

 FLORIDA ATLANTIC UNIVERSITY	COURSE CHANGE REQUEST Undergraduate Programs		UUPC Approval <u>4/24/23</u> UFS Approval _____ SCNS Submittal _____ Confirmed _____ Banner Posted _____ Catalog _____
	Department Chemistry and Biochemistry College College of Science		
Current Course Prefix and Number CHM 4273		Current Course Title Introduction to Drug Design	
<i>Syllabus must be attached for ANY changes to current course details. See <u>Checklist</u>. Please consult and list departments that may be affected by the changes; attach documentation.</i>			
Change title to: RI: Introduction to Drug Design Change prefix From: _____ To: _____ Change course number From: _____ To: _____ Change credits* From: _____ To: _____ Change grading From: _____ To: _____ Change WAC/Gordon Rule status** Add <input type="checkbox"/> Remove <input type="checkbox"/> Change General Education Requirements*** Add <input type="checkbox"/> Remove <input type="checkbox"/> <small>*Review <u>Provost Memorandum</u></small> <small>**WAC/Gordon Rule criteria must be indicated in syllabus and approval attached to this form. See <u>WAC Guidelines</u>.</small> <small>***General Education criteria must be indicated in syllabus and approval attached to this form. See <u>GE Guidelines</u>.</small>		Change description to: Basic principles of organic chemistry and biochemistry vital to drug design and drug action are the focus of this course with use of important drugs as examples. The course is further enhanced with student case projects, with the goal to encourage creative-and-critical thinking. Change prerequisites/minimum grades to: CHM 2210 or BCH 3033 Remove "minimum grade" requirement Change corequisites to: Change registration controls to: Please list existing and new pre/corequisites, specify AND or OR and include minimum passing grade (default is D-).	
Effective Term/Year for Changes: Spring 2024		Terminate course? Effective Term/Year for Termination:	
Faculty Contact/Email/Phone Predrag Cudic, pcudic@fau.edu, 6-8375			
Approved by Department Chair <u>Andrew Tenen's</u> College Curriculum Chair <u>[Signature]</u> College Dean <u>[Signature]</u> UUPC Chair <u>Ethlyn Williams</u> Undergraduate Studies Dean <u>Dan Meeroff</u> UFS President _____ Provost _____		Date 3/29/23 4-5-23 4/5/23 4/24/23 4/24/23	

Email this form and syllabus to mjenning@fau.edu seven business days before the UUPC meeting.



RI CHM 4273
RI: Introduction to Drug Design

Summer 2023

Prof. Predrag Cudic, Ph.D.
Office: SE 364
Telephone: 561-799-8375
Email: pcudic@fau.edu

Class Meeting Days:	Mondays, Wednesdays, and Fridays, 05/13/2023-06/23/2023
Class Meeting Hours:	2:15 PM - 4:25 PM
Class Location:	General Classroom South, room 103
Office Hours:	M,W and F, 12/noon-2PM or by appointment, Location: SE 364
Course Withdrawal:	May 19, 2023. Last day to drop course without a "W".
Number Credit Hours:	3
Instructional Method:	In-Person.

I. Course Description:

Basic principles of organic chemistry and biochemistry vital to drug design and drug action are the focus of this course with use of important drugs as examples. The course is further enhanced with student case projects, with the goal to encourage creative-and-critical thinking.

This course covers the basic principles of how new drugs are discovered with emphasis on lead compound discovery and optimization, identification of drug targets, development of bioassays, structure-activity relationships and pharmacophores, drug resistance and drug synergism, drug metabolism and prodrugs. Recent advances in drug design that use rational and combinatorial chemistry approaches will also be covered.

II. Research-Intensive (RI) Designated Course

This course contains an assignment or multiple assignments designed to help students conduct research and inquiry at an intensive level. If this class is selected to participate in the university-wide assessment program, students will be asked to complete a consent form and submit electronically some of their research assignments for review. Visit the Office of Undergraduate Research and Inquiry (OURI) for additional opportunities and information at <http://www.fau.edu/ouri>.

III. Course Objectives and Student Learning Outcomes:

Those who successfully complete this course will be proficient in understanding the processes involved in drug discovery and development from lead identification to introduction into clinical studies. Students will also be proficient in explaining organic chemistry strategies used in drug discovery as well as how drug functions at the molecular level.

Research projects are expected to achieve all six of the following Student Learning Outcomes (SLOs):

SLO 1: Knowledge. Students are expected to demonstrate content knowledge of the basic principles of drug design/discovery and applications.

SLO 2: Formulate Questions. Students are required to formulate research questions and scholarly or creative problems in a manner relevant to the drug design and discovery field.

