### Biophysics 9501A - Biophysics of Transport Systems

The physics of blood flow and vascular mechanics in the microcirculation and large vessels, surface energy and interactions at biological interfaces such as the lung, diffusive and convective transport and exchange.

**Instructor**  
Dr. John McGuire  
(John.McGuire@schulich.uwo.ca)

**Course Credit**  
0.5

**Term Offered**  
Fall Term

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### Biophysics 9507A/B - Clinical Physics: Practice and Quality Assurance

*CAMPEP Requirement*  
This course covers radiation detection, dosimetry, and instrumentation in relation to radiation field surveying; legislation governing the use of radiation and nuclear material; production of radioactivity and managing radioactive waste; quality assurance in medical imaging including equipment testing and artifact identification; and the codes and guidelines for the Canadian College of Physicists in Medicine and the Canadian Partnership for Quality Radiotherapy. This course covers compulsory components of the CAMPEP Core Graduate Curriculum not covered by other courses.

**Instructor**  
Dr. Stewart Gaede  
(Stewart.Gaede@lhsc.on.ca)

**Course Credit**  
0.5

**Term Offered**  
Fall Term or Winter Term
### Biophysics 9509A - Digital Image Processing

Provides a solid background in the fundamentals of digital image processing, and covers many topics in the field, including image representation, 2D linear systems theory and Fourier analysis, digital filtering and segmentation.

<table>
<thead>
<tr>
<th>Instructor</th>
<th>Dr. Hanif Ladak (<a href="mailto:hladak@uwo.ca">hladak@uwo.ca</a>)</th>
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</thead>
<tbody>
<tr>
<td>Course Credit</td>
<td>0.5</td>
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<td>Term Offered</td>
<td>Fall Term</td>
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</table>

### Biophysics 9510A - Hemodynamics


<table>
<thead>
<tr>
<th>Instructor</th>
<th>Dr. Dan Goldman (<a href="mailto:dgoldma2@uwo.ca">dgoldma2@uwo.ca</a>)</th>
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<tbody>
<tr>
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<td>0.5</td>
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<td>Fall Term</td>
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### Biophysics 9513 - Scientific Communications

It involves practical work in oral and written communication related to the student's research. Students are required to participate in a two and ten minute oral presentation on his or her research project. Poster presentations, abstract writing, preparation of writing a paper, grant applications and an overview of ethics, authorship and data representation are also covered. Students are encouraged to take a minimal number of additional courses to supplement their background. With the help of their supervisor, graduate students' courses will be individually selected to contribute to their background knowledge and research project.

<table>
<thead>
<tr>
<th>Instructor</th>
<th>Dr. Matthew Teeter (<a href="mailto:Matthew.Teeter@lhsc.on.ca">Matthew.Teeter@lhsc.on.ca</a>)</th>
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<tbody>
<tr>
<td>Course Credit</td>
<td>1.0 (2 term course)</td>
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<tr>
<td>Term Offered</td>
<td>Fall Term and Winter Term</td>
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### Biophysics 9515A - Medical Imaging

*CAMPEP Requirement*

This survey course is an introduction to the different medical imaging modalities, including x-rays, nuclear medicine, ultrasound, computed tomography and magnetic resonance imaging. The physical and mathematical principles involved in the formation of medical images will be presented, along with discussions of the limitations to resolution and image noise. Examples of primary applications for each modality will be given.

<table>
<thead>
<tr>
<th>Instructor</th>
<th>Dr. Maria Drangova (<a href="mailto:mdrangova@robarts.ca">mdrangova@robarts.ca</a>)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Credit</td>
<td>0.5</td>
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<td>Term Offered</td>
<td>Fall Term</td>
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</table>
Biophysics 9516B - Imaging Principals  
This course lays the foundation for the evaluation and optimization of imaging systems. Linear system theory in the Fourier domain is used to describe both signal and noise.

