IB 151 Organismal and Evolutionary Biology Laboratory credit: 1 hour

Welcome to Integrative Biology151

It is our pleasure to welcome you to IB 151. We hope you find this course both rewarding and enjoyable. If you have any questions or problems, do not hesitate to contact any of us.

This is an introductory lab course covering fundamental lab techniques in basic genetics, ecology, physiology and biodiversity, with a particular focus on human health and disease transmission. You will learn the use of basic statistics for hypothesis testing, population genetics and estimating ecological diversity; basic molecular biology lab techniques and the application of simulation programs for examining models of disease transmission. Credit is not given for majors in IB or MCB.

Student Learning Outcomes: Major Goals for the Course

1. Learn to formulate a scientific hypothesis and to test it with quantifiable predictions
2. Learn how to design an experiment to test an idea or hypothesis with predictions
3. Learn what kind of data constitutes strong/weak evidence in support of a hypothesis
4. Learn how to apply basic statistical analysis to determine the strength of the data you have collected to test a hypothesis, and to generate figures and tables that summarize your experimental findings.

Important Prerequisite: IB150 is a pre- or co-requisite for IB151, although these are two independent courses.

Lab Times: Lab meets once a week for 3 hours; students can register for one of multiple offered sections during the week; lab times are 9am-11:50pm, 12pm-2:50pm or 3pm-5:50pm, depending on the section.

Course Webpage

All lab exercise readings and assignments are available each week on the Moodle course webpage: https://learn.illinois.edu

Login with your University NetID and password. You may bookmark this page after accessing it.

Course Coordinator

Sydney Cameron is currently the course/lab coordinator for IB 151 and is in charge of the labs. Dr. Cameron supervises the teaching assistants, prep staff, and oversees the labs.
Contact information for Dr. Cameron: sacamero@illinois.edu; office: 215 Morrill Hall.

Laboratory Teaching Assistants: Your lab TA is your primary contact person for IB 151. She/he will introduce you to the lab material each week, guide you through the lab exercises, administer pre-lab activities (quizzes), exams and assignments, and grade your work.

Prep Staff: The prep staff are undergraduates just like you. They set up the lab each week before each lab session and sometimes pass out material during the lab. Please be respectful of them and their important role in making IB151 go smoothly for you. NOTE: THIS SEMESTER, THE PREP STAFF ARE NEW SO WE HAVE TO BE FLEXIBLE IN CASE THERE IS AN OCCASIONAL DELAY. Additional information about lab responsibilities and procedures will be presented during the first lab period and at the beginning of other lab periods as required.

Textbook: There is no textbook required for IB 151. You will be given weekly exercises from the set of the IB 151 Lab Exercises, which you will have access to via Moodle. It might help if you have a general biology textbook on hand to consult for added background information on a given subject.

Late Registration

Adding the course after the first day of classes does NOT excuse you from assignments you have missed. If you add the course late, contact your TA and the lab coordinator within 24 hours of adding the course to arrange make-up assignments. Students that add late will have due dates extended one week following their add date to allow the opportunity to complete missed assignments. Assignments not completed within this time frame will earn a zero.

Required Course Materials

The following materials are required for IB 151:

1. A laptop with Wi-Fi connectivity
    - **Note**: If you do not own a laptop please let your TA know during the first week of class.
2. A three-ring binder and a 3-hole punch.

    You must print out the lab exercise pages from Moodle each week. Assignment instructions/worksheets are included in these pages.
3. A non-programmable calculator (**NO PHONES**).
4. An introductory biology textbook to reference when necessary; no need to buy a new one.

Tentative Laboratory Schedule – Fall 2021

Week of	Laboratory Exercise
Aug 23	Lab 1: Introduction to IB151; Scientific Hypothesis Testing
Aug 30	Lab 2: Respiratory and Cardiovascular Systems
Sept 6	LABOR DAY - NO LAB FOR THE WEEK
Sept 13	Lab 3: Genetics and Inheritance- Blood Typing
Sept 20	Lab 4: Genetics of PTC Tasting Part I
Sept 27	Lab 5: Genetics of PTC Tasting Part II
Oct 4	Lab 6: Enzymes as Biological Catalysts
Oct 11	Lab 7: Lab Exam I
Oct 18	Lab 8: Pathogens and Human Health
Oct 25	Lab 9: Exploring Measurements of Species Richness and Diversity
Nov 1	Lab 10: Abiotic Factors in Pathogen Transmission

