

**PGY 630: Understanding Light Microscopy**  
**Spring 2020**  
**“TBD”, 11 AM Monday and Wednesday**

<i>Faculty</i>	<i>Dept.</i>	<i>Office</i>	<i>Phone</i>	<i>Email</i>
<b>Course Director</b> Thomas Wilkop	Physiology	HSRB 001	323-6108	twi272@g.uky.edu
<b>Instructors</b>				
Gregory Frolenkov	Physiology	MS 615	323-8729	gregory.frolenkov@uky.edu
Thomas Wilkop	Physiology	HSRB 001	323-6108	twi272@g.uky.edu
Chris Richards	Chemistry	209 Chemistry- Physics Building	218-0971	chris.richards@uky.edu

**A. COURSE DESCRIPTION**

PGY 630 (Understanding Light Microscopy) is a 2-credit hour semester course consisting of lectures on a number of related topics covering: light and vision, diffraction and image formation, microscope anatomy, fluorescence and fluorophores, optical section, image recording, standard fluorescence microscopy applications and sample preparation. Course emphasis is on the descriptive narrative, conceptual understanding and comprehension of factors influencing good imaging practices and quantitative data extraction. Students are not expected to have an advanced background in mathematics or physics. Live demonstrations and data from real world imaging experiments will be extensively used to illustrate key concepts throughout the course. Grading will be carried out on the basis of two exams and an assignment due at the end of the course.

**B. COURSE OBJECTIVES and LEARNING OUTCOMES**

To provide students with a detailed understanding of how a light microscope works and how to successfully design and carry out imaging experiments. All practically relevant aspects of microscopy will be covered in detail including sample preparation, microscope modality and instrument choice, experimental parameter optimization, robust quantitative data analysis and preparing images for publication.

**C. CLASS ATTENDANCE**

It should be noted that class attendance is expected! A sign-up sheet will be issued at every class. **Students may be required to sign their own name to prove attendance. If so, the sign-up sheet will be collected 5 minutes after the start of class. Please inform Dr. Wilkop if you have any excused absences.** (See F).

**D. TEXT AND COURSE MATERIALS**

Faculty will provide lecture outlines, notes for their lectures and illustrative data used in the course. These will be provided during the course via UK Canvas (see <https://www.uky.edu/canvas/>). Students are encouraged to check the website on a daily basis for course information and course announcements.

*Understanding Light Microscopy* 1<sup>th</sup> Edition, Jeremy Sanderson will be the reference text book.

**E. PREREQUISITES**

General College Physics or equivalents. Students are encouraged to talk with the course director if they are not sure whether they have the appropriate prerequisites.

**F. GRADING AND ATTENDANCE POLICIES:**

Students will be evaluated on the basis of 2 written examinations and one assignment. The first exam will account for 25%, the second exam will count for 35% and the assignment due at the end of the course will account for 40% of the total grade.

<b>A:</b>	<b>85-100%</b>
<b>B:</b>	<b>70-85%</b>
<b>C:</b>	<b>55-75%</b>
<b>Fail:</b>	<b>below 55%</b>

All examinations must be taken at the scheduled time except when legitimate medical or personal reasons make it impossible to do so. Prior notification of your absence to the course director is required. In these cases, either an oral or written make-up examination will be given. An "I" grade will not be assigned to students who simply miss an examination.

**Incompletes:** An incomplete grade due to illness or other emergencies may be arranged. A request for an incomplete due to illness must be accompanied by a letter from your doctor, the Student Health Service, or a hospital. Lack of time to complete assigned work, or other reasons not relating to unavoidable excused absences, will not be accepted as a valid reason for petitioning for an incomplete. No incompletes will be given unless you have a prior written agreement with the instructor BEFORE the end of classes.

#### ***G. UNDERGRADUATE ENROLLMENT***

Undergraduate students may enroll in the course with the permission of the course director and the Graduate School.

#### ***H. OFFICE HOURS***

The course director and faculty will be available for consultation. Students are encouraged to consult with all participating faculty; in general, email is the most effective means of scheduling a meeting.

#### ***I. DAY, DATES & TIMES***

PGY 630 meets Monday and Wednesday, 11:00 -11:50 AM in the Medical Sciences Building “TBD” unless otherwise noted. Exam times during the semester and the due date of the assignment are listed in the schedule. Please refer to the **Room** listing for the correct classroom for each lecture and each exam.