<table>
<thead>
<tr>
<th>Instructor</th>
<th>Dr. Ian Cunningham (<a href="mailto:icunningham@robarts.ca">icunningham@robarts.ca</a>)</th>
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<tbody>
<tr>
<td>Course Credit</td>
<td>0.5</td>
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<td>Winter Term</td>
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Biophysics 9518B - Molecular Imaging  
This course will introduce 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. Students will be evaluated based on an oral presentation of a journal article and a written literature review.

<table>
<thead>
<tr>
<th>Instructor</th>
<th>Dr. Savita Dhanvantari (sdhanvan@lawsonimaging)</th>
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<tbody>
<tr>
<td>Course Credit</td>
<td>0.5</td>
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<td>Winter Term</td>
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Biophysics 9519B - Advanced Image Processing  
Digital image processing has various applications ranging from remote sensing and entertainment to medical applications. This course explores a few major areas of digital image processing at an advanced level, with primary emphasis on medical applications. Topics covered include image filtering and enhancement, visualization, image segmentation and image registration. For image registration, in addition to classical techniques that are based on image feature or intensity, a newly emerging technique based on the biomechanics of tissue deformation will be also covered. Examples will be presented to give the students exposure to real-world applications in medicine and other applications.

<table>
<thead>
<tr>
<th>Instructor</th>
<th>Dr. Aaron Ward (<a href="mailto:award54@uwo.ca">award54@uwo.ca</a>)</th>
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<tbody>
<tr>
<td>Course Credit</td>
<td>0.5</td>
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<tr>
<td>Term Offered</td>
<td>Winter Term</td>
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Biophysics 9520B - Advanced Image Processing  
Practical investigations using clinical, medical-imaging equipment to introduce techniques in film radiology, digital subtraction angiography, clinical ultrasound, magnetic resonance imaging, computed tomography and nuclear medicine.

<table>
<thead>
<tr>
<th>Instructor</th>
<th>Dr. Aaron So (<a href="mailto:aso@robarts.ca">aso@robarts.ca</a>)</th>
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<tbody>
<tr>
<td>Course Credit</td>
<td>0.5</td>
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<td>Winter Term</td>
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</table>
**Biophysics 9522B - Inferencing from Data Analysis** *(return to chart)*  
Prepares students to choose the proper inferential tools for data analysis, build databases, interpret SPSS outputs, and write an analysis for publication.  
**Instructor** Dr. Yves Bureau (ybureau@lawsonimaging.ca)  
**Course Credit** 0.5  
**Term Offered** Winter Term

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**Biophysics 9567B - Radiation Biology with Biomedical Applications**  
*CAMPEP Requirement* *(return to chart)*  
**Instructor** Dr. Scott Karnas (Scott.Karnas@lhsc.on.ca)  
**Course Credit** 0.5  
**Term Offered** Winter Term - Offered by Distance Studies

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**Biophysics 9640B - Biomedical Ultrasound** *(return to chart)*  
Fundamental physics and instrumentation of biomedical ultrasound imaging presented at a level suited to graduate students performing thesis research in ultrasound imaging. The course will encourage students to develop a unified conceptual and mathematical understanding of ultrasound imaging and will emphasize the use of computer simulation to illustrate and extend key concepts. Topics covered will include physical acoustics, beam and image formation, coherent speckle, and blood-flow and tissue-motion estimation.  
**Instructor** Drs. Tamie Poepping ad James Lacefield (poepping@uwo.ca and jlacefie@uwo.ca)  
**Course Credit** 0.5  
**Term Offered** Winter Term

