



## COURSE UNIT DESCRIPTION

| Course unit title                  | Code |
|------------------------------------|------|
| <b>Basics of Molecular Biology</b> | -    |

| Lecturer(s)   | Department(s)   |
|---|---|
| <b>Coordinator:</b> Dr. Julija Armalytė<br>Lectures – 32 h.<br>Seminars – 16 h. | Life Sciences Center, Institute of Biosciences,<br>Saulėtekio av., 7, Vilnius |

| Cycle    | Level of the course unit | Type of the course unit |
|----------|--------------------------|-------------------------|
| Bachelor | 1 out of 1               | Elective                |

| Mode of delivery   | Period of delivered | Language(s) of instruction |
|--------------------|---------------------|----------------------------|
| Contact/auditorium | Spring semester     | English                    |

| Prerequisites and corequisites                               |                                    |
|--|------------------------------------|
| <b>Prerequisites:</b><br>Biochemistry (basics), Cell biology | <b>Corequisites (if any):</b><br>- |

| Number of credits allocated to the course unit | Student's total workload | Contact hours |    | Self-study and research hours |
|--|--------------------------|---------------|----|-------------------------------|
| 5  | 133                      | Lectures      | 32 | 85                            |
|  |                          | Seminars      | 16 |                               |

| Purpose of the course unit: programme competences to be developed  |   |                              |
|--|---|------------------------------|
| <p>Upon the successful completion of this course, students will acquire:</p> <p><i>Subject-specific competences:</i></p> <ul style="list-style-type: none"> <li>• Knowledge of the basic concepts of molecular biology, the basic knowledge of the mechanisms by which the genetic material of the cells is replicated, transcribed and translated into proteins; knowledge of the similarities and differences of major molecular biology processes in prokaryotic and eukaryotic cells.</li> <li>• Skills to analytically, critically and systemically analyze and evaluate information related to molecular biology field.</li> </ul> <p><i>General competences:</i></p> <ul style="list-style-type: none"> <li>• skills for self-development, study skills in order to study molecular biology;</li> <li>• skills to present in written and verbal forms the knowledge of the molecular biology;</li> <li>• skills to participate in the scientific discussion;</li> <li>• skills to organize and plan their work and time.</li> </ul> |   |                              |
| Learning outcomes of the course unit   | Teaching and learning methods   | Assessment methods           |
| The student will understand and be able to apply the knowledge about the basic structural units, molecular and cellular processes, their relationships and importance in determining the functions of all living organisms.  | Lectures, tutorials, self-evaluation tests, discussions during seminars, self-study | Exams, seminar presentations |
| The student will understand the basis of life processes at the   | Lectures, tutorials, self-  | Exams, seminar               |

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|---|---|--|
| molecular level; will be able to explain the structural and functional properties and transformations of basic biological molecules.  | evaluation tests, discussions during seminars, self-study                       | presentations  |
| The student will develop the skills to analytically, critically and systemically find, analyze and evaluate information in scientific literature related to molecular biology field | Self-study for preparing the material for seminars, discussions during seminars | Seminar presentation   |
| The student will develop the skills to participate in scientific discussion related to molecular biology field  | Discussions during seminars   | Seminar presentation, extra credits for active participation |

| Content: breakdown of the topics   | Contact hours |           |          |           |                 |                           |               | Self-study work: time and assignments |   |
|--|---------------|-----------|----------|-----------|-----------------|---------------------------|---------------|---------------------------------------|---|
|  | Lectures      | Tutorials | Seminars | Exercises | Laboratory work | Internship/work placement | Contact hours | Self-study hours                      | Assignments   |
| <b>Introduction to Molecular biology</b>   | 2             |           | 2        |           |                 |                           | 4             | 5                                     | Self-directed assessment of knowledge level in biochemistry and cell biology  |
| Introduction to the origin and field of study of Molecular biology, general definitions used.  | 2             |           |          |           |                 |                           | 2             | 2                                     | The same  |
| Assessment of students' level of knowledge and assignment of additional reading material if need be.   |               |           | 2        |           |                 |                           | 2             | 3                                     | The same  |
| <b>1. The molecular structure of DNA, RNA and proteins</b>   | 7             |           | 4        |           |                 |                           | 11            | 15                                    | Analysis of the topic presented at the lectures. Self-study of the topic-related material (course e-resources). Preparation of presentations and discussions during seminars. |
| The molecular structure of DNA, supercoiling. Molecular structure of chromatin, levels of DNA compaction. Nucleosome structure and higher levels of chromatin packaging. | 3             |           | 2        |           |                 |                           | 5             | 6                                     | The same  |
| Molecular structure of RNA, differences from DNA. RNA functions and their diversity.   | 2             |           | 2        |           |                 |                           | 4             | 6                                     | The same  |
| Molecular structure of proteins. Function and diversity of proteins  | 2             |           |          |           |                 |                           | 2             | 3                                     | The same  |
| <b>2. DNA biosynthesis</b>   | 5             |           | 4        |           |                 |                           | 9             | 15                                    | Analysis of the topic presented at the lectures. Self-study of the topic-related material (course e-  |