Nov 8	Lab 11: Pharmacology and Infectious Diseases
Nov 15	Lab 12: Lab Exam II
Nov 22	FALL (THANKSGIVING) BREAK
Nov 29	Lab 13: Pandemic Project with Presentations

All labs require careful reading of the lab exercise for each week of lab. The exercise is provided on Moodle. Each lab will begin with a pre-lab activity in the form of a brief quiz based on the information presented in the lab exercise. A lab assignment based on in-class exercises with members of your lab group will also be due at the end each lab period.

Synopsis of each lab:

Lab 1: Introduction to IB 151 and hypothesis testing
Goals and Learning Objectives
After this lab, you should be able to:

1. Learn to formulate a useful hypothesis and distinguish from testing with predictions.
2. Learn about components of experimental design.
3. Gain an understanding of data analyses in science.
4. Perform statistical analyses and generate figures and tables by hand.

No equipment or organisms used; you will be presented with raw data to review hypothesis design, graphical display of data and statistics used to test support for a hypothesis.

Lab 2: Respiratory and Cardiovascular Systems
Goals and Learning Objectives
After this lab, you should be able to:

1. Apply concepts from Lab 1 including hypothesis construction, experimental design, data analyses and communication of results.
2. Understand the main functions of the human cardiovascular and respiratory systems.
3. Learn the major anatomical components of human cardiovascular and respiratory systems.
4. Learn how to quantify human cardiovascular and respiratory system function.
5. Conduct experiments to uncover the relationship between the human cardiovascular and respiratory systems.

Equipment Lab 2: spirometer (tidal volume of air displaced between inhalation and exhalation); blood pressure cuff (measures blood pressure and pulse rate)

Lab 3: Genetics and Inheritance of Blood Type
Goals and Learning Objectives
After this lab, you should be able to:

1. Review the vocabulary of genetics.
2. Determine your ABO and Rh blood type.
3. Model inheritance in a population.
4. Investigate sickle cell in a population.

5. Demonstrate how allele, genotype and phenotype frequencies can be calculated.

Equipment Lab 3: Blood typing kit supplies; blood spill/clean-up kits

Lab 4: Genetics of Taste (using Phenylthiocarbamide -PTC)
Goals and Learning Objectives
After this lab, you should be able to:

1. Use some new vocabulary of population and molecular genetics (allele and genotype frequencies, Hardy-Weinberg estimate of change in allele frequency).
2. Demonstrate how evolution is defined as changes in the frequency of alleles in a population.
3. Perform a chi square statistical test.
4. Use essential molecular biology techniques to collect genetic data from a human population (your lab class).
5. Explain the steps required to extract DNA from cells.
6. Describe the basis and steps of the Polymerase Chain Reaction (PCR).

Equipment Lab 4: tools for extracting DNA from cheek cells and PCR amplification of DNA; you will use DNA extraction reagents (Chelex stock solution), pipettors, PCR reagents (Taq polymerase, dNTPs [free bases], primers [forward and reverse], $MgCl_2$, buffer, and water), and a thermocycler.

Lab 5: Genetics of PTC Tasting – Part II
Goals and Learning Objectives
After this lab, you should be able to:

1. Use molecular biology lab techniques to collect genetic data from a human population (your lab class).
2. Explain the role of restriction enzymes in analyzing and manipulating DNA.
3. Explain the use of gel electrophoresis in analyzing DNA.
4. Obtain your PTC genotype and compare it with your PTC tasting phenotype.
5. Determine whether a population is evolving by calculating allele frequency changes.
6. Perform chi square statistical test.

Equipment Lab 5: gel rigs for electrophoresis of DNA fragments, restriction enzymes, DNA ladder, PTC paper for detecting taste of PTC.

Lab 6: Enzymes as Biological Catalysts
Goals and Learning Objectives
After this lab, you should be able to:

1. Explain the importance of enzymes in sustaining life.
2. Design, conduct, and interpret the results of an experiment using the enzyme amylase.
3. Explain how enzymes function at specific rates and these rates are sensitive to environmental conditions.
4. Use a spectrophotometer to measure the concentration of a dissolved solute, and thus the progress of an enzyme catalyzed reaction.

