BIOE 302: Modeling Human Physiology

Meeting time: MWF, 10:00 – 10:50 AM
Location: 2100 Sidney Lu Mechanical Engineering Building (LuMEB)

Credit hours: 3
Semester: Fall 2024
Prerequisites: BIOE 205 and BIOE 206 (or MCB 252)

COURSE INFORMATION

Instructor Information

Name and email	Megan Griebel, Ph.D., mgriebel@illinois.edu
Office location	EL 3250
Office hours	See Canvas Office Hours Page (and by appointment)

Teaching Assistant Information

Name and email	Kamile Aleksaite, kamilea2@illinois.edu
Office hours	See Canvas Office Hours Page

Course Graders Information

Name and email	Leah Ju, lju4@illinois.edu
Name and email	Varshini Murugesh, vm23@illinois.edu

Course Description

The course is divided into modules by physiological system: nervous system, cardiovascular system, respiration, skeletal muscle, renal filtration, the endocrine system, and cross-system integration through examination of aging. Students learn basic terminology, anatomy, and physiology at the cell, tissue, and organ levels of several human systems. Students apply mathematical models to examine regulation and homeostasis of these systems. Students use dynamic mathematical modeling concepts, such as differential equations and linear systems, to provide quantitative descriptions of biological systems. Additionally, students investigate and explore the limitations of the models.

Learning Objectives

At the end of the course, the student should:

- Understand basic terminology, anatomy, and physiology of several major human organ systems.
- Be able to model dynamic physiological relationships between components of these systems.
- Understand the limitations of the models used in the course.
- Describe methods of measurement and monitoring of physiological systems.
- Be able to work in teams create, test, validate, and present a numerical model of a physiological system.

COURSE RESOURCES

Course Website

The Canvas site (https://canvas.illinois.edu/) will be used for all course announcements and materials. Gradescope (integrated with Canvas; or https://gradescope.com/) will be used to turn in assignments.

Communication

Email communication is preferred between students and the instructor/TA for anything of a personal nature. The **Canvas discussion board is preferred for questions relating to course content** and will be monitored by the instructor and TA. We will do our best to respond to emails and discussion posts within one business day. Please allow two business days before sending a follow-up email. Any course-related communication between students and Course Graders should occur within Gradescope.

Textbook and MATLAB

Required Text: Feher. Quantitative Human Physiology, 2nd Edition. Academic Press, 2017. E-link to book (on campus or VPN): https://www.sciencedirect.com/book/9780128008836/quantitative-human-physiology

Supplementary Text: Hoppensteadt and Peskin. Modeling and Simulation in Medicine and the Life Sciences. Springer-Verlag, 2004.

MATLAB and Simulink are now free for UIUC students (as of Aug 26, 2024). We will use these resources heavily in BIOE 302. Please download MATLAB and Simulink here: https://www.mathworks.com/academia/tah-portal/university-of-illinois-urbana-champaign-31483508.html. If you do not have a personal laptop or computer with which to use this software, please familiarize yourself with on campus engineering workstations (EWS): https://engrit.illinois.edu/ews. Late work penalties will not be waived due to technology malfunctions.

COURSE POLICIES

Academic Integrity

Students are expected to uphold the highest ethical standards, be honest, and practice academic integrity. This includes doing original work and citing sources used, including any type of artificial intelligence (AI). Group discussions with classmates (only those currently enrolled in the course) about course content, homework, and MATLAB assignments are encouraged. However, all work submitted by you must be your own original work.

Working on course material with students who are not currently enrolled in the course is prohibited. Also, using course materials from previous semesters is prohibited. This is cheating as defined in the student code and is a violation of academic integrity.

Academic dishonesty may result in a failing grade on individual assignments or in the course. Every student is expected to review and abide by the Academic Integrity Policy: https://studentcode.illinois.edu/article1/part4/1-401/. **Ignorance is not an excuse for any academic dishonesty**. It is your responsibility to read this policy to avoid any misunderstanding. ***Do not hesitate to ask the instructor if you are ever in doubt about what constitutes plagiarism, cheating, or any other breach of academic integrity*.**

Absence Policy

There will be no excused absences for quizzes, but the lowest *three* quiz grades will be dropped. For prolonged illnesses, please contact the instructor ASAP.

Late Work Policy

Homework not submitted to Gradescope by the deadline will be accepted **up to 48 hours late**. Students will receive **two free passes to submit homework up to 48 hours late, without penalty,** which will be applied automatically to late assignments. After both passes are used, late assignments will receive a **50% penalty**. After 48 hours, homework solutions will be released, and **no late work will be accepted**. If you have extenuating circumstances that cause you to miss class for a week or more, you must contact the instructor ASAP.