|   |          |  |          |  |  |  |           |           |   |
|---|----------|--|----------|--|--|--|-----------|-----------|---|
|   |          |  |          |  |  |  |           |           | resources). Preparation of presentations and discussions during seminars.   |
| Prokaryotic and eukaryotic DNA polymerases, intrinsic mechanisms of replication accuracy    | 1        |  |          |  |  |  | 1         | 2         | The same  |
| Replication in prokaryotes and eukaryotes   | 2        |  |          |  |  |  | 2         | 4         | The same  |
| Extrachromosomal replication mechanisms and diversity (mitochondria, chloroplasts plasmids) |          |  | 2        |  |  |  | 2         | 3         | The same  |
| Replication initiation and control during the cell cycle                                    | 2        |  | 2        |  |  |  | 4         | 6         | The same  |
| <b>Midterm Exam</b>   | <b>4</b> |  |          |  |  |  | <b>4</b>  | <b>10</b> | Self-directed learning in preparation for Midterm Exam. 1-3 topic discussion during consultation/tutorial   |
| Consultation/tutorial on the topics presented prior to Midterm Exam                         | 2        |  |          |  |  |  | 2         | 10        | The same  |
| Midterm Exam  | 2        |  |          |  |  |  | 2         |           | The same  |
| <b>3. RNA biosynthesis</b>  | <b>7</b> |  | <b>4</b> |  |  |  | <b>11</b> | <b>15</b> | Analysis of the topic presented at the lectures. Self-study of the topic-related material (course e-resources). Preparation of presentations and discussions during seminars. |
| RNA polymerases, the mechanism of transcription.  | 1        |  |          |  |  |  | 1         | 2         | The same  |
| Transcription in prokaryotes.<br>Transcription in eukaryotes<br>Transcription regulation.   | 4        |  | 2        |  |  |  | 6         | 7         | The same  |
| RNA processing  | 2        |  | 2        |  |  |  | 4         | 6         | The same  |
| <b>4. Protein biosynthesis</b>  | <b>5</b> |  | <b>2</b> |  |  |  | <b>7</b>  | <b>15</b> | Analysis of the topic presented at the lectures. Self-study of the topic-related material (course e-resources). Preparation of presentations and discussions during seminars. |
| Translation apparatus. Ribosome structure   | 2        |  |          |  |  |  | 2         | 4         | The same  |
| The principles of translation.<br>Translation in prokaryotes and eukaryotes                 | 2        |  |          |  |  |  | 2         | 5         | The same  |
| Post-translational modification   | 1        |  | 2        |  |  |  | 3         | 6         |   |
| <b>Preparation for final Exam</b>   | <b>2</b> |  |          |  |  |  | <b>2</b>  | <b>10</b> | Self-directed learning in preparation for Midterm Exam. 1-3 topic discussion during consultation/tutorial   |
| Consultation/tutorial on the topics presented prior to Exam                                 | 2        |  |          |  |  |  | 2         | 10        | The same  |

|              |           |  |           |  |  |           |           |  |
|--------------|-----------|--|-----------|--|--|-----------|-----------|--|
| <b>Total</b> | <b>32</b> |  | <b>16</b> |  |  | <b>48</b> | <b>85</b> |  |
|--------------|-----------|--|-----------|--|--|-----------|-----------|--|