SLO 3: Plan of Action. Students are expected to develop and implement a plan of action (lead discovery, high throughput screening, target identification, target validation, hit series, assay development, screening cascade, lead optimization) to address research and inquiry questions or scholarly problems.

SLO 4: Critical Thinking. Students are expected to apply critical thinking skills to evaluate information, their own work, and the work of others.

SLO 5: Ethical Conduct. Students will identify significant ethical issues in research and inquiry and/or address them in practice.

SLO 5: Communication. Students will convey all aspects of their research and inquiry (processes and/or products) in appropriate formats, venues, and delivery modes. Students are encouraged to participate in OURI Annual Undergraduate Research Symposium http://www.fau.edu/ouri/undergrad_symposium.php.

IV. Recommended Texts and Materials:

- 1) The Organic Chemistry of Drug Design and Drug Action, R. B. Silverman, M. V. Holladay, Academic Press, 3rd edition (2014). ISBN: 978-0123820303
- 2) An Introduction to Drug Synthesis G. L. Patrick, Oxford University Press, 1st edition (2015). ISBN: 978-0198708438
- 3) An Introduction to Medicinal Chemistry, G. L. Patrick, Oxford University Press, 5th edition (2013). ISBN: 978-0199697397

V. Course Prerequisites:

Organic Chemistry 1 or Biochemistry 1.

VI. Attendance Policy:

Students are expected to attend all of their scheduled University classes and to satisfy all academic objectives as outlined by the instructor. The effect of absences upon grades is determined by the instructor, and the University reserves the right to deal at any time with individual cases of non-attendance. Students are responsible for arranging to make up work missed because of legitimate class absence, such as illness, family emergencies, military obligation, court-imposed legal obligations or participation in University-approved activities. Examples of University-approved reasons for absences include participating on an athletic or scholastic team, musical and theatrical performances and debate activities. It is the student's responsibility to give the instructor notice prior to any anticipated absences and within a reasonable amount of time after an unanticipated absence, ordinarily by the next scheduled class meeting. Instructors must allow each student who is absent for a University-approved reason the opportunity to make up work missed without any reduction in the student's final course grade as a direct result of such absence.

VII. Counseling and Psychological Services (CAPS) Center

Life as a university student can be challenging physically, mentally and emotionally. Students who find stress negatively affecting their ability to achieve academic or personal goals may wish to consider utilizing FAU's Counseling and Psychological Services (CAPS) Center. CAPS provides FAU students a range of services – individual counseling, support meetings, and psychiatric services, to name a few – offered to help improve and maintain emotional well-being. For more information, go to <https://www.fau.edu/counseling/>

VIII. Disability Policy Statement:

In compliance with the Americans with Disabilities Act Amendments Act (ADAAA), students who require reasonable accommodations due to a disability to properly execute coursework must register with Student Accessibility Services (SAS) and follow all SAS procedures. SAS has offices across three of FAU's campuses – Boca Raton, Davie and Jupiter – however, disability services are available for students on all campuses. For more information, please visit the SAS website at www.fau.edu/sas/.

IX. Code of Academic Integrity Policy Statement:

Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the university mission to provide a high-quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see [University Regulation 4.001](#).

X. Policy on the Recording of Lectures

Students enrolled in this course may record video or audio of class lectures for their own personal educational use. A class lecture is defined as a formal or methodical oral presentation as part of a university course intended to present information or teach students about a particular subject. Recording class activities other than class lectures, including but not limited to student presentations (whether individually or as part of a group), class discussion (except when incidental to and incorporated within a class lecture), labs, clinical presentations such as patient history, academic exercises involving student participation, test or examination administrations, field trips, and private conversations between students in the class or between a student and the lecturer, is prohibited. Recordings may not be used as a substitute for class participation or class attendance and may not be published or shared without the written consent of the faculty member. Failure to adhere to these requirements may constitute a violation of the University's Student Code of Conduct and/or the Code of Academic Integrity, [University Regulation 4.001](#).

XI. Drops/Withdrawals:

Students are responsible for completing the process of dropping or withdrawing from a course. Please click on the following link for more information on dropping and/or withdrawing from a course, <https://www.fau.edu/registrar/registration/faqs.php>

XII. Religious Accommodation Policy Statement

In accordance with rules of the Florida Board of Education and Florida law, students have the right to reasonable accommodations from the University in order to observe religious practices and beliefs with regard to admissions, registration, class attendance, and the scheduling of examinations and work assignments. For further information, please see Academic Policies and Regulations.

