

PHAR 6722 PRINCIPLES OF MEDICINAL CHEMISTRY- SPRING 2020

Meeting Time, Place, Credits

Credits:	2.1 credits (40 in-class/80 out of class)
Course Web Site:	https://canvas.umn.edu/courses/162672
Term:	Spring 2020
Course Schedule and Location:	Note some exceptions in the detailed course schedule below T (10:10-11:00; WHD 7-135/Lib 410) W (2:30-3:20 or 3:35-4:20; Moos 1-450/ 163LS) F (1:25-2:15 or 2:30-3:20; Moos 1-450/163LS)
Dates:	January 17 – May 10, 2020
Target audience:	PD1

Course Instructional Team

Course Directors:	Natalia Tretyakova (TC) 2-147 CCRB 612-626-3432 trety001@umn.edu	Venkatram R. Mereddy (Duluth) 136 Chemistry 218-726-6766 vmereddy@d.umn.edu
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Course Overview: *Principles of Medicinal Chemistry* is an introductory course that will familiarize you with the discipline of medicinal chemistry and its principles of drug design and drug metabolism. The course will also introduce you to several drug classes. The content of this course is divided into three main parts: (1) Foundations of medicinal chemistry, (2) Drug metabolism, and (3) Select therapeutic drug classes. In the foundations of medicinal chemistry part, an overview of modern drug discovery and development process and the role natural products play in drug discovery and their basis for use in herbal medications is provided. This is followed by a discussion of how the physico-chemical properties of drugs and drug-like molecules impact their biological activity and therapeutic use. The concepts of drug ionization, drug-receptor binding interactions, isosterism/bioisosterism, molecular modification, stereochemistry, prodrugs, and the principles of mechanism- and structure-based drug design are elaborated. The section on drug metabolism focuses on biotransformation reactions, the enzymes involved, and the chemical, biological, and genetic factors that influence drug metabolism interactions, therapeutic effectiveness, and toxicity. In the final part, students are introduced to drugs that act on the eicosanoid, histaminergic, cholinergic, and adrenergic systems with specific emphasis on how molecular structure affects a drug's mechanism of action, ADME properties, and therapeutic utility.

This course builds upon the content presented in Phar 6702, *Integrated Biochemical Sciences*, particularly the protein structure, enzyme kinetics and inhibition, and cell communication and signaling cascade sections. The therapeutic drug classes that are covered are strategically aligned with similar concurrent content in *Principles of Pharmacology* (Phar 6726) and *Applied Pharmaceutical Care* (6716). The material presented in this course provides the scientific foundation for the medicinal chemistry, pharmacology, and pharmacotherapy content in subsequent courses in the curriculum.

Course Format: *Principles of Medicinal Chemistry* is primarily a lecture-based course. Recorded lectures will be available for view. Readings from the course e-textbook will be assigned. Some instructors may use ParticiPol questions, responses, and discussions. Assessments and learning activities will include four exams, five individual problem sets, and a final comprehensive exam. To achieve the optimal integration with Phar 6726, *Principles of Pharmacology*, some lectures in this course will occur during the class times scheduled for the pharmacology course and some pharmacology lectures will be presented during class times scheduled for *Principles of Medicinal Chemistry*. Refer to the integrated schedule for Phar 6722 and Phar 6726 provided on the course Canvas site.

Course Goals and Learning Concepts: The course goals are to describe what drugs are, how new therapeutic agents are developed, how drug structure affects their activity, function, and use, and how drug metabolism and genetic differences affect individual response to therapy. Four general concepts will be addressed in the course. Specific learning objectives for each section of the course can be found on the course Canvas site.

Concept 1: The Role of Medicinal Chemistry in Drug Discovery, Drug Action, and Pharmacy Practice.

Medicinal chemistry plays a principal role in the process of pre-clinical drug discovery and the evolving new technologies in the pharmaceutical industry. Natural products are important to the drug discovery process and are widely used in herbal medications. Drug-target interactions, physico-chemical properties, and stereochemistry affect specific drug action. Quantitative and qualitative structure-activity relationships, enzyme inhibitor design, molecular modification, and prodrug design strategies are common methods used to generate lead compounds and to modify molecules to optimize their activity. Metal-chelating agents and radioisotopes serve as diagnostic and imaging agents.

