

Department of Physiology and Pharmacology  
Pharmacology 4320a

Course outline for Fall 2020



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



Working microphone



Working webcam

2. Course Overview and Important Dates:



Delivery Mode	Dates	Time
Online	Tuesday	9:30 – 11:30 AM

\*Details about design and delivery of the course are listed below in Section 4

Classes Start	Reading Week	Classes End	Study day(s)	Exam Period
September 9	November 2 - 8	December 9	December 10	December 11 - 22

\* November 12, 2020: Last day to drop a first-term half course or a first-term full course without penalty

3. Contact Information



Course Coordinator	Contact Information
Dr. Qingping Feng	OWL message

Instructor(s) or Teaching Assistant(s)	Contact Information
Nidhi Kulkarni	OWL message

## 4. Course Description and Design

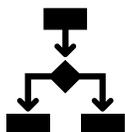
The course is designed to teach students the principles of cardiovascular pharmacology and therapeutics. We will focus on the underlying mechanistic bases of cardiovascular diseases including ischemic heart disease and heart failure, especially at the cellular and molecular levels, and examine how these 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.



Mode	Dates	Time	Frequency
Virtual synchronous	Tuesday	9:30 – 11:30 AM	weekly
Virtual asynchronous	N/A	4 hours	weekly

- Asynchronous pre-work must be completed 1 day prior to synchronous sessions
- Attendance at synchronous sessions is required
- A recording will be provided for synchronous 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



SEPT 15	<b>Introduction, regulation of cardiovascular function, sites of drug action in the cardiovascular system</b> 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.
SEPT 22	<b>Regulation of cardiovascular function by nitric oxide</b> 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.  <b>Paper to Discuss:</b> Kolijn D, 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. <a href="https://doi.org/10.3389/fphys.2020.00345">https://doi.org/10.3389/fphys.2020.00345</a> .
SEPT 29	<b>Cardiomyocyte death and heart disease</b> 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.  <b>Paper to Discuss:</b> 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. <a href="https://doi.org/10.1038/s43018-020-0039-1">https://doi.org/10.1038/s43018-020-0039-1</a> .
OCT 6	<b>Angiogenesis, a potential treatment for heart disease</b> Coronary angiogenesis and collateral growth are chronic adaptations to myocardial ischemia, which are aimed at restoring coronary blood flow and salvaging myocardium

	<p>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><b>Paper to Discuss:</b> Johnson T, et al. Exosomes derived from induced vascular progenitor cells promote angiogenesis in vitro and in an in vivo rat hindlimb ischemia model. <i>Am J Physiol, Heart and Circulatory Physiology</i> 2019;317: H765–76. <a href="https://doi.org/10.1152/ajpheart.00247.2019">https://doi.org/10.1152/ajpheart.00247.2019</a>.</p>
<b>OCT 13</b>	<p><b>Regulation of the cardiovascular system by G protein-mediated signal transduction</b></p> <p>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><b>Paper to Discuss:</b> Rainbow RD, et al. Small-molecule G protein-coupled receptor kinase inhibitors attenuate G protein-coupled receptor kinase 2-mediated desensitization of vasoconstrictor-induced arterial contractions. <i>Molecular Pharmacology</i> 2018;94(3): 1079–91. <a href="https://doi.org/10.1124/mol.118.112524">https://doi.org/10.1124/mol.118.112524</a>.</p>
<b>OCT 20</b>	<b>MIDTERM EXAM</b>
<b>OCT 27</b>	<p><b>Drugs for treatment of hypertension</b></p> <p>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><b>Paper to Discuss:</b> Pang X, et al. Novel therapeutic role for dipeptidyl peptidase III in the treatment of hypertension. <i>Hypertension</i> 2016;68(3): 630–41. <a href="https://doi.org/10.1161/HYPERTENSIONAHA.116.07357">https://doi.org/10.1161/HYPERTENSIONAHA.116.07357</a>.</p>
<b>Nov 3</b>	<b>Reading Week (NO Class)</b>
<b>Nov 10</b>	<p><b>Diuretics for treatment of cardiovascular disease</b></p> <p>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><b>Paper to Discuss:</b> Lax A, et al. Mineralocorticoid receptor antagonists modulate galectin-3 and interleukin-33/ST2 signaling in left ventricular systolic dysfunction after acute myocardial infarction. <i>JACC Heart Failure</i>. 2015;3:50-8. DOI: 10.1016/j.jchf.2014.07.015</p>

