зверев В.В., Бойченко М.Н., Несвижский Ю.В. Микробиология, вирусология. Руководство к практическим занятиям. Учебное пособие. - М.: ГЭОТАР-Медиа, 2022. 408с. URL: https://www.rosmedlib.ru/book/ISBN9785970467114.html - limited access	Microorganisms: classification and taxonomy. Morphological forms of bacteria. Structure and chemical composition of a bacterial cell. Features of the hereditary material of bacteria. Cultivation and identification of bacteria. Bacteria that cause human diseases. Immunobiological preparations.
Зверев В.В., Бойченко М.Н. Медицинская микробиология. Учебник. – М.: ГЭОТАР-	Microorganisms: classification and taxonomy. Morphological forms of bacteria. Structure and

Медиа, 2023. 656 с. URL: https://www.rosmedlib.ru/book/ISBN9785970473313.html - limited access	chemical composition of a bacterial cell. Features of the hereditary material of bacteria. Cultivation and identification of bacteria. Bacteria that cause human diseases. Immunobiological preparations.

Reading list in English	**Corresponding topic**
Campbell N. A., Urry L. A., Cain M. L., Wasserman S. A., Orr R. A., Minorsky P. V., Reece J.B.. Biology: A Global Approach. – Generic. 1510 p. URL: https://www.amazon.com/Biology-Global-Approach-12th-Latest/dp/B09Y93QQMJ - limited access	Microorganisms: classification and taxonomy. Morphology of bacteria. The structure and chemical composition of the bacterial cell. Bacterial genome structure. Cultivation and identification of bacteria. Bacteria causing human diseases. Immunobiological preparations.
Hewlett M. J., Camerini D., Bloom D. C. Basic Virology, Fourth Edition. – Wiley-Blackwell, 2021. - 576 p. URL: https://www.wiley.com/en-cn/Basic+Virology%2C+4th+Edition-p-9781119314066- limited access	Microorganisms: classification and taxonomy. Morphology of bacteria. The structure and chemical composition of the bacterial cell. Bacterial genome structure. Cultivation and identification of bacteria. Bacteria causing human diseases. Immunobiological preparations.
Madigan M. T., Martinko J. M., Bender K. S., Buckley D. H., Stahl D. A., Brock T. Brock Biology of Microorganisms. – Pearson, 2014. 1056 p. URL: https://www.amazon.com/Brock-Biology-Microorganisms-Michael-Madigan/dp/0134261925 - limited access	Microorganisms: classification and taxonomy. Morphology of bacteria. The structure and chemical composition of the bacterial cell. Bacterial genome structure. Cultivation and identification of bacteria. Bacteria causing human diseases. Immunobiological preparations.
Subhash Chandra Parija Microbiology and Immunology. – Jawaharlal Institute of Postgraduate Medical Education and Research Puducherry, India.: Elsevier, 2012. – 684 p. URL: https://link.springer.com/book/10.1007/978-981-19-3315-8– free access	Microorganisms: classification and taxonomy. Morphology of bacteria. The structure and chemical composition of the bacterial cell. Bacterial genome structure. Cultivation and identification of bacteria. Bacteria causing human diseases. Immunobiological preparations.
Zverev V.V., Boichenko M.N. Medical microbiology, virology, immunology. – Moscow, GEOTAR-Media, 2020. – Vol. 1 – 384 p. URL: https://www.studentlibrary.ru/book/ISBN9785970456071.html- limited access	Microorganisms: classification and taxonomy. Morphology of bacteria. The structure and chemical composition of the bacterial cell. Bacterial genome structure. Cultivation and identification of bacteria. Bacteria causing human diseases. Immunobiological preparations.