#### ***J. TOPIC***

Readings are loosely based on ***Understanding Light Microscopy*** (1<sup>th</sup> Edition, Jeremy Sanderson), which will be the reference text book. Presentations will be made available before class. A copy of the course textbook will be put on hold in the Medical Center Library.

#### ***K. ACADEMIC HONESTY and INTEGRITY***

The University has a policy that neither condones nor allows cheating, plagiarism, falsification or misuse of data. No exception to this policy will be tolerated. The course director reserves the right to assign a zero for the assignment in question as a minimum action. Further breaches may lead to referring the student for suspension from the University. It is the responsibility of the student to become familiar with the rules of academic

dishonesty as outlined in the Code of Student Rights and Responsibilities (<http://www.uky.edu//Ombud>). Ignorance of these guidelines is not a defensible position against these rules.

Part II of *Student Rights and Responsibilities* (<http://www.uky.edu/StudentAffairs/Code/part2.html>) states that all academic work, written or otherwise, submitted by students to their instructors or other academic supervisors, is expected to be the result of their own thought, research, or self-expression. In cases where students feel unsure about the question of plagiarism involving their own work, they are obliged to consult their instructors on the matter before submission.

When students submit work purporting to be their own, but which in any way borrows ideas, organization, wording or anything else from another source without appropriate acknowledgement of the fact, the students are guilty of plagiarism. Plagiarism includes reproducing someone else's work, whether it is a published article, chapter of a book, a paper from a friend or some file, or something similar to this. Plagiarism also includes the practice of employing or allowing another person to alter or revise the work that a student submits as their own, whoever that other person may be.

Students may discuss assignments among themselves or with an instructor or tutor, but ***when the actual work is done, the student, and the student alone must do it.*** When a student's assignment involves research in outside sources of information, the student must carefully acknowledge exactly what, where and how these were employed. If the words of someone else are used, the student must put quotation marks around the passage in question and add an appropriate indication of its origin. Making simple changes while leaving the organization, content and phraseology intact is plagiaristic. However, nothing in these Rules shall apply to those ideas that are so generally and freely circulated as to be a part of the public domain (Section 6.3.1). Programs and resources including, but not limited to, sources such as <http://www.plagiarism.org/> will be employed to insure academic integrity.

## ***L. ACCOMMODATIONS***

If you have a documented disability that requires academic accommodations, please see the Course Director as soon as possible during scheduled office hours. In order to receive accommodations in this course, a Letter of Accommodation must be provided from the Disability Resource Center (725 Rose Street, Suite 407 Multidisciplinary Science Building, Lexington, KY 40536-0082, [www.uky.edu/DRC](http://www.uky.edu/DRC)) for coordination of campus disability services available to students with disabilities.

## ***M. INCLEMENT WEATHER***

The University of Kentucky has a detailed policy for decisions to close in inclement weather. The snow policy is described in detail at [http://www.uky.edu/PR/News/severe\\_weather.htm](http://www.uky.edu/PR/News/severe_weather.htm) or you can call (859) 257-5684.

## ***N. ABSENCES*** (per Senate Rule 5.2.4.2)

**Attendance:** there will be a sign-up sheet, and students are asked to sign in at the beginning of class. Attendance is required, and three unexcused absences over the semester will result in a loss of a letter grade, and continued absences will result in further grade loss. Students must call or email the instructor at the numbers/address listed on the first page of this syllabus to let him/her know of an absence. *Missed exams due to conflicts, illness or emergencies (see below) must be reported to the Course Director prior to the exam.* Make these arrangements as soon as you know of the conflict--BEFORE the exam. When there is an excused absence, students will be given the opportunity to make up missed work and/or exams. No makeup opportunities (including exams) will be given for unexcused absences.

**The following are several typically accepted reasons for excused absences from exams:**

1. Serious illness.
2. Illness or death of a family member.
3. Approved University-related trips or activities.
4. Major religious holidays.
5. Conflict with another class.
6. Other circumstances found to be "reasonable cause for nonattendance" (i.e., subpoenas, jury duty, military service)

Students anticipating an absence for a major religious occasion are responsible for notifying the instructor in writing of anticipated absences due to their observance of such holidays no later than the last day for adding a class. More information regarding religious observation accommodations can be found at <https://www.uky.edu/ombud/religious-observation-accommodations>.