Course Content

Homework	20%
Quizzes	10%
Enduvo Activities	5%
Midterms (2)	20%
Final Exam	20%
Project	15%
Participation	10%

The score distribution above may be altered at the discretion of the instructor. The standard grading scale is below and may be altered at the discretion of the instructor. Grades will be rounded to the nearest 0.1% Any changes to course grading policies will be communicated to students.

≥97.0	A+	≥87.0	B+	≥77.0	C+	≥67.0	D+
≥93.0	A	≥83.0	B	≥73.0	C	≥63.0	D
≥90.0	A-	≥80.0	B-	≥70.0	C-	≥60.0	D-

Homework: Approximately two assignments will be completed (approximately one per week) for each module of the course. The first assignment (mostly book problems) will cover knowledge of the anatomy, physiology, and key relationships of each system. The second assignment (Simulation homework) will be to complete a MATLAB Simulink program. The MATLAB assignment will include a skeleton program given to the student to structure the model. The student will be required to complete the program, generate the relevant output plots, and write a short report describing the simulation, relevant physiological relationships simulated, model outputs, assumptions, and limitations. **Students may discuss homework problems but must write up solutions independently. Not all homework problems will be graded. Students are expected to study the solution sets to ensure that they have understood all of the problems assigned.**

Readings and Quizzes: There are many short quizzes used in the course to assess understanding as we progress through the material. The lowest 3 quiz grades will be dropped. Quizzes will cover the assigned reading and prep work from the current unit of the course, **up to and including the current day's assigned prep work**. The student will consider the **readings as required material** and may be quizzed on items not covered during lecture. A significant reading load is necessary to cover the physiological concepts that will be modeled. Quizzes may also include homework topics, up to and including the homework due on the day of the quiz. Students are expected to keep up with the reading through the reading and lecture schedule on the Canvas course home page.

Virtual Reality (Enduvo) Activities: There are interactive virtual-reality learning experiences that will be assigned throughout the semester. These will have short quizzes inside the activities; more details will be provided during the course.

Exams: The course will consist of three exams. The first two exams will cover material in the first 4 modules (2 modules each) and the final exam will cover material in the final modules and comprehensive concepts from all modules. **Midterm 1 is scheduled for Tuesday, October 15, 7-8:30pm. Midterm 2 is scheduled for Tuesday, November 19, 7-8:30pm.** Per University policy, one lecture period will be canceled to make up for evening exams. Please see the course schedule on Canvas for up-to-date information and exam locations, once available. **The final exam will be 8-11am on Thursday, December 19.**

Project: The course will also include a group project. Each group will create a simulation of a physiological system of interest and will prepare a short report in the second half of the semester.

Participation: This score will be based on feedback from group partner(s), the TA, and the instructor at the end of the semester. Attendance, contribution to class discussions, contribution to group work, and other criteria may be factored into the participation score. Score breakdown will be communicated to students via Canvas Gradebook.

University Policies and Resources

Community of Care: As members of the Illinois community, we each have a responsibility to express care and concern for one another. If you come across a classmate whose behavior concerns you, whether in regards to their well-being or yours, we encourage you to refer this behavior to the Student Assistance Center (217-333-0050 or http://odos.illinois.edu/community-of-care/referral/). Based on your report, the staff in the Student Assistance Center reaches out to students to make sure they have the support they need to be healthy and safe.

Further, as a Community of Care, we want to support you in your overall wellness. We know that students sometimes face challenges that can impact academic performance (examples include mental health concerns, food insecurity, homelessness, personal emergencies). Should you find that you are managing such a challenge and that it is interfering with your coursework, you are encouraged to contact the Student Assistance Center (SAC) in the Office of the Dean of Students for support and referrals to campus and/or community resources.

Disability-Related Accommodations: To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor as soon as possible and provide the instructor with a Letter of Academic Accommodations from Disability Resources and Educational Services (DRES). To ensure that disability-related concerns are properly addressed from the beginning, students with disabilities who require assistance to participate in this class should apply for services with DRES and see the instructor as soon as possible. If you need accommodations for any sort of disability, please speak to me after class, or make an appointment to see me or see me during my office hours. DRES provides students with academic accommodations, access, and support services. To contact DRES, you may visit 1207 S. Oak St., Champaign, call 217-333-1970, e-mail disability@illinois.edu or visit the DRES website at http://www.disability.illinois.edu/. Here is the direct link to apply for services at DRES, https://www.disability.illinois.edu/applying-services.