Virology

Reading list in Russian	Corresponding topic
Зверев В.В., Буданова Е.В. Основы микробиологии и иммунологии. – М.: Academia, 2024. 320 с. URL: https://academia-moscow.ru/catalogue/5538/816744/ - limited access	Viruses and bacteriophages. Structure. Hereditary material of viruses. Viral vectors. Cultivation and indication of viruses. The development cycle of viruses and bacteriophages. Viruses that cause human diseases. Immunobiological preparations.
Зверев В.В., Бойченко М.Н., Несвижский Ю.В. Микробиология, вирусология. Руководство к практическим занятиям. Учебное пособие. - М.: ГЭОТАР-Медиа, 2022. 408с. URL: https://www.rosmedlib.ru/book/ISBN9785970467114.html- limited access	Viruses and bacteriophages. Structure. Hereditary material of viruses. Viral vectors. Cultivation and indication of viruses. The development cycle of viruses and bacteriophages. Viruses that cause human diseases. Immunobiological preparations.
Зверев В.В., Бойченко М.Н. Медицинская микробиология. Учебник. – М.: ГЭОТАР-Медиа, 2023. 656 с. URL: https://www.rosmedlib.ru/book/ISBN9785970473313.html- limited access	Viruses and bacteriophages. Structure. Hereditary material of viruses. Viral vectors. Cultivation and indication of viruses. The development cycle of viruses and bacteriophages. Viruses that cause human diseases. Immunobiological preparations.

Reading list in English	Corresponding topic
Campbell N. A., Urry L. A., Cain M. L., Wasserman S. A., Orr R. A., Minorsky P. V., Reece J.B.. Biology: A Global Approach. – Generic. 1510 p. URL: https://www.amazon.com/Biology-Global- Approach-12th-Latest/dp/B09Y93QQMJ - limited access	Viruses and bacteriophages. Structure. The genetic material of viruses. Viral vectors. Cultivation and indication of viruses. Types of reproduction of viruses and bacteriophages. Viruses causing human diseases. Immunobiological preparations.
Hewlett M. J., Camerini D., Bloom D. C. Basic Virology, Fourth Edition. – Wiley-Blackwell, 2021. - 576 p. URL: https://www.wiley.com/en-cn/Basic+Virology%2C+4th+Edition-p-9781119314066- limited access	Viruses and bacteriophages. Structure. The genetic material of viruses. Viral vectors. Cultivation and indication of viruses. Types of reproduction of viruses and bacteriophages. Viruses causing human diseases. Immunobiological preparations.
Madigan M. T., Martinko J. M., Bender K. S., Buckley D. H., Stahl D. A., Brock T. Brock Biology of Microorganisms. – Pearson, 2014. 1056 p. URL: https://www.amazon.com/Brock-Biology- Microorganisms-Michael-Madigan/dp/0134261925 - limited access	Viruses and bacteriophages. Structure. The genetic material of viruses. Viral vectors. Cultivation and indication of viruses. Types of reproduction of viruses and bacteriophages. Viruses causing human diseases. Immunobiological preparations.

Subhash Chandra Parija Microbiology and Immunology. – Jawaharlal Institute of Postgraduate Medical Education and Research Puducherry, India.: Elsevier, 2012. – 684 p. URL: https://link.springer.com/book/10.1007/978-981-19-3315-8- free access	Viruses and bacteriophages. Structure. The genetic material of viruses. Viral vectors. Cultivation and indication of viruses. Types of reproduction of viruses and bacteriophages. Viruses causing human diseases. Immunobiological preparations.
Zverev V.V., Boichenko M.N. Medical microbiology, virology, immunology. – Moscow, GEOTAR-Media, 2020. – Vol. 1 – 384 p. URL: https://www.studentlibrary.ru/book/ISBN9785970456071.html- limited access	Viruses and bacteriophages. Structure. The genetic material of viruses. Viral vectors. Cultivation and indication of viruses. Types of reproduction of viruses and bacteriophages. Viruses causing human diseases. Immunobiological preparations.

Biochemistry & molecular biology

Reading list in Russian	**Corresponding topic**
Бунева, В. Н., Кудряшова Н.В., Воробьев П.Е., Мызина С.Д. Биохимия: Задачи и упражнения. – Новосибирск: РИЦ НГУ, 2023. 92 с. URL: https://www.studentlibrary.ru/book/ISBN9785443714561.html- limited access	Low molecular weight bioregulators. Biopolymers. Non-polymeric biological macromolecules. Methods for detecting biomolecules. Aerobes and anaerobes. Catabolism in living systems. Matrix biosyntheses. Replication, transcription, translation. Regulation of gene expression. Photosynthesis. Chemosynthesis. Cellular and humoral immunity. Humoral regulation. The concept of hormones and their types. Biochemistry of the nerve impulse. Neurotransmitters. Digestive enzymes. Vitamins.
Давыдов В. В., Вавилова Т.П., Островская И.Г. Биохимия: учебник. – М.: ГЭОТАР-Медиа, 2022. 704 с. URL: https://www.studentlibrary.ru/book/ISBN9785970469538.html - limited access	Low molecular weight bioregulators. Biopolymers. Non-polymeric biological macromolecules. Methods for detecting biomolecules. Aerobes and anaerobes. Catabolism in living systems. Matrix biosyntheses. Replication, transcription, translation. Regulation of gene expression. Photosynthesis. Chemosynthesis.

