Microscopy of Life  
Fall 2013 (3 Credits)  

Biomedical Engineering 619  
(Physics 619, Radiology 619, Anatomy 619, Chemistry 619, Medical Physics 619, Pharmacology 619)

Sponsored by the UW Laboratory for Optical and Computational Instrumentation (LOCI), http://www.loci.wisc.edu

Instructors:  
Paul Campagnola, Professor of Biomedical Engineering, pcampagnola@wisc.edu (lead and primary contact)  
Kevin Eliceiri, Director, LOCI, eliceiri@wisc.edu (co-instructor)

Location: 1152 Mechanical Engineering (for all lectures)  
Lecture: 1:20-2:10pm Tuesdays, Thursdays  
Lab Section: 5:00pm-7:00pm Wednesdays (Locations are on campus, announced each week)

Course Mailing List: microlife@loci.wisc.edu  
Course Webpage: www.loci.wisc.edu/outreach/microscopyoflife  
Course Materials: Learn@UW

Course Description:

Biological Imaging is a vast field ranging from single molecule imaging, electron microscopy, live cell imaging and fluorescence approaches to medical and diagnostic imaging techniques. In this survey class we will review many of the fundamental aspects of biological microscopy and biological and biomedical imaging in general. Students will be exposed to biological imaging research from across the UW and in lab tours take part in imaging and computational demonstrations. It is the goal that at the end of this "Microscopy of Life" course, given a real-research imaging or micro-analytical problem in biology or medicine, a successful student will be able to identify which technique is best suited to answer a variety of biological or physiological questions. The course is designed to be a lead-in for more advanced imaging subject matter courses at the UW such as “BME 601-Special Topics in Biological Microscopy”, “Med Phys 530-Medical Imaging Systems” and “Med Phys 471-Multimodality Molecular Imaging in Living Subjects”.

Course Prerequisites:

There are no prerequisites for this course though introductory biology and physics courses are recommended. Please ask the instructors if any questions or concerns.

Course Expectations and evaluation:

Slides for each lecture will be made available on Learn@UW. There is no textbook for this class.

Labs meet in different locations across campus. The exact location and time is announced on this webpage and announced in class in previous lecture. The Lab schedule will be between 5pm and 7pm on Wednesdays.

Attendance at labs and lectures is mandatory. Attendance will be taken and will count as 25% of the course grade. There can be one unexcused absence, after that each absence will result in half grade point per class missed. Excused absences will be considered on a case by case basis.

50% of the grade will be a term paper based on a topic presented in the class. The term paper is in lieu of a final exam and the format will be that of a journal in the field of the chosen topic. Details on format/content will follow. There will be two shorter written assignments during the semester which will collectively constitute the remaining 25% of the course grade.
Schedule as of September 11th, 2013

Lec T Sept 3rd Introduction to Imaging—scale and dimensionality, Kevin Elsner, Director LOCI (www.loci.wisc.edu)

Lab W Sept 4th CAVE, 3D Printing—Professor Kevin Ponte, Wisconsin Institutes of Discovery—meet at front desk of WID at 5pm
Everyone come at 5pm, will split into two groups at WID.

Lec Th Sept 5th Professor Paul Campagnola, Biomedical Engineering, Introduction to Fluorescence

Lec T Sept 10th Dr. Jayne Squirrel, Scientist LOCI, Live Cell and Confocal Imaging

Lab W Sept 11th Professor Tim Gomez, Neuroscience, Live Imaging Demo (TIRF and Confocal), meet 257 Bardeen Labs
Group I: 5pm Group II 6pm (for group II, meet at Bardeen labs door next to lot 21 if doors are locked)

Lec Th Sept 12th Professor Paul Campagnola, Biomedical Engineering, Second Harmonic and Multiphoton Microscopy

Lec T Sept 17th Professor Jill Wildonger, Biochemistry, Live neuron imaging in the fruit fly

Lab W Sept 18th Campagnola Lab Demo, led by Kirby Campbell and Karissa Tilbury, meet 2027 Engineering Centers
Group 1: 5pm, Group 2: 6pm

Lec Th Sept 19th Professor Jeff Hardin, Zoology, DIC, Video Microscopy

Lec T Sept 24th Professor Marissa Otegui, Botany, Correlative Electron Microscopy

Lab W Sept 25th Plant Imaging Center (PIC) Tour (EM, HPF, Confocal), Dr. Sarah Swanson and Dr. Otegui

