

Assessment Report for the 2024-2025 Academic Year Biology Major

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Mission Statement:

The core mission of the University of San Francisco is to educate students in the knowledge and skills required to succeed as professionals and as persons, while also teaching the sensitivity and values necessary to participate in a world shared by all people. The Department of Biology particularly emphasizes the core Jesuit value of advancing the freedom and responsibility to pursue truth and to follow evidence to its conclusion. In pursuit of these values, the faculty of the Department of Biology educates the undergraduate students in current biological concepts, methodologies, and ethical practices in the laboratory and natural environment to prepare them to succeed personally and professionally with the potential for advanced training in the sciences.

(No changes since last report)

Program Learning Outcomes (PLOs):

The Biology Major prepares students to:

1. Analyze scientific questions using both in-depth and broad knowledge of concepts that comprise the biological sciences.
2. Implement the scientific process by designing and conducting experiments, testing hypotheses, analyzing and evaluating results, and communicating conclusions.
3. Use laboratory, field, and analytical techniques to address complex questions in the life sciences.
4. Evaluate, synthesize, and communicate information from the scientific literature.
5. Apply principles of social awareness and responsibility to scientific investigations in the life sciences.

(No changes since last report)

Curriculum Map:

See attached.

(No changes since last report)

Schedule for Assessment of PLOs:

- 2023-2024: Program review reflection/planning
- 2024-2025: PLO #4; Development of longitudinal survey
- 2025-2026: PLO #1
- 2026-2027: PLO #2
- 2027-2028: PLO #5
- 2028-2029: Assessment reflection

Methods for 2024-2025 Assessment:

Assessment of PLO #4:

To assess PLO #4: Evaluate, synthesize, and communicate information from the scientific literature, we collected grant proposals prepared by students in BIOL 333/334-Endocrinology/Lab and BIOL 346/347-General Microbiology/Lab during the 2024-2025 academic year. Ten proposals were randomly selected from each class, and student names were removed from the proposals to ensure that the rating of proposals was masked. Two evaluators (Louise Goupil, Scott Nunes) rated the proposals for Endocrinology, and two evaluators (Leslie King, Scott Nunes) rated the proposals for General Microbiology. The evaluators were not involved in teaching the courses from which the proposals were collected. Proposals were rated on three criteria: 1) Provides rationale and background for the proposed investigation based on assessment of primary literature related to the topic, 2) Explains relevance of outcomes/expected results of proposed investigation based on assessment of primary literature related to the topic, and 3) Presents information and ideas in a clear, well-organized, and logical manner. We developed a rubric for assessing these criteria (see attached). Each sample of student work was rated by two evaluators using the rubric, and ratings for each sample were averaged between the evaluators.

Development of longitudinal survey:

As part of our assessment of the overall Biology curriculum, we utilized the [GenBioMAPS assessment survey](#) administered by the [Cornell Physics Education Lab](#). The survey assesses student understanding of the five core concepts of biology identified in the [Vision & Change Report](#) from the American Association for the Advancement of Science (AAAS). The five core concepts are:

1. Evolution - The diversity of life evolved over time by processes of mutation, selection, and genetic change.
2. Structure and Function - Basic units of structure define the function of all living things.
3. Information Flow, Exchange, and Storage - The growth and behavior of organisms are activated through the expression of genetic information in context.
4. Transformations of Energy and Matter - Biological systems grow and change by processes based upon chemical transformation pathways and are governed by the laws of thermodynamics.
5. Systems - Living systems are interconnected and interacting.

The BioMAPS survey asks students a series of true/false questions about a given biological scenario to investigate student understanding of multiple concepts related to that scenario.

Each student is presented with a randomized set of 15 scenarios, each with 4-5 connected true/false statements. After the survey is complete, each student's overall score on the survey is reported along with their scores on questions relating to each of the five core concepts.

We deployed the survey in four courses over AY 2024-2025 to capture student responses at three time points. For entering first-year students, we gave the survey to students enrolled in BIOL 105L (General Biology: Cells and Molecules Lab) and BIOL 106L (General Biology: Diversity of Life Lab) during the first week of labs in Fall 2024 only. For second-year students, we gave the survey to students in BIOL 311 (Genetics Lab) near the end of the semester in both Fall 2024 and Spring 2025. For fourth-year students, we gave the survey to students in BIOL 414 (Evolution) near the end of the semester in both Fall 2024 and Spring 2025. Students were incentivized to participate in most courses with nominal extra credit for completing the survey.

