

The University of Chicago - Summer Course

BIOS 10002-97: Biology and its Modern Applications

Monday, Tuesday, Wednesday, Thursday, and Friday Lecture: 9:00-11:30am; BSLC 240

Laboratory: 1:00-3:00pm; BSLC 206

Instructor: Robert Bednarczyk, Ph.D.

Assistant Instructional Professor

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Office: BSLC 338

Office Hours: Tuesday and Thursday 4:00-5:00pm

Teaching Assistant:

Ally Chen

Course Description

This course aims at developing the basic concepts that form the crux of life from both structural and functional perspectives. It will cover cellular functioning and organization and the transformation of energy. In addition, concepts of evolution and natural selection will be investigated. The course also introduces the student to the continuity of life from genetic and molecular perspectives. The course will extrapolate to demonstrate how cells communicate through cell signaling and how defects in such communication often lead to diseases. The course will conclude by discussing current applications of biology in fields such as medicine, drug discovery, nanotechnology, forensics, and bioengineering. The goals of this course will be realized through various course activities including group labs, group projects and presentations, and team-based learning. Both synchronous and asynchronous modes of interaction and communication will be used in this course.

This course would be particularly appealing to students who would like to learn more about principles of biology and the multiple innovative careers that the study of biology can prepare them for.

Course Objectives

By the end of the quarter, students should be able to:

1. Gain a comprehensive understanding of what is defined as life and all characteristics of life.
2. Learn the important macromolecules of life and be able to define their respective functions.
3. Compare prokaryotes and eukaryotes to understand the similarities and differences between these two groups.
4. Study various cellular processes including cell division and cell signaling as well as understand what the outcomes are when these processes go awry.
5. Understand the principles of energy and metabolism providing examples in both cellular respiration and photosynthesis.
6. Understand the principles of genetics with a focus on DNA replication, gene expression, and gene regulation.
7. Understand how genes are passed down from organisms, how genetic diversity arises via mutations, and the importance of evolution in nature.

8. Learn about how diverse organism interactions are important for the proper functioning and stability of ecosystems and learn what happens when this synchrony is disrupted.
9. Discover different recent applications of biology in disciplines such as Law, Engineering, IT and Medicine.
10. Use PubMed and Google Scholar to locate scientific literature articles on diverse topics in biology.
11. Make progress on reading scientific primary literature articles pertaining to different topics in the field of biology.
12. Create a short presentation that includes data from an article from the primary literature.

Learning Environment

Class sessions will involve lectures and laboratories based on the designated topics as well as discussion of conducted experiments and assigned readings. Therefore, your attendance and active participation will be very important for each class session.

Students will be asked to complete assigned readings in addition to short assignments outside of class. Those materials will be posted and found within Canvas.

Recommended Textbooks

There is no required textbook for the course; however, any basic biology book does suffice for the topics that will be covered. Below is a list of books that will be referenced in the course lecture and/or laboratory material.

- *Campbell Biology*, 9th Edition, Reece et al., ISBN: 0321558235
- *Biology*, 11th Edition, Raven et al., ISBN: 1259188132
- *Prescott's Microbiology*, 11th Edition, Willey et al., ISBN: 9781260408973
- *Nester's Microbiology: A Human Perspective*, 10th Edition, Anderson et al., ISBN: 1260735508

Reading Materials

Additional reading materials including articles, journals, website links, and slides will be posted on Canvas.

Graded Components

- Attendance 5%
 - Students are expected to attend each class session since lab activities will require individual and group effort.
- Lecture Assignments 25%
 - Lectures and/or readings will have assigned questions to be completed by specific due dates.
- Laboratory Notebook 20%
 - Each student will fill out and submit a laboratory notebook at the end of the course. The laboratory notebook will include for each lab session: date of experiment, experiment title, introduction, experimental protocol, and conclusions.
- Laboratory Assignment Activities 25%
 - Groups will work on lab activity questions that will be submitted via Gradescope.
- Group Presentation 25%
 - A final poster presentation based on the group choosing a topic of interest in any biology topic. The presentation will include: introduction/background, data/results, conclusions, and references.