<p><b>Nov 17</b></p>	<p><b>Coronary heart disease and antianginal agents</b>  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><b>Paper to Discuss:</b>  Kinjo T, et al. Enhanced P122RhoGAP/DLC-1 expression can be a cause of coronary spasm. <i>PLoS One</i> 2015;10(12): e0143884.  <a href="https://doi.org/10.1371/journal.pone.0143884">https://doi.org/10.1371/journal.pone.0143884</a>.</p>
<p><b>Nov 24</b></p>	<p><b>Drugs for treatment of hyperlipidemia</b>  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><b>Paper to Discuss:</b>  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. <a href="https://doi.org/10.1186/s12967-019-2045-6">https://doi.org/10.1186/s12967-019-2045-6</a>.</p>
<p><b>DEC 1</b></p>	<p><b>Drugs for treatment of arrhythmias</b>  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 proarrhythmic actions.</p> <p><b>Paper to Discuss:</b>  Dybkova 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. DOI: 10.1093/cvr/cvy152.</p>
<p><b>DEC 8</b></p>	<p><b>Cardiac hypertrophy and heart failure</b>  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><b>Paper to Discuss:</b>  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.  <a href="https://doi.org/10.1002/ejhf.1328">https://doi.org/10.1002/ejhf.1328</a>.</p>

## 7. Online Participation and Engagement



- Students are expected to participate and engage with content as much as possible
- Students can participate during virtual synchronous 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	Date
Midterm	Short answer and essay	35%	Oct. 20, 2020
Final exam	Short answer and essay	40%	TBA
Quiz	Multiple choice and/or short answer	10%	In all virtual synchronous sessions on OWL (timed)
Paper critique	Live oral presentation on Zoom	10%	Schedule for student groups will be issued
Participation in discussion	Asking questions on papers presented by students	5%	All virtual synchronous sessions

- Written work will be submitted to Turnitin (statement in policies below)
- 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 documentation or a self-reported absence will be subject to a late penalty 10%/day
- Late assessments with a self-reported absence should be submitted within 24 hours of submission of the self-report
- A missed quiz with a self-reported absence or approved submitted documentation to academic counselling, will be reweighed to the other quizzes
- A make-up test will be offered
- If a make-up assessment is missed, the student will receive an INC and complete the task the next time the course is offered

## 9. Communication:



- Students should check the OWL site every 24 – 48 hours
- A weekly update will be provided on the OWL announcements
- Students should email their instructor(s) and teaching assistant(s) using OWL “messages”
- Emails will be monitored daily; students will receive a response in 24 – 48 hours
- This course will use Zoom for discussions
- This course will use the OWL forum for discussions
- Students should post all course-related content on the discussion forum so that everyone can access answers to questions
- The discussion forums will be monitored daily by instructors or teaching assistants

## 10. Office Hours:



- Office hours will be held remotely using Zoom on Fridays upon request
- Students will be able to sign up for an appointment using Sign Up on OWL
- Group office hours will be held, recorded, and posted for everyone to view

## 11. Resources



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

## 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:



- Students are expected to follow online etiquette expectations provided on OWL
- All course materials created by the instructor(s) are copyrighted and cannot be sold/shared
- 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
- All recorded sessions will remain within the course site

## 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

#### [Policy on Academic Consideration for Student Absences](#)

If you are unable to meet a course requirement due to illness or other serious circumstances, you must seek approval for the absence as soon as possible. Approval can be granted either through a **self-reported absence** or via the **Academic Counselling** unit. Students have two self-reports to use throughout the academic year; absence from course commitments including tests, quizzes, presentations, labs, and assignments that are worth 30% or less can be self-reported. Self-reported absences cover a student for 48 hours (yesterday + today or today + tomorrow). Your instructor will receive notification of your consideration; however, you should contact your instructor immediately regarding your absence. Students are expected to submit missed work within 24 hours of the end of the 48-hour period. Please review details of the [university's policy on academic consideration for student absences](#).

If you have used both their self-reported absences or will miss more than 48 hours of course requirements, a Student Medical Certificate (SMC) should be signed by a licensed medical or mental health practitioner and you should contact academic counselling. Academic Counselling will be operating virtually this year and can be contacted at [scibmsac@uwo.ca](mailto:scibmsac@uwo.ca).

### Accommodation for Religious Holidays

The policy on Accommodation for Religious Holidays can be viewed [here](#).

### 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](#).

## 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

### 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.

## 16. Support Services

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

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

[Appeal Procedures](#)

[Registrarial Services](#)

[Student Development Services](#)

[Student Health Services](#)