

Department of Physiology and Pharmacology
Pharmacology 4320A

Course outline for Fall 2023



Although this academic year might be different, Western University is committed to a **thriving campus**. We encourage you to check out the [Digital Student Experience](#) website to manage your academics and well-being. Additionally, the following link provides available resources to support students on and off campus: <https://www.uwo.ca/health/>.

1. Technical Requirements:



Stable internet connection



Laptop or computer

2. Important Dates:



| Classes Begin | Classes End |
|-----------------------------|--------------------------|
| Thursday, September 7, 2023 | Friday, December 8, 2023 |

* November 13, 2023: Last day to drop a first-term half course without academic penalty

** September 29, 2023 is National Day for Truth and Reconciliation and is a non-instructional day

| Reading Week | Study day(s) | Exam Period |
|-----------------------|--------------|----------------|
| October 30–November 5 | December 9 | December 10–22 |

3. Contact Information



| Course Coordinator | Contact Information |
|--------------------|---------------------|
| Dr. Qingping Feng | Use OWL message |

| Instructor(s) or Teaching Assistant(s) | Contact Information |
|--|---------------------|
| Dr. Qingping Feng | qfeng@uwo.ca |
| TA: Ms. Ryleigh van Neck | rvanneck@uwo.ca |

4. Course Description and Design

Delivery Mode: in-person

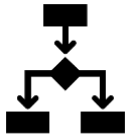
The course is designed to teach students the principles of cardiovascular pharmacology and therapeutics. We will focus on the underlying mechanistic bases of cardiovascular diseases including ischemic heart disease and heart failure, especially at the cellular and molecular levels, and examine how these relate to therapeutic interventions. Throughout the course, mechanisms, either of disease processes or drug actions are stressed. In addition, recent and late-breaking developments in the understanding and treatment of cardiovascular disease represent important components of the course.

Requisites:

Prerequisite(s): Pharmacology 3620 and either Physiology and Pharmacology 3000E or the former Pharmacology 3580Z; or Physiology 3120; or Pharmacology 3620 and registration in Year 4 of a module in Pathology.

Senate regulation regarding the student's responsibility regarding requisites:

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.



Timetabled Sessions

| Component | Date(s) | Time | Room |
|-----------|----------|----------|----------|
| ████████ | ████████ | ████████ | ████████ |

- Attendance at sessions is required
- Missed work should be completed within 24 hours
- A recording will be provided of the sessions

All course material will be posted to OWL: <http://owl.uwo.ca>. Any changes will be indicated on the OWL site and discussed with the class.

If students need assistance, they can seek support on the [OWL Help page](#). Alternatively, they can contact the [Western Technology Services Helpdesk](#). They can be contacted by phone at 519-661-3800 or ext. 83800.

[Google Chrome](#) or [Mozilla Firefox](#) are the preferred browsers to optimally use OWL; update your browsers frequently. Students interested in evaluating their internet speed, please click [here](#).

5. Learning Outcomes

Upon successful completion of this course, students will be able to:

- To define the principles of drugs for the treatment of cardiovascular disease
- To explain cellular and molecular mechanisms of cardiovascular disease in relation to pharmacological treatments
- To assess and critique studies on the effects and mechanisms of cardiovascular drugs

