

Syllabus

MEDS3090, Medical Imaging: Science and Application

Instructor Contact Information

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Formal Instruction Hours

Tuesdays and Thursdays 9:30-10:50am
In-person sessions held in MSB E-255 WebEx sessions can be accessed through this link.

Office Hours

Dr. Haworth will hold online office hours via WebEx on Mondays from 1:00-2:30pm and Wednesdays 8:30-10:00am or by appointment (please use email for scheduling). Please note that the office hours WebEx link is different from the normal class period WebEx link. You may come or go any time during office hours. Office hours are your opportunity to meet and discuss your work, progress, and concerns. We can also go through assignments to provide more feedback or talk about other aspects of the class. Please read the [WebEx Participant Guide](#) before joining your first session (whether that be office hours or class).

Course Learning Management Software

Canvas will be the learning management software system for this course. A [student guide](#) is available.

Intellectual Foundation

Course Description and Learning Outcomes

MEDS3090 is a single-semester course designed for undergraduate students interested in the creation and use of medical images. The course will cover the major medical imaging modalities: magnetic resonance imaging, ultrasound, nuclear medicine imaging, x-ray, computed tomography, and endoscopy. For each imaging modality, students will learn about the fundamental physics associated with the radiation, how the radiation interacts with tissue, the hardware associated with acquiring image data, and the software and algorithms used to produce images. This information will be integrated together to develop an understanding of what tissue properties are imaged by each modality and how the imaging modalities are used clinically. Discussion of clinical application will be led by physicians in order to provide practical exposure. The major learning objectives of this course are:

- List the major medical imaging modalities used in clinical practice
- Identify and describe the underlying science associated with the production of medical images, including the nature of the associated radiation and how it interacts with tissue.
- Describe the basic hardware and software associated with major imaging modalities.
- Compare and contrast imaging modalities and describe how the differences impact their use in diagnosing specific diseases or conditions.
- Describe the historical development of medical imaging modalities and discuss their effects on society.

Pre-requisites

Students are expected to have successfully completed a course in calculus (i.e., MATH1044 or MATH1061). Although the course will not have extensive problems requiring the numerical implementation of calculus, concepts within calculus are essential to understanding the image formation process.

Baccalaureate Competencies

Baccalaureate competencies are the primary goals and desired outcomes to be achieved by all University of Cincinnati graduates. These goals and outcomes are pervasive components of all courses and experiences, and equip students with the knowledge, skills, and attitudes for a full and productive life. In this course, competencies in critical thinking, knowledge integration, and effective communication will be developed, and assessed. Critical thinking, which is the ability to analyze, synthesize, and evaluate information and ideas from multiple perspectives, will be developed and assessed through activities that compare and contrast different imaging modalities. Knowledge integration, which is the ability to fuse information and concepts from multiple disciplines, will be developed and assessed as you learn about different facets of each imaging modality, such as the physics and biology of image formation, which are coupled to clinical application. Effective communication will be developed and assessed through a group project. Working with your group will provide opportunities to develop effective communication with your peers and your final report will require effective communication to Dr. Haworth.

Course Structure

Class During a Time of Pandemic

Flexibility

As you have likely been told numerous times, this semester is unprecedented. To achieve the intellectual knowledge, growth, and learning objectives described above, this course has been designed to maximize the opportunities presented within the learning constraints of a pandemic. In particular, a hybrid didactic learning approach (described in the Course Format) will be used. Dr. Haworth will approach any issues with maximum flexibility in mind. However, there will be limitations to the available flexibility based on the need to provide a rigorous course. Nonetheless, if something needs to be modified to help you adapt to learning during a pandemic, please reach out.

Masks

Medicine (and thus the related medical sciences) is based on the premise of maintaining and improving health. Thus, it is incumbent upon all of us to take necessary precautions during a pandemic to not just protect our own health but the health of those around us. We do not know what underlying co-morbidities those around us may have or those they may live with. Toward that end, it is important that we abide by the best science available, which indicates that maintaining at least 6' of physical distance, frequent hand washing, and wearing a mask can all work to dramatically reduce transmission of the sars-cov-2 virus. Per the Dean of the College of Medicine, it is a requirement that all individuals on the medical campus wear a mask. As dictated by the Provost, faculty and staff are required to report students who repeatedly forget to wear a mask to the Office of Student Conduct and Community Standards.

