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| Course Title | **Molecular Biology and Biotechnology** | | | | |
| Course Code | ABS210 | | | | |
| Course Type | Mandatory | | | | |
| Level | BSc (Level 1) | | | | |
| Year / Semester | 3rd / 4th Semester | | | | |
| Teacher's Name | Dr Despina Charalambous. Dr Panagiotis Kouis | | | | |
| ECTS | 6 | Lectures / week | 3 | Laboratories/week | 2 |
| Course Purpose | The purpose of the course is to understand the systems that control gene expression in (prokaryotic and eukaryotic) organisms at every level. Another goal is to understand basic concepts of Molecular Biology, such as DNA, RNA and the relevant mechanisms related to genetic information of the cell, cell division and cell death. Other goals are to provide knowledge regarding the molecular processes that relate to cancer. The course also aims at introducing students to biotechnology and its applications in the field of pharmacy. | | | | |
| Learning Outcomes | By the end of this course, the students should be able to:<br>Recognize and explain what genetic material is.<br>Recognise differences regarding the genetic material of eukaryotic cells, prokaryotic cells and viruses.<br>Identify and describe basic concepts such as genome, chromosomes, DNA, RNA, nucleotides, ribonucleotides, inheritance.<br>Analyse the process of genetic information transfer from DNA to proteins.<br>Distinguish the way genetic information is organised stored and expressed.<br>Identify and explain what genes are and identify the basic characteristics of eukaryotic genes.<br>Describe gene expression regulation.<br>Describe cell division, cell differentiation and cell death.<br>Describe what cancer is, at the molecular level and explain the role of oncogenes.<br>Distinguish what genetic engineering is and outline key tools and components of recombinant DNA technology (such as electrophoresis, restriction enzymes, ligase and polymerase, cloning, sequencing methods, gene therapy).<br>Assess the use of molecular biology in medical chemistry: such as in cell tests for drug discovery, the use of gene knock-out models, etc.<br>Familiarize with pharmacogenetics and its role in drug metabolism | | | | |

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| | Understand basic concepts of biotechnology and manufacturing of biotechnological products with genetic engineering technology<br><br>Describe what vaccines are and how they are produced, the advantages and disadvantages of each class of vaccine and their application in the prevention and treatment of disease.<br><br>Refer to monoclonal antibodies and their application in the treatment of diseases. | | |
| Prerequisites | ABS105 | Corequisites | - |
| Course Content | Theory:<br>Genetic material of eukaryotic, prokaryotic cells and viruses.<br>DNA and RNA structure.<br>Genetic information from DNA to proteins.<br>Organization, storage and expression of genetic information.<br>Cell division, differentiation and cell death.<br>Genes and key characteristics of eukaryotic genes.<br>Gene expression regulation.<br>Cancer and oncogenes.<br>Genetic engineering. Basic tools of recombinant DNA technology and genome analysis (electrophoresis, restriction enzymes, ligase and polymerase, sequencing methods, generation of directed mutations).<br>Pharmacogenetics and Pharmacogenomics<br><br>Introduction to Biotechnology. Applications in Pharmacy. Vaccine and monoclonal antibodies production<br><br>Laboratory experiments/exercises:<br>As part of the course, laboratory exercises are carried out on the course material for a better deepening and consolidation of the theoretical part. Indicative exercises are: laboratory techniques in molecular biology, bacterial transformation, isolation of plasmid DNA from *E. coli*, restriction enzyme digest of plasmid DNA with restriction endonucleases, DNA agarose gel electrophoresis, PCR and cloning . | | |
| Teaching Methodology | The final assessment of the students is formative and summative and is assured to comply with the subject's expected learning outcomes and the quality of the course. Teaching methodology includes lectures to better understand concepts of Molecular Biology and Biotechnology. Detailed lecture notes are presented with image-rich material and short animations to help understand better several biological processes. Methods such as discussion, questions/answers and cooperative learning are used to enhance the student's participation. Recent research results are included and discussed in the course. The written assignment helps students to | | |

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| | grasp the ideas and concepts presented in the course. It is also used to demonstrate knowledge.<br><br>As part of the developing students' skills, laboratory exercises are carried out by the students themselves in the Laboratory of Biochemistry and Molecular Biology with the proper laboratory equipment and under the supervision of teaching personnel. Appropriate preparation and demonstration by the laboratory personnel is preceded by each laboratory exercise. Assessment of laboratory exercises is performed by submitting laboratory reports or filling out special forms / questionnaires for each student. |
| Bibliography | Textbook:<br><br>1. "Molecular Biology", 3rd edition, (2019), David P. Clark, Nanette J. Pazdernik and Michelle R. McGehee, Elsevier Inc.<br>2. "Φαρμακευτική Βιοτεχνολογία: Έννοιες και εφαρμογές", G. Walsh, Wiley; 1η έκδοση, 2012<br>3. Current applications of Pharmaceutical Biotechnology, Silva et al., Springer, 2020.<br><br>References:<br><br>4. "Βασικές Αρχές Κυτταρική Βιολογίας" (2018) B. Alberts, D. Bray, K. Hopkin, A. Johnson, J. Lewis, M. Raff, K. Roberts, P. Walter., Εκδοτικός Οίκος: Ιατρικές Εκδόσεις Πασχαλίδης.<br>5. "Ανασυνδυασμένο DNA. Γονίδια και γονιδιώματα-Μια συνοπτική παρουσίαση", 3η έκδοση (2007) Watson, J. D., Myers, R.M., Caudy, A.A., Witkowski, J.A., Ακαδημαϊκές Εκδόσεις Ι. Μπάσδρα & Σια. |
| Assessment | For student evaluation, the overall grade is determined by a written midterm exam (20%), a laboratory grade (20%) and a written final exam (60%).<br><br>The mid-term exam is carried out between the 6th and 8th week and it mainly includes short answer questions and problem- solving questions and examines specific modules of the course.<br><br>As far as the laboratory grade is concerned, it comprises of the evaluation of the laboratory reports which mainly includes short answer questions and problem-solving questions. In the laboratory reports, students are asked to describe the experiment procedure, to evaluate and analyse their results and to answer specific questions. The following criteria are taken into account when evaluating laboratory reports: (a) experimental data collection (30%), (b) data analysis (40%), and application of theory to draw conclusions (30%).<br><br>The final exam of the course is carried out during the 14th-16th week of each semester and includes short answer questions, decision questions, and problem-solving questions regarding all course modules. |
| Language | Greek, English |