6. Course Content and Schedule

INSTRUCTOR: DR. QINGPING FENG

| | |
|--|--|
| <p>SEPT 12 WEEK 1</p> | <p>Introduction, regulation of cardiovascular function, sites of drug action in the cardiovascular system The purpose of this session is to provide an overview on the cardiovascular system. Topics to be covered will include the regulation of cardiovascular function by adrenergic, cholinergic, and renin-angiotensin systems. Major drug targets in the cardiovascular system will be reviewed.</p> |
| <p>SEPT 19 WEEK 2</p> | <p>Regulation of cardiovascular function by nitric oxide This session will focus on the role of nitric oxide as an important signalling molecule in the regulation of cardiovascular function. Topics to be discussed include the basic concept of nitric oxide pathway, the regulation of nitric oxide production, and effects of nitric oxide on cardiovascular function during normal physiological conditions and heart failure. This session will help to understand the pharmacological actions of NO donors in cardiovascular disease.</p> <p>Paper to Discuss: Kolijn, et al. Enhanced cardiomyocyte function in hypertensive rats with diastolic dysfunction and human heart failure patients after acute treatment with soluble guanylyl cyclase (SGC) activator. <i>Frontiers in Physiology</i> 2020;11: 345. https://doi.org/10.3389/fphys.2020.00345</p> |
| <p>SEPT 26 WEEK 3</p> | <p>Cardiomyocyte death and heart disease Loss of cardiomyocyte occurs in the heart during all stages of myocardial infarction. Necrosis, apoptosis and autophagy may contribute to cardiomyocyte death during the acute ischemic stage, as well as for a progressive loss of surviving cells during the subacute and chronic stages. This session will discuss current understanding of the role of myocardial apoptosis and autophagy in myocardial infarction and development of heart failure, and the possibility of therapeutic anti-apoptotic interventions.</p> <p>Paper to Discuss: Amgalan D, et al. A small-molecule allosteric inhibitor of BAX protects against doxorubicin-induced cardiomyopathy. <i>Nature Cancer</i> 2020; 1(3): 315–28. https://doi.org/10.1038/s43018-020-0039-1</p> |
| <p>OCT 3 WEEK 4</p> | <p>Angiogenesis, a potential treatment for heart disease Coronary angiogenesis and collateral growth are chronic adaptations to myocardial ischemia, which are aimed at restoring coronary blood flow and salvaging myocardium in an ischemic region. Although there is as of yet no consensus about the mechanisms and causal factors for these coronary adaptations to ischemia, recent evidence strongly suggests that a balance between growth factors and growth inhibitors is critical. This session will discuss the mechanisms of angiogenesis and its recent development in the treatment of ischemic heart disease.</p> <p>Paper to Discuss: Reboll MR, et al. Meteorin-like promotes heart repair through endothelial KIT receptor tyrosine kinase. <i>Science</i> 2022;376 (6599): 1343–47. https://doi.org/10.1126/science.abn3027.</p> |

| | |
|---------------------------------|--|
| OCT 10 WEEK 5 | <p>Regulation of the cardiovascular system by G protein-mediated signal transduction This session will review the mechanics of G protein-mediated signal transduction and provide an overview of how the heart and vasculature are regulated by GPCRs that are activated in response to a wide variety of hormones, neurotransmitters, paracrine factors and autocrine factors. In addition there will be an overview of cardiovascular drugs that produce their effects via GPCRs.</p> <p>Paper to Discuss: Yano H, et al. Overexpression of GRK2 in vascular smooth muscle leads to inappropriate hypertension and acute heart failure as in clinical scenario 1. <i>Scientific Reports</i> 2023;13(1): 7707. https://doi.org/10.1038/s41598-023-34209-5.</p> |
| OCT 17 WEEK 6 | MIDTERM EXAM |
| OCT 24 WEEK 7 | <p>Diuretics for treatment of cardiovascular disease Diuretics are drugs that are used to regulate volume and/or composition of body fluids in clinical conditions including hypertension and heart failure. This lecture will briefly introduce renal anatomy and physiology, which are relevant to diuretic pharmacology. The session will focus on categories of diuretics, mechanism of action, site of action, effects on urinary composition and their applications in the treatment of hypertension and heart failure.</p> <p>Paper to Discuss: Pieronne-Deperrois M, et al. Mineralocorticoid receptor blockade with finerenone improves heart function and exercise capacity in ovariectomized mice. <i>ESC Heart Failure</i> 2021;8 (3): 1933–43. https://doi.org/10.1002/ehf2.13219.</p> |
| OCT 31 WEEK 8 | Reading Week (NO Class) |
| Nov 7 WEEK 9 | <p>Drugs for treatment of hypertension In this session the mechanisms of actions of drugs used in the treatment of hypertension will be discussed. With particular focus on the different classes of anti-hypertensive agents currently utilized in the treatment of hypertension.</p> <p>Paper to Discuss: Uijl E, et al. Strong and sustained antihypertensive effect of small interfering RNA targeting liver angiotensinogen. <i>Hypertension</i> 2019;73 (6): 1249–57. https://doi.org/10.1161/HYPERTENSIONAHA.119.12703.</p> |
| Nov 14 WEEK 10 | <p>Coronary heart disease and antianginal agents Pathophysiology of coronary heart disease with particular reference to Angina Pectoris and treatment strategies will be discussed. The session will focus on the mechanisms of action of drugs used for treatment of angina. Three families of drugs will be discussed, which include organic nitrates, beta blockers and calcium channel blockers.</p> <p>Paper to Discuss: Ishida Y, et al. Diltiazem inhibits coronary spasm via inhibition of Cav1.2 phosphorylation and protein kinase C activation in a mouse model of coronary spastic angina. <i>International Heart Journal</i> 2021; 62(4): 910–18. https://doi.org/10.1536/ihj.20-366.</p> |
| Nov 21 | Drugs for treatment of hyperlipidemia |