	Cellular and humoral immunity. Humoral regulation. The concept of hormones and their types. Biochemistry of the nerve impulse. Neurotransmitters. Digestive enzymes. Vitamins.
Нельсон Д., Кокс М. Основы биохимии Ленинджера. В 3 т. Т. 1. Основы биохимии, строение и катализ. – М.: Лаборатория знаний, 2020. - 749 с. URL: https://djvu.online/file/7wGeXxXSe23ht- free access	Low molecular weight bioregulators. Biopolymers. Non-polymeric biological macromolecules. Methods for detecting biomolecules. Aerobes and anaerobes. Catabolism in living systems. Matrix biosyntheses. Replication, transcription, translation. Regulation of gene expression. Photosynthesis. Chemosynthesis. Cellular and humoral immunity. Humoral regulation. The concept of hormones and their types. Biochemistry of the nerve impulse. Neurotransmitters. Digestive enzymes. Vitamins.
Нельсон Д., Кокс М. Основы биохимии Ленинджера. В 3 т. Т. 2. Биоэнергетика и метаболизм. – М.: Лаборатория знаний, 2020. - 691 с. URL: https://djvu.online/file/3FBJ7Kx37enjP - free access	Low molecular weight bioregulators. Biopolymers. Non-polymeric biological macromolecules. Methods for detecting biomolecules. Aerobes and anaerobes. Catabolism in living systems. Matrix biosyntheses. Replication, transcription, translation. Regulation of gene expression. Photosynthesis. Chemosynthesis. Cellular and humoral immunity. Humoral regulation. The concept of hormones and their types. Biochemistry of the nerve impulse. Neurotransmitters. Digestive enzymes. Vitamins.
Нельсон Д., Кокс М. Основы биохимии Ленинджера. В 3 т. Т. 3: Пути передачи информации. – М.: Лаборатория знаний,	Low molecular weight bioregulators. Biopolymers. Non-polymeric biological macromolecules. Methods for detecting

2022. - 441 с. URL: https://djvu.online/file/kMfUDEFb9LvVl - free access	biomolecules. Aerobes and anaerobes. Catabolism in living systems. Matrix biosyntheses. Replication, transcription, translation. Regulation of gene expression. Photosynthesis. Chemosynthesis. Cellular and humoral immunity. Humoral regulation. The concept of hormones and their types. Biochemistry of the nerve impulse. Neurotransmitters. Digestive enzymes. Vitamins.
Рослый И. М., Муфтеева Г.Р. Биохимия метаболического ядра: руководство для врачей. – М.: ГЭОТАР-Медиа, 2024. 32 с. URL: https://www.studentlibrary.ru/book/ISBN9785970481486.html- limited access	Low molecular weight bioregulators. Biopolymers. Non-polymeric biological macromolecules. Methods for detecting biomolecules. Aerobes and anaerobes. Catabolism in living systems. Matrix biosyntheses. Replication, transcription, translation. Regulation of gene expression. Photosynthesis. Chemosynthesis. Cellular and humoral immunity. Humoral regulation. The concept of hormones and their types. Biochemistry of the nerve impulse. Neurotransmitters. Digestive enzymes. Vitamins.

Reading list in English	**Corresponding topic**
Baigildina, A. A., Davydov V. V. Laboratory Manual on Biological Chemistry: for foreign students of Medical Department of Higher Education Institutions: tutorial. - Moscow: GEOTAR-Media, 2019. 304 p. URL : https://www.studentlibrary.ru/book/ISBN9785970449714.html- limited access	Low molecular weight bioregulators. Biopolymers. Non-polymeric biological macromolecules. Methods for detecting biomolecules. Aerobes and anaerobes. Catabolism in living systems. Matrix biosyntheses. Replication, transcription, translation. Regulation of gene expression. Photosynthesis. Chemosynthesis. Cellular and humoral immunity.