Grading Scale

The following is a breakdown of the grading scale that will be used in this course for assignments, assessments, and final grade:

>93	A	83-86.99	B	73-76.99	C	63-66.99	D
90-92.99	A-	80-82.99	B-	70-72.99	C-	60-62.99	D-
87-89.99	B+	77-79.99	C+	67-69.99	D+	<60	F

Respect for Diversity and Inclusion

The University of Chicago is committed to promoting a learning environment of respect, civility, and inclusion, which emphasizes the importance of recognizing and valuing diversity. The President and Provost message can be found with the following link: [President & Provost Message | UChicago Diversity Initiative | The University of Chicago](#). Additionally, a message from the University of Chicago Biological Sciences Collegiate Division (BSCD) can be found with the following link: [Statement On Diversity & Inclusion | BSD Diversity \(uchicago.edu\)](#).

As a person and educator, I believe in and promote this message of diversity and inclusion in order to establish and maintain the best learning environment for the class. At any point, please share with me anything that may make you uncomfortable/concerns within the class. Moreover, if you have a name and/or set of pronouns that differ from the official records, please let me know.

Student Disability Accommodations

I completely support the commitment by the University of Chicago to ensuring equitable access to all of its programs and services. Students with disabilities who have been approved for the use of academic accommodations by the Student Disability Services (SDS) and need a reasonable accommodation(s) to participate in this course should follow the procedures established by the SDS for using accommodations. Please make sure to complete in a timely manner the SDS procedures for requesting accommodations. If you have any questions about these procedures or academic accommodations, you are advised to contact SDS as soon as possible. The SDS contact information is the following: website-[The University of Chicago Student Disability Services \(uchicago.edu\)](#); phone-(773) 702-6000; email-disabilities@uchicago.edu.

Academic Honesty Policy

Students are expected to maintain academic honesty and integrity to the highest standards within this course as well as any other courses taken at the University of Chicago. Any written work and presentation materials must be in your own words and cited with the appropriate reference when using outside sources. Cases of academic dishonesty will result in a loss of credit and a report will be submitted to the Master of Biological Sciences Collegiate Division and the Dean of Students Office, which disciplinary results may occur. A statement from the University of Chicago on academic honesty can be found with the following link: [Academic Honesty & Plagiarism | Student Manual | The University of Chicago \(uchicago.edu\)](#).

Summer Quarter Schedule

The schedule is subject to change during the quarter

Week	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1:			Lecture: Biosafety Training Lab: Lab Safety Basics Micropipetting	Lecture: What is Life? Macromolecules Cell Structure and Function Lab: Microscopy Plating Bacteria	Lecture: Cell Signaling Examine Poster Presentations Lab: Examine Poster Presentations Scientific Method Introduce Literature Search
Week 2:	Lecture: Cell Division Cancer Lab: Evaluation of Plates Broth Inoculation Gram Staining	Lecture: Energy and Metabolism Lab: Evaluation of Broths Polymerase Chain Reaction (PCR) Setup Literature Search Cont.	Lecture: DNA Replication Smart Museum Event Lab: Guest Speaker	Lecture: Transcription and Translation Lab: Gel Electrophoresis of PCR Reactions Sequencing Analysis via BLAST	Lecture: Gene Expression Regulation Lab: ELISA
Week 3: 7/21-7/25	Lecture: Mendelian Genetics of Inheritance	Lecture: Mutations and Evolution	Lecture: Ecology	Lecture: Biotechnology and Other Real-World Applications of Biology	Presentation Day

	Lab: CRISPR Day 1	Lab: CRISPR Day 2	Lab: CRISPR Day 3	Lab: Presentation Work Day	
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REPRESENTATIVE SYLLABUS