Results and Findings of 2024-2025 Assessment:

Assessment of PLO #4:

The majority of student work rated in this assessment demonstrated competence in evaluating, synthesizing and communicating information from the primary literature. Student work consisted of grant proposals prepared in two upper division courses (Endocrinology, General Microbiology). In general, students were effective in using the scientific literature to develop scientific investigations related to current areas of research in the biological sciences, and were clear and organized in conveying scientific information. A total of 80% of student work met or exceeded expectations in criterion #1, and 70% of student work met or exceeded expectations in criteria #2 and #3 (Table 1).

Table 1. Ratings of student work related to evaluating, synthesizing, and communicating information from the primary scientific literature.

	Criterion 1: Provides rationale and background for the proposed investigation based on assessment of primary literature related to the topic.	Criterion 2: Explains relevance of outcomes/expected results of proposed investigation based on assessment of primary literature related to the topic.	Criterion 3: Presents information and ideas in a clear, well-organized, and logical manner.
Average rating of student work on scale of 1-4.	3.13	2.95	3.03
Proportion of student work meeting or exceeding expectations	16/20 = 80%	14/20 = 70%	14/20 = 70%

Students did slightly better at using the scientific literature to formulate and describe a research question than to explain the broader relevance of the question (Table 1, Figure 1). Some of the deficiencies in student work included leaving out details when explaining complex concepts or

ideas, including details not relevant to understanding concepts, and not fully explaining connections between ideas.

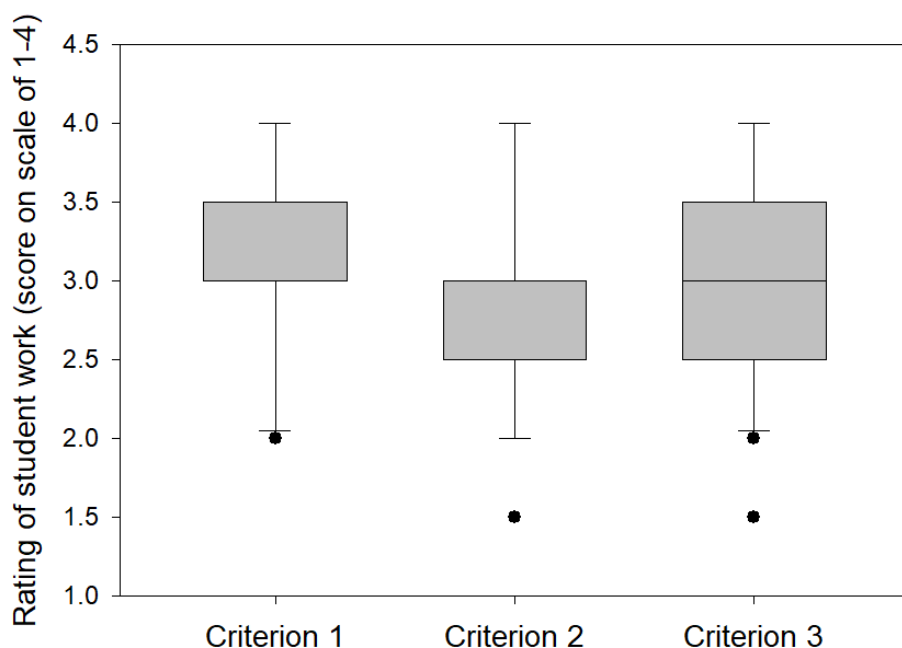


Figure 1. Rating of student work related to evaluating, synthesizing, and communicating information from the primary scientific literature. The median score for each criterion was 3. The sample included 20 grant proposals prepared by students in upper division Biology courses (Endocrinology, General Microbiology).

Development of longitudinal survey:

Over the course of AY 24-25, we collected student scores from first-year students in General Biology (BIOL 105 and 106), second-year students in Genetics (BIOL 310), and fourth-year students in Evolution (BIOL 414) on the General Biology BioMAPS survey. Across all sections, total participation in the survey (including both majors and nonmajors) in Fall 2024 was 79.6% (223 responses out of 280 enrolled students) and in Spring 2025 was 84.1% (90 responses out of 107 enrolled students). Limiting the respondents only to Biology majors, we received 72 responses from General Biology, 77 responses from Genetics, and 46 responses from Evolution (Table 2).

Incoming first-year students had an average total score of 60.7% while students in the capstone course of Evolution scored 71.6% (Table 2, Figure 2).

Table 2. Summary of responses and total scores for the General Biology BioMAPS survey. For each course, responses and averages only include students who are declared Biology majors.

