1. Course Information

Pharmacology 4620a: Molecular and Structural Basis of Drug Action
Fall Term 2017

This course will present an overview of the drug discovery process and introduce the principal mechanisms of action at the molecular and structural levels of the major receptor, ion channel, exchanger and other protein families that drive crucial cell signaling processes in health and disease and are important drug targets. Mechanisms of pharmacological intervention as well as drug design concepts will be discussed as treatment strategies to correct dysfunctional signaling pathways. Students will have an opportunity to explore protein-drug interactions using molecular viewing software and prepare short video presentations of their favourite pathways as an assignment contributing to their final grade, also made up of midterm and final exams.

Lectures:
Time: 2 hours per week (Tuesdays 2:30-4:30), 0.5 credit
Location: Western Science Centre (WSC Rm 240)

Requisites:
Prerequisite(s): Pharmacology 3620 or Biochemistry 3381a; or Departmental permission.

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.

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 Services for Students with Disabilities (SSD) at 661-2111 x82147 for any specific question regarding an accommodation.

2. Instructor Information

Instructors	Email	Office	Phone ext.	Office Hours
Dr. Peter Stathopulos (Course Coordinator)	peter.stathopulos@schulich.uwo.ca	MSB 232	83238	After lectures
Dr. Rithwik Ramachandran	rramach@uwo.ca	MSB 270	82142	After lectures

OWL:

Students with OWL issues should see: https://owl.uwo.ca/portal/site/owldocs

3. Course Syllabus

Objectives:

This course will present mechanisms of major druggable receptor, ion channel, exchanger and other protein actions that drive cell signaling processes in health and disease. Pharmacological interventions and drug design will be discussed in relation to dysfunctional cell signalling pathways and available protein structure information.

Course Learning Outcomes:

By the end of this course, successful students will be able to:

a) Identify the major classes of protein drug targets and explain how the related signaling pathways function in health and become dysfunctional in disease.

b) Explain the molecular and structural bases for specific protein-drug interactions.

c) Apply learning outcomes a) and b) to conceptually develop new drugs for disease treatment.

Course Topics and Tentative Schedule:

Date	**Topic**	**Instructor(s)**
Sept. 12th	Introduction / drug discovery and delivery / structure-based drug discovery / PyMOL – downloading and installing	RR and PS
Sept. 19th	ADMET, Pharmacokinetics and Pharmacodynamics	RR
Sept. 26th	G-Protein Coupled Receptors, structure, activation,	RR
Oct. 3rd	GPCRs signaling, desensitization, trafficking	RR
Oct. 10th	**Fall Reading Week**	
Oct. 17th	Receptor Tyrosine Kinases and Kinases	RR
Oct. 24th	GTPase structure and function: GEFs, GAPs, GDIs, membrane association; drugging GTPases in disease / PyMOL – visualizing protein structure and alignment	PS
Oct. 31st	WEEK OF MIDTERM Ungated ion channel structure and function (K+ channels); drugging K+ channels in disease / PyMOL – visualizing biological assembly and measuring distances	PS
Nov. 7th	Voltage and ligand gated ion channel structure and function (Ca2+ sensing proteins, IP3R, RyR); drugging RyRs in disease / PyMOL – visualizing protein surface charges - I	PS
Nov. 14th	Cotransporter/exchanger structure and function (Na+/Ca2+ exchanger NCX proteins); pharmacological modulation of NCX activity / PyMOL – visualizing protein surface charges - II	PS

Nov. 21st	Active transporter/pump structure and function (V, F, P-type ATPases); small molecule targeting of ATPases / PyMOL – viewing protein structures in stereo	PS
Nov. 28th	Video Presentations and Discussion	RR and PS
Dec. 5th	Video Presentations and Discussion	RR and PS
Dec. 10th-21st	FINAL EXAM	

4. Course Materials

There will be no mandatory text for this course; rather, the presented information will be drawn from a range of sources including articles, book series and text books. Some useful text books for this course include:

Molecular Pharmacology: from DNA to Drug Discovery; Dickenson et al., ISBN: 978-0-470-68443-6
Biochemical Pharmacology; Palmer et al., ISBN: 978-0-470-17445-6
Pharmacology; Rang and Dale, ISBN: 978-0-702-05497-6

5. Evaluation:

Component	**Date**	**% of Final Mark**
Midterm test	Monday, October 30th (6:00pm-9:00pm) WSC 240	40
Assignment	Due Friday, December 1st, 2017	20
Final examination	TBA (Dec. 10th – 21st, 2017)	40

The midterm examination will test all lecture material presented in the first 6 lectures. The final examination will test all lecture material presented in the last 5 lectures.