XIII. Faculty Rights and Responsibilities:

Florida Atlantic University respects the rights of instructors to teach and students to learn. Maintenance of these rights requires classroom conditions that do not impede their exercise. To ensure these rights, faculty members have the prerogative:

- To establish and implement academic standards.
- To establish and enforce reasonable behavior standards in each class.
- To refer disciplinary action to those students whose behavior may be judged to be disruptive under the Student Code of Conduct.

Instructor reserves the right to adjust this syllabus as necessary.

XIV. Exams:

There will be three exams (80 min each). Exams will cover the material on the outlines, handouts and lecture power points from the preceding classes (for example, Exam 1 will cover the material for the week of May 13

and May 24 etc.). Exam rules will be clearly shown on the front page of each exam and it is the responsibility of each student to read and adhere to these rules.

There will be no make-up exams, except in the following cases:

1. Medical emergency or problem
2. Death in the immediate family
3. Participation in an FAU-sponsored academic or athletic activity/event
4. Required appearance in a civil or criminal court
5. Military obligations
6. Religious Holiday

A request for exemption from the exam policy for any of the above reasons will be considered only if the student *does not attempt* a given exam AND written documentation (e.g. medical certificate etc.) is submitted to the professor within 1 day (before or after) of the scheduled exam date. Also, please see the Attendance Policy.

XV. Assignments:

One assignment in written and oral form will be given to a group of three student. The assignment will be to design a drug discovery strategy starting with a clinical lead compound from the literature (a drug for which no clinical studies have been published). Students will select an underserved disease, describe the clinical need and financial viability of the proposed new drug and identify drug target that could provide improved clinical treatment for the disease. Students will also describe how the target will be validated, how lead compounds acting on the target will be identified, how these lead compounds will be optimized and the criteria that will be used to select a clinical candidate compound. Written form of the assignment cannot exceed four pages (excluding the reference list) and PowerPoint presentations will be 30 min long. The assignment will be graded based on the following criteria: clarity, depth of the description of the proposed strategy, feasibility of the proposed strategy, literature used for project preparation, class discussion. Due dates are toward the end of the semester to maximize the amount of information available to the student prior to completing the assignment.

INTEGRATION OF SLOS AND ASSIGNMENTS

SLOs	Assignment Requirements and Assessments		
	Exposure (Knowledge & Comprehension)	Skill Building (Application & Analysis)	Intensive (Synthesis & Evaluation)
SLO 1: Knowledge	Students will summarize previous literature and reported work and will demonstrate knowledge of basic principles of drug design and discovery. Knowledge of written, and oral communication, and use of PowerPoint, and chemical drawing software (ChemDraw, access available through the Department of Chemistry and Biochemistry) are also required to incorporate research findings in written assignments and presentations.	Students will demonstrate information literacy by searching literature databases (e.g. PubMed), and by searching the SciFinder database of the Chemical Abstract Service (division of the American Chemical Society). Students will also appraise appropriateness of theoretical framework(s)	Students will be able to assess scientific premise of the previous work, create new knowledge and apply that knowledge to their projects.
SLO 2:	Students are required to develop a problem statement in which they specifically address	Students will identify gaps in the existing	Students will compose logical arguments for

Formulate Questions	their research questions. The students are expected to present a clear concise statement of the research problem in the context of the targeted disease and new drug discovery.	knowledge and be able to formulate new questions. When appropriate, the students should be able to break down principal problems related to drug discovery into smaller solvable sub-problems.	the working hypothesis.
SLO 3: Plan of Action	Students will create a plan for the discovery and validation of a hypothetical drug candidate (plan of action) that will encompass the following elements: (i) scope of the study; (ii) literature review; (iii) planning context; (iv) problem statement and design methodology; (v) data analysis and design background; (vi) developing a design project. The students will develop hypothesis, identify research methods and experimental designs, and select appropriate statistical techniques. Using the course timeline as a template, each student is expected to develop her/his own planning project management plan with specific tasks related to the topic in consideration.	Students will employ appropriate methodologies relevant to identification of a drug candidate medicinal chemistry, biochemical assays.	Students will synthesize and evaluate plan(s) of inquiry.
SLO 4: Critical Thinking	Students will demonstrate critical thinking skills by taking into consideration multiple perspectives, examining implications and consequences of an action or planning alternative; ability to use literature evidence and reasoning to distinguish between categories or rank them, ability to apply standards and make judgments according to established personal, professional, or social rules or criteria, ability to build predictive models and transform knowledge. Peer reviews will be used for the initial drafts.	Students are expected to interpret information from the literature, identify gaps in the previous research, provide strategies to address these gaps, analyze results, analyze feedback.	Students will be able to justify conclusions, prepare critical review, evaluate and respond to feedback.
SLO 5: Ethical Conduct	All students are required to familiarize themselves with the NIH Scientific Integrity Policy: https://www.nih.gov/sites/default/files/about-nih/nih-director/testimonies/nih-policies-procedures-promoting-scientific-integrity-2012.pdf . Student will be required to complete CITI training of academic research on-line at http://www.fau.edu/graduate/events/citi-training.php . Students are also encouraged to attend FAU OURI workshops on topics related responsible conduct of research. Information on OURI workshops can be found here http://www.fau.edu/our/student_workshops.php	Students are expected to identify significant ethical issues (research integrity and research misconduct) in research and inquiry and/or address them in practice.	Students will be able to identify best practices for ensuring research integrity.