	General Biology	Genetics	Evolution
N Responses	72	77	46
Average	0.607	0.672	0.716
Standard Deviation	0.102	0.135	0.123

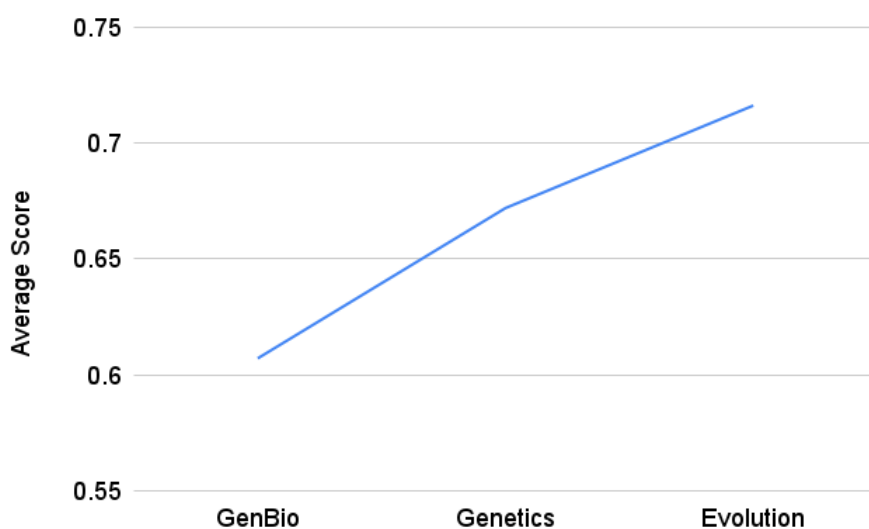


Figure 2. Average total scores on the General Biology BioMAPS survey for students at the beginning of their first year (GenBio), at the end of their second year (Genetics), and in their final year (Evolution).

Separating out the results by the five Vision & Change core concepts (Evolution, Information Flow, Structure & Function, Transformations of Energy & Matter, and Systems), this preliminary cross-sectional analysis shows an increase in scores by at least 10 percentage points for four of the five core concepts (Table 3, Figure 3).

Table 3. Average scores for each of the five Vision & Change core concepts.

Core Concept	GenBio	Genetics	Evolution
Evolution	0.601	0.692	0.722
Information Flow	0.569	0.620	0.693
Structure & Function	0.623	0.698	0.739
Transformations of Energy & Matter	0.605	0.678	0.708
Systems	0.642	0.664	0.664

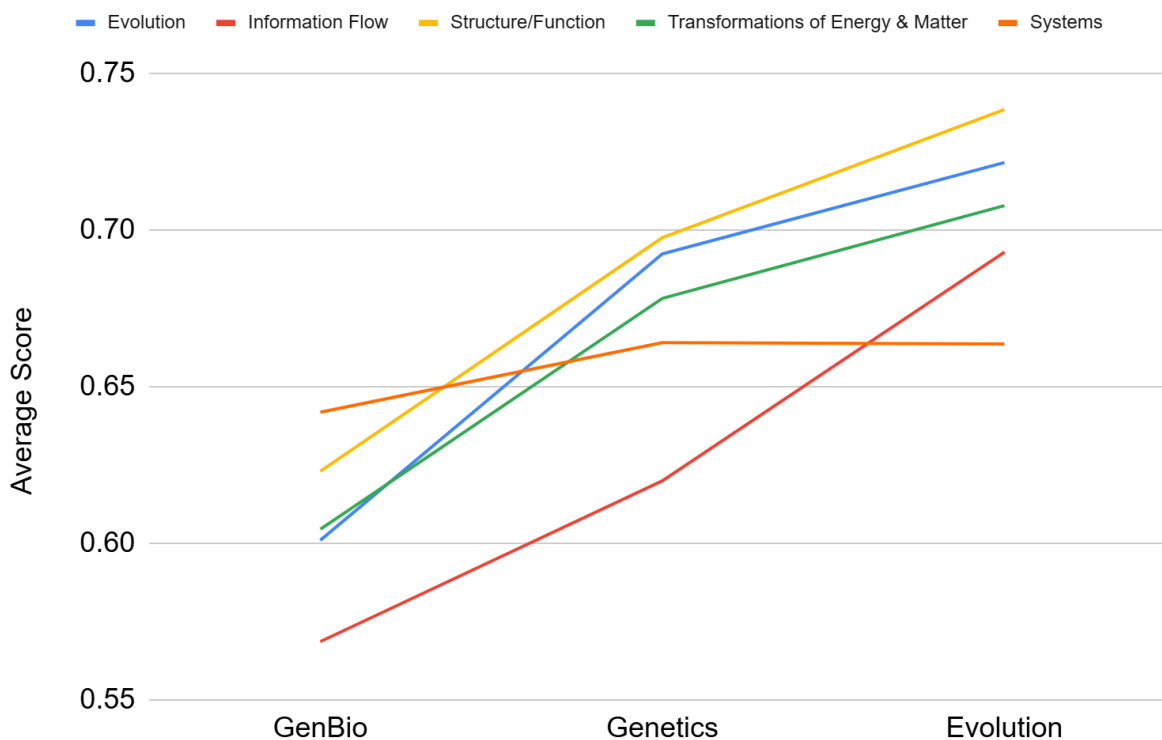


Figure 3. Average scores for the five Vision & Change core concepts on the General Biology BioMAPS survey for students at the beginning of their first year (GenBio), at the end of their second year (Genetics), and in their final year (Evolution).