Students will have Midterm test grades by November 10th, 2017.

The midterm test and final exam will consist of short answer written and/or essay type questions. Practice questions will be provided upon request for the midterm test and final exam so that students can familiarize themselves with the style of questioning.

Policy on Rounding and Bumping of Grades
Across the Basic Medical Sciences Undergraduate Education programs and within the department of ***Physiology and Pharmacology*** 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** in 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.

6. Additional Information/Statements

Statement on Use of Electronic Devices

No electronic devices will be allowed during midterm tests or final examinations.

Statement on Use of Personal Response Systems ("Clickers")

No personal response systems will be used in this course.

Statement on Academic Offences

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following website: http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf .

All required written assignments may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All documents 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 The University of Western Ontario and Turnitin.com (http://www.turnitin.com).

Policy on Plagiarism

The Department of Physiology and Pharmacology strongly condemns plagiarism. Plagiarism is the "act or instance of copying or stealing another's words or ideas and attributing them as ones own." (Excerpted from Black's Law Dictionary, West Group, 1999, 7th ed. Pg 1170 and the definition used by Western's Scholastic Discipline document). Plagiarism can be intentional or unintentional and regardless of intent, is a scholastic offence. It should be noted that self-plagiarism, plagiarizing ones own words for multiple assignments is subjected to the same penalty as plagiarizing another. Courses in Physiology and Pharmacology use turnitin, a similarity checking software embedded within OWL. We encourage all students to run their assignments through turnitin prior to submitting their reports for grading. Any report flagged as yellow (25-49% matching text), orange (50-74% matching text) or red 75-100% matching text) will be considered plagiarism (pending investigation by the instructor). It should be noted that a document could be plagiarized yet still pass the similarity check on turnitin. The ***minimum*** penalty for a first time plagiarism offence of any kind is a grade of zero on the assignment. In addition, details of the offence will be forwarded to Dean's office and stored. A second offence will carry a much stricter penalty in line with Western's Scholastic Discipline policies:
(https://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf).

Absence from course commitments

A. Absence for medical illness:

Students must familiarize themselves with the Policy on Accommodation for Medical Illness for Undergraduate Students at the following link:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf

The policy is also accessible from the Medical Accommodation Policy link at:
https://studentservices.uwo.ca/secure/index.cfm

Statement from the Academic Counselling Office, Faculty of Science (for Science and BMSc students)

If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to the Academic Counselling Office 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 by the Academic Counselling Office and the instructor has been informed. In the event of a missed final exam, a "Recommendation of Special Examination" form must be obtained from the Academic Counselling Office immediately. For further information please see:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf

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:
https://studentservices.uwo.ca/secure/index.cfm

B. Absence for non-medical reasons:

For **non-medical absences** from midterm tests or late assignments, documentation is required; such documentation must be submitted by the student directly to the appropriate Faculty Dean's Office and **not** to the coordinator/instructor. It will subsequently be the Dean's Office that will determine if accommodation is warranted.

C. Special Examinations

A Special Examination is any examination other than the regular final examination, and it may be offered only with the permission of the Dean/Academic Counselling Office 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.

A Special Examination must be written at the University or an Affiliated University College no later than 30 days after the end of the examination period involved. To accommodate unusual circumstances, a date later than this may be arranged at the time permission is first given by the Dean/Academic Counselling Office of the Faculty. The Dean/Academic Counselling Office will consult with the instructor and Department Chair and, if a later date is arranged, will communicate this to the Office of the Registrar. If a student fails to write a scheduled Special Examination, permission to write another Special Examination will be granted only with the permission of the Dean/Academic Counselling Office in exceptional circumstances and with appropriate supporting documents. In such a case, the date of this Special Examination normally will be the scheduled date for the final exam the next time the course is offered.

When a grade of Special (SPC) or Incomplete (INC) appears on a student's record, the notations will be removed and replaced by a substantive grade as soon as the grade is available.

Support Services:
Registrarial Services:
http://www.registrar.uwo.ca

Academic Counselling (Science and Basic Medical Sciences):
http://www.uwo.ca/sci/undergrad/academic_counselling/index.html

USC Student Support Services:
http://westernusc.ca/services/

Student Development Services:
http://www.sdc.uwo.ca

Student Health Services:
http://www.shs.uwo.ca/

Students that are in emotion/mental distress should refer to Mental Health@Western for a complete list of options about how to obtain help at the following link:
http://www.uwo.ca/uwocom/mentalhealth