Facilities

Per the directive of the Dean of the College of Medicine please abide by the following rules and activities

- When entering the classroom maintain 6 feet of physical distance between you and anyone else. Enter through the west door (the one closest to the main MSB hallway and exit through the east door. Follow the direction of any arrows on the hallway to maintain one-way traffic.
- Upon entering the classroom use the provided cleaning and disinfecting supplies to clean your assigned seating area. Prior to leaving the classroom you must also clean and disinfect your assigned seating area. Please arrive early to class and clean your space before we begin (however the lecture will not begin until everyone has cleaned their space).
- Assigned seats will be determined on the first in-person class period that you attend. You will use this seat location for the duration of the semester. If you must change for some reason, you need to email Dr. Haworth describing both your prior and new seating location and why you changed.
- Shuttles between campuses may be more limited, please give yourself more travel time to class than normal.

Wellness Checks and Self-Reporting

Everyone must perform a [wellness self-check](#) before leaving their domicile to come to campus or interact with anyone on campus. If you have any [symptoms](#), you should self-quarantine and contact COVIDwatch@uc.edu. Additional details on [self-reporting are available](#). If your symptoms are troublesome to you, contact University Health Services or your primary care physician. For [severe symptoms](#) that create an emergency situation, go to the nearest emergency department.

Course Format

MEDS3090 will be conducted in a combination of online and in-person campus-based sessions (note that if you have concerns about in-person instruction due to the pandemic, contact Dr. Haworth so that alternative arrangements can be made that will maximize your learning opportunities). Due to gathering size limitations, for each class period some students will attend in-person and the remainder will watch live via WebEx. The WebEx session will be recorded and posted to the course site on Canvas. It may take 24-48 h for recordings to be posted due to server processing times. You are encouraged to review the recorded session to help solidify your mastery of course material and also if you have internet connectivity or bandwidth issues that cause you to have a disrupted learning experience. Watching the recorded sessions should not be considered a substitute for attending the live session because it does not enable you to interact with the instructor. That interaction is important as it enables the instructor to gauge your learning in real time and it allows you to ask questions. Of course, every reasonable effort will be made to support the learning of those students with poor access to the live lectures. When contributing to course discussions, please keep in mind that you will be recorded and therefore you should refrain from disclosing personal or restricted data about yourself or others, including health, financial, educational, or other sensitive information.

Many classes will have pre-work, which is detailed in the Course Calendar. Pre-work may include both assigned readings or videos. The goal of the pre-work is to provide background information and a conceptual framework of concepts so that during the live class periods you are able to spend more time learning at higher domains (see [Bloom's taxonomy](#)). Pre-work will be posted at

least one week in advance of a lecture. It will be your responsibility regularly check the course calendar on Canvas to identify necessary pre-work assignments (though course announcements will also be used when new posts are made). The pre-work will be coupled with a short quiz to be taken prior to the live class period.

Course Materials

As noted above, pre-work will be required of students. All reading and video assignments will be posted in the MEDS3090 Canvas course site. None of the pre-work material will require a fee. There is no required textbook for this course. The use of WebEx sessions and a required final written report will necessitate that you have access to a computer and good Wi-Fi connection. Please ensure you have access to these technologies. If you need assistance UC Information Technology services has a [website guide](#) to assist you.

Course Assessment

Pre-work Quizzes

All students will need to complete a short pre-work quiz before many lectures (see the course calendar). Each quiz (nominally 3-7 questions) is intended to be completed in a short period of time (10 min or less). The purpose of these quizzes is multifold. 1) They are intended to ensure that the pre-work is done, which will facilitate a higher-quality learning experience during live class periods. 2) They provide feedback to the instructor to better understand the class' overall grasp of the material. 3) They provide a deadline and routine to help students stay focused and motivated, which can otherwise be difficult in hybrid/remote instruction formats.

