

## BIOL 1615 Summer 2024

Section 001-004

### Fundamental Principles of Biology Lab I: Cells, Genetics, and Biochemistry

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| Instructor   | Email                        | Office   | Office hours   |
|--|------------------------------|----------|--|
| Adam Rupper, Ph.D.<br><i>Preferred Adam<br/>(he/him/his)</i> | Adam.Rupper@biology.utah.edu | CSC 132B | By appointment<br><i>I spend time in all lab sections, if you have any questions, please ask. I am also happy to meet with you by appointment.</i> |

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#### Communication Plan

All course materials, such as lecture slides, assignments, grades, etc. will be posted on the course Canvas site. Class announcements will be done via email through the Canvas server. Should you have questions or concerns please contact the lab teaching assistants (TAs) or your instructor through Canvas. TA names and section numbers can be found on Canvas under "Instructors & TAs".

All 4 sections share a common Canvas page. No matter what your section is (see below) Canvas will show BIOL1615-001.

#### BIOL 1615 Meeting Times and Locations

This course meets in person.

Sections 001- 004, please meet in the center classroom, CSC 144, for lab introduction lecture before going into the lab.

| Section | Day       | Time       | Room number |
|---------|-----------|------------|-------------|
| 001     | Tuesday   | 9:00-12:00 | CSC 146     |
| 002     | Tuesday   | 9:30-12:30 | CSC 147     |
| 003     | Tuesday   | 1:00-4:00  | CSC 146     |
| 004     | Wednesday | 1:30-4:30  | CSC 147     |

#### Course

##### Catalog Course Description

This lab course introduces the scientific method through inquiry-based experiments focusing on cells, genetics, and biochemistry. Prerequisites: C- or better in BIOL 1210 OR AP Biology score of 4+ OR IB Biology score of 5. Corequisites: C- or better in BIOL 1610. This course is 1 credit.

##### Purpose/Rationale for this Course

This is a one-semester introductory biology laboratory course aimed at Biology majors and pre-professionals and is part of a year-long "Fundamentals in Biology" sequence. This course incorporates Tiny Earth (TE) project developed by Dr. Jo Handelsman, director of the Wisconsin Institute of Discovery, that uses the undergraduate student research to address the threat of disappearing usable antibiotics while teaching some fundamental concepts in biology. This course will use student-driven experiments to analyze soil samples from Utah, isolate a diverse array of microbes from the soil,

test them for antibiotic production and characterize the inhibitory properties of the producers. Students will get to participate in an authentic research experience that will expose them to multiple fundamental biology concepts and to the process of science while participating in a crowdsourcing endeavor that could potentially lead to life-saving discoveries.

\*Although concepts are complementary, it is important to remember that BIOL 1615 is a separate class from BIOL 1610, which is why students must register for this course independently.

### Course Fee

Registration for this course requires payment of a \$50 lab fee. The fee is used to buy lab supplies and equipment for this course.

### Text and Instructional Materials

1. Tiny Earth - A Research Guide to Studentsourcing Antibiotic Discovery - available from the bookstore or online [here](#). Either edition is fine. Lab copies (that stay in the lab) are available.
2. Students will maintain an electronic lab notebook using OneNote software. Instructions for setting up notebooks will be provided on the first day of lab.
3. You will need access to a computer with internet to complete and submit online assignments. You are not required to bring a computer to lab. Computers are available at each lab bench. No personal computers are allowed in the lab.

### Learning Outcomes

Upon successful completion, students should be able to apply the process of science to identify knowledge gaps, formulate hypotheses, and test them against experimental and observational data to advance an understanding of the natural world. In addition, students will be able to:

1. develop skills to work in a biology lab and use common biology laboratory equipment and methods.
2. think like a biologist and be able to recognize broad patterns and develop critical thinking.
3. understand the scientific method i.e., observe, ask questions, design hypotheses, make predictions, design experiments, conduct experiments, collect data, record and organize data, analyze data, draw conclusions and communicate your findings
4. develop skills to present scientific findings in the form of figures, data summaries, formal scientific writing, and oral presentations.

### Course Expectations

**Before Lab:** There will be pre-lab quizzes and exercises on course material posted on Canvas. Your instructors will direct you to videos, readings, and online materials that will guide your preparation. The Tiny Earth Research Guide includes concepts and principles to help you navigate the course as well as all research protocols we use in lab. You are expected to read the guide **before** lab. Reading the guide before lab will help you prepare for each lab session by understanding critical underlying concepts and will help the lab session move smoothly. There will be pre-lab quizzes on the assigned reading posted on Canvas.