Equipment Lab 6: tubes of 1% starch, iodine and 0.1NHCl, pH 7 buffer; hot water baths, test tube racks, ice buckets

Lab 7: Exam I (given during the lab period; based on material learned in labs 1-6)

Lab 8: Pathogens and Human Health
Goals and Learning Objectives
After this lab, you should be able to:

1. Describe the various means by which pathogens are transmitted.
2. Quantify the composition of a community.
3. Model pathogen transmission within a human population.
4. Design and conduct an experiment to quantify microbial biodiversity.

Equipment Lab 8: phenolphthalein as an indicator dye, 10% bleach solution, cotton swabs, plastic cups for high exposure tests, 1% KOH and LB (Luria broth) agar plates to culture bacteria, selected fomites

Lab 9: Exploring Measures of Species Richness and Diversity
Goals and Learning Objectives
After this lab, you should be able to:

1. Investigate the composition of a biological community.
2. Calculate species richness and diversity.
3. Analyze data from an experiment on community diversity and disturbance.

Equipment Lab 9: bottle to collect water sample from Boneyard Creek on campus, microscopes for identifying organisms and to estimate species richness and diversity, wildflower gallery selected from disturbed and undisturbed local forests for comparing species richness and diversity

Lab 10: Abiotic Factors in Pathogen Transmission
Goals and Learning Objectives
After this lab, you should be able to:

1. Run simulation software Netlogo
2. Predict how abiotic factors can affect pathogen transmission.
3. Conduct and explain the results of an experiment investigating the effect of climate on the transmission of a mosquito-borne pathogen.

Equipment Lab 10: Modelling software, **Netlogo,** provides a useful simulation that models the interactions between a virus and its vectors, reservoirs, and hosts under “normal” environmental condition and under different scenarios of climate change.

Lab 11: Pharmacology and Infectious Diseases
Goals and Learning Objectives:
After this lab, you should be able to:

1. Explain the concept of herd immunity.

2. Describe the biological targets of antibiotics.
3. Model how populations of bacteria are affected by antibiotics.
4. Describe appropriate uses of antibiotics.

Equipment Lab 11: online dice for analysis of proper or improper antibiotic use (https://www.random.org/dice/); use of online simulator software, FRED (Framework for Reconstructing Epidemiological Dynamics), to simulate a measles epidemic under different vaccination rates (below and at herd immunity levels).

Lab 12: Exam II (given during the lab period; based on material given in labs 8-11)

Lab 13: Pandemic Project
Goals and Learning Objectives
By the end of this lab, you should be able to:

1. Use the scientific method to determine the pathogen responsible for a contagious disease.
2. Identify reliable resources and use them to synthesize information to propose a treatment plan for an illness.
3. Use a basic and powerful bioinformatics tool available over the internet.
4. Compile and present findings from a scientific investigation to your peers and teaching assistant.

Equipment Lab 13: Profiles of patient symptoms (a different one provided for each student group), BLAST sequence against reference in NCBI, PowerPoint software to make slides for student presentation

Rules of the Laboratory

1. Food and drink are *not allowed* in any of the laboratories.
2. You must wear *closed-toed shoes* or you will be asked to leave.
3. The faculty and staff of IB 151 are not responsible for any student's belongings during labs; bring only necessary items to class.
    - Student belongings must be stored so all walk areas are clear.
4. Clean up at the end of each lab period. Wash your hands with soap before leaving the laboratory.
    - The lab should be as clean as or even cleaner than when you entered.
    - Failure to clean up at the end of the lab will result in a 10% penalty for the lab assignment.
5. Notify your TA if you are pregnant, color blind, allergic to any insects or chemicals, taking immunosuppressive drugs, or have a medical condition that may require special measures or attention in the laboratory.
6. In case of fire, leave the lab complex and exit the building via the North stairwell.
7. In case of tornado, leave the lab complex and assemble in the basement along the West wall.

8. All students are assumed to have read and understood the CODE of POLICIES and REGULATIONS APPLYING to ALL STUDENTS, University of Illinois and will be expected to act accordingly. (studentcode.illinois.edu)
9. Dr. Cameron and the TAs are in charge of the orderly conduct of the labs and may exclude any student who does not comply with a reasonable request in this regard.
10. Do not perform any unauthorized experiments. Do not use equipment without permission.