Homework Assignments

For each of the five major imaging modalities covered (ultrasound, magnetic resonance imaging, optical, radiography, and nuclear imaging), there will be a homework assignment. The assignments are designed to have you evaluate, apply, and extend the knowledge that you learned in that module. They will also serve as an assessment tool that will be used when grading and provide each student an opportunity to determine their own knowledge and where they may need additional study in order to fully master the material. Reviewing graded homework assignments and understanding any mistakes made on the assignment is considered a critical part of the learning experience. Students may cooperatively work on the homework assignments (i.e., study groups are fine). However, it will be considered a violation of the Student Code of Conduct for a student to copy another student's work. Furthermore, copying another's answer cheapens your learning experience and is a waste of your tuition dollars. Homework assignments are due at the start of the class period that is indicated on the Course Calendar.

Exams

The course will have two non-cumulative exams. Exam 1 will cover non-ionizing imaging modalities (ultrasound, magnetic resonance imaging, and optical imaging). Exam 2 will cover ionizing imaging modalities (radiography and nuclear imaging). The format of these exams will be discussed in class.

Group Project

Over the course of the semester, students will work on a group project. Students will select their own groups of approximately 3 individuals. Each group will then select a project topic on which they will perform research and analysis. Project topics will be in one of three areas: 1) a medical imaging case study, which will be carried out in conjunction with a medical resident or fellow, 2) a report on an advanced form of medical imaging not discussed in detail during lectures, or 3) a report on health inequities, health disparities, or minority health issues in the context of medical imaging. Additional details regarding the project and grading rubrics can be found on the course webpage. To facilitate the learning experience, each group will turn in a non-graded outline and draft written report during the semester (see the Course Calendar) for which they will receive feedback. At the end of the semester (see the Course Calendar), a final written report to be submitted and graded.

Class Policies

Attendance

As in all university courses, participation is important to student success. In this course, attendance will not be recorded for the purposes of grading. Your attendance and participation are still expected. Missing quizzes, exams, or other activities without previous approval will result in a failing grade for that activity. It is understood that during this time of pandemic increased flexibility is needed. If you are unable to attend a class (in-person or online) and you miss a graded activity you must contact Dr. Haworth via email before class to make other arrangements for completing the activity. In the case of an emergency, please email Dr. Haworth as soon as possible. For the purposes of contact tracing, attendance will be taken for in-person activities.

Should Dr. Haworth be unable to attend class, a message will be posted through Canvas as soon as possible. In the unlikely circumstance that Dr. Haworth is not present within the first 15 minutes of class, students should consider that class to be cancelled and look for an email from Dr. Haworth with instructions for how the material will be covered in an alternate format.

Grading Policy

Students will be assigned a [letter grade](#) at the end of the semester. The letter grade will be based on your performance on pre-work quizzes, homework assignments, exams, and a semester-long project. The breakdown of the grade calculation will be:

| | |
|---|-----|
| Pre-work Quizzes | 15% |
| Homework Assignments | 35% |
| Exam #1 (Non-ionizing Imaging Modalities) | 15% |
| Exam #2 (Ionizing Imaging Modalities) | 15% |
| Group project final report | 20% |

Homework assignments will be assigned an equal weight when computing the cumulative homework contribution to your final grade (i.e., each of the five homework assignments will be 7% of your final grade). Similarly, all pre-work quizzes will be weighted equally.

The conversion of a score percentage to a letter grade will be determined as:

- A: 93.33-100%
- A-: 90.00 to less than 93.33%
- B+: 86.66 to less than 90.00%
- B: 83.33 to less than 86.66%
- B-: 80.00 to less than 83.33%
- C+: 76.66 to less than 80.00%
- C: 73.33 to less than 76.66%
- C-: 70.00 to less than 73.33%
- D+: 66.66 to less than 70.00%
- D: 63.33 to less than 66.66%
- D-: 60.00 to less than 63.33%
- F: less than 60.00%

The instructor reserves the right to use a curve to adjust the above percentages, but the curve will always be favorable to students (e.g., the lower bound for any letter grade may be changed to a lower percentage).

Late Assignments

Pre-work quizzes not completed before the assigned class period (see Course Calendar) will receive a grade of 0%. You must reach out to the instructor before the assigned class period if an accommodation is needed due to unforeseen circumstances, such as illness. Late homework assignments will have ten percentage points taken from the graded score for each 24 h they are late. Exams must be taken in the timeslot specified by the Course Calendar.