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|--|---|
| <p>WEEK 11</p> | <p>In this session the mechanisms of action of drugs used in the treatment of hyperlipidemia will be discussed. With particular focus on the pharmacology of the different classes of lipid-lowering drugs currently used in the treatment of hyperlipidemia.</p> <p>Paper to Discuss: Lorza-Gil E, et al. Diabetogenic effect of pravastatin is associated with insulin resistance and myotoxicity in hypercholesterolemic mice. <i>Journal of Translational Medicine</i> 2019;17 (1): 285. https://doi.org/10.1186/s12967-019-2045-6</p> |
| <p>Nov 28</p> <p>WEEK 12</p> | <p>Drugs for treatment of arrhythmias</p> <p>For the majority of patients with cardiovascular risk, mortality and morbidity is due to cardiac arrhythmia. Arrhythmia is due to impulse initiation, impulse propagation or a combination. For many arrhythmias, pharmacological therapy is a first-line approach to treatment. This session will explore the bases of arrhythmia, the classification of antiarrhythmic agents and their potential therapeutic as well as the risk of potential pro-arrhythmic actions.</p> <p>Paper to Discuss: Dybкова N, et al. Differential regulation of sodium channels as a novel proarrhythmic mechanism in the human failing heart. <i>Cardiovascular Research</i> 2018;114:1728-1737. https://doi.org/10.1093/cvr/cvy152</p> |
| <p>DEC 5</p> <p>WEEK 13</p> | <p>Cardiac hypertrophy and heart failure</p> <p>Cardiac hypertrophy is an adaptive response to myocardial injury and constitutes an important component of myocardial remodelling which eventually results in heart failure. The underlying mechanism of remodelling, and particularly hypertrophy of the cardiac cell represents an important component which will be discussed during this session. Particular emphasis will be placed on understanding some of the key cell signalling events which participate in the hypertrophy program and how understanding these events could lead to the development of better therapeutic strategies for treating heart failure. Pharmacological agents for the treatment for heart failure and their mechanisms of action will be presented.</p> <p>Paper to Discuss: Pabel S, et al. Empagliflozin directly improves diastolic function in human heart failure. <i>European Journal of Heart Failure</i> 2018;20 (12): 1690–1700. https://doi.org/10.1002/ehf.1328</p> |

7. Participation and Engagement



- Students are expected to participate and engage with content as much as possible
- Students are expected to participate during in-person sessions
- Students can also participate by interacting in the forums with their peers and instructors

8. Evaluation

Below is the evaluation breakdown for the course. Any deviations will be communicated.

| Assessment | Format | Weighting | Due Date |
|----------------|--|-----------|---------------------------|
| Midterm | Short answer and essay | 35% | Oct. 17, 2023 |
| Final exam | Short answer and essay | 50% | TBA |
| Paper critique | Oral presentation | 10% | See presentation schedule |
| Participation | Asking questions on papers presented by students | 5% | All in-person sessions |

- All assignments are due at 6:00 pm EST unless otherwise specified
- Written assignments will be submitted to Turnitin (statement in policies below)
- If a student can't do the oral presentation on the scheduled date, the instructor should be informed 2 weeks in advance. Only one rescheduling can be made. If a rescheduled presentation is missed, the student will not receive any marks for oral presentation.
- A student may not receive the same grade as their group members if it is determined that the distribution of work was not equal
- After an assessment is returned, students should wait 24 hours to digest feedback before contacting their evaluator; to ensure a timely response, reach out within 7 days

Click [here](#) for a detailed and comprehensive set of policies and regulations concerning examinations and grading. The table below outlines the University-wide grade descriptors.



| | | |
|----|----------|---|
| A+ | 90-100 | One could scarcely expect better from a student at this level |
| A | 80-89 | Superior work which is clearly above average |
| B | 70-79 | Good work, meeting all requirements, and eminently satisfactory |
| C | 60-69 | Competent work, meeting requirements |
| D | 50-59 | Fair work, minimally acceptable |
| F | below 50 | Fail |

Information about late or missed evaluations:

- Late assessments without academic accommodation will be subject to a late penalty 10%/day.
- Late assessments with academic accommodation should be submitted within 24 hours of the end of the accommodation
- An assessment cannot be submitted after it has been returned to the class.
- One make-up test will be offered.
- If a make-up assessment is missed with documentation, the student will receive an INC and complete the task the next time the course is offered

INC (Incomplete Standing): If a student has been approved by the Academic Counselling Office (in consultation with the instructor/department) to complete term work at a later date, an INC will be assigned. Students with INC will have their course load in subsequent terms reduced to allow them to complete outstanding course work. Students may request permission from Academic Counselling to carry a full course load for the term the incomplete course work is scheduled.