Attendance and Punctuality

1. **Attendance may be recorded at the beginning of every lab session. You must be present for the entire lab period to be considered eligible to turn in the lab assignment.**
2. **Students must attend their scheduled lab sections every week unless they have been assigned to a make-up lab section by the lab coordinator.** Teaching assistants cannot reschedule students to any other lab sections including their own. *Only students who can provide an acceptable (see below) and documentable reason for absence will be eligible for a make-up lab.* Make-up labs are limited by the availability of space in other sections and are only available the same lab week, so they are not guaranteed to be available even if you have an excused absence.
3. **Students who miss their lab section must present written and dated documentation of a personal or medical emergency or a confining illness in a timely fashion.** Written documentation must specify the nature of the problem and document that it prevented the student from attending lab at the time in question. Students who visit McKinley Health Center or private physicians must provide verification of confining illness for the date in question. Letters for absences lasting more than three consecutive days should request a letter through the Office of the Dean of Students (Turner Student Services Building, 610 E. John, (333-0050). The lab coordinator will make final determinations regarding if the absence is excusable or not. ***Documentation must be received by the lab coordinator within 1 week of the absence unless you are working with the Office of the Dean of Students.***
4. We understand that some IB151 students need to attend professional interviews during the semester. Such interviews are expected to be scheduled so as not to conflict with IB 151 labs. However, if this is not possible, a student may make ***one*** request during the semester to attend another lab section due to an interview. In order to obtain permission to do so, the student must notify the IB 151 Course Coordinator ***at least 1 week in advance*** of the make-up lab that they are requesting to attend. The request must include documentation showing, 1) the interview day and time and 2) that they made every effort possible to schedule the interview outside of lab time. Remember, space is limited in every section. The student must attend the make-up lab in its entirety and all assignments must be turned in during the make-up lab. **If all of the requirements listed in this section are not met, then the absence will be considered unexcused and no credit can be earned for the lab.**
5. **Travel, weddings, jobs, other courses, etc., must be planned around the laboratory as make-ups will NOT be offered for these reasons.**

6. **Students who need to miss lab for any other reason (religious observances, University of Illinois student athletic meets, etc.) should contact the lab coordinator at the start of the semester.** Permission to attend a make-up lab is at the discretion of the lab coordinator and TA. ***Students must request accommodation for religious observance from the student assistance center within the first two weeks of the semester. For other anticipated absences, documentation must be received by the lab coordinator at least 1 week prior to the absence, unless you are working with the Office of the Dean of Students.***
7. **Regularly scheduled classes take precedence over other exams according to University guidelines.** *If you have an exam that is scheduled during your regularly scheduled IB151 lab, then the class in conflict is obligated to offer you another exam time.* We will not let you attend another lab section to make up the missed lab.

Make-up assignments/grading when absent
All assignments due during the time period in question must be completed *before* the student's absence. You cannot earn credit for a lab you did not attend or for which you have an unexcused absence. If you have an excused absence, we will try to arrange a make-up lab or make-up assignment. A prorate will be given for an assignment associated with an excused absence if a make-up lab/assignment cannot be arranged. A prorate is the weighted average score of all similar assignments. If you miss an excessive number of labs, additional exercises may be assigned. Exam grades will **NOT** be pro-rated. Make-up exams will be in a different format than exams given during lab time and must be taken within 72 hours of the missed lab absence.

Grading and the Course Gradebook
IB 151 is a lab-only course. Your course point total will be determined by four main types of assignments: pre-lab quizzes, lab exercise assignments, exams, and a final project presentation.

Pre-lab quiz activities (5% of course grade). A short quiz activity will be completed in the first 15 minutes of most lab classes. These will require you to synthesize and apply information from the lab exercise readings. You will not have access to the lab exercise pages during the quiz so be sure to read the lab exercise carefully before class. If you are late to class, you will have less time to complete the quiz as these are also used to encourage arriving to lab on time.

In-lab assignments (40% of course grade). Depending on the lab exercise, you will be asked to turn in an assignment at the end of lab. The point value of each assignment will typically range from 10-25 points. Your TA will clarify what needs to be completed for each lab. All lab assignments must be handed in at the end of the lab period unless otherwise noted. Any assignment not turned in on time will automatically have 25% deducted with an additional 25% deducted for each additional 24 hours that it is late.