Concept 2: Drug Metabolism Controls the Excretion, Target Concentration, Dosing, and Efficacy of Drugs. Drug metabolism involves chemical reactions catalyzed by cellular enzymes. In most cases, metabolism converts drugs to inactive molecules (metabolites) that are removed from the body. Therefore, drug metabolism influences the concentrations of drugs at their target site. Drug structures can be modified to control the rate of drug excretion and to develop new dosing protocols. In some cases, metabolism produces active metabolites, and this process can be used for drug delivery (prodrug strategy).

Concept 3: Polymorphisms in Drug Metabolizing Genes, Diet, and Drug-Drug Interactions Can Affect Their Metabolism.

Genetic polymorphisms affecting drug-metabolizing enzymes can influence metabolic rates. These polymorphisms occur with different frequency in various ethnic/racial groups, which should be taken into account. In addition, many patients have multiple diseases and are taking multiple medications, which can affect each other's metabolism.

Concept 4: Drug Structure Determines the Mechanism of Action, ADME Properties, and Therapeutic Use of Drugs Acting on the Eicosanoid, Histaminergic, Cholinergic, and Adrenergic Systems. These four systems are major and fundamental components of the human body. They affect a wide range of physiological functions and thus drugs that affect these systems find use in treating a wide variety of diseases and conditions. Many of the drugs are among the most widely used prescription drugs and OTC preparations. The major objective of this section is to describe how a drug's molecular structure affects its mechanism of action, its pharmacological profile, its absorption, distribution, metabolism and excretion properties, and ultimately its therapeutic use.

Course faculty have an open door policy for students to meet and discuss the course material. Students should feel free to drop by their office or to call or e-mail them either to schedule an appointment or to arrange for a phone, ITV or Skype interaction in the event the professor is on the coordinate campus.

Course Materials

- Copies of the lecture slides posted on the course Canvas site
- eTextbook: Foye's *Principles of Medicinal Chemistry*, 8th Edition, T. L. Lemke and D. A. Williams, Eds., Wolters Kluwer/Lippincott Williams & Wilkins, 2020. Available on the course Canvas site.

Computer and Technology Requirements

- Canvas: This course will use Canvas to distribute learning materials and assignments. Lecture slides will be posted here.
- E-Mail: Course instructors will communicate through email about course administrative issues. We suggest that you check your email daily.
- Student-response systems: Dr. Tretyakova will use ParticiPoll software during her lectures, thus, you will need access to phone/internet.

Attendance Policy: Students are expected to attend every class session. To minimize disruptions, please refrain from talking to each other (except during group assignments) and walking in and out of the lecture room.

Assessments and Grading: In terms of calculating the course grade, three general types of assessment will be employed: unit exams, problem sets, and a comprehensive final exam. The unit exams will primarily consist of short answer-type questions, but some multiple choice, true/false, matching, or essay questions may appear on an exam. The individual problems sets are aimed at reinforcing the key concepts being presented in the course and evaluating the students' progress in understanding this material. The problem set questions will consist of short answer-type questions that are similar in format to the questions students will encounter on the respective unit exams. The comprehensive final exam will have a multiple-choice format consisting of 50 questions.

The course score will be determined by applying the following percentage (weight) to each assessed activity.

Unit	Assessment Activity	Percentage of Final Grade	Date
The Role of Medicinal Chemistry in Drug Discovery, Drug Action, and Pharmacy Practice	Problem Set 1	2%	January 29
	Problem Set 2	3%	February 12
	Exam 1	20%	February 14
Drug Metabolism	Problem set 3	5%	March 3
	Exam 2	20%	March 6
Histaminergic and Eicosanoid Agents	Problem set 4	5%	March 31
	Exam 3	10%	April 3
Cholinergic and Adrenergic Agents	Problem set 5	5%	April 17
	Exam 4	10%	April 24
Final	Comprehensive final exam	20%*	Finals week

*An extra 1 point will be given to those who complete online course evaluation

A letter grade will be assigned using the course score according to the following grading scale:

A: 93–100; A–: 90–92; B+: 87–89; B: 83–86; B–: 80–82; C+: 77–79; C: 73–76; C–: 70–72;
D: 60–69; F: 0–59

Our practice regarding the rounding-off of the final course score, which is calculated to one decimal point, to determine the course grade can be illustrated as follows. In considering final course scores that fall between 92 and 93, the cutoffs for A– and A, respectively, a score between 92.5 and 92.9 for example will be rounded up to a 93 and will be an A, while a final course score between 92.1 and 92.4 will be rounded down to a 92 and will be an A–. Analogous rounding-off will be done for each grade cut-off.