SLO 6: Communication	Students will be required to write and present a research proposal, (e.g., elaborate significance, analysis, findings and recommendations, NIH style), and be prepared to present all stages of their planning project as outlined in SLO3.	Students are expected to demonstrate knowledge of technical report writing, visualization, and presentation	Students will convey all aspects of their research and inquiry (processes and/or products) in appropriate formats, venues, and delivery modes.
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XVI. Course Grade:

The grading scale for the course will be A (95-100%), A- (90-94%), B+ (87-89%), B (83-86%), B- (79-82%), C+ (75-78%), C (71-74%), C- (68-70%), D+ (64-67%), D (60-63%), and F (<59%).

The course grade is made up of the following components:

Exam 1	=	15 points
Exam 2	=	15 points
Exam 3	=	15 points
<u>Assignment</u>	=	<u>55 points (30 points written + 25 points oral presentation)</u>
Total	=	100 points (max)

Incomplete grade: Incompletes will not be given unless: a) a student is passing the course and b) a student encounters severe and unexpected problems and was not able to complete some portion of the work assigned to all students as a regular part of the course. Incompletes are given only by arrangement with the instructor. Students are expected to make up incompletes as soon as reasonably possible. Incompletes are not given because a student is doing poorly in the course.

Grade Appeal Process: A student may request a review of the final course grade when she/he believes that one of the following conditions apply:

- There was a computational or recording error in the grading.
- Non-academic criteria were applied in the grading process.
- There was a gross violation of the instructor's own grading system.
- Procedures for a grade appeal (Regulation 4.002) may be found at:
<https://www.fau.edu/artsandletters/documents/grade-review-grievance-procedures.pdf>

XVII. Tentative Course Schedule:

Week of	Topic	Information
May 15	Concepts of drug discovery	general consideration, finding a lead, optimizing target interactions, optimizing access to the target, etc.
	Research misconduct	general consideration, discussion of the literature example (selected from the Retraction Watch Database and/or PubMed).
	Lead discovery and lead modification	general consideration, sources of lead compounds, identification of pharmacophore, functional group

		modification, structure-activity relationship, structure modification to increase potency, therapeutic index and ADME properties, combinatorial and parallel synthesis, etc.
	*Student Assignments	Case projects
May 22	Receptors	general consideration, drug-receptor interactions, determination of drug-receptor interactions, assay design, etc.
	Enzymes	general consideration, mechanisms of enzyme catalysis, coenzyme catalysis, enzyme inhibition and inactivation, assay design, etc.
	**Exam 1	Time: 2:15 PM Gen. Class. South, room 103
May 29	DNA-interactive agents	general consideration, DNA-drug interaction, classes of drugs that interact with DNA, etc.
	Drug resistance and synergism	general consideration, mechanisms of drug resistance, mechanism of drug synergism, use of multiple drugs for the same target, etc.
	Progress evaluation on student assignments	Discussion and feedback from the instructor.
	**Exam 2	Time: 2:15 PM Gen. Class. South, room 103
June 5	Drug metabolism	general consideration, synthesis of radioactive compounds, pathways for drug deactivation and elimination, reductive reactions, conjugation reactions, etc.
	Prodrugs	general consideration, enzyme activation of drugs, types of prodrugs, mechanisms of drug inactivation, etc.
	Progress evaluation on student assignments	Discussion and feedback from the instructor.
June 12	Drug delivery systems	general consideration, macromolecular drug carrier systems, bioprecursor prodrugs, oxidative activation, reductive activation, etc.
	Student presentations	Class discussions
TBD	**Exam 3	Time: 2:15 PM Gen. Class. South, room 103

Notes	<p>*Case projects are required for all students; all students are required to attend presentations and participate in discussions. Please note that the versions of Exams 1-3 for undergraduate students will contain questions related to presented research papers.</p> <p>**Exams will be given at the beginning of the class period, starting promptly at 2:15 pm ET.</p>	