

BIOL298 : Undergraduate Research in Microbiology and Molecular Biology

General Information

Author:	<ul style="list-style-type: none">• Karoline Rostamiani• Thai, Shelley
Course Code (CB01) :	BIOL298
Course Title (CB02) :	Undergraduate Research in Microbiology and Molecular Biology
Department:	BIOL
Proposal Start:	Spring 2025
TOP Code (CB03) :	(0430.00) Biotechnology and Biomedical Technology*
CIP Code:	(15.0401) Biomedical Technology/Technician.
SAM Code (CB09) :	Clearly Occupational
Distance Education Approved:	Yes
Will this course be taught asynchronously?:	No
Course Control Number (CB00) :	CCC000557468
Curriculum Committee Approval Date:	02/28/2024
Board of Trustees Approval Date:	04/16/2024
Last Cyclical Review Date:	11/01/2019
Course Description and Course Note:	BIOL 298 is intended to give undergraduate students hands-on experience in microbiology and molecular biology research while working collaboratively in a laboratory setting with a faculty-led team of students on various projects. It allows the student to practice and apply various scientific techniques and methods (e.g. wet lab skills) and concepts learned in biology (e.g. molecular biology, microbiology, genomics, and bioinformatics). Applications of current Good Manufacturing Process (cGMP), Good Laboratory Practice (GLP), and Standard Operating Procedures (SOP's) in relation to these techniques will also be taught to prepare students for careers in biotechnology and research. Students are expected to apply knowledge from prerequisite courses, to use their problem-solving skills in carrying out assigned projects, and to write up and present the results of their research on-campus.
Justification:	Coding/Category Change
Academic Career:	<ul style="list-style-type: none">• Credit
Author:	<ul style="list-style-type: none">• Karoline Rostamiani• Thai, Shelley

Academic Senate Discipline

Primary Discipline:	<ul style="list-style-type: none">• Biological Sciences
Alternate Discipline:	No value
Alternate Discipline:	No value

Course Development

Basic Skill Status (CB08)

Course is not a basic skills course.

Allow Students to Gain Credit by Exam/Challenge

Course Special Class Status (CB13)

Course is not a special class.

Pre-Collegiate Level (CB21)

Not applicable.

Grading Basis

- Grade with Pass / No-Pass Option

Course Support Course Status (CB26)

Course is not a support course

Transferability & Gen. Ed. Options

General Education Status (CB25)

Not Applicable

Transferability

Transferable to CSU only

Transferability Status

Approved

Units and Hours

Summary

Minimum Credit Units (CB07) 4

Maximum Credit Units (CB06) 4

Total Course In-Class (Contact) Hours 162

Total Course Out-of-Class Hours 54

Total Student Learning Hours 216

Credit / Non-Credit Options

Course Type (CB04)

Credit - Degree Applicable

Noncredit Course Category (CB22)

Credit Course.

Noncredit Special Characteristics

No Value

Course Classification Code (CB11)

Credit Course.

Variable Credit Course

Funding Agency Category (CB23)

Not Applicable.

Cooperative Work Experience

Education Status (CB10)

Weekly Student Hours

	In Class	Out of Class
Lecture Hours	1.5	3
Laboratory Hours	7.5	0
Studio Hours	0	0

Course Student Hours

Course Duration (Weeks)	18
Hours per unit divisor	54
Course In-Class (Contact) Hours	
Lecture	27
Laboratory	135
Studio	0

Total 162

Course Out-of-Class Hours

Lecture	54
Laboratory	0
Studio	0
Total	54

Time Commitment Notes for Students

No value

Units and Hours - Weekly Specialty Hours

Activity Name	Type	In Class	Out of Class
No Value	No Value	No Value	No Value

Pre-requisites, Co-requisites, Anti-requisites and Advisories

Prerequisite

BIOL101 - General Biology I

Objectives

- Identify the properties of lipids, carbohydrates, proteins, and nucleic acids.
- Describe the structure of prokaryotic and eukaryotic cells.
- Describe the processes of DNA replication, transcription, and translation.
- Explain the basic mechanisms of gene regulation in prokaryotes and eukaryotes.
- Demonstrate proper use of laboratory equipment including the microscope, spectrophotometer, and micropipettes.
- Demonstrate proficiency with data collection, analysis, and graphical representation.

OR

Prerequisite

BIOL112 - Microbiology

Objectives

- Demonstrate a general understanding of the taxonomy and major characteristics of the various microorganisms.
- Demonstrate general knowledge of the physical and chemical structure of prokaryotes and eukaryotes.
- Demonstrate an understanding of the biochemical processes of the cell, including cell respiration, DNA replication, genetic recombination, transcription, translation, and cellular transport.
- Demonstrate an understanding of the physical and chemical methods and mechanisms used to control microbial growth.
- Demonstrate an understanding of the disease process of various microorganisms.
- Demonstrate proper aseptic techniques and proficiency in performing various staining procedures and biochemical tests on microorganisms.

