Discovery-Based Laboratory III
Biological Probiotic/Drug Discovery Through Hands-on Screens III
IPHY/MCDB 1181

Lab Coordinator: Christopher Lowry, PhD.
Email: christoper.lowry@colorado.edu
Office Hours: Monday 10:00am-12:00pm
or by appointment, Ramaley C186

TA: Christine Cho
Email: christine.cho@colorado.edu
Office Hours: by appointment

Dr. Lowry's Biography

My background is in the field of Stress Physiology. I completed a Ph.D. in Zoology at Oregon State University in 1995. After graduation, I received postdoctoral training at the University of Bristol, Bristol, UK, from 1995-2002. In 2002, I was awarded the Henry Wellcome Research Career Development Award from 2002-2006. I joined the faculty of the Department of Integrative Physiology and the Center for Neuroscience in 2007, where I have taught Human Anatomy, Endocrinology, and Critical Thinking in Integrative Physiology courses. In addition to my teaching responsibilities, I have a secondary appointment in the Department of Physical Medicine and Rehabilitation (PM&R), University of Colorado Anschutz Medical Campus, I'm a member of the Centers for Neuroscience at CU Boulder and the University of Colorado Anschutz Medical Campus, I'm a Principal Investigator in the Department of Veterans Affairs Eastern Colorado Health Care System, VA Rocky Mountain Mental Illness Research, Education, & Clinical Center (MIRECC), Denver Veterans Affairs Medical Center (VAMC), and I'm director of the Behavioral Neuroendocrinology Laboratory at CU Boulder. I was recently awarded a Young Investigator award from the Brain & Behavior Research Foundation, where our work was recognized as one of the Top 10 Advancements & Breakthroughs by Foundation Grantees in 2016. Brain & Behavior Research Foundation. https://bbrfoundation.org/2016-research-highlights. I've been awarded a National Science Foundation CAREER award, and the Donald F. Klein Early Career Investigator Award from the Anxiety Disorders Association of America. I'm Co-Founder and Co-Director, with Dr. Lisa Brenner, of the Military and Veteran Microbiome Consortium for Research and Education (MVM-CoRE). My research program focuses on understanding 1) stress-related physiology and behavior with an emphasis on the role of the microbiome-gut-brain axis in stress resilience, health and disease, and 2) neural mechanisms underlying anxiety and affective disorders, and development of novel strategies for both the prevention and treatment of these disorders and their medical comorbidity, such as allergy, asthma, and inflammatory bowel disease. I have published over 125 peer-reviewed articles and I'm currently an editorial board member for *Stress: The International Journal on the Biology of Stress*. The Office of Naval Research, National Institutes of Health, Department of Veterans Affairs Office of Research and Development (VA-ORD), Colorado Clinical & Translational Sciences Institute (CCTSI) Center for Neuroscience, the Colorado Department of Public Health and Environment (CDPHE), and the Alfred P. Sloan Foundation currently fund our research.

Recommended Pre- or Co-requisite

Course Materials
Required
Optional

Canvas

Material related to the course, including the syllabus, announcements, lecture notes, case studies, in-class worksheets, recitation activities, homework, web links, and grades, is available on Canvas (http://learn.colorado.edu). Check your grades on Canvas periodically during the semester.

Course Overview
Students will work in pairs to screen novel mycobacterial strains for use as probiotics or immunoregulatory/anti-inflammatory drugs using THP-1 cells, a human monocytic cell line. Topics covered include the hygiene or "Old Friends" hypothesis, the human microbiome, approaches to screening for new probiotics or therapeutics, and statistical analysis of the data. The final few weeks of the course will focus students on researching, writing up, and presenting their results.

Course Objectives
The goal of this introductory course is for students to become familiar with a number of biology concepts and research techniques including approaches to screening for new therapeutics, statistical analyses, and presentation of data to a committee and in a research report. Students will:

- Understand the scientific method and apply it throughout this course
- Understand model system biology, the human microbiome, and immunology within the scope of reactions between Mycobacteria and the human immune system
- Develop laboratory techniques such as pipetting, dilutions, media preparation, ELISA, cell viability assays
- Participate in Mycobacteria screening, data entry and data analysis
- Validate and statistically analyze results
- Conduct a literary analysis
- Successfully prepare and present findings through scientific writings and poster presentations

Evaluation

35% Lab participation: includes performing experiments, recording data in lab notebooks and database, data analysis and interpretation
35% Weekly quizzes and pre-lab assignments (typically based on assigned readings)
15% Final written report
15% Final poster/oral presentation

Standard rounding practices will be used. Grades with a tenth decimal place equal to or above 5 will be rounded to the next whole number. There is NO CURVE at any time in this course, and no grades will be dropped.