	Humoral regulation. The concept of hormones and their types. Biochemistry of the nerve impulse. Neurotransmitters. Digestive enzymes. Vitamins.
Clark D. P., Pazdernik N. J. Molecular biology. – Elsevier, 2012. 928 p. URL: https://shop.elsevier.com/books/molecular-biology/clark/978-0-12-378594-7- limited access	Low molecular weight bioregulators. Biopolymers. Non-polymeric biological macromolecules. Methods for detecting biomolecules. Aerobes and anaerobes. Catabolism in living systems. Matrix biosyntheses. Replication, transcription, translation. Regulation of gene expression. Photosynthesis. Chemosynthesis. Cellular and humoral immunity. Humoral regulation. The concept of hormones and their types. Biochemistry of the nerve impulse. Neurotransmitters. Digestive enzymes. Vitamins.
Glukhov, A. I., Garin V.V. Biochemistry with exercises and tasks. - Moscow: GEOTAR-Media, 2020. 296 p. URL : https://www.studentlibrary.ru/book/ISBN9785970453179.html- limited access	Low molecular weight bioregulators. Biopolymers. Non-polymeric biological macromolecules. Methods for detecting biomolecules. Aerobes and anaerobes. Catabolism in living systems. Matrix biosyntheses. Replication, transcription, translation. Regulation of gene expression. Photosynthesis. Chemosynthesis. Cellular and humoral immunity. Humoral regulation. The concept of hormones and their types. Biochemistry of the nerve impulse. Neurotransmitters. Digestive enzymes. Vitamins.
Glukhov, A. I., Gubareva A. E. Essential Biochemistry for Medical Students with Problem-Solving Exercises. - Moscow: GEOTAR-Media, 2020. 584 p.	Low molecular weight bioregulators. Biopolymers. Non-polymeric biological macromolecules. Methods for detecting biomolecules.

URL : https://www.studentlibrary.ru/book/ISBN9785970456507.html- limited access	Aerobes and anaerobes. Catabolism in living systems. Matrix biosyntheses. Replication, transcription, translation. Regulation of gene expression. Photosynthesis. Chemosynthesis. Cellular and humoral immunity. Humoral regulation. The concept of hormones and their types. Biochemistry of the nerve impulse. Neurotransmitters. Digestive enzymes. Vitamins.
Nelson L, Cox M. Lehninger Principles of Biochemistry. - W. H. Freeman, 2005. 1119 p. URL: http://aulanni.lecture.ub.ac.id/files/2012/01/15616949-Lehninger-Principles-of-Biochemistry-1-copy.pdf- free access	Low molecular weight bioregulators. Biopolymers. Non-polymeric biological macromolecules. Methods for detecting biomolecules. Aerobes and anaerobes. Catabolism in living systems. Matrix biosyntheses. Replication, transcription, translation. Regulation of gene expression. Photosynthesis. Chemosynthesis. Cellular and humoral immunity. Humoral regulation. The concept of hormones and their types. Biochemistry of the nerve impulse. Neurotransmitters. Digestive enzymes. Vitamins.
Zurabyan, S. E. Fundamentals of bioorganic chemistry. - Moscow: GEOTAR-Media, 2012. - 304 p. URL: https://www.studentlibrary.ru/book/ISBN9785970421406.html - limited access	Low molecular weight bioregulators. Biopolymers. Non-polymeric biological macromolecules. Methods for detecting biomolecules. Aerobes and anaerobes. Catabolism in living systems. Matrix biosyntheses. Replication, transcription, translation. Regulation of gene expression. Photosynthesis. Chemosynthesis. Cellular and humoral immunity. Humoral regulation. The concept of hormones and their types. Biochemistry of the nerve impulse.

	Neurotransmitters. Digestive enzymes. Vitamins.

