



CUMMING SCHOOL OF MEDICINE
GRADUATE COURSE OUTLINE

COURSE TITLE: Fundamentals of optical microscopy			
Course	MSGE 632		
Pre/Co-Requisites	Permission of instructor		
Faculty	Cumming School of Medicine, Graduate Science Education		
Instructor Name(s)	Pina Colarusso Grant Gordon	Email	gcolarus@ucalgary.ca gordong@ucalgary.ca
Office Location	HSC2829	Office Hours	By appointment
Instructor Email Policy	Instructor will respond to emails with 2-3 business days		
Telephone No.	Please do not contact by phone		
Class Term, Days	Fall Term 2020 Monday, September 14 Wednesday, September 16 Monday, September 21 Wednesday, September 23 Monday, September 28 Wednesday, September 30 Wednesday October 7 (presentation day; delivered via Zoom)		
Class Times	1:30-3:30 pm		
Class Location	Blended online learning involving synchronous and asynchronous work. Live virtual sessions delivered via Zoom		

This course will take place **online** via Desire2Learn (D2L) and Zoom via synchronous and asynchronous instruction. To best succeed in the course, students are encouraged to participate in the asynchronous learning tasks using the D2L learning environment and synchronous Zoom sessions. When unable to participate live due to the time difference or unforeseen circumstances, inform the instructor in advance and propose and implement propose an alternative participation activity.

COURSE INFORMATION/DESCRIPTION OF THE COURSE
The Light Microscopy Module is targeted to students who have little formal training in optical microscopy. Key concepts such as the optical light path, spatial resolution, and sampling will be emphasized.
LEARNING RESOURCES/REQUIRED READING
All materials provided online (creative commons license or through University of Calgary library resources)

COURSE OBJECTIVES/LEARNING OUTCOMES

- Identify the parts of a standard brightfield microscope
 1. Trace the light path of a standard brightfield microscope from the source to the detector
 2. Learn how to set up Koehler illumination and explain why it is important for optimizing image quality of an optical microscopy
 3. Describe image formation for simple convex lenses using the ray model
 4. Describe how the objective and the eyepiece or the objective and the projection lens work together to form magnified images in a compound microscope
 5. Define and identify conjugate planes in a microscope
 6. Define and describe numerical aperture and its link to spatial resolution
 7. Differentiate between the magnification and the numerical aperture and to explain which is more important when considering the spatial resolution of a microscope objective
 8. Explain how the different types of objective features influence image quality
 9. Trace the light paths of a widefield fluorescence system identify the components of the light path, and describe the purpose of each component
 10. List the acquisition settings such as lamp intensity, binning, and exposure time and describe how these settings influence the image quality
 11. By the end of the online workshop, you should be able to:
 12. Describe the main ways contrast is generated in optical microscopy, with an emphasis on fluorescence as the mode of contrast
 13. Explain the relevance of white-light and fluorescence microscopy
 14. Navigate the different classes of optical microscopy, and provide general guidelines for selecting the appropriate technique for the application
 15. Identify the parts of a standard brightfield microscope
 16. Trace the light path of a standard brightfield microscope from the source to the detector and list the steps required for setting up imaging using Koehler illumination
 17. Describe how the objective and the eyepiece or the objective and the projection lens work together to form magnified images in a simple microscope
 18. Define diffraction and explain how it limits the spatial resolution of standard optical microscopes
 19. Define and describe the concept of numerical aperture
 20. Describe the connection between numerical aperture, diffraction, and spatial resolution
 21. Differentiate between the magnification and the numerical aperture and to explain which is more important when considering the spatial resolution of a microscope objective
 22. Explain the different optical parameters listed on objectives and their relevance to your research project
 23. Explain the relevance of sampling to image acquisition
 24. Trace the light paths of a widefield fluorescence system identify the components of the light path, and describe the purpose of each component
 25. Select the appropriate fluorochrome to match filter sets on a fluorescence microscope
 26. Define a digital image
 27. Define bit depth and its relevance to optical imaging data sets
 28. List the acquisition settings such as lamp intensity, binning, and exposure time and describe how these settings influence the image quality



- 29. Describe how to acquire fluorescence images using one or more fluorescent channels
- 30. Recognize and apply best practices and common pitfalls in optical microscopy
- 31. Apply concepts to designing an optical imaging experiment directly related to your research

