Medical Biophysics 2582B – Imaging in Biology

1. Course Information

The course will provide an introduction to concepts that are involved in the imaging and quantification of biological processes using light, radiation and electromagnetism. Students will be introduced to imaging methods that detect and measure gene expression, protein synthesis, and molecular processes within cells and organs.
Antirequisite(s): None
Prerequisite(s): Biology 1001A and Biology 1002B, or the former Biology 1222 or 1223; Chemistry 1301A/B and 1302A/B or the former 1100A/B and 1200B, or the former Chemistry 1050; Calculus 1000A/B or 1500A/B or the former 1100A/B; Calculus 1301A/B or 1501A/B; Physics 1028A/B or 1301A/B or 1501A/B; Physics 1029A/B or 1302A/B or 1502A/B
Pre-or Corequisite(s): Biochem 2280A, Biol 2581B
Extra Information: 3 lecture hours per week (Mon, Wed, Fri), 0.5 course.

This course is open to second- and third-year students. Senior students interested in taking Biophysics 2582B as an elective may do so with permission of the course coordinator.

The objective of the course is to help students to integrate the knowledge gained in first year physics courses and second year biochemistry and biology and to expose students to concepts in imaging and biology. Concepts surveyed in this course will be further expanded in the third and fourth year biophysics courses.

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.

2. Instructor Information

Instructors	Email	Office	Phone	Office Hours
Dr. Savita Dhanvantari (Course Coordinator)	sdhanvan@lawsonimaging.ca	Lawson		Email for appointment
Dr. Donna Goldhawk (Co-Coordinator)	dgoldhawk@lawsonimaging.ca	Lawson		Email for appointment
Dr. Paula Foster	pfoster@robarts.ca	Robarts		Email for appointment

Dr. Mamadou Diop	mdiop@lawsonimaging.ca	Lawson	64863	Email for appointment
Guest lecturers	At the instructors' discretion			
TA	TBA (if required)			

3. Course Syllabus

General information

from http://www.uwo.ca/univsec/handbook/
"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."
"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 Web site: http://www.uwo.ca/univsec/handbook/appeals/scholoff.pdf.

Course structure

The course consists of 27 lectures, 3 in-class tests and 4 problem assignments. It will cover four topics within the discipline of quantitative measurements of biological processes, with emphasis on imaging in biology.

Topic 1: Imaging and quantification of gene expression

Instructor: Dr. Donna Goldhawk
Lecture Dates: 6 lectures Jan 6-20

a. Jan 6: Introduction
b. Jan 9: Using molecular cloning to study gene expression
c. Jan 11: Transcription factor/DNA interactions
d. Jan 13: Factors influencing transcription
e. Jan 16: Reporter gene expression
f. Jan 18: Assessing transcription efficiency
g. Jan 20: In-class test #1

Topic 2: Quantification of proteins using imaging tracers

Instructor: Dr. Savita Dhanvantari
Lecture Dates: 8 lectures Jan 23-Feb 10

a. Jan 23: Introduction: why we need to measure proteins
b. Jan 25: Principles of radioactivity
c. Jan 27: Using radioactivity to quantify proteins in vitro
d. Jan 30: Basic principles of positron emission tomography (PET) (part 1)
e. Feb 1: The steps in PET image formation and analysis (part 2)

f. Feb 3: Using PET to explore the living human brain
g. Feb 6: Demonstration: Computerized tomography image formation
h. Feb 8: Review lecture
i. Feb 10: in-Class Test #2

Topic 3: Using electromagnetism to measure biological processes

Instructor: Dr. Paula Foster
Lecture Dates: 8 lectures Feb 13-17, 27-Mar 10

a. Feb 13: History of Biomedical Imaging
b. Feb 15: Basic principles: The MRI Signal
c. Feb 17: Basic principles: Contrast and Contrast Agents
d. Feb 27: Quantitative MRI
e. Mar 1: Cell Tracking with MRI
f. Mar 3: Emerging topics in MRI: hyperpolarized MRI
g. Mar 6: John Ronald guest lecture: MRI reporter gene imaging
h. Mar 8: Review lecture
i. Mar 10: In-Class Test#3