AND

Advisory

ESL151 - Reading And Composition V

Objectives

- Read and critically analyze various academic readings.
- Summarize readings.
- Compose a 500 to 550-word essay which: summarizes and cites appropriately a reading passage; includes a clear thesis statement; uses evidence to support the thesis; shows clear organization into an introduction, body, and conclusion.

- Revise writing to eliminate errors in syntax, and grammatical constructions.
- Employ basic library research techniques.
- Compose one research paper (1,000 words) or two short research papers (500-700 words each) with citations.

OR

Advisory

ENGL101 - Introduction to College Reading and Composition

Objectives

- Read, analyze, and evaluate a variety of primarily non-fiction readings for content, context, and rhetorical merit with consideration of tone, audience, and purpose.
- Apply a variety of rhetorical strategies in writing unified, well-organized essays directed by a well-reasoned thesis statement with persuasive support.
- Develop varied and flexible strategies for generating, drafting, and revising essays.
- Analyze stylistic choices in their own writing and the writing of others.
- Write timed, in-class essays exhibiting acceptable college-level control of mechanics, organization, development, and coherence.
- Integrate the ideas of others through paraphrasing, summarizing, and quoting without plagiarism.
- Find, evaluate, analyze, and interpret primary and secondary sources, incorporating them into written essays using appropriate documentation format.
- Proofread and edit essays for presentation so they exhibit no disruptive errors in English grammar, usage, or punctuation.

Entry Standards

Entry Standards

Critically read materials from a variety of perspectives in order to identify arguments and develop analytical response based on textual evidence.

Write and revise thesis-driven essays that demonstrate critical thinking skills through a variety of rhetorical and analytical strategies appropriate to the academic context, including appropriate use of sources, evidence, tone, style, and semantics.

Prepare and revise writing projects that select, evaluate, synthesize, and apply source material gathered through academic research methods, employing quotation, paraphrase, summary, and analysis as effective means of support and development of the writer's ideas, cited and formatted according to academic conventions.

Course Objectives

Cross Listed or Equivalent Course

Specifications

Methods of Instruction

Methods of Instruction Lecture

Methods of Instruction Laboratory

Methods of Instruction Discussion

Methods of Instruction Multimedia

Methods of Instruction Collaborative Learning

Methods of Instruction Demonstrations

Methods of Instruction Field Activities (Trips)

Methods of Instruction Presentations

Methods of Instruction Guest Speakers

Out of Class Assignments

- Data analysis (e.g. analysis of experimental results)
- Individual project (e.g. creation of a gene annotation notebook)
- Written critique (e.g. of relevant scientific articles)
- Group project (e.g. writing a peer-reviewed scientific article)

Methods of Evaluation

Rationale

Exam/Quiz/Test

Quizzes

Evaluation

Instructor analysis of student work

Presentation (group or individual)

Presentations

Activity (answering journal prompt, group activity)

Laboratory practices record keeping in lab notebook

Activity (answering journal prompt, group activity)

Gene annotation notebook

Activity (answering journal prompt, group activity) Effective participation in team assignments
Report Group paper and formal presentation of results

Textbook Rationale

No Value

Textbooks

Author	Title	Publisher	Date	ISBN
Sadava, David E., et al	Life: The Science of Biology	W.H. Freeman	2017	978-1319010164
Lodish, Harvey	Molecular Cell Biology	WH Freeman	2016	978-1464183393

Other Instructional Materials (i.e. OER, handouts)

Description Assigned peer-reviewed scientific research articles
Author No value
Citation No value
Online Resource(s)

Materials Fee

A material/lab fee may be required for this course.

Learning Outcomes and Objectives

Course Objectives

Demonstrate aseptic laboratory techniques and safe laboratory practices.

Communicate effectively in a collaborative work environment.

Apply chemical formulas to make appropriate media

Troubleshoot problems when carrying out experiments.

Keep meticulous daily records of lab activities, experimental procedures, outcomes of experiments, and creative thoughts in a lab notebook.

Demonstrate competence in use and application of various equipment and techniques used in molecular biology and microbiology.

Read and analyze peer-reviewed articles in the field of study.

Present results of project to student peers and professors.

Write a peer-reviewed article using proper citation format and documentation style.

Demonstrate work-readiness skills.

SLOs

Demonstrate proficiency in use of various molecular and microbiology techniques to complete the assigned project.

Expected Outcome Performance: 70.0

<i>BIOL</i> Core PLOs	Demonstrate correct use of basic biology laboratory equipment, and critically examine and interpret biological data.
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<i>ILOs</i> Core ILOs	Demonstrate depth of knowledge in a course, discipline, or vocation by applying practical knowledge, skills, abilities, theories, or methodologies to solve unique problems.
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<i>ILOs</i> General	analyze, interpret, and present research evidence
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Education	apply reasoning to evaluate hypotheses and theories
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	examine causality or associations between or among variables of the natural world
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Exhibit industry standards of current Good Manufacturing Practice (GMP), and Standard Operating Practice (SOP) while carrying out the laboratory procedures and experiments.