Communication

Brightspace (By D2L) is located on the University of Calgary server and will be used extensively for communication with Students. A link to the zoom class will be provided on D2L. It is the student’s responsibility to ensure that they receive all posted communications and documents and that they receive e-mails send by instructors of fellow students through D2L. Only your @ucalgary.ca e-mail address maybe linked to D2L. Please ensure that you are regularly checking your @ucalgary.ca account

Learning Technology Requirements

In order to successfully engage in learning experiences at the University of Calgary, students taking online, remote and blended courses are required to have reliable access to the following technology:

- A computer with a supported operating system, as well as the latest security and malware updates;
- A current and updated web browser;
- Webcam (built-in or external);
- Microphone and speaker (built-in or external), or headset with microphone;
- Current antivirus and/or firewall software enabled;
- Broadband internet connection

Most current laptops will have a built-in webcam, speaker and microphone.

Please see the following for a detailed explanation of the minimal required technology for online learning <https://elearn.ucalgary.ca/technology-requirements-for-students/>

A laptop, desktop, tablet or mobile device is required for D2L access. If you need help accessing or using D2L, please visit the Desire2Learn resource page for students: <http://elearn.ucalgary.ca/d2l-student/>.

CUT POINTS FOR GRADES			
This course adheres to the grading system outlined in the University of Calgary, Faculty of Graduate Studies Calendar. Grades of A+ and A are not distinguished in the calculation of GPAs. Percentage/letter grade conversion used for this course is as follows			
Grade	Grade Point Value	Percentage Conversion	Graduate Description
A+	4.00	95-100	Outstanding

A	4.00	90-94	Excellent – superior performance showing comprehensive understanding of the subject matter
A-	3.70	85-89	Very Good Performance
B+	3.30	77-84	Good Performance
B	3.00	72-76	Satisfactory Performance
B-	2.70	68-71	Minimum Pass for Students in the Faculty of Graduate Studies
C+	2.30	63-67	All grades below ‘B-’ are indicative of failure at the graduate level and cannot be counted toward Faculty of Graduate Studies course requirements

Assessment Components: The University policy on grading related matters is outlined in the [2019-2020 Calendar](#).

Assessment Methods	Description	Weight %	Due Date <u>and</u> Time
Assignment 1	Application/concept/synthesis long answer	33.33	D2L work including self-assessments, Discussion Board, and related activities. Will be due at dates specified in D2L and the course outline.
Talk	Short presentation on an application of wide-field fluorescence microscopy held over zoom	33.33	October 7 (class time)
Assignment 2	Application/concept/synthesis long answer	33.33	October 14 by 5pm

ASSESSMENT AND EVALUATION INFORMATION

ATTENDANCE AND PARTICIPATION EXPECTATIONS:

Must attend all live classes and must complete work on D2L site.

GUIDELINES FOR SUBMITTING ASSIGNMENTS:

All assignments should be submitted electronically.

FINAL EXAMINATIONS:

No final exam

EXPECTATIONS FOR WRITING:

Assignments require long answer/essay format.

LATE AND/OR MISSING ASSIGNMENTS:

5% per day deduction.

Is a passing grade on a particular component essential to pass the course as a whole?

NO

		COURSE TIMETABLE	
Course Schedule Date	Topic & Reading	Instructor	Assignments/Due Dates & Times
Monday, September 14	Making the invisible visible: overview of optical microscopy	Colarusso/Gordon	Weekly short activities on the D2L site. Due Monday, September 14 by noon.
Wednesday, September 16 and Monday, September 21	Delving into fluorescence microscopy	Colarusso/Goron	Weekly short activities on the D2L site. Due Wednesday, September 16 at noon and Monday, September 21 at noon.
Wednesday, September 23 and Monday, September 28	Essential optics for biological microscopy and optimizing image acquisition		Weekly short activities on the D2L site. Due Wednesday, September 23 at noon and Monday, September 28 at noon.
Wednesday, September 30	Learning by example: case studies	Colarusso/Gordon	Weekly short activities on the D2L site. Due Wednesday, September 30 at noon.
Wednesday, October 7	Transfer of learning to practice: student presentations and course wrap up		Talk slides due Tuesday, October 6 by 8 pm Talk presented on Wednesday, October 7
October 14	Assignment		Due October 14 by 5 pm

Guidelines for Zoom Sessions

Zoom is a video conferencing program that will allow us to meet at specific times for a 'live' video conference, so that we can have the opportunity to meet each other virtually and discuss relevant course topics as a learning community.