Grading scale:
A = 93-100%, A- = 90-92.9%, B+ = 87-89.9%, B = 83-86.9%, B- = 80-82.9%, C+ = 77-79.9%, C = 73-76.9%, C- = 70-72.9%, D+ = 67-69.9%, D = 63-66.9%, D- = 60-62.9%, F = below 60%

Grades will be assigned based on the scale above. At the end of the semester if the average for the course is <75%, this average will be adjusted by adding points to every student's grades to accomplish a 75% course average. No adjustments will be made if the course average is ≥75%. Extra credit assignments will not be offered.

Grades of Incomplete will be assigned according to University guidelines and will only be granted to students who have been unable to complete the course requirements for reasons *beyond their control*. Students must complete and collect signatures on an Incomplete Form prior to submission to the Dean's Office for approval. An attempt to avoid receiving an undesirable grade does not warrant an Incomplete.

Late Assignments

Attendance Policy

Excused absences

Absences due to health issues, deaths, official university activities, or major events beyond your control (e.g., a court appearance, car accidents, etc.) *may be excused* by your Instructor or TA with appropriate documentation. Documentation to request an excusal must be submitted in advance or immediately upon return from an unplanned absence.

Requests for accommodating an excused absence in a different recitation section must be requested BEFORE the start of your recitation. When notifying your TA of your excused absence, please indicate the time of the recitation you'd like to attend.

One EXCUSED absence is allowed per semester. In order to receive full credit, you must attend a different recitation. (In a situation where you cannot attend another recitation section, your quiz score will be prorated.) After this one excused absence, 10% will be deducted from each quiz for attending a different section.

Unexcused absences

An unexcused absence (e.g., family trip/vacation, non-university sponsored activity, tardiness, truancy) will result in a zero on the quiz and recitation activity. Missing your assigned recitation and attending another section (without the prior approval of your TA) will count as an unexcused absence.

Missing more than two recitations (either excused or unexcused) will result in an F for the entire course.

Tardiness policy

You are expected to be on time each and every week. Showing up to lab late will result in a point deduction from your quiz.

Make-up Policy

Laboratory Conduct

Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. For more information, see the policies on classroom behavior and the Student Code of Conduct.

The Discovery Lab is considered a LGBTQ Safe Zone and aims to provide an inclusive, non-discriminatory environment for all.

Accommodation for Disabilities

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed.

Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the Disability Services website. Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance. If you have a temporary medical condition or injury, see Temporary Medical Conditions under the Students tab on the Disability Services website.

Religious Observances
Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, you must inform the instructor within the first two weeks of class if you have a conflict due to a religious observance. See campus policy regarding religious observances for full details.

Sexual Misconduct, Discrimination, Harassment, and/or related Retaliation
The University of Colorado Boulder (CU Boulder) is committed to fostering a positive and welcoming learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct (including sexual assault, exploitation, harassment, dating or domestic violence, and stalking), discrimination, and harassment by members of our community. Individuals who believe they have been subject to misconduct or retaliatory actions for reporting a concern should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127 or cureport@colorado.edu. Information about the OIEC, university policies, anonymous reporting, and the campus resources can be found on the OIEC website.

Please know that faculty and instructors have a responsibility to inform OIEC when made aware of incidents of sexual misconduct, discrimination, harassment and/or related retaliation, to ensure that individuals impacted receive information about options for reporting and support resources.

Honor Code
Do not cheat. All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the policy may include: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the Honor Code (honor@colorado.edu); 303-492-5550). Students who are found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code as well as academic sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found at the Honor Code Office website.

Plagiarism and Copyrights
As commonly defined, plagiarism consists of passing off as one's own, the ideas, words, or writings that belong to another. In accordance with this definition, you are committing plagiarism if you copy the work of another person and turn it in as your own, even if you have the permission of that person. Plagiarism is one of the most serious forms of academic misconduct.