Of the five core concepts, only Systems showed a relatively flat line, with scores on this subsection rising from 64.2% to 66.4% across the four-year curriculum.

These results are largely consistent with those reported in the published work describing the survey's deployment at other institutions, but given our relatively small sample size and that the sample is cross-sectional we are reluctant to form any firm conclusions from these results alone. However, they do demonstrate that we are able to administer the survey with minimal effort and we believe that it will supply us with information that may prove useful in further development of our curriculum. We will continue to collect information with the survey into AY 25-26 and report on our first longitudinal results (General Biology -> Genetics) in next year's report.

Department Discussion and Response to Results:

Currently the Biology Department offers introductory coverage of PLO #4 (Evaluate, synthesize, and communicate information from the scientific literature) in BIOL 212-Cell Physiology, intermediate coverage in BIOL 310/311-Genetics/Lab, and advanced coverage in most upper division electives as well as the capstone course BIOL 414-Evolution. Students learn how to analyze each section of a scientific paper in BIOL 212-Cell Physiology and apply their analytical skills to evaluating a paper related to bioethics and social responsibility in BIOL

310/311-Genetics. Nearly all upper division courses have at least one assignment or activity in which students evaluate and communicate information from the scientific literature. Prior departmental discussions of PLO #4 led many faculty members to include or expand on analysis of the scientific literature in the upper division courses. In these prior discussions, faculty members noted that competence in evaluating the scientific literature is not an easy skill to acquire for many students, and increased exposure to the scientific literature would help students develop competence.

Response to Previous Year's Report Feedback:

Last year was a reflection year and did not have feedback to respond to.

Attachments:

- Curriculum map.
- Rubric for assessing PLO #4: Evaluate, synthesize, and communicate information from the scientific literature.

Assessment Rubric for Program Learning Outcome #4: Evaluate, synthesize, and communicate information from the primary scientific literature.

RUBRIC CRITERIA	PERFORMANCE STANDARDS			
	<i>Exceeds Expectations (4)</i>	<i>Meets Expectations (3)</i>	<i>Needs Improvement (2)</i>	<i>Below Expectations (1)</i>
1. Provides rationale and background for the proposed investigation based on assessment of primary literature related to the topic.	Papers evaluated cover an extensive range of topics related to the proposed investigation. Information from the papers is accurate and detailed. Relevance of the papers to the proposed investigation is explained in detail.	Papers evaluated cover a range of topics related to the proposed investigation. Information from the papers is accurate. Relevance of the papers to the investigation is explained.	The range of topics in the papers evaluated is limited and does not provide a clear rationale for the proposed investigation OR some information from the papers is inaccurate OR the relevance of the papers is not explained.	The range of topics in the papers evaluated is limited and does not provide a clear rationale for the proposed investigation AND some information from the papers is inaccurate AND the relevance of the papers is not explained.
2. Explains relevance of outcomes/expected results of proposed investigation based on assessment of primary literature related to the topic.	Papers evaluated cover an extensive range of topics related to applications of the proposed investigation. Information from the papers is accurate and detailed. A detailed explanation is provided of how the expected results/outcomes fit into a broad scientific context.	Papers evaluated cover a range of topics related to applications of the proposed investigation. Information from the papers is accurate and detailed. The expected results/outcomes are placed into a broad scientific context.	The range of topics in the papers evaluated is limited OR some information from the papers is inaccurate OR the expected results/outcomes are not placed into a broad scientific context.	The range of topics in the papers evaluated is limited AND some information from the papers is inaccurate AND the expected results/outcomes are not placed into a broad scientific context.
3. Presents information and ideas in a clear, well-organized, and logical manner.	Information and ideas are clearly and concisely explained and presented in a logical sequence. Potentially difficult concepts are explained lucidly and in detail.	Information and ideas are presented in a logical sequence, and potentially difficult concepts are explained clearly.	Sequencing of ideas and information lacks logical structure OR potentially difficult concepts are not adequately explained.	Sequencing of ideas and information lacks logical structure AND potentially difficult concepts are not adequately explained.