4.1. Recommended online-courses
Biotechnology & applied microbiology

Online-courses in English	**Link**	**Summary**
Chemical Biology	https://coursera.org/learn/chemical-biology	The concept of chemical biology. Applied, translational concepts in the life sciences.
Drug Development Product Management	https://coursera.org/specializations/drug-development-product-management	Drug discovery, development, and commercialization
Industrial Biotechnology (Coursera)	https://www.coursera.org/learn/industrial-biotech	Key technologies underlying biotechnology research, including enzyme discovery and development, systems and synthetic biology, and biochemical and process engineering.
Systems Biology and Biotechnology (Coursera)	https://www.coursera.org/specializations/systems-biology	Methodologies in Systems Biology Including Bioinformatics, Dynamical Modeling, Genomics, Network and Statistical Modeling, Proteomics, Omics Technologies Single Cell Research Technologies
Introduction to Biomedical Engineering	https://openedu.ru/course/spbstu/BIOENG/	The basics of modern biomedical engineering, including the development of human-robotic interfaces and systems such as bionic prosthetics.
Methods of molecular biology	https://openedu.ru/course/spbstu/MOLBIO/	The structure and properties of proteins and nucleic acids as well as various molecular mechanisms underlying biological processes and life itself.
Online-courses in Russian	**Link**	**Summary**
Наноматериалы в биотехнологии и биоинженерии	https://openedu.ru/course/ITMOUniversity/NANOM1/?session=self_2024	Nanoparticles and nanocomposite polymer materials as promising materials for modern medicine, pharmaceuticals and biotechnology.
Введение в молекулярную биологию и биомедицину	https://stepik.org/course/549/promo?search=4738386913	The basic structure of the physical and chemical objects that make up the living world. General principles of processes in this world.
Регенеративная медицина и	https://stepik.org/course/4844/promo?search=4738386917	General aspects of tissue engineering, experiment and clinical use of regenerative

тканевая инженерия		medicine, and advanced technologies and legal control in regenerative medicine

Biology

Online-courses in English	**Link**	**Summary**
General Biology	https://sechenov.online/course/general-biology	Cell as a unit of life. The cell cycle. Mytosis. The cycle control. Meiosis. Gametogenesis
Anatomy Specialization (Coursera)	https://www.coursera.org/specializations/anatomy	Basics of human anatomy. Basic organ systems, their functioning and reliability.
Science of Stem Cells (Coursera)	https://www.coursera.org/learn/stem-cells	History and basic biology of stem cells, new research methods.
TSU Applicant's Online School: Biology	https://ido.skills.tsu.ru/course/view.php?id=122	Basic sections of biology. History and fundamentals of biology.
Online-courses in Russian	**Link**	**Summary**
Биология	https://sechenov.online/course/biologia	Division. Reproduction. Ontogenesis.
Эволюционная история позвоночных: от рыб к динозаврам и человеку	https://openedu.ru/course/spbu/EVOLUT/?session=self_paced_2021	Review of vertebrate evolution. Emergence of important vertebrate traits.
Основы онтогенеза	https://dovuz.sechenov.ru/mod/book/view.php?id=1628&chapterid=189	Description of the basics of ontogenesis. Embryonic development.
Обзор основных отрядов млекопитающих	https://dovuz.sechenov.ru/mod/book/view.php?id=1628&chapterid=216	General description of the diversity of mammal orders.

Genetics and heredity

Online-courses in English	**Link**	**Summary**
Genetics	https://sechenov.online/education/genetics	Essentials of genetics. Chromosome theory og inheritance. DNA replication. DNA repair
Genomics: Decoding the Universal	https://coursera.org/learn/genomics-research	The concept of genome. Decoding the language of the genome.