SPC (Special examination): If a student has been approved by the Academic Counselling Office to write a Special Examination and the final exam is the only outstanding course component, an SPC will be assigned. If the class has a makeup exam, the student is expected to write the makeup exam. If the class doesn't have a makeup exam or the student misses the

makeup exam for reasons approved by the Academic Counselling Office, the student will write the exam the next time the course is offered. Outstanding SPCs will reduce the course load for the term the exam is deferred as outlined in [Types of Examinations](#) policy.

9. Communication:



- Students should check the OWL site every 24 – 48 hours
- Students should email their instructor and teaching assistant using OWL messages.
- Emails will be monitored daily; students will receive a response in 24 – 48 hours
- This course will use OWL forum for discussions
- Students should post all course-related queries on the discussion forum so that everyone can access the questions and responses

10. Office Hours:



- Office hours will be held remotely using Zoom.
- Office hours will be held on Fridays from 1-3 pm.
- Office hours will be booked.
- Office hours will be individual or group.

11. Resources

- All resources will be posted in OWL
- Additional resources (free with Western Library access)

Reference books:



Goodman & Gilman's: The Pharmacological Basis of Therapeutics. 13th edition, by Laurence L Brunton, et al. Publisher: McGraw-Hill Education, 2018.

Cardiovascular Physiology, 9th Edition, by David E. Mohrman and Lois Jane Heller. Publisher: McGraw-Hill Education, 2018.

Physiology of the Heart, 5th Edition, by Arnold M Katz. Publisher: Lippincott Williams and Wilkins, 2011

Drugs for the heart, 8th Edition, by Lionel H. Opie and Bernard Gersh. Publisher: Elsevier Saunders, 2013.

12. Professionalism & Privacy:



Western students are expected to follow the [Student Code of Conduct](#). Additionally, the following expectations and professional conduct apply to this course:

- All course materials created by the instructor(s) are copyrighted and cannot be sold/shared (e.g., Must Knows Facebook group, Course Hero, Chegg, etc.)
- Recordings are not permitted (audio or video) without explicit permission
- Permitted recordings are not to be distributed
- Students will be expected to take an academic integrity pledge before some assessments

Western is committed to providing a learning and working environment that is free of harassment and discrimination. All **students**, staff, and faculty have a role in this commitment and have a responsibility to ensure and promote a safe and respectful learning and working environment. Relevant policies include Western's [Non-Discrimination/Harassment Policy](#) (M.A.P.P. 1.35) and [Non-Discrimination/Harassment Policy – Administrative Procedures](#) (M.A.P.P. 1.35).

Any **student**, staff, or faculty member who experiences or witnesses' behaviour that may be harassment or discrimination **must report the behaviour** to the Western's [Human Rights Office](#). Harassment and discrimination can be human rights-based, which is also known as EDI-based,

(sexism, racism, transphobia, homophobia, islamophobia, xenophobia, antisemitism, and ableism) or non-human rights-based (personal harassment or workplace harassment).

13. How to Be Successful in this Class:

Students enrolled in this class should understand the level of autonomy and self-discipline required to be successful.



1. Invest in a planner or application to keep track of your courses. Populate all your deadlines at the start of the term and schedule time at the start of each week to get organized and manage your time.
2. Make it a daily habit to log onto OWL to ensure you have seen everything posted to help you succeed in this class.
3. Follow weekly checklists created on OWL or create your own to help you stay on track.
4. Take notes as you go through the lesson material. Treat this course as you would a face-to-face course. Keeping handwritten notes or even notes on a regular Word document will help you learn more effectively than just reading or watching the videos.
5. Connect with others. Try forming an online study group and try meeting on a weekly basis for study and peer support.
6. Do not be afraid to ask questions. If you are struggling with a topic, check the online discussion boards or contact your instructor(s) and or teaching assistant(s).
7. Reward yourself for successes. It seems easier to motivate ourselves knowing that there is something waiting for us at the end of the task.

14. Western Academic Policies and Statements

Absence from Course Commitments

A. Absence for medical illness:

Students must familiarize themselves with the [Accommodation for Illness Policy](#).

A student seeking academic accommodation for any **work worth less than 10%** must contact the instructor or follow the appropriate Department or course specific instructions provided on the course outline. Instructors will use good judgment and ensure fair treatment for all students when considering these requests. You are not required to disclose details about your situation to your instructor; documentation is not required in this situation, and you should not send any pictures to your instructor.

If you are unable to meet a course requirement for any **work worth 10% or greater** due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to the Academic Counseling as soon as possible and contact your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor has been informed. Please note that the format of a make-up test, exam, or assignment is at the discretion of the course coordinator.