	PLO1	PLO2	PLO3	PLO4	PLO5
Institutional Learning Outcomes X Program Learning Outcomes	Demonstrate both in-depth and broad knowledge of the concepts that comprise the biological sciences and apply fundamental concepts to analyze and answer scientific questions.	Apply the scientific process, including designing and conducting experiments, testing hypotheses, analyzing and evaluating results, and communicating findings.	Use laboratory, field, and analytical techniques to address complex questions in the life sciences.	Examine, evaluate, synthesize, and communicate information from the primary scientific literature.	Demonstrate an awareness of the significance of social responsibility in the biological sciences.
Institutional Learning Outcomes					
1. Students reflect on and analyze their attitudes, beliefs, values, and assumptions about diverse communities and cultures and contribute to the common good.					X
2. Students explain and apply disciplinary concepts, practices, and ethics of their chosen academic discipline in diverse communities.	X	X		X	X
3. Students construct, interpret, analyze, and evaluate information and ideas derived from a multitude of sources.	X	X		X	X
4. Students communicate effectively in written and oral forms to interact within their personal and professional communities.		X		X	X
5. Students use technology to access and communicate information in their personal and professional lives.		X	X	X	
6. Students use multiple methods of inquiry and research processes to answer questions and solve problems.		X	X	X	X
7. Students describe, analyze, and evaluate global interconnectedness in social, economic, environmental and political systems that shape diverse groups within the San Francisco Bay Area and the world.					

	PLO1	PLO2	PLO3	PLO4	PLO5
Program Learning Outcomes X Courses	Demonstrate both in-depth and broad knowledge of the concepts that comprise the biological sciences and apply fundamental concepts to analyze and answer scientific questions.	Apply the scientific process, including designing and conducting experiments, testing hypotheses, analyzing and evaluating results, and communicating findings.	Use laboratory, field, and analytical techniques to address complex questions in the life sciences.	Examine, evaluate, synthesize, and communicate information from the primary scientific literature.	Demonstrate an awareness of the significance of social responsibility in the biological sciences.
Courses or Program Requirement					
BIOL 105-General Biology I	I	I	I		I
BIOL 106-General Biology II	I		I		I
BIOL 212-Cell Physiology	M			I	I
BIOL 310/311-Genetics/Lab	A	M	M	M	M
BIOL 390-Biology Seminar	A				
BIOL 414-Evolution	A	(A)	(A)	A	A
BIOL 312/313-Interdisciplinary Life Sciences/Lab					
BIOL 315/316-Biology of Marine Mammals/Lab	A	M	A	A	
BIOL 317/318-Biology of the Galapagos/Lab	A	A	A	A	A
BIOL 319-Ecology	A	M		M	
BIOL 322/323-Ornithology/Lab	A	A	A	A	
BIOL 324/325-Molecular Ecology/Lab	A	A	A	A	M
BIOL 326/327-Field Botany/Lab	A	M	A	A	
BIOL 328/329-Invertebrate Zoology/Lab	A	A	A	A	M
BIOL 330-Female Biology	A			A	A
BIOL 331/332-Herpetology/Lab	A	A	A	A	M
BIOL 333/334-Endocrinology/Lab	A	A	A	A	A
BIOL 335/336-Pollination Biology/Lab	A	A	A	A	
BIOL 340-Animal Toxicology	A			A	
BIOL 345-Virology	A	A		A	
BIOL 346/347-General Microbiology/Lab	A	A	A	A	
BIOL 350/351-Comparative Animal	A	A	A	A	M
BIOL 352/353-Comparative Anatomy/Lab	A		A	A	
BIOL 355/356-Developmental Biology/Lab	A	A	A	A	A
BIOL 362/363-Histology/Lab	A		A		
BIOL 367-Disease, Physiology, and Immunology	A			A	
BIOL 368-Neurobiology	A	A		A	A
BIOL 379/380-Conservation Biology/Lab	A	A	A	A	M
BIOL 383/384-Biology of Insects/Lab	A		A	A	
BIOL 385/386-Parasitology/Lab	A		A		A
BIOL 387/388-Hematology/Lab	A		A		
BIOL 392/393-Oceanography/Lab	A		A	A	
BIOL 395/396-Plant Biology/Lab	A	A	A	A	
BIOL 398-Readings for Advanced	A			A	
BIOL 405-Molecular Medicine	A	A		A	A
BIOL 420-Molecular Biology	A			A	
BIOL 422/423-Bioinformatics/Lab	A	A	A	A	
BIOL 424/425-Urban Ecology					
BIOL 443/444-Immunology/Lab	A	A	A	A	M
BIOL 485/486-Molecular Genetics and	A	A	A		A
BIOL 498-Research for Advanced	A	A	A	A	
BIOL 598-Thesis Research for Biology Honors	A	A	A	A	
BIOL 599-Thesis Writing for Biology Honors	A			A	
Key:					
I = Introductory					
M = Intermediate					
A = Advanced					
CLO = Course Learning Outcome					
(A) or (M) = variable depending on faculty					

