

1. **Title**  
Introduction to cell biology
2. **Lecturer(s)**  
Vyacheslav Dyachuk
3. **Assistance(s)**  
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4. **Course Language**  
English
5. **Credits and assessment form (exam, ungraded credit test, graded credit test)**  
2 ECTS, exam
6. **Educational program and semester**  
Master: Quantum and Hybrid Materials, 3 semester
7. **Prerequisites (courses and topics, skills and abilities, as a prerequisite for studying the discipline - specify the basic or advanced courses, whether they are present in the Department of Physics and Engineering programs, since under different names of courses there may be different content)**

Since the course is a biological, it is a basic education level for understanding and conditions for attending the course. There is no need to attend additional courses before that.

8. **Brief annotation (in simple and understandable language with the obligatory indication of the points below):**

*description of the course goal and main objectives*

This educational course is an introduction to cell and molecular biology for physical specialties. **The aim** of the course is to obtain basic knowledge in the field of fundamental and applied cell and molecular biology for use by scientists of other specialties for use in their scientific field. This course consists of a special section of fundamental (theoretical) cell biology and molecular biology, followed by an applied (experimental) part. In the first part, students will get acquainted with modern data on the organization of model organisms, the structure of cells, organelles, their role and function, interactions between each other, as well as the development of organisms in normal and pathological conditions. The second part of the course will be devoted to the study of methods of molecular biology, genomics, transcriptomics and single cell technologies.

*- description of expected learning outcomes (what the student will be able to do after studying the discipline)*

As a result, students will gain basic knowledge in the field of cell and molecular biology, allowing them to navigate in this area and understand the basic principles of the structure and use of model objects in biology, medicine, physics, and chemistry. In addition, students will learn about new genomic technologies that are not yet available in Russia and can be used in various fields of science.

*- (optional) the relevance of the course, novelty and significance, uniqueness, specialty and narrow profile or the course is basic and time-tested*

9. **Course content**

*The format of classes from the official curriculum is lectures, practices (seminars), students' independent work..*

No section	Section title	The main topics of the section, divided into lectures, practices, laboratory	Classes format	Estimated date (if known)
1	Fundamental principles of cell structure	1. General structure	lecture	1
		2 Organoids	lecture	1
		3 Main cellular methods	Lecture+ Seminar	1+1
2	the Central dogma of molecular biology: DNA, RNA, protein.	4. DNA	lecture	1
		5 RNA	lecture	1
		6 Proteins	lecture	1
		7 Methods	lecture	1
		8 new experiments	lecture+ Seminar	1+1
3	model objects of cell and molecular biology	Mice as a main object	lecture	1
		Danio rerio	lecture	1
		Human	lecture	1
		Invertebrates	lecture	1
4	The latest methods for studying the genome. transcriptome and proteome	Immunocytochemistry	lecture	1
		DNA investigations, genomes	lecture	1
		RNA investigations, transcriptomes	lecture	1
		Protein methods	lecture+ Seminar	1+1

*Indicate if it is possible to replace sections or topics with an online course (add link if possible). Clarify if you plan to replace existing lesson formats with an online course*

**10. Resources and references (required and recommended - be sure to add at least 2 links to an electronic source available at ITMO, as well as to an online course, if used)**

Molecular Biology of the Cell. by Bruce Alberts, Alexander D. Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, Peter Walter. ISBN-10 : 9780815344322

Genome Editing and Engineering: From TALENs, ZFNs and CRISPRs to Molecular Surgery. st Edition by Krishnarao Appasani (Editor), George M. Church. ISBN-10: 1107170370

Гены и геномы: В 2-х т. Автор: Сингер М., Берг П.

**11. Evaluation of course progress (grading policy) and examples of assignments**

Choose the types of tasks from the list below or fill in your own in the table indicating the weight of the task in points and possible comments. The table must be filled in completely (comments if desired or if there are important details), and in the deadlines indicate the approximate expected dates or study weeks.

Форма контроля	Assignment's type	Score %	Minimum threshold for attestation (grade E or credit)%	Deadlines	Comments
Current attestation during the course (Monitoring of progress)	report at the seminar	10	Credit 10%	Seminar time	Evaluation of personal talk during seminar and answer a question
Mid-term attestation	report at the seminar	10	Credit 10%	Seminar time	Evaluation of personal talk during seminar and answer a question
Admission to attestation (if any)	report at the seminar	10	Credit 10%	Seminar time	Evaluation of personal talk during seminar and answer a question
Attestation	examination	70	Credit 70%	by agreement	the answers to the questions of examination papers and the practical task
$\Sigma$		100	100%		

### Tasks examples

Indicate for each type of assignment examples that can be used in the course or are similar to actual assignments with decoding of the component parts according to the points from the table below. For example, if you have questions for a colloquium, exam or a set of topics for reports, then indicate the list. Supplement with an example or pattern for completing the assignment for those where a structured uniform design is important.

Indicate the requirements for completing assignments with justification, for which certain points are awarded, for which the number of points is reduced, which parts of the assignment are mandatory or additional (if there are or send examples of student work from past years to the dean's office)

An indicative list of possible assignments to complete and how they can be assessed

№	Type of task	Component parts of the task	How could be used
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<b>№</b>	<b>Type of task</b>	<b>Component parts of the task</b>	<b>How could be used</b>
<b><i>Monitoring of progress / Mid-term attestation</i></b>			
1	Debate / discussion / round table	new methods for studying gene expression	Online forum, interactive voting, videoconference, etc.
2	Case / situational (problem) task	Confocal microscopy or tomography?	Group analysis of a specific situation, individual-group work with cases and problematic tasks
3	Colloquium	microscopic methods for studying living and non-living objects	Automated system of self-assessment and mutual assessment
4	Report	atomic force microscopy in the study of single DNA and RNA molecules	Overall report, cross-report analysis
5	Report	Biom mineralization processes in invertebrates and their potential use as new materials for medicine	Overall report, cross-report analysis
6	Report	Brainbow technology and genetic tracing	Overall report, cross-report analysis
7	Report	RNA-velocity	Overall report, cross-report analysis
8	Report	TALEN and Crips-Cas9 technology	Overall report, cross-report analysis
9	Report	Molecular machines for moving organelles in the cell	Overall report, cross-report analysis
10	Presentation	Alzheimer's disease: methods of biology and physics for diagnosis and treatment	Video clip, stand, etc.
11	Presentation	Disease Parkinsona: methods for detection and Biophysics a study of the causes and consequences	Video clip, stand, etc.
12	Message	Biophysics of muscle contraction	Videoconference, webinar
13	Message	single cell transcriptome analysis (on slides)	Videoconference, webinar
14	Message	bulk and plate single cell transcriptome analysis	Videoconference, webinar
15	Message	atomic force microscopy in the study of single DNA and RNA molecules	Videoconference, webinar
16	Message	What is morpholino?	Videoconference, webinar
<b><i>Attestation/ Session</i></b>			
25	Passing ticket interview	<ul style="list-style-type: none"> <li>• Description of application technology</li> <li>• An indicative list of questions / tasks</li> </ul>	Interview with experts, cross-interview, written

№	Type of task	Component parts of the task	How could be used
		for credit <ul style="list-style-type: none"> <li>• The procedure for generating a ticket</li> <li>for offset</li> <li>• Grading scale and assessment criteria</li> </ul>	response to ticket

### **12. Additional comments**

*The information will become available only for those registered for the course: indicate the format of communication with the teacher and a link to the materials for the course on <https://study.physics.itmo.ru>, google drive, <https://cloud.physics.itmo.ru/>*