Language of Life (Coursera)		
Introduction to Genetics and Evolution (Coursera)	https://www.coursera.org/learn/genetics-evolution	Principles underlying genetics and evolution. Speciation and phylogenetics.
TSU Applicant's Online School: Biology	https://ido.skills.tsu.ru/course/view.php?id=122	Basic sections of biology. History and fundamentals of biology.
Online-courses in Russian	**Link**	**Summary**
Генетика	https://sechenov.online/course/genetika	Genome variability. Medical genetics.
Закономерности наследования признаков	https://dovuz.sechenov.ru/mod/book/view.php?id=1628&chapterid=201	Genetics and description of the basic laws of G. Mendel
Взаимодействие генов	https://dovuz.sechenov.ru/mod/book/view.php?id=1628&chapterid=200	Interaction of allelic and non-allelic genes
Сцепленное наследование	https://dovuz.sechenov.ru/mod/book/view.php?id=1628&chapterid=199	Description of the laws of Genetic linkage
Генетическое определение пола. Часть 1.	https://dovuz.sechenov.ru/mod/book/view.php?id=1628&chapterid=198	Consideration of the basic principles of gender development
Генетическое определение пола. Часть 2.	https://dovuz.sechenov.ru/mod/book/view.php?id=1628&chapterid=197	Continuation of the description of the genetics of sex. Analysis of pathologies of sexual development, options for determining sex, main types of inheritance
Медицинская генетика	https://dovuz.sechenov.ru/mod/book/view.php?id=1628&chapterid=196	Medical genetics, tasks and methods of medical genetics
Матричный синтез: Репликация, репарация	https://dovuz.sechenov.ru/mod/book/view.php?id=1628&chapterid=195	Description of the structure of DNA. Concept of DNA replication and repair
Реализация генетической информации, биосинтез белка	https://dovuz.sechenov.ru/mod/book/view.php?id=1628&chapterid=194	Description of the protein biosynthesis process

Cell biology

Online-courses in English	**Link**	**Summary**
General Biology	https://sechenov.online/course/general-biology	A cell as a unit of life. The cell cycle. Mytosis. The cycle control. Meiosis. Gametogenesis
Anatomy Specialization (Coursera)	https://www.coursera.org/specializations/anatomy	Basics of human anatomy. Basic organ systems, their functioning and reliability.
Science of Stem Cells (Coursera)	https://www.coursera.org/learn/stem-cells	History and basic biology of stem cells, new research methods.
TSU Applicant's Online School: Biology	https://ido.skills.tsu.ru/course/view.php?id=122	Basic sections of biology. History and fundamentals of biology.
Online-courses in Russian	**Link**	**Summary**
Цитология	https://sechenov.online/course/citologia	General biology, section cytology. Cell structure.
Вирусы	https://dovuz.sechenov.ru/mod/book/view.php?id=1628&chapterid=188	Description of viruses, their properties, classification, reproduction and significance.
Строение эукариотической клетки	https://dovuz.sechenov.ru/mod/book/view.php?id=1628&chapterid=187	General biology, section cytology. Cell structure.
Энергетический обмен	https://dovuz.sechenov.ru/mod/book/view.php?id=1628&chapterid=236	The concept of energy metabolism and its stage.
Фотосинтез	https://dovuz.sechenov.ru/mod/book/view.php?id=1628&chapterid=186	Review of photosynthesis. Principles, types, stages and phases of photosynthesis.

Ecology

Online-courses in English	**Link**	**Summary**
Big Stuff: Evolution and Ecology (Coursera)	https://www.coursera.org/learn/the-big-stuff-evolution-and-ecology	Biodiversity. Basic principles of ecology. Ecology and the interrelation of life.
Ecology: Ecosystem Dynamics and Conservation (Coursera)	https://www.coursera.org/learn/ecology-conservation	Introduction to ecology and ecosystem dynamics. Population studies. Coexistence of species.

Understanding Plants - Part I: What a Plant Knows (Coursera)	https://coursera.org/learn/plantknows	Fundamentals of plant biology. Sense organs of plants.
Understanding Plants - Part II: Fundamentals of Plant Biology (Coursera)	https://coursera.org/learn/plant-biology	Fundamental science plant biology. Structure and function of plants and plant cells. How plants grow and develop. Photosynthesis.
TSU Applicant's Online School: Biology	https://ido.skills.tsu.ru/course/view.php?id=122	Basic sections of biology. History and fundamentals of biology.
Online-courses in Russian	**Link**	**Summary**
Экологические факторы: абиотические	https://dovuz.sechenov.ru/mod/book/view.php?id=1628&chapterid=227	Types of abiotic factors, their classification, patterns of action, and adaptation to them.
Экологические факторы: биотические	https://dovuz.sechenov.ru/mod/book/view.php?id=1628&chapterid=228	Review of biotic factors. Types of biotic factors, classification of interspecific interactions.
Биоценоз. Биогеоценоз. Экосистема	https://dovuz.sechenov.ru/mod/book/view.php?id=1628&chapterid=229	The concept of ecological succession, the general strategy for the development of ecosystems, their classification, and stages.
Экология экосистем. Синэкология	https://dovuz.sechenov.ru/mod/book/view.php?id=1628&chapterid=230	The concept of ecosystems, their characteristics, types, as well as components of ecosystems and types of food chains.
Учение о биосфере	https://dovuz.sechenov.ru/mod/book/view.php?id=1628&chapterid=231	The concept of the biosphere, the history of the emergence of the doctrine of the biosphere, as well as a description of various processes within the biosphere.