	PLO1	PLO2	PLO3	PLO4	PLO5
Program Learning Outcomes X Courses	Demonstrate both in-depth and broad knowledge of the concepts that comprise the biological sciences and apply fundamental concepts to analyze and answer scientific questions.	Apply the scientific process, including designing and conducting experiments, testing hypotheses, analyzing and evaluating results, and communicating findings.	Use laboratory, field, and analytical techniques to address complex questions in the life sciences.	Examine, evaluate, synthesize, and communicate information from the primary scientific literature.	Demonstrate an awareness of the significance of social responsibility in the biological sciences.
Courses or Program Requirement					
BIOL 105-General Biology I	I	I	I		I
CLO (& Assignment): Demonstrate a basic understanding of biochemistry, cell biology, genetics, evolution, and ecology (lecture exams, lab exercises, lab reports)	X				X
CLO (& Assignment): Perform laboratory procedures to explore the content and principles of biology (lab exercises, lab reports)	X	X	X		
CLO (& Assignment): Carry out laboratory work in a socially responsible manner, which includes treating live organisms humanely, respecting animals used for dissection, observing laboratory safety procedures, adhering to waste disposal regulations, and refraining from cheating or plagiarizing in any way (lab exercises, lab reports)					X
BIOL 106-General Biology II	I		I		I
CLO (& Assignment): Demonstrate a basic understanding of the phylogenies, life histories, physical characteristics, physiology, and ecological importance of living organisms (lecture exams, lab exercises, lab practicals)	X				
CLO (& Assignment): Perform laboratory or field procedures to explore the content and principles of biology (lab exercises, lab practicals)			X		
CLO (& Assignment): Carry out laboratory work in a socially responsible manner, which includes treating live organisms humanely, respecting animals used for dissection, observing laboratory safety procedures, adhering to waste disposal regulations, and refraining from cheating or plagiarizing in any way (lab exercises, lab practicals)					X
BIOL 212-Cell Physiology	M			I	I
CLO (& Assignment): Describe the subcellular structure of prokaryotic and eukaryotic cells. (lectures, quizzes, exams)	X				
CLO (& Assignment): Understand the roles that biological macromolecules such as proteins, nucleic acids, lipids, and carbohydrates play within the cell. (lectures, quizzes, exams)	X				
CLO (& Assignment): Understand the molecular mechanism, regulation, and control of cellular processes such as intracellular transport, cell communication, and the cell division cycle. (lectures, quizzes, exams)	X				
CLO (& Assignment): Be able to find, read, and understand scientific review articles and primary scientific papers. (scientific paper assignments, scientific literature summary report)				X	
CLO (& Assignment): Understand how defects in DNA, proteins, and cells can cause a variety of human diseases. (lectures, quizzes, exams)					X
BIOL 310/311-Genetics/Lab	A	M	M	M	M
CLO (& Assignment): Analyze the biochemistry underlying genetics (lecture exams)	X				
CLO (& Assignment): Investigate the chromosome theory of heredity (lecture exams, lab exercises, lab reports)	X	X	X	X	
CLO (& Assignment): Apply the concepts of genic interactions and gene-protein-	X	X	X	X	
CLO (& Assignment): Recognize the impact of recent advancements in the area of	X	X	X	X	
CLO (& Assignment): Examine population genetics, evolutionary genetics, and	X		X		
CLO (& Assignment): Research the significance of ethics in the field of genetics.	X			X	X
BIOL 390-Biology Seminar	A				
CLO (& Assignment): Demonstrate knowledge of a range of biological topics	X				
BIOL 414-Evolution	A	A	A	A	A
JS - CLO (& Assignment): Evaluate the forces that drive evolutionary change within	X	X		X	
JS - CLO (& Assignment): Evaluate phylogenetic relationships among organisms	X	X	X	X	
JS - CLO (& Assignment): Assess the relevance of evolutionary theory in modern	X			X	X
JS - CLO (& Assignment): Evaluate the role evolution plays in all areas of research	X		X	X	X
DK - CLO: Recall the notions of evolution before Darwin and discuss how the	X				
DK - CLO: Define evolution and describe the various processes that bring about	X				
DK - CLO: Recognize the bodies of evidence in support of evolutionary biology, and	X				
DK - CLO: Recognize the relevance of evolutionary theory in many modern issues,	X			X	X
DK - CLO: Demonstrate the ability to read, understand, and critically review				X	
JP - CLO 1 Understand the historical progression of evolutionary		X		X	X
JP - CLO 2 Understand the patterns of evolution preserved in fossils,	X			X	
JP - CLO 3 Understand and evaluate the forces that drive	X	X		X	
JP - CLO 4 Assess the role of mutation in evolution and understand	X			X	
JP - CLO 5 Recognize and evaluate the evidence from fossils,	X			X	
JP - CLO 6 Evaluate the phylogenetic relationships among organisms	X	X		X	
JP - CLO 7 Recognize the relevance of evolutionary biology to other				X	X
JP - CLO 8 Understand the arguments and misconceptions touted in					X
BIOL 315/316-Biology of Marine Mammals/Lab	A	M	A	A	
CLO (& Assignment): Identify local marine mammals species and discuss the varied	X	X	X		
CLO (& Assignment): Keep a scientific journal of field excursions and research		X	X		
CLO (& Assignment): Read, analyze, and discuss research from the primary	X			X	
CLO (& Assignment): Communicate the ecological importance of marine mammals	X				
BIOL 317/318-Biology of the Galapagos/Lab	A	A	A	A	A
CLO (& Assignment): Identify the roles of biotic and abiotic forces as agents of	X			X	
CLO (& Assignment): Describe the ecological impacts of human populations,					X

