

Course Title	Advanced Pharmaceutical Biotechnology				
Course Code	PHA419				
Course Type	Advanced Pharmacy Elective				
Level	MPharm (Level 2)				
Year / Semester	4 th / 8 th Semester				
Teacher's Name	Dr Despina Charalambous, Dr Maria Pantelidou				
ECTS	6	Lectures / week	3	Laboratories/week	2
Course Purpose	<p>The course aims to exposing students to various advanced topics in biotechnology such as topics involving the criteria for regulatory approval for biotechnology drugs, the technology in genetic engineering and its application to pharmacy and tissue culture. Students will also be exposed to methods in producing commercial products using fermentation biotechnology. This course will also discuss the clinical, epidemiological, economical and ethical aspects of the use of biotechnological drugs. More specifically, the aim of this course is to teach the ways of interference in the genetic mechanisms of cells and of creation of gene libraries. Furthermore, to teach how mutations are made and detected, as well as how proteins can be specifically engineered, and which proteins can be produced by genetic engineering. Other aims are realisation of the benefits of biotechnology for pharmacy and pharmacotherapeutics, production of knock-out animals, transgenic animals, Gene therapy and Pharmacogenetics, tissue and cell (animal, plant) cultures and examination of the human genome for the discovery of new drugs. Recent scientific findings presented in selected scientific literature on pharmaceutical biotechnology will be discussed.</p>				
Learning Outcomes	<p>By the end of this course, the students should be able to:</p> <ul style="list-style-type: none"> • Describe the applications of genetic engineering • Recognise the molecular mechanisms of DNA cloning, methods for creating recombinant DNA molecules and applications for diagnosis and treatment of disease; • Explain pharmacogenetics/pharmacogenomics and its applications; • Familiarize with animal research and tissue culture applications; • Recognise the mechanisms of transgenic technology, gene therapy and stem cells as well as their application in pharmacy; • Describe the basics of Bioreactor Technology and the manufacturing of commercial biotechnology products; • List and describe recent applications of biotechnology in Pharmacy (amino acids, proteins, enzymes, hormones, vitamins, secondary metabolites, antibiotic production, vaccines and monoclonal antibodies production). 				

	<ul style="list-style-type: none"> Review scientific articles and critically assess research findings 		
Prerequisites	PHA212	Corequisites	-
Course Content	<p>Genetic engineering technology (ways of interfering with cellular genetic mechanisms, gene library building, species and mutation detection, recombinant proteins, transgenic animals, protein expression systems, DNA imprinting and sequencing methods)</p> <p>Gene therapy (characteristics and use of tissues and cells, animal and plant cell cultures, methods of DNA transfer, transformation and transfection of cell systems, stem cells).</p> <p>Bioreactor technology (species, characteristics, types of bioreactors, purification and isolation of fermentation products, exploitation of biotechnology advantages)</p> <p>Pharmacogenetic and Pharmacotherapeutic (clinical, epidemiological, economic and ethical aspects of the use of biotechnological drugs, genetic polymorphisms).</p> <p>Applications of biotechnology in Pharmacy (amino acids, proteins, enzymes, hormones, vitamins, secondary metabolites, antibiotic production, vaccines and monoclonal antibodies production)</p> <p>Review of selected scientific articles. Class discussion. Completion of assignment.</p> <p>Practical Exercises using fermentation biotechnology:</p> <ol style="list-style-type: none"> Yeast transformation with recombinant DNA Yeast protein of interest isolation and quantification using SDS PAGE electrophoresis 		
Teaching Methodology	<p>Teaching methodology includes lectures to better understand concepts of Pharmaceutical 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, pros/cons, brainstorming, debates, and cooperative learning are used to enhance the student's participation. A debate-focused flipped classroom will be used to enhance student engagement, while also improving learning outcomes. Recent research results are included and discussed in the course. The written assignment helps students to grasp the ideas and concepts presented in the course. It is also used to demonstrate knowledge.</p>		

Bibliography	<p>(a) <u>Textbooks</u>:</p> <ol style="list-style-type: none"> 1. Current applications of Pharmaceutical Biotechnology, Silva et al., Springer, 2020. 2. Pharmaceutical Biotechnology, Fundamentals and Applications, Crommelin, Daan J. A., Sindelar, Robert, Meibohm, Bernd, 5th edition, 2019. 3. List of recent scientific articles on pharmaceutical biotechnology <p>(b) <u>References</u>:</p> <ol style="list-style-type: none"> 1. “Φαρμακευτική Βιοτεχνολογία: Έννοιες και εφαρμογές”, G. Walsh, Wiley; 1η έκδοση, 2012 <p>Ανασυνδρασμένο DNA. Γονίδια και γονιδιώματα Μια συνοπτική παρουσίαση. “ Watson, J. D., Myers, R.M., Caudy, A.A., Witkowski, J.A. Ακαδημαϊκές Εκδόσεις Ι. Μπάσδρα & Σια, 2012</p>
Assessment	<p>The overall grade is determined by a written midterm exam (30%), a written assignment on advanced research topic of pharmaceutical biotechnology (10%) and a written final exam (60%).</p> <p>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.</p> <p>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.</p> <p>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.</p>
Language	Greek, English