## Schedule: All classes are in **TBD**

#		Date	Topic	Instructor	Time
1	Wed	15-Jan	<b>Microscopy in a historical context</b>	Wilkop	11.00-11.50
2	Mon	20-Jan	<b>Our Eyes and the microscope</b>	Wilkop	11.00-11.50
3	Wed	22-Jan	<b>Light</b>	Wilkop	11.00-11.50
4	Mon	27-Jan	<b>Diffraction and image formation in a microscope</b>	Wilkop	11.00-11.50
5	Wed	29-Jan	<b>Abbe experiment</b>	Wilkop	11.00-11.50
6	Mon	3-Feb	<b>Microscope anatomy and design</b>	Wilkop	11.00-11.50
7	Wed	5-Feb	<b>Illumination in a microscope</b>	Wilkop	11.00-11.50
8	Mon	10-Feb	<b>Microscope objectives</b>	Wilkop	11.00-11.50
9	Wed	12-Feb	<b>Contrast mechanisms</b>	Wilkop	11.00-11.50
10	Mon	17-Feb	<b>Fluorescence and fluorophores</b>	Wilkop	11.00-11.50
11	Wed	19-Feb	<b>Fluorescent proteins</b>	Wilkop	11.00-11.50
	Wed	19-Feb	<b>First Exam (#1)</b>		TBD
12	Mon	24-Feb	<b>Fluorescence Microscopy 1: Confocal optical sectioning</b>	Wilkop	11.00-11.50
13	Wed	26-Feb	<b>Fluorescence Microscopy 2: Multipoint optical sectioning</b>	Wilkop	11.00-11.50
14	Mon	2-Mar	<b>Fluorescence Microscopy 3: Deconvolution, software optical sectioning</b>	Wilkop	11.00-11.50
15	Wed	4-Mar	<b>Fluorescence Microscopy 4: Spectral bleed through and linear unmixing</b>	Wilkop	11.00-11.50
16	Mon	9-Mar	<b>Anatomy of a modern multimodal research microscope</b>	Wilkop	11.00-11.50
17	Wed	11-Mar	<b>Recording images 1: Theory</b>	Wilkop	11.00-11.50
18			<b>Spring Break 16-21 March</b>	Wilkop	11.00-11.50
19	Mon	23-Mar	<b>Recording images 2: Applied</b>	Wilkop	11.00-11.50
20	Wed	25-Mar	<b>Optical aberrations and noise</b>	Wilkop	11.00-11.50
21	Mon	30-Mar	<b>Image filters</b>	Wilkop	11.00-11.50
22	Wed	1-Apr	<b>Seeing is Believing: Quantitative data v. pretty pictures</b>	Frolenkov	11.00-11.50
	Wed	1-Apr	<b>Second Exam #2</b>		TBD
23	Mon	6-Apr	<b>Microscopy performance 1: Theoretical considerations</b>	Frolenkov	11.00-11.50
24	Wed	8-Apr	<b>Microscopy performance 2: Practical case studies</b>	Frolenkov	11.00-11.50

25	Mon	13-Apr	<b>Common fluorescent microscopy applications 1: FRAP</b>	Richards	11.00-11.50
26	Wed	15-Apr	<b>Common fluorescent microscopy applications 2: Co-localization</b>	Frolenkov	11.00-11.50
27	Mon	20-Apr	<b>Common fluorescent microscopy applications 3: FRET</b>	Richards	11.00-11.50
28	Wed	22-Apr	<b>Microscope selection: Which microscope platform answers my question</b>	Wilkop	11.00-11.50
29	Mon	27-Apr	<b>Optimizing image quality and troubleshooting: Practical tips and tricks</b>	Wilkop	11.00-11.50
30	Wed	29-Apr	<b>Data and image presentation for publication</b>	Wilkop	11.00-11.50
31	Mon	4-May	<b>Sample preparation for microscopy 1: Fixed samples</b>	Wilkop	11.00-11.50
32	Wed	6-May	<b>Sample preparation for microscopy 2: Optimizing live cell experiments</b>	Wilkop	11.00-11.50
	Wed	6-May	<b>Assignment due</b>		TBD