Microbiology

Online-courses in English	**Link**	**Summary**
General microbiology	https://sechenov.online/education/general-microbiology	Morphology of the microbes. Morphology of bacteria. Physiology of the microorganisms
Virology	https://sechenov.online/course/virology	General Virology. Infection. Infectious process.
Special microbiology	https://sechenov.online/course/special-microbiology	Enteric bacterial pathogens. E-coli. Vibrio cholerae. Opportunistic pathogens. Types of hepatitis.
Bacteria and Chronic	https://www.coursera.org/learn/bacterial-infections	Single-celled bacteria, biofilm formation, acute and chronic infections.

Infections (Coursera)		
Biology Everywhere (Coursera)	https://coursera.org/specializations/biology-everywhere	Concepts of cell biology, conservation and genetics. Current biological problems in modern society
Epidemics - the Dynamics of Infectious Diseases (Coursera)	https://www.coursera.org/learn/epidemics	Main topics in the dynamics of infectious diseases. Dynamics of influenza, measles, whooping cough. Malaria.
Immunology: Immune system and Infectious Diseases (Coursera)	https://www.coursera.org/learn/immunology-immune-system-and-infectious-diseases	Infectious diseases. Immune response. Mechanisms produced by pathogens.
Immunology	https://sechenov.online/education/immunology	Introduction to the Immunology. Adaptive immunity. Immunological memory. Anti-infectious immunity. Immune response in different conditions
Online-courses in Russian	**Link**	**Summary**
Основы медицинской микробиологии	https://sechenov.online/course/osnovy-mikrobiologii	The main characteristics of microorganisms: morphology, structure, and metabolism of bacteria. The genetic apparatus of bacteria, methods transmitting genetic information, and use in medical practice are characterized. Microecology studies the distribution of microorganisms in nature, as well as the normal microbiome of the human body and its changes.
Учение об инфекции. Иммунология	https://sechenov.online/course/immunologia	The main characteristics of the infectious process and infectious disease, types and forms of infection, and pathogenicity factors of microorganisms. Immunology, current issues of protecting the body from pathogens, immunobiological drugs used for the prevention and specific therapy of infectious diseases.
Частная бактериология	https://sechenov.online/course/castnaa-bakteriologia	Enteric bacterial pathogens. E-coli. Vibrio cholerae. Opportunistic pathogens. Types of hepatitis…
Введение в общую микробиологию	https://stepik.org/course/68410/promo?search=4738439753	The diversity of microorganisms and their role in general biological processes.

Введение в детскую аллергологию	https://stepik.org/course/57862/promo	The concepts of “allergy” and “Evidence-based medicine”. Prevalence of allergic diseases.
Вакцинопрофилактика пневмококковой инфекции	https://stepik.org/course/7186/promo	Strategy and tactics of vaccine prevention of pneumococcal infection at the present stage.

Virology

Online-courses in English	**Link**	**Summary**
General microbiology	https://sechenov.online/education/general-microbiology	Morphology of the microbes. Morphology of bacteria. Physiology of the microorganisms.
Virology	https://sechenov.online/course/virology	General Virology. Infection. Infectious process.
Special microbiology	https://sechenov.online/course/special-microbiology	Enteric bacterial pathogens. E-coli. Vibrio cholerae. Opportunistic pathogens. Types of hepatitis.
Bacteria and Chronic Infections (Coursera)	https://www.coursera.org/learn/bacterial-infections	Single-celled bacteria, biofilm formation, acute and chronic infections.
Biology Everywhere (Coursera)	https://coursera.org/specializations/biology-everywhere	Concepts of cell biology, conservation and genetics. Current biological problems in modern society.
Epidemics - the Dynamics of Infectious Diseases (Coursera)	https://www.coursera.org/learn/epidemics	Main topics in the dynamics of infectious diseases. Dynamics of influenza, measles, whooping cough. Malaria.
Immunology: Immune system and Infectious Diseases (Coursera)	https://www.coursera.org/learn/immunology-immune-system-and-infectious-diseases	Infectious diseases. Immune response. Mechanisms produced by pathogens.
Immunology	https://sechenov.online/education/immunology	Introduction to the Immunology. Adaptive immunity. Immunological memory. Anti-infectious immunity. Immune response in different conditions
Online-courses in Russian	**Link**	**Summary**