Pass/Fail, Audit, and Withdrawal Policy

Undergraduates are expected to complete this course for a letter grade. A pass/fail option will be made available to undergraduates only at the recommendation of the Provost or College of Medicine Dean's office due to unexpected and unusual circumstances. The reason for limiting the pass/fail option is to ensure all students are maximally engaged in the course material.

Pending seating availability, graduate students, postdoctoral research fellows, and other individuals in possession of a baccalaureate degree may audit the course. Individuals interested in this option should contact the instructor before the start of the semester.

The withdrawal deadline for the Fall 2020 semester is November 13. Students will have completed 4 of 5 homework assignments, 1 of 2 exams, and received feedback on their final project. Students may use that information to determine if they wish to withdraw from the course. They are also encouraged to consult with Dr. Haworth to assess their performance. Students considering withdrawal should review all relevant policies from the [Office of the Registrar](#). At the time of the withdrawal, students are assigned a grade of "W;" however, it is the instructor's right to change the "W" to an "F" if it is determined to be warranted through the final grading process.

Diversity, Equity, and Inclusion Statement

The University of Cincinnati embraces diversity, equity, and inclusion as core values that empower individuals to transform their lives and achieve their highest potential. The University of Cincinnati recognizes a very broad and inclusive concept of diversity

that includes commonly recognized considerations such as race, ethnicity, gender, age, disability status, socioeconomic status, gender identity and expression, sexual identity, sexual orientation, religion, and regional or national origin. Inclusion authentically brings traditionally excluded individuals and/or groups into processes, activities, and decision making.

Dr. Haworth is committed to the fundamental principles of academic freedom and human dignity, especially within the above context. All participants in the course are asked to commit to creating and fostering a positive learning environment based on open communication, mutual respect, and inclusion. If there are aspects of the course design, instruction, and/or experiences that result in barriers to your inclusion, participation, or the accurate assessment of your achievement, contact Dr. Haworth.

The University of Cincinnati and I [do not tolerate discrimination](#) on the basis of the above concept of diversity. If you feel that you are being discriminated against, please reach out for help from myself or the [Office of Equal Opportunity & Access](#).

Academic Integrity

As a student, you have many support structures. As the instructor, I will do my utmost to help assist you in your learning. Coupled with those rights and support structures are responsibilities. Although the pressure of grades may be very real, it never constitutes an excuse for academic dishonesty. The UC [Student Code of Conduct](#) and description of [Academic Misconduct](#) should be reviewed. While collaboration amongst students is encouraged, students must turn in work representing their individual efforts. Aiding and abetting misconduct, cheating, fabrication, and plagiarism may all trigger an [Academic Misconduct Process](#). When in doubt about whether an action may constitute a violation of academic integrity, contact me to discuss the situation.

General UC Faculty Senate Policies

Students are expected to review and respect the following [UC Faculty Senate policies](#):

- [Academic Integrity](#)
- [Title IX \(Sex-Based Discrimination/Harassment & Sexual Violence\)](#)
- [Accessibility](#)
- [Counseling Services](#)

Classroom Procedures

Communication

The best way to contact Dr. Haworth is through Office Hours (described above) or via [email](#). When sending an email message, you can expect a response within 24 business hours. If you have not received a response, you should consider sending another email. You may try to contact Dr. Haworth via office phone (513.558.3536), but during the pandemic he will often be working remotely.

For email contact, please add the following to the subject line: "MEDS3090: <Student's last name, first name>". This will help ensure that your email does not get lost in the many emails received each day. Consider using proper and professional etiquette when communicating via email.

For communication from Dr. Haworth to students, announcements will either be made during live class sessions (which can be reviewed at a later time via recordings) or via a Canvas announcement. Please plan to check the Canvas course announcements multiple times per week. You can also configure your Canvas announcements to be sent to you via email.

In developing your critical thinking skills in this course, you may disagree with other students. Please note that you can disagree without being disagreeable. It is the expectation of the instructor that all communications will remain professional and not include ad hominem arguments.

Technology use during/for class

As a hybrid course, the use of technology during and for class is essential. Whether you are attending in-person or remotely you will be expected to have access to online tools via a computer, tablet, or smart phone. The goal of technology use is to enhance your learning experience. Using the technology for other reasons (e.g., answering email, surfing the web, checking social media, individual or group messaging) is highly discouraged. In particular think about the individuals around you. If they can see you are not focused on the class, they may also become distracted.