Expected Outcome Performance: 70.0

Additional SLO Information

Does this proposal include revisions that might improve student attainment of course learning outcomes?

Yes

Is this proposal submitted in response to learning outcomes assessment data?

No

If yes was selected in either of the above questions for learning outcomes, explain and attach evidence of discussions about learning outcomes.

As Bio 298 is now an optional course requirement for the Biotechnology Certificate and AS degree program, this proposal will better prepare students for careers in industry.

SLO Evidence

No Value

Course Content

Lecture Content

Aseptic Laboratory Techniques and Safe Laboratory Practices (3 hours)

- Proper handling of bacterial cultures
- Proper preparation of bacterial growth media

Bacterial Genetics and Gene Regulation (4 hours)

- Structural and regulatory genes in an operon
- Gene regulation in bacteria
- Transposon mutagenesis
- Bacterial genomics

Basic Wet Laboratory Skills and Recombinant DNA Technology (6.5 hours)

- Proper use of pipettor
- Preparation of various bacterial growth media and stock solutions
- Preparation of antibiotics (e.g. kanamycin)
- DNA gel electrophoresis
- Extraction of plasmids using miniprep kits
- Methods for streaking bacteria
- Bacterial mating and mutagenesis
- Selection of and screening for mutants
- Genomic DNA isolation
- Restriction digestion
- DNA ligation
- Bacterial transformation via electroporation

Bioinformatics (3.5 hours)

- DNA sequencing and sequence analysis
- Basic local alignment search tool (BLAST) Gene annotation

Analysis of Peer-Reviewed Scientific Research Articles (3 hours)

- Analyze and critique relevant peer-reviewed articles
- Class presentation of analysis

Final Presentation and Documentation (3.5 hours)

- Analyze results of experiments
- Troubleshoot obstacles faced during execution of experiments
- Produce collaborative research paper detailing scope and result of project
- Collaborative oral presentation of project

Industry Practices (3.5 hours)

- Good Laboratory Practice (GLP)
- Current Good Manufacturing Practice (cGMP)
- Standard Operating Procedures (SOP's)
- Use of lab notebooks or other laboratory documentation methods (e.g. e-notebook, Benchling)
- Regulatory policies
- Quality Control
- Validation

Total hours: 27

Laboratory/Studio Content**Aseptic Laboratory Techniques and Safe Laboratory Practices (10 hours)**

- Proper handling of bacterial cultures
- Proper preparation of bacterial growth media

Bacterial Genetics and Gene Regulation (8 hours)

- Structural and regulatory genes in an operon
- Gene regulation in bacteria
- Transposon mutagenesis
- Bacterial genomics

Basic Wet Laboratory Skills and Recombinant DNA Technology (60 hours)

- Proper use of pipettor
- Preparation of various bacterial growth media and stock solutions
- Preparation of antibiotics (e.g. kanamycin)
- DNA gel electrophoresis
- Extraction of plasmids using miniprep kits
- Methods for streaking bacteria
- Bacterial mating and mutagenesis
- Selection of and screening for mutants
- Genomic DNA isolation
- Restriction digestion
- DNA ligation
- Bacterial transformation via electroporation

Bioinformatics (15 hours)

- DNA sequencing and sequence analysis
- Basic local alignment search tool (BLAST) Gene annotation

Analysis of Peer-Reviewed Scientific Research Articles (13 hours)

- Analyze and critique relevant peer-reviewed articles
- Class presentation of analysis

Final Presentation and Documentation (17 hours)

- Analyze results of experiments
- Troubleshoot obstacles faced during execution of experiments
- Produce collaborative research paper detailing scope and result of project
- Collaborative oral presentation of project

Industry Practices (12 hours)

- Good Laboratory Practice (GLP)
- Current Good Manufacturing Practice (cGMP)
- Standard Operating Procedures (SOP's)
- Use of lab notebooks or other laboratory documentation methods (e.g. e-notebook, Benchling)
- Regulatory policies
- Quality Control
- Validation
- ng execution of experiments
- Produce collaborative research paper detailing scope and result of project
- Collaborative oral presentation of project

Total hours: 135

Additional Information

Is this course proposed for GCC Major or General Education Graduation requirement? If yes, indicate which requirement in the two areas provided below.

No

GCC Major Requirements

No Value

GCC General Education Graduation Requirements

No Value

Repeatability

Not Repeatable

Justification (if repeatable was chosen above)

No Value

Resources

Did you contact your departmental library liaison?

No

If yes, who is your departmental library liason?

No Value

Did you contact the DEIA liaison?

No

Were there any DEIA changes made to this outline?

No

If yes, in what areas were these changes made:

No Value

Will any additional resources be needed for this course? (Click all that apply)

- No

If additional resources are needed, add a brief description and cost in the box provided.

No Value