A student requiring academic accommodation due to illness should use the Student Medical Certificate when visiting an off-campus medical facility or request a Record's Release Form (located in the Dean's Office) for visits to Student Health Services. The form can be found at: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

B. Absence for non-medical reasons:

Student absences might also be approved for non-medical reasons such as religious holidays and compassionate situations. Please review the policy on [Accommodation for Religious Holidays](#). All non-medical requests must be processed by Academic Counselling. Not all absences will be approved; pay attention to the academic calendar and final exam period when booking any trips.

C. Special Examinations

A Special Examination is any examination other than the regular examination, and it may be offered only with the permission of the Dean of the Faculty in which the student is registered, in consultation with the instructor and Department Chair. Permission to write a Special Examination may be given on the basis of compassionate or medical grounds with appropriate supporting documents. To provide an opportunity for students to recover from the circumstances resulting in a Special Examination, the University has implemented Special Examinations dates. These dates as well as other important information about examinations and academic standing can be found [here](#).

Academic Offenses

Scholastic offences are taken seriously, and students are directed [here](#) to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence.

Accessibility Statement

Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Accessible Education (AE) at 661-2111 x 82147 for any specific question regarding an accommodation or review [The policy on Accommodation for Students with Disabilities](#)

Correspondence Statement

The centrally administered **e-mail account** provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner. You can read about the privacy and security of the UWO email accounts [here](#).

Discovery Credit Statement

Students are permitted to designate up to 1.0 Discovery Credit course (or equivalent) for pass/fail grading that can be counted toward the overall course credits required for their degree program. The details of this policy and the deadlines can be found [here](#).

Turnitin and other similarity review software

All assignments will be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. Students will be able to view their results before the final submission. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between Western University and [Turnitin.com](#).

15. BMSUE Academic Policies and Statements

Cell Phone and Electronic Device Policy (for in-person tests and exams)

The Schulich School of Medicine & Dentistry is committed to ensuring that testing and evaluation are undertaken fairly across all our departments and programs. For all tests and exams, it is the policy of the

School that any electronic devices, e.g., cell phones, tablets, cameras, smart glasses, smart watch or iPod are strictly prohibited. These devices MUST be left either at home or with the student's bag/jacket at the front of the room and MUST NOT be at the test/exam desk or in the individual's pocket. Any student found with one of these prohibited devices will receive a grade of zero on the test or exam. Non-programmable calculators are only allowed when indicated by the instructor. The program is not responsible for stolen/lost or broken devices.

Copyright and Audio/Video Recording Statement

Course material produced by faculty is copyrighted and to reproduce this material for any purposes other than your own educational use contravenes Canadian Copyright Laws. You must always ask permission to record another individual and you should never share or distribute recordings.

Rounding of Marks Statement

Across the Basic Medical Sciences Undergraduate Education programs, we strive to maintain high standards that reflect the effort that both students and faculty put into the teaching and learning experience during this course. All students will be treated equally and evaluated based only on their actual achievement. **Final grades** on this course, irrespective of the number of decimal places used in marking individual assignments and tests, will be calculated to one decimal place and rounded to the nearest integer, e.g., 74.4 becomes 74, and 74.5 becomes 75. Marks WILL NOT be bumped to the next grade or GPA, e.g., a 79 will NOT be bumped up to an 80, an 84 WILL NOT be bumped up to an 85, etc. The mark attained is the mark you achieved, and the mark assigned; requests for mark "bumping" will be denied.

Use of ChatGPT and other Artificial Intelligence (AI) Platforms Statement

Within this course, students are permitted to use AI tools exclusively for information gathering and preliminary research purposes. These tools are intended to enhance the learning experience by providing access to diverse information sources. However, it is essential that students critically evaluate the obtained information, exercise independent thinking, and engage in original research to synthesize and develop their own ideas, arguments, and perspectives. The use of AI tools can serve as a starting point for exploration, with students expected to uphold academic integrity by appropriately attributing all sources and avoiding plagiarism. Assignments and/or lab reports should reflect the students' own thoughts and independent written work. By adhering to these guidelines, students contribute to a responsible and ethical learning environment that promotes critical thinking, independent inquiry and allows them to produce original written contributions.

16. Support Services

The following links provide information about support services at Western University.

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at

https://www.uwo.ca/health/student_support/survivor_support/get-help.html.

To connect with a case manager or set up an appointment, please contact support@uwo.ca.

[Academic Counselling \(Science and Basic Medical Sciences\)](#)

[Appeal Procedures](#)

[Registrarial Services](#)

Student Development Services

Student Health Services