Your success in this course is of paramount importance. If there are circumstances that may affect your performance in this class, please contact the instructor as soon as possible so that, together, strategies can be developed for adapting assignments to meet both your needs and the requirements of the course. Dr. Haworth will do his best to provide information in an accessible manner per [Faculty Senate policy](#). However, please reach out to Dr. Haworth or the [Accessibility Office](#) if you need additional resources or assistance. Dr. Haworth will never consider it a burden to adapt course material to increase its accessibility.

Student Resources

There are [many resources available](#) to students. Below is a summary of a select number of them.

Counseling Services, Clifton Campus

Students have access to counseling and mental health care through the University Health Services (UHS), which can provide both psychotherapy and psychiatric services. In addition, Counseling and Psychological Services (CAPS) can provide professional counseling upon request; students may receive five free counseling sessions through CAPS without insurance. Students are encouraged to seek assistance for anxiety, depression, trauma/assault, adjustment to college life, interpersonal/relational difficulty, sexuality, family conflict, grief and loss, disordered eating and body image, alcohol and substance abuse, anger management, identity development and issues related to diversity, concerns associated with sexual orientation and spirituality concerns, as well as any other issue of concerns. After hours, students may call UHS at 513.556-2564 or CAPS Cares at 513-556-0648. For urgent physician consultation after-hours students may call 513-584-7777.

UC Police & Public Safety

If you are the victim of a crime contact the UC police at 513-556-1111. In an emergency dial 911. The UC Police have a dedicated [victim support team](#). Making a police report and ensuring that evidence is collected is important to preserving the option of prosecution, but it does not mean you have to prosecute. You can also request an investigation [online](#).

Women Helping Women

This is a non-university, community-based free, confidential support, accompaniment, and advocacy organization. Walk-in services are available at 215 East 9th St. on the 7th Floor or you can call their 24-hour crisis hotline at 513-381-5610. For more information visit the [Women Helping Women](#) website. The group also has a campus-based advocacy team located at 559 Steger Student Life Center.

Crisis Services

For students needing immediate support, telephone consultations and afterhours support are available. Someone is available to answer the main line 24/7; call 513-556-0648 and select option 1. You can also find a number additional on-campus and off-campus support numbers through the [CAPS Emergent Services](#).

Title IX

Title IX is a federal civil rights law that prohibits discrimination on the basis of your actual or perceived sex, gender, gender identity, gender expression, or sexual orientation. Title IX also covers sexual violence, dating or domestic violence, and stalking. If you disclose a Title IX issue to any faculty member, we are required to forward that information to the Title IX Office. They will follow up with you about how the University can take steps to address the impact on you and the community and make you aware of your rights and resources. The Title IX office priority is to make sure you are safe and successful at UC. You are not required to talk with the Title IX Office. If you would like to make a report of sex or gender-based discrimination, harassment or violence, or if you would like to know more about your rights and resources on campus, you can consult their [website](#) or contact the office at 556-3349. If you wish to speak with someone who is not required to report to the Title IX office, you can visit the [Women Helping Women](#) office located at 559 Steger Student Life Center (513-431-1563).

Bearcats Pantry

The UC Bearcats Pantry provides free food, hygiene items, cleaning supplies, and professional clothing to students of all backgrounds with food and other insecurities. You can access these resources through their [website](#) or visiting the Pantry at Stratford Heights Building 16, Room 007.

Course Calendar

[UC Faculty Senate recommends that all syllabi contain learning objectives, a tentative schedule of class meetings with an indication of topics, assignment and due dates, and examination dates. Learning objectives for each module of a course can be easily incorporated into the course calendar to indicate the skills and knowledge that students should acquire by the end of the module. If you would like information on [writing course learning outcomes and student learning objectives](#), you can consult the resources on the CET&L website or [request a consultation](#) with CET&L staff.]

| Week | Module | Student Learning Objectives | In-class activities | Outside-of-class responsibilities |
|-------------|---------------|------------------------------------|----------------------------|--|
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I reserve the right to update this syllabus as class needs arise. Be assured that I will communicate to you any changes to our schedule, syllabus or policies quickly and efficiently through **(method of contact here)**.