**During Lab:** Each lab session will be coordinated by a teaching assistant trained extensively by the instructor. Students will lead their own research project using guidelines provided by your instructors. Hands-on experimentation and problem solving will be an integral part of your lab work. It is expected that each student will follow the guidelines explained to you by the TA and follow the course policies listed below. Each student is expected to record lab activities in an electronic lab notebook (we will provide this for you). In addition, as the lab is

a shared research space, it is critical that we maintain a clean and organized lab spaces and follow all standard safety procedures.

Not every experiment will take the entire three-hour lab period. Additional lab time when you are not working on your experiments is meant for you to work on lab notebooks, assignments, presentations, and lab reports. This is in an effort to minimize the amount of time outside of lab required to work on these assignments. Additionally, we recommend you work on assignments during lab time in order to benefit from being able to ask your TAs and Dr. Rupper any questions you may have.

**After Lab:** After each set of experiments each student will submit a lab notebook that includes information about the experiment they just completed. This will include pictures, graphs, tables, and summaries of experiments as described by your instructor, detailed in the lab notebook rubric, and on Canvas for each lab period.

**Communication:** If you have any questions, message your TA through Canvas. When emailing the Instructor, Dr. Rupper (adam.rupper@biology.utah.edu), please include your name and section number.

### How to Succeed in This Course (Course Requirements)

As your instructor, I will do everything I can to help you achieve your goals but I can only provide opportunities to succeed. If you are having problems in class, please come talk to me, the supplemental instructor from the academic development center, or visit the Student Learning Collaborative center in person.

#### Keys to success

1. Come to class.
2. The Canvas site for the class always contains the most up to date course information and should be checked regularly for assignments, due dates, announcements, changes, etc.
3. Assignments must be turned in on time.
4. You are responsible for your education and are responsible for your own work. Not only is it your responsibility to do the work required of you for the class, but you should be constantly assessing yourself and discovering what you know and do not know. It is also your responsibility to seek help from fellow students and the instructor when you need it.

### Assessment

#### Grading Scale

|           |           |           |
|-----------|-----------|-----------|
| A 93-100% | B- 80-82% | D+ 67-69% |
| A- 90-92% | C+ 77-79% | D 63-66%  |
| B+ 87-89% | C 73-76%  | D- 60-62% |
| B 83-86%  | C- 70-72% | E 0-59%   |

Please note that these percentages use whole numbers. Regular rules of rounding will be used in this course. For instance, if your grade on Canvas is 84.63%, this rounds to 85%.

#### Types of Assignments

| Percent | Grade Component          |
|---------|--------------------------|
| 10 %    | Attendance and etiquette |
| 20 %    | Quizzes, assignments     |

## Attendance and Etiquette

Attendance in lab is required. Each unexcused absence (absence with no explanation/permission from instructor) results in missing the points for that week and the necessary information for the experiments. Please communicate with your TA if you are unable to attend class and arrange to make up missed assignments. **You will not be penalized for missing lab due to illness**, however you *must* communicate with your TAs and your instructor before lab (or as soon as possible). Some assignments can only be completed in lab and it is not possible to make them up if you miss lab. See below for information about extended absences.

Students are required to maintain a respectful and safe learning atmosphere. This includes good communication with your lab partners and TAs and treating them with respect. You are expected to come to lab prepared by having read the assigned reading in the Tiny Earth Research Guide and written out the protocol before lab, being on time, and wearing the proper PPE. Proper PPE means closed-toe shoes that cover your entire foot (i.e. not Boston-style clogs) and legs completely covered. Failure to do so will result in a loss or reduction of points for the day.

Students should follow appropriate safety protocols and general lab rules. Violations of safety policies will result in an automatic deduction of points or failing grade (severe violations) based upon the instructor's judgment.

## Pre-lab Quizzes and Assignments

There will be numerous graded and ungraded assignments completed both in class and at home to help you learn the material, assess your own understanding of the material, and reinforce information gained from lab. All assignments are designed to help your learning process and actively completing them will positively influence your understanding and in turn, your grade. Reading materials either before or after class as assigned is required and necessary to successfully complete course assignments.

