



**COURSE OUTLINE : BIOL 298**

**D Credit – Degree Applicable**

**COURSE ID 010211**

**NOVEMBER 2019**

**COURSE DISCIPLINE :** BIOL  
**COURSE NUMBER :** 298  
**COURSE TITLE (FULL) :** Undergraduate Research in Microbiology and Molecular Biology  
**COURSE TITLE (SHORT) :** Undergraduate Research in Biol

**CATALOG DESCRIPTION**

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). 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.

Total Lecture Units: 1.00

Total Laboratory Units: 2.00

**Total Course Units: 3.00**

Total Lecture Hours: 18.00

Total Laboratory Hours: 108.00

Total Laboratory Hours To Be Arranged: 0.00

**Total Contact Hours: 126.00**

**Total Out-of-Class Hours: 36.00**

Prerequisite: BIOL 101 or BIOL 112 or equivalent.

Recommended Preparation: ENGL 100 or ENGL 120, OR ESL 151.



**ENTRY STANDARDS**

	<b>Subject</b>	<b>Number</b>	<b>Title</b>	<b>Description</b>	<b>Include</b>
1	BIOL	101	General Biology	Identify the properties of lipids, carbohydrates, proteins, and nucleic acids;	Yes
2	BIOL	101	General Biology	describe the structure of prokaryotic and eukaryotic cells;	Yes
3	BIOL	101	General Biology	explain cell respiration and photosynthesis;	No
4	BIOL	101	General Biology	describe the relationships between meiosis and Mendelian genetics;	No
5	BIOL	101	General Biology	describe the processes of DNA replication, transcription, and translation;	Yes
6	BIOL	101	General Biology	explain the basic mechanisms of gene regulation in prokaryotes and eukaryotes.	Yes
7	BIOL	101	General Biology	demonstrate proper use of laboratory equipment including the microscope, spectrophotometer, and micropipettes;	Yes
8	BIOL	101	General Biology	demonstrate proficiency with data collection, analysis, and graphical representation;	Yes
9	BIOL	112	Microbiology	demonstrate a general understanding of the taxonomy and major characteristics of the various microorganisms;	Yes
10	BIOL	112	Microbiology	demonstrate general knowledge of the physical and chemical structure of prokaryotes and eukaryotes;	Yes
11	BIOL	112	Microbiology	demonstrate an understanding of the biochemical processes of the cell, including cell respiration, DNA replication, genetic recombination, transcription, translation, and cellular transport;	Yes
12	BIOL	112	Microbiology	demonstrate an understanding of the physical and chemical methods and mechanisms used to control microbial growth;	Yes



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13	BIOL	112	Microbiology	demonstrate an understanding of the disease process of various microorganisms;	No
14	BIOL	112	Microbiology	demonstrate proper aseptic techniques and proficiency in performing various staining procedures and biochemical tests on microorganisms;	Yes
15	ENGL	100	Writing Workshop	Read, analyze, and evaluate contemporary articles and stories to identify topic, thesis, support, transitions, conclusion, audience, and tone;	No
16	ENGL	100	Writing Workshop	read, analyze, and evaluate contemporary articles and stories for the comprehension of difficult content and the identification of main ideas and (topic-based) evidence;	Yes
17	ENGL	100	Writing Workshop	read, analyze, and evaluate student compositions for unity, development, use of evidence, interpretation, coherence, and variety of sentence form;	No
18	ENGL	100	Writing Workshop	write a summary of a contemporary article or story with correct citation techniques;	Yes
19	ENGL	100	Writing Workshop	write an argumentative essay that has an introduction, body paragraphs, and a conclusion, demonstrating a basic understanding of essay organization;	No
20	ENGL	100	Writing Workshop	write an argumentative essay that addresses the topic, is directed by a thesis statement, uses appropriate textual evidence, develops logical interpretations, and concludes with some compelling observations;	No
21	ENGL	100	Writing Workshop	write an argumentative essay that integrates the ideas of others (i.e., authors) through paraphrasing, summarizing, and quoting with correct citation techniques;	No
22	ENGL	100	Writing Workshop	write an argumentative essay that generates novel ideas (those that add to the conversation rather than repeating the author's ideas) related to the topic and the readings;	No
23	ENGL	100	Writing Workshop	write compositions (e.g., summaries and argumentative essays) that are easy to read and follow, though some errors in grammar, mechanics, spelling, or diction may exist;	Yes
24	ENGL	100	Writing Workshop	proofread and edit essays for content, language, citation, and formatting problems;	Yes
25	ENGL	120	Composition and Reading	compose thesis-based essays at a first-year college level;	No
26	ENGL	120	Composition and Reading	use detailed examples, facts, logical explanations, and other appropriate support for thesis statements;	Yes