To help ensure Zoom sessions are private, do not share the Zoom link or password with others, or on any social media platforms. Zoom links and passwords are only intended for students registered in the course. Zoom recordings and materials presented in Zoom, including any teaching materials, must not be shared, distributed or published without the instructor's permission.

The use of video conferencing programs relies on participants to act ethically, honestly and with integrity; and in accordance with the principles of fairness, good faith, and respect (as the Code of Conduct). When entering Zoom or other video conferencing sessions, you play a role in helping create an effective, safe and respectful learning environment. Please be mindful of how your behaviour in these sessions may affect others. Participants are required to use names officially associated with their UCID (legal or preferred names listed in the Student Centre) when engaging in these activities. Instructors/moderators can remove those whose names do not appear on class rosters. Non-compliance may be investigated under relevant University of Calgary conduct policies. If participants have difficulties complying with this requirement, they should email the instructor of the class explaining why, so the instructor may consider whether to grant an exception, and on what terms. For more information on how to get the most out of your zoom sessions visit: <https://elearn.ucalgary.ca/guidelines-for-zoom/>.

If you are unable to attend a Zoom session, please contact your instructor to arrange an alternative activity (where available). Please be prepared, as best as you are able, to join class in a quiet space that will allow you to be fully present and engaged in Zoom sessions. Students will be advised by their instructor when they are expected to turn on their webcam (such as for group work, presentations, etc).

The instructor may record online Zoom class sessions for the purposes of supporting student learning in this class – such as making the recording available for review of the session or for students who miss a session. Students will be advised before the instructor initiates a recording of a Zoom session. These recordings will be used to support student learning only.

Conduct During Lectures

The classroom should be respected as a safe place to share ideas without judgement - a community in which we can all learn from one another. Students are expected to frame their comments and questions to lecturers in respectful and appropriate language, always maintaining sensitivity towards the topic. Students, employees, and academic staff are also expected to demonstrate behaviour in class that promotes and maintains a positive and productive learning environment.

As members of the University community, students, employees and academic staff are expected to demonstrate conduct that is consistent with the University of Calgary Calendar, the Code of Conduct and Non-Academic Misconduct policy and procedures, which can be found at <https://www.ucalgary.ca/policies/forms/title>.

INTERNET AND ELECTRONIC COMMUNICATION DEVICE INFORMATION



Cell phones must be turned off in class unless otherwise arranged with the instructor.

The use of laptop and mobile devices is acceptable when used in a manner appropriate to the course and classroom activities. Students are to refrain from accessing websites that may be distracting for fellow learners (e.g. personal emails, Facebook, YouTube). Students are responsible for being aware of the University's Internet and email use policy, which can be found at <https://www.ucalgary.ca/policies/files/policies/electronic-communicationspolicy.pdf>.

MEDIA AND RECORDING IN LEARNING ENVIRONMENTS

Media recording for lesson capture

The instructor may use media recordings to capture the delivery of a lecture. These recordings are intended to be used for lecture capture only and will not be used for any other purpose. Although the recording device will be fixed on the Instructor, in the event that incidental student participation is recorded, the instructor will ensure that any identifiable content (video or audio) is masked, or will seek consent to include the identifiable student content to making the content available on University approved platforms.

Media recording for assessment of student learning

The instructor may use media recordings as part of the assessment of students. This may include but is not limited to classroom discussions, presentations, clinical practice, or skills testing that occur during the course. These recordings will be used for student assessment purposes only and will not be shared or used for any other purpose.

Media recording for self-assessment of teaching practices

The instructor may use media recordings as a tool for self-assessment of their teaching practices. Although the recording device will be fixed on the instructor, it is possible that student participation in the course may be inadvertently captured. These recordings will be used for instructor self-assessment only and will not be used for any other purpose.

Student Recording of Lectures

Audio or video recording of lectures is prohibited except where explicit permission has been received from the instructor.