CLO (& Assignment): conceptualize and conduct field-based observation and			X		
BIOL 319-Ecology	A		M		M
CLO (& Assignment): Demonstrate a comprehensive understanding of key	X				
CLO (& Assignment): Be able to appropriately use and apply mathematical and	X				
CLO (& Assignment): Demonstrate proficiency in reading and discussing ecological	X	X		X	
BIOL 324/325-Molecular Ecology	A	A		A	M
CLO 1. Critically read, assess, and discuss research articles on molecular ecology				X	
CLO 2. Differentiate among different classes of molecular markers and know their	X			X	X
CLO 3. Apply population genetic, phylogenetic, and evolutionary principles to the	X				
CLO 4. Write an NSF-style pre-proposal on a molecular ecology topic	X	X		X	
CLO 5. Extract DNA from animals and plants.			X		
CLO 6. Amplify DNA markers using polymerase-chain reaction (PCR)			X		
CLO 7. Build alignments of DNA sequence data.			X		
CLO 8. Analyze DNA sequence data (population genetic and phylogenetic		X			
CLO 9. Conduct basic molecular ecology analyses in the statistical programming		X			
BIOL 326/327-Field Botany/Lab	A	M		A	
CLO 1. Identify native Californian plants to the level of family				X	
CLO 2. Recognize locally important plants to genera and selected plants to species				X	
CLO 3. Develop and keep a scientific field journal and digital photograph				X	
CLO 4.1. Understand the significance of the California flora within an evolutionary	X			X	
CLO 5. Know key morphological and ecological characteristics that define the				X	
CLO 6. Fundamental ecological concepts that help explain the abundance and		X		X	
BIOL 328/329-Invertebrate Zoology/Lab	A	A		A	M
CLO (& Assignment): Develop critical ability to identify the major and minor	X				
CLO (& Assignment): Interpret evolutionary relationships among phyla through the	X	X		X	
CLO (& Assignment): Gain skills in field collection techniques, maintaining field					X
CLO (& Assignment): Evaluate the evolutionary innovations & ecological	X	X		X	
BIOL 330-Female Biology	A			A	A
CLO (& Assignment): Demonstrate knowledge of the anatomy, physiology, and	X				
CLO (& Assignment): Discuss biomedical issues facing women and social justice	X			X	X
BIOL 331/332-Herpetology/Lab	A	A		A	M
CLO (& Assignment): investigate and describe the ecology and evolutionary	X				
CLO (& Assignment): analyze and discuss the adaptive morphological and	X				
CLO (& Assignment): characterize the severe conservation threat amphibians and	X				X
CLO (& Assignment): write a scientific research proposal that includes		X		X	
CLO (& Assignment): Perform dissections of preserved specimens and identify wild					
BIOL 333/334-Endocrinology/Lab	A	A		A	A
CLO: Describe the mechanisms of hormone action in cells including the role of	X	X		X	
CLO: Use learned methodology to design experiments with appropriate controls	X	X		X	X
CLO: Explain the synthesis of hormones, their physiological targets and their	X	X		X	
CLO: Explain the physiological effects of hormones on human health and disease.	X	X		X	X
CLO: Describe the impact and importance of endocrinology on basic scientific as	X	X		X	X
CLO: Read and summarize primary scientific research articles. (journal club, case	X			X	X
CLO: Carry out scientific procedures in an ethical manner, including humane	X	X		X	X
CLO: Accurately observe, record, analyze, and report data collected in the	X	X		X	
CLO: Carry out original scientific research, write up and interpret their results.	X	X		X	
BIOL 340-Animal Toxicology	A			A	
CLO: Demonstrate (on exams and weekly online quizzes) an understanding of	X				
CLO: Demonstrate (on exams and weekly online quizzes) an understanding of	X				
CLO: Demonstrate (on exams and weekly online quizzes) an understanding of	X				
CLO: Demonstrate (written assignment) the ability to critically assess an				X	
BIOL 345-Virology	A	A		A	
CLO (& Assignment): Describe, diagram and label a typical enveloped virus and a	X				
CLO (& Assignment): Suggest an experiment or set of experiments to identify	X				
CLO (& Assignment): Explain how the pattern of gene expression for a particular	X				
CLO (& Assignment): Explain the scientific basis for therapeutic interventions	X				
CLO (& Assignment): Discuss the molecular basis for virus-induced	X				
CLO (& Assignment): Compare and contrast cells, viruses, viroids and prions	X				
CLO (& Assignment): Demonstrate the ability to understand and evaluate both				X	
BIOL 346/347-General Microbiology/Lab	A	A		A	
CLO (& Assignment) Define the science of microbiology and describe methods used	X				
CLO (& Assignment) Describe the interactions and impact of microorganisms with	X				
CLO (& Assignment) Discuss the principles of evolution as they apply to microbiology	X				
CLO (& Assignment) Gain proficiency with basic microbiology lab techniques such as				X	
CLO (& Assignment) Develop analytical skills including collecting, analyzing, and		X		X	
BIOL 350/351-Comparative Animal Physiology/Lab	A			A	M
CLO: • Discuss thermal relations that animals maintain with their environments;	X				
CLO: • Compare and contrast the functioning of the nervous, respiratory,	X				
CLO: • Explain the physiological challenges of living in aquatic and terrestrial	X				
CLO: • Discuss the mechanisms by which aquatic and terrestrial invertebrates and	X				
CLO: • Read and evaluate articles from the primary literature discussing				X	X
CLO (& Assignment): Perform physiological experiments and analyze and interpret		X		X	
BIOL 352/353-Comparative Anatomy/Lab	A			A	
CLO (& Assignment): Demonstrate knowledge of vertebrate anatomy (exams,	X				