Also, although the above grading scale is used in this course, the course faculty reserve the right to adjust this scale at the end of the semester if for some unexpected reason the performance of the class as a whole on one or more exams during the semester falls outside what is typically expected for the exams in this course. This type of adjustment is expected to be a rare occurrence.

Statement on Penalties for Late Work: Assignments turned in after the due date will not be graded unless the instructor has been notified beforehand of an illness or other emergency and an arrangement has been made for turning the assignment in late.

Exam Guidelines:

- Exams must be written in either blue or black ink. If any part of an exam is written in pencil or any color of ink other than blue or black, *re-grading of the exam will not be considered.*
- Students who detect errors in examination questions are asked to notify the instructor or a monitor immediately. During examinations, students should present questions only to the instructor, unless directed otherwise. In the interest of being fair to all students, additional information or explanation of questions will not be given to individuals during examinations.
- Make-up exams will not be offered except under the following circumstances: illness, verified by a note from a licensed professional; a family emergency, verified by a note from the professional person in attendance; or a University-sponsored event, verified by a note from the leader of the sponsoring organization. If a student is unable to attend the scheduled exam, the relevant instructor *must be notified by either email or phone at least 24 hours in advance of the exam time*, unless there are extenuating circumstances. If an acceptable circumstance or adequate documentation is not provided, a grade of zero will be assigned for the exam. The make-up exam date is generally not more than one week after the original exam date, unless there are extenuating circumstances.

Problem Set Guidelines:

- Problem sets will be posted on the course Canvas site at least 1 week prior to due date. These problem sets are to be completed on an individual basis and the honor code is in effect for these assignments.
- The use of previous years' answer keys or graded problem sets from past students in answering these questions is **not allowed** and is considered a violation of the honor code.
- The problem set must be written or typed in either blue or black ink. If any part of a problem set is written in pencil or any color of ink other than blue or black re-grading of such a problem set will not be considered.

Exam and Problem Set Re-grading Guidelines: If a student wishes to have an examination or problem set re-graded, the student must arrange for it within one week after the graded exam or problem set has been returned. The student must explain in writing the grading error and justify why their answer is consistent with that provided in the key or is otherwise correct. Such explanations should be concise and to the point. Re-grading requests are to be made to the instructor giving the exam or problem set. Remember that when you request a re-grade of a question the whole question will be re-graded, which means you can either lose points or gain points.

Minimum Passing Level: Per University and College Policy, students who receive a grade below D in this course must successfully repeat the course before advancing to courses which require this course as a prerequisite.

Lecture Schedule: Refer to the integrated lecture schedule for *Principles of Medicinal Chemistry* (Phar 6722) and *Principles of Pharmacology* (Phar 6726) on the course Canvas site.

For information about College-wide policies, see:

[University of Minnesota and College of Pharmacy Policy Reference \(Centralized Syllabus\)](#)

[This page includes all required UMN and CoP policies, e.g., Academic Freedom; Copyright; Course Evaluations; Disability Accommodations; FERPA, etc.]

Disability and Mental Health statement:

The University of Minnesota is committed to providing equitable access to learning opportunities for all students. Disability Services (DS) is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations. If you have, or think you may have, a disability (e.g., mental health, attentional, learning, chronic health, sensory, or physical), please contact DS at 612-626-1333 to arrange a confidential discussion regarding equitable access and reasonable accommodations. If you are registered with DS and have a current letter requesting reasonable accommodations, we encourage you to contact your instructor early in the semester to review how the accommodations will be applied in the course. Mental Health Syllabus Statement: As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating, and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce your ability to participate in daily activities. University of Minnesota services are available to assist you with addressing these and other concerns you may be experiencing. You can learn more about the broad range of confidential mental health services available on campus via www.mentalhealth.umn.edu <<http://ecommunication.umn.edu/t/407738/37315516/23351/0/>>_

University of Minnesota and College of Pharmacy Policy Reference (Centralized Syllabus)

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