1. Course Information

Pharmacology 4620a: Molecular and Structural Basis of Drug Action
Fall Term 2016

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 assignments contributing to their final grade, also made up of midterm and final exams.

Lectures:
2 hours per week (Tuesdays 2:30-4:30), 0.5 credit

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

<table>
<thead>
<tr>
<th>Instructors</th>
<th>Email</th>
<th>Office</th>
<th>Phone ext.</th>
<th>Office Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Peter Stathopulos</td>
<td><a href="mailto:peter.stathopulos@schulich.uwo.ca">peter.stathopulos@schulich.uwo.ca</a></td>
<td>MSB 232</td>
<td>83238</td>
<td>After lectures</td>
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<tr>
<td>(Course Coordinator)</td>
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<tr>
<td>Dr. Rithwik Ramachandran</td>
<td><a href="mailto:rramach@uwo.ca">rramach@uwo.ca</a></td>
<td>MSB 270</td>
<td>82142</td>
<td>After lectures</td>
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<td>OWL:</td>
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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:

<table>
<thead>
<tr>
<th>Date (week of)</th>
<th>Topic</th>
<th>Instructor(s)</th>
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<tbody>
<tr>
<td>Sept. 12th</td>
<td>introduction / drug discovery and delivery / structure-based approaches to drug development</td>
<td>RR and PS</td>
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<tr>
<td>Sept. 19th</td>
<td>drug transport and metabolism</td>
<td>RR</td>
</tr>
<tr>
<td>Sept. 26th</td>
<td>principles of pharmacology (pharmacokinetics / pharmacodynamics)</td>
<td>RR</td>
</tr>
<tr>
<td>Oct. 3rd</td>
<td>principles of receptor-ligand interactions</td>
<td>RR</td>
</tr>
<tr>
<td>Oct. 10th</td>
<td>major classes of drug targets (receptors, proteins, enzymes)</td>
<td>RR</td>
</tr>
<tr>
<td>Oct. 17th</td>
<td>GPCRs 1: structure, families, activation, post-translational modifications, internalization, heteromeric G-proteins, biased signaling, cross talk</td>
<td>RR</td>
</tr>
<tr>
<td>Oct. 24th</td>
<td>visualizing protein structure / GTPase structure and function / GEFs, GAPs, GDIs, membrane association TENTATIVE WEEK OF MIDTERM</td>
<td>PS</td>
</tr>
<tr>
<td>Oct. 31st</td>
<td>visualizing protein-drug interactions / ungated ion channel structure and function (K+, Cl- leak channels)</td>
<td>PS</td>
</tr>
<tr>
<td>Nov. 7th</td>
<td>Voltage and ligand gated ion channel structure and function (Na+, Ca2+, IP3R, RyR, CRAC, TRPs)</td>
<td>PS</td>
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<tr>
<td>Nov. 14th</td>
<td>Cotransporter/exchanger structure and function (Na+/H+, Na+/Ca2+, H+/Ca2+)</td>
<td>PS</td>
</tr>
<tr>
<td>Nov. 21st</td>
<td>Active transporter/pump structure and function (SERCA, ABC, PMCA) / nuclear hormone receptor structure and function (estrogen, androgen, thyroid)</td>
<td>PS</td>
</tr>
<tr>
<td>Nov. 28th</td>
<td>Video Presentations and Discussion 1</td>
<td>RR and PS</td>
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<tr>
<td>Dec. 5th</td>
<td>Video Presentations and Discussion 2</td>
<td>RR and PS</td>
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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:

- *Biochemical Pharmacology*; Palmer et al., ISBN: 978-0-470-17445-6

5. Evaluation:

<table>
<thead>
<tr>
<th>Component</th>
<th>Date</th>
<th>% of Final Mark</th>
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<tbody>
<tr>
<td>Midterm test</td>
<td>TBA (Oct 24 – 31, 2016)</td>
<td>40</td>
</tr>
<tr>
<td>Assignments</td>
<td>TBA (Nov 28 – Dec 5, 2016)</td>
<td>20</td>
</tr>
<tr>
<td>Final examination</td>
<td>TBA (Dec 11 – 22, 2016)</td>
<td>40</td>
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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.

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.

Note: it is the policy of the Department of Physiology and Pharmacology and the BMSc program in the Schulich School of Medicine and Dentistry to report the grade you earned in the course. Grades will not be “bumped”. For example, if your final grade is 78.45%, it will be entered as 79% and will not be “bumped” to 80%.

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](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).

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