## Lab Notebook

Your lab notebook is the most important record of your research, as such it is **worth 40% of your grade**. Each student is expected to record lab activities in an electronic lab notebook (we will provide this for you). It is important that you learn to record all the details of your experiments and observations. Guidelines and rubrics for lab notebooks are posted on Canvas.

All procedures conducted in lab and data collected in lab should be accessible to all members of the lab group. Preventing a group member's access, withholding data, or deleting data collected in lab is a serious offence and will result in disciplinary action and an automatic deduction of points or failing grade (severe violations) based upon the instructor's judgment.

Generally, we start experiments one week then observe and record the results and conclusions the following week. Lab notebooks are due two days after the lab where you record the results and conclusions. While everyone works in groups, each person in the lab group is responsible for submitting their own lab notebook entries for a grade.

## Mini-Lab Reports and Presentations

Effectively communicating scientific findings is an important part of research. Throughout the semester each student will present their results in the form of three mini lab reports. You will have assignments to help build your lab reports. You will also be presenting your research to the class in the form of short presentations where students can share their results with their peers. While everyone works in groups, each person in the lab group is responsible for submitting their own lab report for a grade. Please see Canvas for rubrics and instructions for these activities.

## Late Submission Policy

Without prior permission, assignments submitted late will receive a 10% deduction per day late. Assignments will not be accepted more than four days late. If you are going to be late submitting an assignment due to unforeseen circumstances, please get permission from your TA or instructor. This does not apply to pre-lab quizzes. Pre-lab quizzes are meant to be completed before lab so you have the background knowledge to understand lab for that week. Pre-lab quizzes close at 11:59 PM the night before your lab section meets.

## Absences

Timely attendance is required. You are required to keep your lab section day and time free for all your lab work. Unexcused absences and chronic tardiness will result in an automatic deduction from your final course grade. Please note that you can only attend the lab section you are registered for. Given the in-person nature of this course, attendance is required, and I cannot guarantee that adjustments will be granted to allow non-attendance. If you miss lab due to COVID-19, severe illness, or severe unexpected circumstances please notify the instructor as soon as possible and I will do my best to make necessary arrangements to help you make up missed graded assignments, but making-up missed lab exercises cannot be arranged due to space and time restrictions. Documentation of restrictions or illnesses will need to be provided to get accommodations. Please note that missing three or more lab sessions without prior accommodations with the instructor will result in an automatic failing grade as I cannot guarantee that you would have met the laboratory course learning outcomes with that many absences. We will notify you via email when you are at risk of failing due to non-attendance. If you are facing extenuating circumstances that will make you miss more than 3 labs, we suggest withdrawal from the course or discussing the incomplete grade option with the instructor.

## Resources

### University Policies and Student Resources

1. **Drop/Withdrawal** Last day to add/drop is Friday January 12. The last day to withdraw from class is Friday March 1. The last day to reverse CR/NC option is Friday April 19.
2. **The Americans with Disabilities Act** The University of Utah seeks to provide equal access to its programs, services, and activities for people with disabilities. If you will need accommodations in this class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, (801) 581-5020. CDS will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in an alternative format with prior notification to the Center for Disability Services. [Center for Disability Services](#).
  - a. Given the nature of this course, attendance is required and adjustments cannot be granted to allow non-attendance. However, if you need to seek an ADA accommodation to request an exception to this attendance policy due to a disability, please contact the [Center for Disability and Access](#) (CDA). CDA will work with us to determine what, if any, ADA accommodations are reasonable and appropriate.
3. **University Safety Statement** The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit [safeu.utah.edu](http://safeu.utah.edu)
4. **Addressing Sexual Misconduct** Title IX makes it clear that violence and harassment based on sex and gender (which includes sexual orientation and gender identity/expression) is a civil rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veteran's status or genetic information. If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to the police, contact the Department of Public Safety, 801-585-2677(COPS).
5. **Wellness** Personal concerns such as stress, anxiety, relationship difficulties, depression, cross-cultural differences, etc., can interfere with a student's ability to succeed and thrive at the University of Utah. For helpful resources contact the [Student Wellness Center](#); 801-581-7776. Code of Student's Rights and Responsibility <http://www.regulations.utah.edu/academics/6-400.html>

**6. Academic Conduct**

- a. In order to ensure that the highest standards of academic conduct are promoted and supported at the University, students must adhere to generally accepted standards of academic honesty. Acts of academic misconduct include cheating, plagiarizing, research misconduct, misrepresenting one's work, and inappropriately collaborating. Suspected cases of academic misconduct will be dealt with according to the procedures found in the Student Code, University Policy 6-400(V) <http://regulations.utah.edu/academics/6-400.php>. Instances of academic misconduct will be recorded in a database that may be made available to other University of Utah Departments and Colleges.