| <b>Assessment strategy</b> | <b>Weight, %</b> | <b>Assessment period</b>                            | <b>Assessment criteria</b>   |
|----------------------------|------------------|---|--|
| Midterm Exam               | 40%              | 8 <sup>th</sup> week (+/- one week) of the semester | <p>A test on the course virtual environment (moodle platform), composed of 25-40 questions on the topics covered in 1-2 parts. The questions include: multiple choice, true/false, arranging answers to a given question in the correct order, short open questions.</p> <p>A grade from 1 to 10 is assigned according the percentage of correct answers (10 – all questions are answered correctly, 9 – 90% questions answered correctly, etc.).</p> <p>Less than 45% of correct answers (a grade of &lt;4.5) is considered as failed Midterm Exam. A fail in the Midterm Exam prohibits from taking the final Exam.</p> <p>The Midterm Exam must be taken in person at the auditorium at the assigned date (during lecture time, unless alternative time is agreed between the lecturer and students in advance), except when a justifiable reason (with a confirming document) is presented. Not showing up for Midterm Exam without a justifiable reason is considered a fail.</p> |
| Exam                       | 40%              | Exam session  | <p>A test the course virtual environment (moodle platform), composed of 25-40 questions on the topics covered in 3-4 parts. The questions include: multiple choice, true/false, arranging answers to a given question in the correct order, short open questions.</p> <p>A grade of 1 to 10 is assigned according the percentage of correct answers (10 – all questions are answered correctly, 9 – 90% questions answered correctly, etc.).</p> <p>Less than 45% of correct answers (a grade of &lt;4.5) is considered as failed Exam. The Exam must be taken in person at the auditorium at the assigned date during exam session, except when a justifiable reason (with a confirming document) is presented. Not showing up for Exam without a justifiable reason is considered a fail.</p>  |
| Seminars                   | 20%              | Every second week of the semester                   | <p>Individual preparation and oral presentation of the course related topic, selected from the list (presented on the course virtual environment (moodle platform)) at the beginning of course by the student, or chosen by the student and approved by the lecturer until the indicated date.</p> <p>The presentation must be made at the assigned seminar date and be of the indicated length and format, which are agreed at the beginning of the course between the lecturer and the students. Failure to present at the assigned date without a justifiable reason (with a confirming document) will reduce the seminar grade to 0.</p> <p>During the presentation, three aspects of the presentation are graded by the lecturer (grades 1 to 10):</p> <ul style="list-style-type: none"> <li>- Adequate covering of the topic;</li> <li>- Presentation quality and clarity;</li> <li>- Answers to the question from lecturer and other students.</li> </ul>                      |

|                                     |                    |   |   |
|-------------------------------------|--------------------|---|---|
|                                     |                    |   | <p>The grades are assigned according the quality in the mentioned three aspects:</p> <p>10 – Outstanding<br/> 9 – Excellent<br/> 8 – Very good<br/> 7 – Good<br/> 6 – Acceptable<br/> 5 – Passable<br/> 4 – Below average<br/> 3 – Significantly below average<br/> 2 – Failing<br/> 1 – Unprepared</p> <p>The average of the three grades is the final grade for the seminars.</p> <p>Participation in the seminars during the semester is mandatory. If a student fails to attend the seminars without a justifiable reason (with a confirming document), the seminar grade is reduced, depending on the number of seminars not attended:</p> <p>1 seminar – no reduction of grade;<br/> 2 seminars – the seminar grade is reduced by half;<br/> 3 or more seminars – the seminar grade is reduced to 0</p> |
| Extra credit (active participation) | 10% (extra credit) | The whole semester (during lectures and seminars) | <p>To gain extra credit, students are encouraged to:</p> <ul style="list-style-type: none"> <li>- During the seminars, ask presenting students questions and participate in scientific discussion;</li> <li>- Participate in voluntary self-evaluation quizzes at the end of each lecture.</li> </ul> <p>The most active students can be awarded 5-10% extra credit to their final score.</p>   |
| Total                               | 100%               |   | <p>Midterm Exam and Exam parts each must be completed with minimal passable evaluation (<math>\geq 4.5</math>) to be eligible to obtain the final evaluation.</p> <p>The final grade is the weighted average of Midterm Exam, Exam and Seminar grades; Extra credits can be added to the final grade (not exceeding the maximum final grade of 10)</p>  |

| Author   | Year of publication | Title   | Publishing place and house or web link                          |
|--|---------------------|---|---|
| <b>Compulsory reading</b>                              |                     |   |   |
| Course e-resources in the virtual learning environment | Since 2025          | Basics of Molecular Biology                             | <a href="https://emokymai.vu.lt/">https://emokymai.vu.lt/</a>   |
| <b>Optional reading</b>                                |                     |   |   |
| Allison L.A.   | 2012                | Fundamental Molecular Biology (2 <sup>nd</sup> edition) | John Wiley & Sons Inc (available at Vilnius University library) |