If you are concerned you have a disability-related condition that is impacting your academic progress, there are academic screening appointments available that can help diagnosis a

previously undiagnosed disability. You may access these by visiting the DRES website and selecting “Request an Academic Screening” at the bottom of the page.

Disruptive Behavior: Behavior that persistently or grossly interferes with classroom activities is considered disruptive behavior and may be subject to disciplinary action. Such behavior inhibits other students’ ability to learn and an instructor’s ability to teach. A student responsible for disruptive behavior may be required to leave class pending discussion and resolution of the problem and may be reported to the Office for Student Conflict Resolution (https://conflictresolution.illinois.edu; conflictresolution@illinois.edu; 333-3680) for disciplinary action.

Diversity and Inclusion: We value all students regardless of background and are committed to fostering a climate of inclusion in the classroom. The diversity of participants in this course is a valuable source of ideas, problem solving strategies, and engineering creativity. If you feel that your or any other student’s contribution is not being valued for any reason, please speak with us directly or submit anonymous feedback.

Emergency Response Recommendations: Emergency response recommendations can be found at the following website: http://police.illinois.edu/emergency-preparedness/. You are encouraged to review this website and the campus building floor plans website within the first 10 days of class.

Family Educational Rights and Privacy Act (FERPA): Any student who has suppressed their directory information pursuant to Family Educational Rights and Privacy Act (FERPA) should self-identify to the instructor to ensure protection of the privacy of their attendance in this course. See https://registrar.illinois.edu/academic-records/ferpa/ for more information on FERPA.

Grainger College of Engineering Statement on Anti-Racism and Inclusivity: The Grainger College of Engineering is committed to the creation of an anti-racist, inclusive community that welcomes diversity along a number of dimensions, including, but not limited to, race, ethnicity and national origins, gender and gender identity, sexuality, disability status, class, age, or religious beliefs. The College recognizes that we are learning together in the midst of the Black Lives Matter movement, that Black, Hispanic, and Indigenous voices and contributions have largely either been excluded from, or not recognized in, science and engineering, and that both overt racism and micro- aggressions threaten the well-being of our students and our university community.

The effectiveness of this course is dependent upon each of us to create a safe and encouraging learning environment that allows for the open exchange of ideas while also ensuring equitable opportunities and respect for all of us. Everyone is expected to help establish and maintain an environment where students, staff, and faculty can contribute without fear of personal ridicule, or intolerant or offensive language. If you witness or experience racism, discrimination, micro-aggressions, or other offensive behavior, you are encouraged to bring this to the attention of the course director if you feel comfortable. You can also report these behaviors to the Bias Assessment and Response Team (BART) (https://bart.illinois.edu/). Based on your report, BART members will follow up and reach out to students to make sure they have the support they need to be healthy and safe. If the reported behavior also violates university policy, staff in the Office for Student Conflict Resolution may respond as well and will take appropriate action.

Mental Health: Significant stress, mood changes, excessive worry, substance/alcohol misuse or interferences in eating or sleep can have an impact on academic performance, social development, and emotional wellbeing. The University of Illinois offers a variety of confidential services including individual and group counseling, crisis intervention, psychiatric services, and specialized screenings which are covered through the Student Health Fee. If you or someone you know experiences any of the above mental health concerns, it is strongly encouraged to contact or visit any of the University's resources provided below. Getting help is a smart and courageous thing to do for yourself and for those who care about you.

- Counseling Center (217) 333-3704
- McKinley Health Center (217) 333-2700
- National Suicide Prevention Lifeline (800) 273-8255
- Rosecrance Crisis Line (217) 359-4141 (available 24/7, 365 days a year)

If you are in immediate danger, call 911.

Religious Observances: Illinois law requires the University to reasonably accommodate its students' religious beliefs, observances, and practices in regard to admissions, class attendance, and the scheduling of examinations and work requirements. You should examine this syllabus at the beginning of the semester for potential conflicts between course deadlines and any of your religious observances. If a conflict exists, you should notify your instructor of the conflict to request appropriate accommodations. **This should be done in the first two weeks of classes.**

Sexual Misconduct Reporting Obligation: The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to the University's Title IX Office. In turn, an individual with the Title IX Office will provide information about rights and options, including accommodations, support services, the campus disciplinary process, and law enforcement options.

A list of the designated University employees who, as counselors, confidential advisors, and medical professionals, do not have this reporting responsibility and can maintain confidentiality, can be found here: https://wecare.illinois.edu/resources/students/#confidential. Other information about resources and reporting is available here: https://wecare.illinois.edu/