**7. Accommodation Policy** (see Section Q): <http://regulations.utah.edu/academics/6-100.php>

- 8. Learners of English as and additional/second language** If you are an English language learner, please be aware of several resources on campus that will support you with your language and writing development. These resources include: the Writing Center (<http://writingcenter.utah.edu/>); the Writing Program (<http://writing--program.utah.edu/>); the English Language Institute (<http://continue.utah.edu/eli/>). Please let me know if there is any additional support you would like to discuss for this class.

**9. [Veterans Center](#)****10. [LGBT Resource Center](#)**

ADDITIONAL STUDENT RESOURCES ARE POSTED ON CANVAS

## Summer 2024 Schedule

This course is an authentic research experience and as such, you may not move through the topics exactly as depicted below. You are NOT behind if you have to repeat an experiment, it is the nature of research. Lecture material presented in class may not always line up exactly with the experimental step you are on. This schedule is tentative and may change at any time. Below is an idealized schedule of lab activities.

LNB = Lab notebook

| Day | Date    | Lab Activity  | Assignments   | Tiny Earth Reading Assignment     |
|-----|---------|---|---|-----------------------------------|
| 1   | May 14  | <b>Tiny Earth introduction</b> , lab safety, learn to use pipettes and how to do serial dilutions, pick up soil collection kit  | Safety, syllabus, and intro quiz<br>Serial dilution activity, Lab partner agreement     | pg. 4-20                          |
| 2   | May 16  | <b>Part 1: Isolate Bacteria from Soil</b><br>Characterize soil sample, soil dilutions   | Pre-lab quiz<br>Soil information sheet  | pg. 24-27,<br>179-181,<br>169-171 |
| 3   | May 21  | Quantify microbes and pick diverse colonies to make library plates (redo for those who need to)   | Pre-lab quiz<br>LNB-serial dilutions  | pg. 32-38,<br>159-160             |
| 4   | May 23  | <b>Part 2: Screen for Antibiotic Production</b><br>Meet the ESKAPE pathogens and their relatives<br>Initial screen against ESKAPE pathogens for antibiotic production | Pre-lab quiz<br>ESKAPE presentation<br>LNB-Pick & patch<br>In-class figure presentation | pg. 56-75<br>pg. 162-164          |
| 5   | May 28  | Isolate antibiotic producing bacteria using streak plate technique  | Pre-lab quiz<br>Mini-lab report 1<br>LNB-Initial screen                                 | pg. 48-52,<br>185-189,<br>139-141 |
| 6   | May 30  | Screen against 8 ESKAPE relatives   | Pre-lab quiz<br>LNB-Streak plate  |                                   |
| 7   | June 4  | <b>Part 3: Characterize Antibiotic Producing Isolate</b><br>Colony PCR - 16S  | Pre-lab quiz<br>LNB-Screen all ESKAPE relatives   | pg. 80-85,<br>155                 |
| 8   | June 6  | Agarose gel electrophoresis; prep of samples for 16S sequencing<br>Learn to use a microscope  | Pre-lab quiz<br>In-class figure presentation<br>LNB-PCR and agarose gel electrophoresis | pg. 123-124,                      |
| 9   | June 11 | Gram stain  | Mini-lab report 2<br>Pre-lab quiz   | pg. 84-85,<br>150-152             |
| 10  | June 13 | Test growth of isolates on different media<br>Catalase assay  | Pre-lab quiz<br>media<br>LNB-Gram stain   | pg. 153-154                       |
| 11  | June 18 | All Results   | LNB-Growth on different   |                                   |
| 12  | June 20 | 16S sequence analysis<br>Last lab of the semester   | Pre-lab quiz<br>Sequence analysis and comparison assignment<br>LNB-Catalase assay       | pg. 106-109, 129-130              |

The syllabus and schedule are meant to serve as outline and guide for this course. Please note that I may modify it with reasonable notice to you. I may also modify the course schedule to accommodate the needs of our class. Any changes will be posted on the course website.