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**Biophysics 9645A - Intro to Biomedical Optics** *(return to chart)*  
The course will serve as an introduction to the physical and biophysical principles underlying the methodology and technology for the medical use of light. Upon successful completion, students will have an understanding of the physics of light and the physics of the interaction of light with matter. Students will be able to use mathematical and computational tools to solve problems relevant to biomedical optical practice and research. Furthermore, students will be able to assess the advantages and limitations of current optical methods for detection and treatment of disease and evaluate the suitability of new optical technologies for medical research using established physical and biophysical principles.  
**Instructor** Dr. Jeff Carson (jcarson@lawsonimaging.ca)  
**Course Credit** 0.5  
**Term Offered** Fall Term
### Biophysics 9650A - Conceptual MRI

The purpose of this course is to provide students with an understanding of the conceptual underpinnings of Magnetic Resonance Imaging. This course will focus on the concepts needed to interpret MR images and design MRI experiments. It is intended for graduate students that will be using MR images in their thesis work, as opposed to students needing an in-depth knowledge of MR physics. Those students should consider BIOPHYS 9662/9663 instead.

**Instructor**
Dr. Charles McKenzie (cmcken@uwo.ca)

**Course Credit**
0.5

**Term Offered**
Fall Term

### Biophysics 9663B - MRI Physics

The purpose of this course is to provide an understanding of the principles of magnetic resonance imaging and extend the concepts introduced in the pre-requisite course BIOPHYS 9662. The course will focus on the concepts of spatial data encoding (k-space), selective excitation (radio-frequency pulses), image contrast, and image signal to noise ratio. Students will be introduced to various MRI pulse sequences and gain a thorough understanding of the elements required for image formation and the generation of image artefacts. This course serves as the pre-requisite to the advanced graduate magnetic resonance imaging course in Medical Biophysics: Advanced MRI Physics.

**Instructor**
Dr. Rob Bartha (rbartha@robarts.ca)

**Course Credit**
0.5

**Term Offered**
Winter Term

### Biophysics 9665A - Advanced MRI Physics

The purpose of this course is to provide an understanding of advanced magnetic resonance pulse sequences and specialized methods used in current clinical and research settings. This course will assume an understanding of the concepts covered in BIOPHYS 9663 and 9662.

**Instructor**
Dr. Jean Theberge (jtheberge@lawsonimaging.ca)

**Course Credit**
0.5

**Term Offered**
Fall Term

### Biophysics 9670 - Nuclear Medicine Physics

This course covers the concepts and instrumentation associated with clinical nuclear medicine physics. Topics include: atomic and nuclear physics and modes of decay, interaction of radiation and matter, production of radionuclides, radiation detectors and instrumentation, spectrometry and radiation counting, principles of gamma cameras, Single Photon Emission Computed Tomography (SPECT) and Positron emission Tomography (PET), Radiation Safety Practice and Regulations, Tracer Kinetic Modeling, and Internal Radiation Dosimetry. The course is enriched by guest lectures covering medical cyclotrons and other imaging modalities complementary to Nuclear Medicine.

**Instructor**
Dr. Rob Stodilka (Rob.Stodilka@lhsc.on.ca)

**Course Credit**
1.0

**Term Offered**
Fall and Winter Terms (offered alternate academic years)
**Biophysics 9672 - Practical Radiotherapy Physics**  
*CAMPEP Requirement*

This course covers the concepts, processes, and instrumentation required in the clinical application of ionizing radiation to the treatment of cancer. Topics include: external beam therapy, with a specific focus on the high energy Linac; radiation safety and treatment bunker design; commissioning equipment and techniques; quality assurance processes and scope; dosimetry instruments and dose measurement; image guided radiation therapy (IGRT); medical imaging in the context of radiation treatment planning; dose calculation and beam modelling, including tabulated dose data sets (e.g. depth-dose, TPR, SPR, ROF); radiation dose prescription and translation to beam parameters; brachytherapy; other treatment machines and special techniques. Students are expected to be available for lectures and demonstrations of equipment at the London Regional Cancer Program.