Общая вирусология	https://sechenov.online/course/obsaa-virusologia	The main biological features of viruses and bacteriophages are considered. Structure of viruses and bacteriophages, characteristics of reproduction, interaction with cells, indication methods.
Частная вирусология	https://sechenov.online/course/castnaa-virusologia	Viruses that cause human diseases are considered. Attention is paid to the epidemiology and spread of viral infections. Modern methods of laboratory diagnostics, identification, as well as immunobiological drugs for prevention are considered.
Вирусы	https://dovuz.sechenov.ru/mod/book/view.php?id=1628&chapterid=188	Description of viruses, their properties, classification, reproduction and significance.
Молекулярная вирусология	https://openedu.ru/course/nsu/virology/?session=2024_apr_dec	The variety of viruses and their forms. Difference from living organisms and mechanisms of damage to human cells.
Эпидемиологические особенности пневмококковой инфекции	https://stepik.org/course/7185/promo	Epidemic situation of pneumococcal infection in Russia and abroad, its etiology and clinical picture.

Biochemistry & molecular biology

Online-courses in English	**Link**	**Summary**
Biochemical Principles of Energy Metabolism (Coursera)	https://www.coursera.org/learn/energy-metabolism	Energy and fat metabolism. Photosynthesis. Glucose oxidation and energy production. Energy homeostasis.
Chemical Biology (Coursera)	https://coursera.org/learn/chemical-biology	Fundamental understanding of chemical biology. Applied, translational concepts in life sciences
Industrial Biotechnology (Coursera)	https://coursera.org/learn/industrial-biotech	Engineering of biochemical and bioprocesses. Pharmaceuticals. Enzymes. Discovery and development of enzymes.
Biochemistry Open & Free (Carnegie Mellon University)	https://oli.cmu.edu/courses/biochemistry-open-free/	Effect of molecular interactions on the biochemical properties of systems.

Principles of Biochemistry (Harvard University)	https://www.harvardonline.harvard.edu/course/principles-biochemistry	This introduction to biochemistry explores the molecules of life, starting at simple building blocks and culminating in complex metabolism.
Immunology	https://sechenov.online/education/immunology	Introduction to the Immunology. Adaptive immunity. Immunological memory. Anti-infectious immunity. Immune response in different conditions.
Fundamentals of Immunology (Coursera)	https://www.coursera.org/specializations/immunology	Basics of innate immunity, including complement, and its role in inflammation and activation of adaptive immunity. Principles of chemical communication between immune cells.
Fundamentals of Immunology: T Cells and Signaling (Coursera)	https://coursera.org/learn/immunologyfundamentalstcellssignaling	Fundamentals of immunology. Innate immunity and B cell functions. T cell functions and coordination of the immune response.
Introductory Human Physiology (Coursera)	https://www.coursera.org/learn/physiology	The main organ systems of the body. Basic concepts that define the complex functioning of the body as an intact organism.
Methods of molecular biology	https://openedu.ru/course/spbstu/MOLBIO/	The structure and properties of proteins and nucleic acids as well as various molecular mechanisms underlying biological processes and the life itself.
Online-courses in Russian	**Link**	**Summary**
Биохимия	https://sechenov.online/course/biohimia	Molecular biology. Gene expression and its regulation.
Введение в молекулярную биологию и биомедицину	https://stepik.org/course/549/promo?search=4738386913	The basic structure of the physical and chemical objects that make up the living world, and the general principles of the flow of processes in this world.
Биохимия белков	https://stepik.org/course/124041/promo	Structure, properties, functions and catabolism of proteins and amino acids.
Молекулярная биология	https://www.lektorium.tv/molecular-biology	Mechanisms of storage, reproduction and transmission of genetic information. Modern methods and directions of research, diagnosis and treatment of hereditary diseases.