

SPRING 2023
PHM809 (SECTION 001)/ CEM809 (SECTION 001) /BMB961 (SECTION 004): DRUG
DISCOVERY AND MEDICINAL CHEMISTRY (2 CREDITS)
TUE-THU 9:10 – 10:00 AM (B330 LIFE SCIENCE)

Instructor: Drs. Kin Sing Lee, Edmund Ellsworth, Rick Neubig, Jetze Tepe, Erika Lisabeth, Alex Dickson, Bryan Copple, Andy Vick, Marc Bailie, Jim Vrbanic and Ken Waterman

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Course Description:

Drug Discovery is a complicated and fascinating adventure, engaging multiple disciplines, strategic decision-making, and problem-solving skills. The selection of a finalist from a pool of drug candidates is often driven by a careful balance of efficacy, safety, and economic considerations. Expert practitioners have some knowledge in chemistry, biochemistry, molecular biology, pharmacology, informatics, toxicology, and physiology to make key decisions.

This course will provide the fundamentals for the drug discovery process including but not limited to basic chemical knowledge, drug design principles, high-throughput screening, computational modeling, drug metabolic pathways and pharmacokinetic/pharmacodynamic analysis. The goal of this course is to equip students with a basic knowledge of discovery pharmaceutical research and to prepare them ultimately to work as a team-member in a discovery program.

Grading:

The course grade will be based on the participation in team presentations, the preparation and presentation of the final group project, and course attendance (**90% attendance is required**):

Group Presentations	50%
Group Written Report	40%
Attendance	10%

The group project will include written reports and presentations. Each group will be assigned a drug discovery project. We will provide each project group a list of potential drug candidates with structural, potency, pharmacokinetic, etc. information. Based on the data provided, each team member should be engaged in the selection of the best candidate from a group of compounds for the next development phase. It is anticipated that each group meets together outside of class time for scholarly discussion for the preparation of their final project and during the semester.

The written report will be graded by the instructors while the presentations (Open to Public) will be graded by both students (40% of the grade of the presentation)

and the attending faculty (60% of the grade of the presentation). The detailed breakdown of the grade for the written report and the presentation are listed below:

Written Report		Presentation	
Criteria	Contribution to the grade (%)	Criteria	Contribution to the grade (%)
Organization	20	Organization	20
Significance	20	Significance	20
Lab Objective and Data Analysis	40	Lab Objective and/or Data Analysis	40
Rationale of the Decision	20	Rationale of the Decision	20

During the semester, each group is required to give **4 presentations (including three 10 min short presentations and a 20 min final presentation)**, each short presentation will be followed by 5 min Q&A and account for 10% of the final grading while the final presentation will account for 20%.

Each group will submit **3 short reports (due on Friday before the short presentation, a template will be provided)** for instructors' comments. The short report should contain individual contributions. Each group will have a week to incorporate our comments into your group report and return the edited report to us for further comments. Instructors and external guest lecturers will provide suggestions and feedback for the project during the presentations and teams are encouraged to contact instructors for questions and advice. Each short report resembles a key section of your final report.

The final report is due on Apr 21st 2023.

Americans with Disabilities Act Accommodations:

Michigan State University is committed to providing equal opportunity for participation in all programs, services, and activities. Requests for accommodations by persons with disabilities may be made by contacting the Resource Center for Persons with Disabilities by phone at 517-884-RCPD or through the web at rcpd.msu.edu. Once your eligibility for an accommodation has been determined, you will be issued a verified individual services accommodation ("VISA") form. Please present this form at the start of the semester and/or at least two weeks prior to the accommodation date. Requests received after this date will be honored whenever possible.

Policy Regarding Academic Dishonesty: Academic dishonesty of any kind will not be tolerated in this course. Please see the following website for information regarding Michigan State University's policy regarding academic dishonesty:

<https://www.msu.edu/~ombud/academic-integrity/index.html>

TENTATIVE SCHEDULE (THE SCHEDULE MAY SUBJECT CHANGES DUE TO UNFORSEEN EVENTS SUCH AS: WEATHER CONDITION, ETC.)

Date	Topic
Introduction	
Jan 10 th , Jan 12 th	<ol style="list-style-type: none"> 1. Different Aspects of Drug Discovery (Dr. Ellsworth) 2. From Hit-to-Drug Candidate (Dr. Ellsworth)
Jan 17 th , Jan 19 th	<ol style="list-style-type: none"> 3. Lab Objectives, Product Profile, Guidance for Lead Selection. (Dr. Ellsworth) 4. Case study (Dr. Lee) (Online Supplemental Lecture) Sources of Chemical Matter – principle of medicinal chemistry (Dr. Lee)
Jan 24 th , Jan 26 th	<ol style="list-style-type: none"> 5. Druggable Target, Target Identification and validation (Dr. Neubig) 6. Chemical Biology/Chemical spaces (Dr. Tepe)
Identification of the Lead Compounds	
Jan 31 st , Feb 2 nd	<ol style="list-style-type: none"> 7. Group presentations (Assignment of target disease, mechanism) 8. High-Throughput Screening and Screening Strategy (Dr. Lisabeth)
Feb 7 th , Feb 9 th	<ol style="list-style-type: none"> 9. Molecular Obesity (Dr. Lee) 10. Important Parameters for Lead Optimization (Dr. Lee)
Feb 14 th , Feb 16 th	<ol style="list-style-type: none"> 11. Concepts of Multiparameter Optimization (Use of Data Warrior) (Dr. Ellsworth) 12. How to pick a lead (Dr. Ellsworth)
Feb 21 st , Feb 23 rd	<ol style="list-style-type: none"> 13. Group presentation: Define lab objective, product profile, and screening Strategy. 14. Different Aspects of Chemical Structure in Drug Design (Dr. Lee)
Feb 28 th , Mar 2 nd	<ol style="list-style-type: none"> 15. Different Aspects of Chemical Structure in Drug Design (Dr. Ellsworth) 16. Crystal Structure and Computational Model Guided Drug Design (Dr. Dickson)
Mar 14 th , Mar 16 th	<ol style="list-style-type: none"> 17. Group presentation: Selection of top 4 candidates for <i>in vivo</i> testing and the potential limitation of the Candidates. 18. Drug Metabolic Pathway and Prediction (Dr. Copple)

Date	Topic
In vivo Aspects in Drug Discovery	
Mar 21 st , Mar 23 rd	19. Pharmacokinetic/ Toxicokinetic and Pharmacodynamic (Dr. Vick) 20. Pharmacokinetic/ Toxicokinetic and Pharmacodynamic (Dr. Vick)
Apr 4 th , Apr 6 th	21. Applying MetID in drug discovery (Dr. Vrbanic) 22. Drug-Drug Interaction + Computational tools for drug discovery (PAINs compound and metabolism prediction) (Drs. Ellsworth and Lee)
Apr 11 th ,Apr 13 th	23. In vitro in vivo toxicological tests (Dr. Lee) 24. Problems (PK, Toxicology) solving with Medicinal Chemistry (Dr. Ellsworth)
Apr 18 th , Apr 20 th	25. Drug Formulation (Dr. Waterman) 26. in vivo Model and Biomarkers
Apr 25 th , Apr 27 th	27. In vivo Toxicology Study 28. Final Group presentation
TBD (Final week)	29. Final Group presentation