**Instructor**  
Dr. Kathleen Surry (Kathleen.Surry@lhsc.on.ca)

**Course Credit**  
1.0

**Term Offered**  
Fall and Winter Terms

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**Biophysics 9674B - Pedagogy in Biophysics**

After completing this course, students will be able to develop and deliver effective university-level course curricula. Students will be able to: (1) precisely define intended learning outcomes; (2) develop course materials that support achievement of these outcomes; and (3) develop evaluation methods to measure whether learning outcomes have been achieved. Students and faculty will participate in discussion groups, examining and learning from canonical and current research papers and other materials covering essential concepts including but not limited to: Bloom’s taxonomy of learning objectives, problem-based learning, learning styles, cognitive load theory, metacognition, and the effects of anxiety and preconceptions on learning efficacy. Students will put all of these concepts into action through the development of pedagogic materials supporting a real course to be delivered at Western.

**Instructor**  
Dr. Aaron Ward (award54@uwo.ca)

**Course Credit**  
0.5

**Term Offered**  
Winter Term

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**Biophysics 9700 - Biophysics Graduate Seminars**  
Annual *COMPULSORY* Enrollment

Strong oral presentation skills are necessary for success in academia, industry and the public sector. The purpose of this course is to provide students with the opportunity to practice their oral presentation and chairing skills via a conference-style venue.

**Instructor**  
Dr. Aaron Ward (award54@uwo.ca)

**Course Credit**  
No credit standing

**Term Offered**  
Fall and Winter Terms
### Biophysics 9702Y - K-T (Knowledge Transfer) for Clinician Scientists

The primary objective of this course is to provide clinician researchers with a practical approach to and experience with presenting science information in a public forum. Emphasis will be placed on presentation to a scientifically educated, but non-specialist audience and proposals to funding agencies. Feedback will be provided from both experienced speakers as well as graduate student peers.

<table>
<thead>
<tr>
<th>Instructor</th>
<th>Dr. Matthew Teeter (<a href="mailto:Matthew.Teeter@lhsc.on.ca">Matthew.Teeter@lhsc.on.ca</a>)</th>
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### Biophysics 9704A - Problem Discovery and Solving

Discovering research problems whose solutions will have high impact is fundamental to both academic and non-academic research. This course will provide the students with a diverse set of tools to aid the student from discovery of a problem to a problem solution, using process skills developed and validated in cognitive science literature. The skills developed in this course will be linked directly to current challenges faced by graduate students and in their future careers in academia and industry.

<table>
<thead>
<tr>
<th>Instructor</th>
<th>Dr. Ali Khan (<a href="mailto:alik@robarts.ca">alik@robarts.ca</a>)</th>
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### Biophysics 9706L - CAMPEP Physiology and Anatomy

This course provides a University level background and training in the fundamentals of anatomy and physiology and covers all the major body systems relevant to CAMPEP training requirements for graduate students, including image representation, cadaveric representation and body systems integrating both structure and function. This course concentrates on exposing students to real-world understandings of human physiology and anatomy as it applies to typical diagnostic and therapeutic clinical physics applications. This course was designed to be aligned with and cover all the the CAMPEP requirements for training in human physiology and anatomy for the PhD-MCSc program.

<table>
<thead>
<tr>
<th>Instructor</th>
<th>Dr. Grace Parraga (<a href="mailto:gparraga@robarts.ca">gparraga@robarts.ca</a>)</th>
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<tbody>
<tr>
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<tr>
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<td>Summer Term</td>
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</table>
Biophysics 9708B - In-vivo Imaging of Physiology

Imaging has become an integral part of clinical diagnosis, prognosis and research. One of the main challenges of medical imaging is providing quantitative measurements of biology and the pathology of disease. Using positron emission tomography (PET) as a platform, this course focuses on the fundamentals of how non-invasive images of specific biological functions can be obtained.

<table>
<thead>
<tr>
<th>Instructor</th>
<th>Dr. Keith St. Lawrence (<a href="mailto:kstlaw@lawsonimaging.ca">kstlaw@lawsonimaging.ca</a>)</th>
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