Topic 4: Quantifying biological processes with Light

Instructors: Dr. Mamadou Diop
Lecture Dates: 8 lectures Mar 13-29

a. Mar 13: Introduction: Light and the electromagnetic spectrum
b. Mar 15: Interactions between light and tissue
c. Mar 17: High resolution optical imaging: Optical Coherence Tomography
d. Mar 20: High resolution optical imaging: Confocal Microscopy
e. Mar 22: Super-resolution optical imaging, or nanoscopy
f. Mar 24: Deep tissue optical imaging and spectroscopy
g. Mar 27: Deep tissue optical imaging and spectroscopy
h. Mar 29: Review lecture

Final Exam (All instructors with emphasis on Topic 4)

4. Course Materials

Course website

Textbook

TBA

Laboratory Tours

TBA

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 a 25% contribution from each of the four topics (see "Course Syllabus" section above). The mark for each topic will be obtained from problem assignments, the midterm tests and the final exam. Note that there is one midterm test per topic for the first 3 topics. The final exam will emphasize topic 4, and will have material from the other 3 topics..

Final grade breakdown

Assignments: 10% X 4 = 40%
Mid-term Tests: 10% X 3 = 30%
Final Exam: 30%

Assignments will be in written format, in short-answer style. The midterm tests and final exam will be in hand-written format. Exam questions will include multiple-choice and short answer questions. The only electronic devices permitted for use during the exams are standard (not programmable) calculators.
Assignments that are submitted late will receive a penalty of 10% per day. For example, an assignment which is 3 days late will receive a penalty of 3 days ×10%/day = 30%. An extension for assignment 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.

Assignment Schedule

	Topic	Assignment Handed Out	Due Date
Assignment 1	Topic 1	Jan 9	Jan 16
Assignment 2	Topic 2	Jan 25	Feb 8
Assignment 3	Topic 3	Feb 15	Mar 8
Assignment 4	Topic 4	Mar 15	Mar 27

6. Additional Information/Statements

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 ."

Absence from course commitments

A. Absence for medical illness:

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

Statement from the Dean's Office, Faculty of Science

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 Dean's 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 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 Dean's Office immediately.
For UWO Policy on Accommodation for Medical Illness, see:
http://www.uwo.ca/univsec/handbook/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/medical_document.pdf
Students seeking academic accommodation on medical grounds for any missed tests, exams, participation components and/or assignments worth 10% or more of their final grade must apply to the Academic Counseling office of their home Faculty and provide documentation. Academic accommodation cannot be granted by the instructor or department.

B. 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.
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 of the Faculty. The Dean will consult with the instructor and Department Chair and, if a later date is arranged, will communicate this to Registrarial Services. 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 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.

C. Support Services:

Registrarial Services: http://www3.registrar.uwo.ca/index.cfm
Academic Counseling (Science and Basic Medical Sciences):
http://www.uwo.ca/sci/counselling/index.html
Student Development Services: http://www.sds.uwo.ca
Student Health Services: http://www.shs.uwo.ca/

D. Accommodations for Religious Holidays

When scheduling unavoidably conflicts with religious holidays which a) require an absence from the University or b) prohibit or require certain activities (i.e., activities that would make it impossible for the student to satisfy the academic requirements scheduled on the day(s) involved), no student will be penalized for absence because of religious reasons, and alternative means will be sought for satisfying the academic requirements involved. If a suitable arrangement cannot be worked out between the student and instructor involved, they should consult the appropriate department chair and, if necessary, the student's Dean. It is the responsibility of such students to inform themselves concerning the work done in classes from which they are absent and to take appropriate action. A student who, for either of the situations outlined in paragraph one above (A or B), is unable to write examinations and term tests on a Sabbath or Holy Day in a particular term shall give notice of this fact in writing to his or her Dean as early as possible, but not later than November 15 for mid-year examinations and March 1 for final examinations, i.e., approximately two weeks after the posting of the mid-year and final examination schedule respectively. In the case of mid-term tests, such notification is to be given in writing to the instructor within 48 hours of the announcement of the date of the mid-term test. If a Special Examination is offered as an alternative means to satisfy the academic requirements, the instructor(s) in the case of mid-term tests and the dean in the case of mid-year and Spring final examinations will arrange for special examination(s) to be written at another time. In the case of midyear and Spring final examinations, the accommodation must occur no later than one month after the end of the examination period involved. It is mandatory that students seeking accommodations under this policy give notification before the deadlines and that the Faculty accommodate these requests. For purposes of this policy the University has approved a list of dates which are recognized religious holidays which require members of those religions to be absent from the University; this list is updated annually and is available at Departmental, Deans' and Faculty advising offices.

E. Accessibility

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 x 82147 for any specific question regarding an accommodation.