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27	ENGL	120	Composition and Reading	critically analyze selected prose works dealing with important contemporary issues;	No
28	ENGL	120	Composition and Reading	summarize, analyze, and synthesize information, express and apply standards for judgment, compare and contrast, and evaluate evidence in order to form and state reasoned opinions;	Yes
29	ENGL	120	Composition and Reading	gather and organize information through library research;	Yes
30	ENGL	120	Composition and Reading	demonstrate a command of grammar, diction, syntax, and mechanics sufficient for college level work: control of standard English at the sentence level, with few major errors in grammar and punctuation.	Yes
31	ESL	151	Reading And Composition V	read and critically analyze various academic readings;	Yes
32	ESL	151	Reading And Composition V	summarize readings;	Yes
33	ESL	151	Reading And Composition V	organize fully-developed essays in both expository and argumentative modes;	No
34	ESL	151	Reading And Composition V	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;	Yes
35	ESL	151	Reading And Composition V	revise writing to eliminate errors in syntax, and grammatical constructions;	Yes
36	ESL	151	Reading And Composition V	employ basic library research techniques;	Yes
37	ESL	151	Reading And Composition V	compose one research paper (1,000 words) or two short research papers (500-700words each) with citations.	Yes



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**EXIT STANDARDS**

- 1 Demonstrate aseptic laboratory techniques and safe laboratory practices;
- 2 communicate effectively in a collaborative work environment;
- 3 apply chemical formulas to make appropriate media;
- 4 troubleshoot problems when carrying out experiments;
- 5 keep meticulous daily records of lab activities, experimental procedures, outcomes of experiments, and creative thoughts in a lab notebook;
- 6 demonstrate competence in use and application of various equipment and techniques used in molecular biology and microbiology;
- 7 read and analyze peer-reviewed articles in the field of study;
- 8 present results of project to student peers and professors;
- 9 write a peer-reviewed article using proper citation format and documentation style.

**STUDENT LEARNING OUTCOMES**

- 1 demonstrate proficiency in use of various molecular and microbiology techniques to complete the assigned project

**COURSE CONTENT WITH INSTRUCTIONAL HOURS**

	Description	Lecture	Lab	Total Hours
1	Aseptic Laboratory Techniques and Safe Laboratory Practices <ul style="list-style-type: none"> <li>• Proper handling of bacterial cultures</li> <li>• Proper preparation of bacterial growth media</li> </ul>	2	2	4
2	Bacterial Genetics and Gene Regulation <ul style="list-style-type: none"> <li>• Structural and regulatory genes in an operon</li> <li>• Gene regulation in bacteria</li> <li>• Transposon mutagenesis</li> <li>• Bacterial genomics</li> </ul>	4	4	8



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3	<p>Basic Wet Laboratory Skills and Recombinant DNA Technology</p> <ul style="list-style-type: none"> <li>• Proper use of pipettor</li> <li>• Preparation of various bacterial growth media and stock solutions</li> <li>• Preparation of antibiotics (e.g. kanamycin)</li> <li>• DNA gel electrophoresis</li> <li>• Extraction of plasmids using miniprep kits</li> <li>• Methods for streaking bacteria</li> <li>• Bacterial mating and mutagenesis</li> <li>• Selection of and screening for mutants</li> <li>• Genomic DNA isolation</li> <li>• Restriction digestion</li> <li>• DNA ligation</li> <li>• Bacterial transformation via electroporation</li> </ul>	6	60	66
4	<p>Bioinformatics</p> <ul style="list-style-type: none"> <li>• DNA sequencing and sequence analysis</li> <li>• Basic local alignment search tool (BLAST)</li> <li>• Gene annotation</li> </ul>	2	15	17
5	<p>Analysis of Peer-Reviewed Scientific Research Articles</p> <ul style="list-style-type: none"> <li>• Analyze and critique relevant peer-reviewed articles</li> <li>• Class presentation of analysis</li> </ul>	2	8	10
6	<p>Final Presentation and Documentation</p> <ul style="list-style-type: none"> <li>• Analyze results of experiments</li> <li>• Troubleshoot obstacles faced during execution of experiments</li> <li>• Produce collaborative research paper detailing scope and result of project</li> <li>• Collaborative oral presentation of project</li> </ul>	2	19	21



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**126**

### **OUT OF CLASS ASSIGNMENTS**

- 1 data analysis (e.g. analysis of experimental results);
- 2 individual project (e.g. creation of a gene annotation notebook);
- 3 written critique (e.g. of relevant scientific articles);
- 4 group project (e.g. writing a peer-reviewed scientific article).

### **METHODS OF EVALUATION**

- 1 quizzes;
- 2 instructor analysis of student work;
- 3 presentations;
- 4 laboratory practices record keeping in lab notebook;
- 5 gene annotation notebook;
- 6 effective participation in team assignments;
- 7 group paper and formal presentation of results.

### **METHODS OF INSTRUCTION**

- Lecture
- Laboratory
- Studio
- Discussion
- Multimedia
- Tutorial
- Independent Study
- Collaboratory Learning
- Demonstration
- Field Activities (Trips)
- Guest Speakers
- Presentations



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**TEXTBOOKS**

<b>Title</b>	<b>Type</b>	<b>Publisher</b>	<b>Edition</b>	<b>Medium</b>	<b>Author</b>	<b>ISBN</b>	<b>Date</b>
Life: The Science of Biology	Supplemental	W.H. Freeman	11	print	Sadava, David E., et al	978-1319010164	2017
Assigned peer-reviewed scientific research articles							
Molecular Cell Biology	Supplemental	WH Freeman	8	Print	Lodish, Harvey	978-1464183393	2016