University of Colorado Boulder's Commitment to Inclusive Excellence

The University of Colorado Boulder (CU Boulder) is committed to pursuing a culture of Inclusive Excellence. http://www.colorado.edu/studentsuccess/inclusive-excellence, a position that we share in this course. Inclusive Excellence (IE) has been defined by the University of Denver, a leader in this field, as

“the recognition that a community or institution's success is dependent on how well it values, engages and includes the rich diversity of students, staff, faculty, administrators, and alumni constituents. More than a short-term project or single office initiative, this comprehensive approach requires a fundamental transformation of the institution by embedding and practicing IE in every effort, aspect, and level of a college or university. The goal is to make IE a habit that is implemented and practiced consistently throughout an institution.” Additional information can be found on the Association of American Colleges & Universities (AAC&U) web site: https://www.aacu.org/making-excellence-inclusive.

Schedule MW 8-10am

Week 1 -- Introduction to the hygiene hypothesis, “Old Friends” hypothesis, and biodiversity hypothesis proposed to explain the increase in inflammatory disease in urban, Westernized societies. Practical activity: culturing THP-1 cells, training on assays for cell viability.		
Monday (date)	Assignment:	Due:
Wednesday (date)	Assignment:	Due:
Week 2 – Discussion of the human microbiome, health and disease. Rea K, Dinan TG, Cryan JF. The microbiome: A key regulator of stress and neuroinflammation. Neurobiol Stress 2016;4:23-33. Practical activity: ELISA techniques.		
Monday	Assignment:	Due:
Wednesday	Assignment:	Due:
Week 3 – Discussion of the “Old Friends” hypothesis and psychiatric disorders. Lowry et al., 2016, Current Environmental Health Reports, 3, 270-286. Practical activity: Preparation of mycobacteria and supernatants from mycobacterial cultures.		
Monday	Assignment:	Due:
Wednesday	Assignment:	Due:
Week 4 – Discussion of use of mycobacteria for prevention of allergic asthma. Zuany-Amorim C, Sawicka E, Manlius C et al. Suppression of airway eosinophilia by killed Mycobacterium vaccae-induced allergen-specific regulatory T-cells. Nat Med 2002;8:625-629. Practical activity: expose THP-1 cells to known inflammatory and anti-inflammatory agents.		
Monday	Assignment:	Due:
Wednesday	Assignment:	Due:
Week 5 – Discussion of the ecology of mycobacteria. Primm TP, Lucero CA, Falkinham JO, III. Health impacts of environmental mycobacteria. Clin Microbiol Rev 2004;17:98-106. Practical activity: Effects of mycobacteria and mycobacteria culture supernatants on LPS-induced secretion TNF from THP-1 cells.		
Monday	Assignment:	Due:
Wednesday	Assignment:	Due:
Week 6 – The Showerhead Microbiome Project. Mycobacteria are enriched in municipal water supplies. Practical activity, ELISA measurement of TNF.		
Monday (date)	Assignment:	Due:
Wednesday (date)	Assignment:	Due:

Week 7 – Good bacteria, bad bacteria: pathogenic strains of mycobacteria, *Mycobacterium tuberculosis*, *Mycobacterium lepra*e, and *Mycobacterium avium*, an opportunistic pathogen causing non-tuberculous mycobacterial (NTM) infections. Calculate average and standard deviations.		
Monday	Assignment:	Due:
Wednesday	Assignment:	Due:
Week 8 – How to craft a protocol from a scientific paper. Practical activity: replicate results.		
Monday	Assignment:	Due:
Wednesday	Assignment:	Due:
Week 9 – Research and development of strategies to validate results.		
Monday	Assignment:	Due:
Wednesday	Assignment:	Due:
Week 10 – Research and development of strategies to validate results		
Monday	Assignment:	Due:
Wednesday	Assignment:	Due:
Week 11-12 – How to search PubMed (all published literature on biomedical research) and Google Scholar for information related to specific mycobacterial strains. Practical activity: Implement strategies to validate results using complementary methods based on protocols from the literature.		
Monday	Assignment:	Due:
Wednesday	Assignment:	Due:
Week 13-14 – How to write a scientific report and prepare a poster. Practical activity: Perform literature searches on mycobacterial strains to learn about their chemistry and possible biological roles. Write up experimental results. Identify a title, prepare an abstract, conclusions and future directions.		
Monday	Assignment:	Due:
Wednesday	Assignment:	Due:
Week 15 – Student presentations and final reports due.		
Monday	Assignment:	Due:
Wednesday	Assignment:	Due: