

Medical Biophysics 9518B – Molecular Imaging

Mondays and Wednesdays 2:30-4:00

MSB M493

Course Information

Medical Biophysics 9518B: Molecular Imaging

Extra Information: 3 lecture hours per week (Mon, Wed), 0.5 course

Learning Objectives and Outcomes:

This course focuses on an introduction to the role of diagnostic imaging in detecting molecules, genes, and cells *in vivo*. Emphasis will be in how these techniques can help study molecular mechanisms of disease *in vivo*. Topics include DNA/protein synthesis, transgenic mice, novel contrast agents and small animal imaging.

This graduate course is open to graduate students in Medical Biophysics, Anatomy and Cell Biology, Biochemistry, Chemistry, Microbiology and Immunology and Pathology.

The objective of the course is to help students to integrate their knowledge of molecular and cell biology with the synthetic chemistry of imaging probes and *in vivo* diagnostic imaging modalities. Learning outcomes include the following:

1. Defining the concept of "molecular imaging."
2. Understanding standard methods and models in molecular and cell biology
3. Understanding how imaging modalities are adapting to image genes, molecules and cells.
4. Applying concepts of molecular imaging to examining molecular mechanisms of infectious and chronic disease.
5. Critically evaluating the current literature on molecular imaging.
6. Predicting how molecular imaging will advance the understanding of both normal physiology and disease progression, from both scientific and clinical perspectives.

2. Instructor Information

Instructors	Email	Office	Phone	Office Hours
Dr. Savita Dhanvantari (Course Coordinator)	sdhanvan@lawsonimaging.ca	Lawson	65738	Email for appointment
Guest lecturers	As appropriate			
Teaching assistant(s)	n/a			

3. Course Syllabus

Course structure

The course consists of 26 1h lectures followed by a 30-min in-class discussion of a relevant scientific article, 1 written review and 1 oral presentation. It will cover two topics within the discipline of molecular imaging.

Topic 1: Identifying imaging biomarkers through molecular and cell biology

Instructor: As listed. Number of lectures per instructor is indicated

Lecture Dates: 13 lectures Jan 6-Feb 15

- a: Introductory lecture: course objectives, evaluations, content: Dhanvantari (1)
- b: Overview of DNA transcription: Dhanvantari (1)
- c: Overview of mRNA translation: Dhanvantari (1)
- d: Engineering imaging contrast using plasmids: Goldhawk (2)
- e: Engineering imaging contrast using DNA minicircles: Ronald (1)
- f: Genomic databases for identifying biomarkers: Dhanvantari (1)
- g: Imaging gene silencing by noncoding RNAs: Dhanvantari (1)
- h: Imaging cellular compartments and transport. Dhanvantari (1)
- i: Molecular imaging of cellular proliferation and apoptosis. Dhanvantari (1)
- j: Molecular imaging of signal transduction. Dhanvantari (1)
- k: Using transgenic mice in imaging: Hoffman (1)
- l: Engineering stem cells for imaging and therapeutics: Hoffman (1)

Topic 2: Cellular and Molecular Imaging Technologies

Instructors: as listed per lecture.

Lecture Dates: 13 lectures, Feb 22-Apr 10

- a: MRI for cellular and molecular imaging: Paula Foster (2)
- b: MRI contrast agents: Paula Foster (1)
- c: PET instrumentation for small animal imaging: Jonathan Thiessen (1)
- d: PET/MRI hybrid imaging: Jonathan Thiessen (1)
- e: Radiomics: Aaron Ward (1)
- f: SPECT and PET isotopes and pharmacokinetics: Justin Hicks (1)
- g: Targeted Molecular Probes for PET/SPECT and Optical: Len Luyt (1)
- h: Deep Tissue Optics: Mamdou Diop (1)
- i: Fluorescence microscopy and super-resolution imaging: Byran Heit (1)
- j: In vivo fluorescence imaging: Steve Kerfoot (1)
- k: Photoacoustics: Jeff Carson (1)
- l: Ultrasound: microbubbles and targeted contrast: Jim Lacefield (1)

Topic 3: Applications for Molecular Imaging

Student written reviews and oral presentations

Final Exam

n/a

4. Course Materials

Textbook (optional)

- Molecular Imaging: Principles and Practice. Weissleder R, Ross BD, Rehemtulla A, Gambhir SS (eds). Available online

Laboratory Tours

Monday March 20: Tour of London Regional Cyclotron Facility by Dr. Hicks

Contact with Instructors regarding course materials

We encourage students to approach and discuss any course-related problems with the relevant instructor. Please make an appointment (preferably via email) utilizing the contact information provided above.

Collaborative work

Students are encouraged to work together, but each student must take total responsibility for their submitted work. Note on Plagiarism: "Students must write their essays and assignments in their own words. Whenever students take an idea, or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence" (see Scholastic Offence Policy in the Western Academic Calendar).

5. Evaluation

The final grade will be based on in-class participation, a written review and an oral presentation, as follows:

Final grade breakdown

In-class participation/assignments: 20%

Written review: 40%

Oral presentation: 40%

Assignments will be in short-answer format. The review will be in essay style format with a set word limit. The oral presentation will be a 15-minute Powerpoint/Keynote-aided talk.

Assignments and reviews that are submitted late will receive a penalty of 10% per day. For example, a review which is 3 days late will receive a penalty of 3 days \times 10%/day = 30%. An extension for submission which is delayed due to medical reasons can only be granted by the Academic Counseling Office. Students are advised to inform the instructor as soon as possible regarding such delays.

Other Considerations

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:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_grad.pdf.

Attendance Policy:

All classes are mandatory, unless otherwise stated. Any student who, in the opinion of the course co-ordinator is absent too frequently from class or laboratory periods in any course, will receive a failing grade after due warning has been given in writing from the course co-ordinator and Graduate Chair.

Cheating and Plagiarism Policy:

Students are encouraged to work together, but each student must take total responsibility for his/her submitted work. Students must write their laboratory reports and final projects in their own words. Whenever students take an idea, or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. University policy states that cheating, including plagiarism, is a scholastic offence. The commission of a scholastic offence is attended by academic penalties which might include expulsion from the program. If a student is caught cheating, there will be no second warning.

All written reports and projects may be subject to submission for textual similarity review to commercial plagiarism detection software under license to the University for the detection of plagiarism. All reports will be included as source documents on 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>).

Use of Electronic Devices Policy:

No electronic devices (e.g., cell phones, MP3 players) may be used during lectures or examinations. The use of non-programmable calculators is permitted during examinations; programmable calculators are prohibited during examinations.

OWL Internet/Bulletin Board Policy:

It is the student's responsibility to read the course website posted on Western's on-line learning management system, OWL (<https://owl.uwo.ca/portal>). This includes the course bulletin board and all information and/or assignments posted about the course. If the student fails to act on information that has been posted on the course site and does so without a legitimate explanation (i.e., those covered under the illness/compassionate form), then there are NO grounds for an appeal.

Request for Assignments Extensions:

Students are advised to inform the course co-ordinator as soon as possible regarding an extension for assignment submissions due to medical reasons or other compassionate reasons. Extensions will only be granted by the course co-ordinators at their discretion.

Absence Due to Medical Illness:

Students must familiarize themselves with the Policy on Accommodation for Medical Illness: <https://studentservices.uwo.ca/secure/index.cfm>

If you are unable to meet a course requirement due to illness or other serious or compassionate circumstances, you must provide valid medical or other supporting documentation to the course co-ordinator immediately. It is the student's responsibility to make alternative arrangements with the co-ordinator to complete missing course requirements.

A student requiring academic accommodation due to illness, should use the Student Medical Certificate:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf when visiting an off-campus medical facility or request a Record's Release Form for visits to Student Health Services.

The form is available at:

<http://www.health.uwo.ca/services/students/policies.html>. The release form will allow the course co-ordinator to confirm with Student Health Services that a student's absence from regular attendance or inability to meet scheduled course commitments is due to medical reasons. The nature of the illness will not be divulged by Student Health Services.

Graduate Students' Mental Health and Physical Wellness:

As part of a successful graduate student experience at Western, students are encouraged to make their health and wellness a priority. Western provides several on campus health-related services to help you achieve optimum health and engage in healthy living while pursuing your graduate degree. For example, to support physical activity, all students, as part of their registration, receive membership in Western's Campus Recreation Centre: http://www.uwo.ca/campus_life/athletics.html

All facets of extracurricular campus life in which graduate students can participate are available on this URL: http://www.uwo.ca/campus_life/arts_culture.html

Information regarding health and wellness-related services available to students may be found at <http://www.health.uwo.ca>. Students seeking help regarding mental health concerns are advised to speak to someone in whom they feel comfortable confiding, such as their graduate supervisor, their program director (Graduate Chair), or other relevant administrators in their unit. Campus mental

health resources may be found at: http://www.health.uwo.ca/mental_health/resources.html

Accessibility to the Course and Course Materials:

Please contact the course co-ordinator 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 x 82147 for any specific question regarding an accommodation.