Midterm Exams (50% of course grade). There will be two exams this semester. Lab sections will have different versions of the exam but of equivalent difficulty. Averages will be calculated for

the entire course (all sections) to ensure fairness. *Communicating to fellow students about the content of exams is considered cheating and will be detrimental to you and your grade in IB151*.

Final Project Presentation (5% of course grade). A final project, conducted during the last lab of the semester, will include a final presentation to be completed in groups of 3-4 students. You will receive more details about this project during the second half of the semester.

Plus and minus final course letter grades will be assigned at the end of the semester. Your course grade will be assigned according to the following scale:

A+ = 99.91-100.00%,	B+ = 86.91-89.90%,	C+ = 76.91-79.90%,	D+ = 66.91%-69.90%,
A = 92.91-99.90%,	B = 81.91-86.90%,	C = 71.91-76.90%,	D = 61.91-66.90%,
A- = 89.91-92.90%,	B- = 79.91-81.90%,	C- = 69.91-71.90%,	D- = 59.91-61.90%
			F ≤ 59.90%

Requesting a Regrade

If you believe that an error has been made in the grading of any assignment in IB 151, you may request that your TA regrade it. Such a request **must be made in writing** and can be made *no more than one week after the assignment was returned to you*. Except for arithmetical errors in point totals, a regrade involves the regrading of the *entire* assignment. The grade earned on the regrade will be the final grade for the assignment even if it is lower than the original grade.

Statement on Academic Integrity

Science, as well as every other area of academic endeavor, cannot usefully proceed without honesty on the part of all parties involved. The faculty and staff of IB 151 expect the students in the course to behave as if they were scientific researchers and to adhere to the highest standards of academic conduct. **Academic dishonesty will not be tolerated.** Academic dishonesty will be dealt with in accordance with course policy and with the University-wide standards in the Code of Policies and Regulations Applying to All Students. All allegations will be submitted to the university FAIR system and sanctions will be proportional to the severity of the violation.

All students are responsible for reading the University of Illinois Student Code. Pay particular attention to http://admin.illinois.edu/policy/code/article1_part4_1-402.html concerning cheating and plagiarism .

Cheating. Cheating is the use of external information (written material, the tests of your fellow students, etc.) to complete an assignment in which such sources had been explicitly prohibited. Students taking quizzes or exams in IB 151 are prohibited from consulting specific IB151 quiz and exam questions *prior* to taking the quiz or exam, any written information *while* they are taking the quiz or exam, and they may not communicate with their fellow students about the quiz or exam. You must formulate answers to questions without any outside assistance of any kind. Allowing other students to copy your work is considered cheating by you. We examine quizzes/exams closely to detect evidence of cheating. Students often like to look around the room while thinking about the answers to questions. But it is best to avoid any behavior that could be construed as looking at the paper of another student.

Any form of cheating on quizzes will result in an automatic score of zero on the quiz and a note in the student file. Any form of cheating on exams I and II will result in an automatic score of zero for the exam and a note in your student file.

Plagiarism. Plagiarism is the presentation of others' work as your own. Science builds upon information that was gathered and published in the past. It is important to cite sources of information both to avoid appearing to take credit for work done by others and to allow the reader to check your statements. Students may (and are encouraged to) discuss the content of the lab assignments with their classmates or others. However the assignment that each student hands in must be written *in his or her own words*. If an experiment is performed by a group, then each student must report the results in her or his own words (unless a group report is specifically requested) and group member names must be listed on each student's assignment.

Citation. On assignments, you must cite information that you obtain from published sources. The information content must always be rewritten *in your own words*. Put the author and date in parentheses after describing previously published work, and provide a complete citation using APA formatting at the end of your write-up in a list headed "Literature Cited". Failure to cite published work is a form of plagiarism and will result in a zero for the assignment and a note in the student file. *Avoid direct quotation of published work (especially lengthy quotations of one or more sentences) unless the exact wording of the quote is important (it very rarely is in science).* Direct quotations are almost never used or necessary in scientific writing, unlike in the humanities.