UNIVERSITY OF CALGARY POLICIES AND SUPPORTS

ACADEMIC ACCOMMODATIONS

Students seeking an accommodation based on disability or medical concerns should contact Student Accessibility Services; SAS will process the request and issue letters of accommodation to instructors. For additional information on support services and accommodations for students with disabilities, visit www.ucalgary.ca/access/. Students who require an accommodation in relation to their coursework based on



a protected ground other than disability should communicate this need in writing to their Instructor. The full policy on Student Accommodations is available at <http://www.ucalgary.ca/policies/files/policies/student-accommodation-policy.pdf>

IMPORTANT INFORMATION

Any research in which students are invited to participate will be explained in class and approved by the appropriate University Research Ethics Board

COPYRIGHT

It is the responsibility of students and professors to ensure that materials they post or distribute to others comply with the Copyright Act and the University's Fair Dealing Guidance for Students (library.ucalgary.ca/files/library/guidance_for_students.pdf). Further information for students is available on the Copyright Office web page (<https://library.ucalgary.ca/copyright>)

A NOTE REGARDING INSTRUCTOR INTELLECTUAL PROPERTY

Generally speaking, course materials created by professor(s) (including course outlines, presentations and posted notes, labs, case studies, assignments and exams) remain the intellectual property of the professor (s). These materials may NOT be reproduced, redistributed or copied without the explicit consent of the professor. The posting of course materials to third party websites such as note-sharing sites without permission is prohibited. Sharing of extracts of these course materials with other students enrolled in the course *at the same time* may be allowed under fair dealing

ACADEMIC INTEGRITY

The Cumming School of Medicine expects intellectual honesty from its students. Course participants should be aware of University policies relating to Principles of Conduct, Plagiarism and Academic Integrity. These are found in the printed Faculty of Graduate Studies Calendar, or online under Academic Regulations in the Faculty of Graduate Studies Calendar, available at [Faculty of Graduate Studies Academic Regulations](#)

ACADEMIC MISCONDUCT

For information on academic misconduct and its consequences, please see the University of Calgary Calendar at <http://www.ucalgary.ca/pubs/calendar/current/k.html>

EMERGENCY EVACUATION AND ASSEMBLY POINTS

Assembly points for emergencies have been identified across campus. The primary assembly points for South Campus (Health Science Centre (HSC); Health & Research Innovation Centre (HRIC); Heritage Medical Research Building (HMRB) and Teaching, Research and Wellness (TRW)) are:

- HSC and HMRB: HRIC Atrium (alternate assembly point is Parking Lot 6)
- HRIC: HMRB Atrium (alternate assembly point is Parking Lot 6)
- TRW: McCaig Tower (alternate assembly point is HMRB – Atrium)

APPEALS

If there is a concern with the course, academic matter or a grade, first communicate with the instructor. If these concerns cannot be resolved, students can proceed with an academic appeal, as per Section N of the Faculty of Graduate Studies Calendar. Students must follow the official process and should contact the



Student Ombuds Office (<http://www.ucalgary.ca/provost/students/ombuds>) for assistance with this and with any other academic concerns, including academic and non-academic misconduct

THE FREEDOM OF INFORMATION AND PROTECTION OF PRIVACY (FOIP) ACT

This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIP) and students should identify themselves on written assignments (exams and term work.) by their name and ID number on the front page and ID on each subsequent page. Assignments given by you to your course instructor will remain confidential unless otherwise stated before submission. The assignment cannot be returned to anyone else without your expressed permission to the instructor. Grades will be made available on an individual basis and students will not have access to other students' grades without expressed consent. Similarly, any information about yourself that you share with your course instructor will not be given to anyone else without your permission

WELLNESS AND MENTAL HEALTH RESOURCES

The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the excellent mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370, MacEwan Student Centre), <https://www.ucalgary.ca/wellnesscentre/services/mental-health-services> and the Campus Mental Health Strategy website <https://www.ucalgary.ca/mentalhealth/>

SUPPORTS FOR STUDENT LEARNING, SUCCESS, AND SAFETY

Student Ombudsman: The Student Ombuds' Office supports and provides a safe, neutral space for students. For more information, please visit www.ucalgary.ca/ombuds/ or email ombuds@ucalgary.ca

Student Union: The SU Vice-President Academic can be reached at (403) 220-3911 or suvpaca@ucalgary.ca; Information about the SU, including elected Faculty Representatives can be found here: <https://www.su.ucalgary.ca>

Graduate Student's Association: The GSA Vice-President Academic can be reached at (403) 220- 5997 or gsa.vpa@ucalgary.ca; Information about the GSA can be found here: <https://gsa.ucalgary.ca>

SAFEWALK

Campus security will escort individuals, day or night, anywhere on campus (including McMahon Stadium, Health Sciences Centre, Student Family Housing, the Alberta Children's Hospital and the University LRT station). Call 403-220-5333 or visit <http://www.ucalgary.ca/security/safewalk>. Use any campus phone, emergency phone or the yellow phone located at most parking lot pay booths. Please ensure your personal safety by taking advantage of this service.