Lec Th Sept 26th Professor Baron Chanda, Neuroscience, Optical Physiology

Lec T Oct 1st Dr. Andreas Velten, LOCI and Morgridge, Bending light for Biological Applications

Lab W Oct 2nd Professor Ramin Pashaie, University of Wisconsin at Milwaukee, Optogenetics
DLP, SLM DEMO AT LOCI (room 271 Animal Sciences), Dr. Velten lead.
Group 1: 5pm, Group 2: 6pm (for group 2 meet at door across from lot 36 parking ramp if building is locked)

Lec Th Oct 3rd Professor Nate Sherer, McArdle Laboratory, Multidimensional Imaging of Viruses

Lec T Oct 8th Professor Vali Raicu, University of Wisconsin at Milwaukee, FRET and FLIM

Lab W Oct 9th FRET/FLIM DEMO at LOCI, Dr. Brian Burkel, Dr. Pam Young and Trilly Gregg, LOCI, meet 271 Animal Sciences
Everyone come at 5pm, will split into two groups at LOCI

Lec Th Oct 10th Professor Mike Murrell, Biomedical Engineering, Imaging complex cellular behavior

Lec T Oct 15th Professor Jim Weisshaar, Chemistry, Super Resolution Imaging

Lab W Oct 16th STORM and PALM tour, Weisshaar laboratory, Somenath Baks lead. All come at 5pm to 4369 Chemistry.

Lec Th Oct 17th Professor Aaron Hoskins, Biochemistry, TIRF

Lec T Oct 22nd Dr. Julie Last, Scientist LOCI and Materials Sciences, Atomic Force Microscopy (AFM)

Lab W Oct 23rd Tour of Materials Science Imaging Center, Dr. Jon McCarthy, Director Materials Science and Dr. Last
Everyone comes at 5pm to Materials Sciences, 1509 University, will split into groups there.

Lec Th Oct 24th Professor Jon Audhya, Biomolecular Chemistry, Integrated Microscopy

Lec T Oct 29th Professor Jeremy Rogers, Biomedical Engineering, Spectral Micro/OCT

Lab W Oct 30th Telescope Tour, Washburn Observatory, Drs. Marsha Wolf and Eric Hooper

Lec Th Oct 31st Professor Bill Bement, Cell and Molecular Biology, Genetically encoded biosensors

Lec T Nov 5th Professor Randy Goldsmith, Chemistry, Single molecule imaging

Lab W Nov 6th Goldsmith Lab Tour, 3309 Chemistry, Group I 5pm, Group II 5:30pm

Lec Th Nov 7th Professor Vikas Singh, Biostatistics, Image Analysis

Lec T Nov 12th Professor Jamey Weichert, Radiology, Introduction to Medical Imaging
Lab W Nov 13th ImageJ/FIJI workshop at LOCI, Room 204 Animal Sciences, Curtis Rueden and Johannes Schindelin lead. Everyone comes to room 204 Animal Sciences at 5pm.

Lec Th Nov 14th Professor Moo Chung, Biostatistics, Medical Informatics

Lec T Nov 19th Professor Sean Fain, Medical Physics, Metabolic Imaging

Lab W Nov 20th Image Analysis Core (IMAC) Lab Tour, Dr. Chihwa Song, group I meet 5pm, group 2 6pm, both in WIMR I lobby

Lec Th Nov 21st Professor Guang-Hong Chen, Medical Physics, MicroCT

Lec T Nov 26th Professor Weibo Cai, Radiology, Molecular Imaging

Lab W Nov 27th –no class Thanksgiving

Lec Th Nov 28th – no class Thanksgiving

Lec T Dec 3rd Professor Jim Zagzebski, Medical Physics, Ultrasound Imaging

Lab W Dec 4th Professor Zagzebski, Ultrasound Tour, all meet in lobby of WIMR I at 5pm

Lec Th Dec 5th Professor Thomas Mackie, Morgridge Institute for Research, Medical Devices

Lec T Dec 10th Professor Beth Meyerand, Biomedical Engineering, Functional MRI

Lab W Dec 11th Meyerand Lab, Applied NeuroMRI Tour, lead Ricardo Pizarro, all meet lobby of WIMR at 5pm

Lec Th Dec 12th Professor Robert Jeraj, Medical Physics, MicroPET