Disability Accommodations
To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES you may visit 1207 S. Oak St., Champaign, call 333-4603 (V/TTY), or e-mail a message to disability@illinois.edu

Covid19 lab safety instructions guidelines
[copied from: https://covid19.illinois.edu/on-campus/on-campus-instructors/]

Following University policy, all students are required to engage in appropriate behavior to protect the health and safety of the community. Students are also required to follow the campus COVID-19 protocols.

Students who feel ill must not come to class. In addition, students who test positive for COVID-19 or have had an exposure that requires testing and/or quarantine must not attend class. The University will provide information to the instructor, in a manner that complies with privacy laws, about students in these latter categories. These students are judged to have excused absences for the class period and should contact the instructor via email about making up the work.

Students who fail to abide by these rules will first be asked to comply; if they refuse, they will be required to leave the classroom immediately. If a student is asked to leave the classroom, the non-compliant student will be judged to have an unexcused absence and reported to the Office for Student Conflict Resolution for disciplinary action. Accumulation of non-compliance complaints against a student may result in dismissal from the University.

Face coverings [during COVID-19]
All students, faculty, staff, and visitors are required to wear face coverings in classrooms and university spaces. This is in accordance with CDC guidance and University policy and expected in this class.

Please refer to the University of Illinois Urbana-Champaign's COVID-19 website for further information on face coverings. Thank you for respecting all of our well-being so we can learn and interact together productively.

Building access [during COVID-19]
In order to implement COVID-19-related guidelines and policies affecting university operations, instructional faculty members may ask students in the classroom to show their Building Access Status in the Safer Illinois app or the Boarding Pass. Staff members may ask students in university offices to show their Building Access Status in the Safer Illinois app or the Boarding Pass. If the Building Access Status says "Granted," that means the individual is compliant with the university's COVID-19 policies—either with a university-approved COVID-19 vaccine or with the on-campus COVID-19 testing program for unvaccinated students.

Students are required to show only the Building Access Screen, which shows compliance without specifying whether it was through COVID-19 vaccination or regular on-campus testing. To protect personal health information, this screen does not say if a person is vaccinated or not. Students are not required to show anyone the screen that displays their vaccination status. No university official, including faculty members, may ask students why they are not vaccinated or any other questions seeking personal health information.

Advice for Your Success in IB151
Laboratory exercises in college science courses can often be challenging for new students, especially for those without a strong science background. In a lab course, you are expected to work more independently than you do in a lecture course and to use equipment and materials with which you may not be familiar. The exercises are meant to be *intellectually* challenging. They present you with problems that you will have to think about. Time in the lab is also limited. You will have exactly three hours every week during which to perform the exercises and complete your assignments. So, **come prepared for lab**. ***You should expect to be in lab the full three hours each week.***

- **Show up for lab every week and *show up on time*.** This sounds obvious and it is. There is no harm in emphasizing the obvious. Laboratory exercises are hands-on experiences. Unlike in lecture courses, it isn't possible to make up for missing a lab by doing some extra studying. Important announcements are usually made at the beginning of a lab period. If you miss part or all of a lab, you will have to spend valuable time later trying to make up as much as possible of what you missed. If you attend every lab and show up on time, you make life a lot easier for yourself. The easiest points to get in the course are the activities. Attendance and punctuality are vital to doing well in this part of the course.
- **Be prepared.** Many students waste a lot of time in lab trying to figure out what they are supposed to do.
    - ***READ YOUR LAB EXERCISE AHEAD OF TIME***. *Make notes for questions.*
    - Email your TA or your lab partners with questions about things you don't understand.
    - Know what you are going to be doing ***before*** you get to lab and your experience will be much more enjoyable and rewarding.
- **Ask questions.** Your instructor can help you the most efficiently if s/he knows what you need to know. If you're not certain about something, try to find the answer in the lab exercise pages. If that doesn't work, do not hesitate to ask your TA. *It's their job*.
- **Familiarize yourself with the basic information in the course syllabus and the weekly lab exercises.** Know what is going to happen when and plan ahead. If a lab exam is during a week in which you have mid-terms in three other courses, get started studying earlier.
- **Manage your time effectively.** Set up a schedule and stick to it. If you need to change your schedule for some reason (maybe you want to go to a movie at a time when you normally study), then 'borrow' time from another activity to avoid falling behind.