CLO (& Assignment): Perform dissections of preserved vertebrate specimens (lab	X			X		
CLO (& Assignment): Discuss primary literature related to vertebrate anatomy and	X				X	
BIOL 355/356-Developmental Biology/Lab	A	A	A	A	A	A
CLO (& Assignment): Evaluate the experimental basis of our current understanding	X	X			X	X
CLO (& Assignment): Gain skills in molecular laboratory techniques used in the		X	X			X
CLO (& Assignment): Critically evaluate experimental evidence to describe	X	X	X		X	X
CLO (& Assignment): Evaluate the evolutionary conservation of developmental	X				X	
BIOL 362/363-Histology/Lab	A		A			
CLO: 1. Demonstrate (on exams) an understanding of the relationship between	X					
CLO: Reconstruct the three-dimensional microanatomy of tissues based on the			X			
CLO: Use histological study resources that are available on the internet..						
CLO: Develop proficiency in the setup and use of the compound microscope.			X			
CLO: Understand the procedures used to make histological sections.			X			
CLO: Demonstrate (on a laboratory practical exam and weekly quizzes) the ability	X					
BIOL 368-Neurobiology	A	A			A	A
CLO (& Assignment): Demonstrate knowledge of the organization of the	X	X				X
CLO (& Assignment): Critically evaluate and present current peer-reviewed		X			X	X
BIOL 379/380-Conservation Biology/Lab	A	A	A	A	A	M
CLO (& Assignment): Demonstrate a comprehensive knowledge of the history of	X					
CLO (& Assignment): Recognize and analyze the value of biodiversity (essays,	X					
CLO (& Assignment): Apply critical reasoning skills to analyze and dissect	X	X	X		X	
CLO (& Assignment): Synthesize the various ecological concepts involved in	X	X	X		X	
CLO (& Assignment): Evaluate the significance of ongoing regional and global	X				X	X
BIOL 383/384-Biology of Insects/Lab	A		A		A	
CLO (& Assignment): Demonstrate knowledge of the physiology, anatomy,	X					
CLO (& Assignment): Collect and identify free-living insects (insect collection).	X		X			
CLO (& Assignment): Research and discuss the primary literature on topics related	X				X	
BIOL 385/386-Parasitology/Lab	A		A			A
Lecture CLO: Demonstrate an understanding of (in exams and weekly online	X					X
Lab CLO: Demonstrate the ability set up and use a compound light microscope.			X			
Lab CLO: Describe (on sketches) the detailed structure of parasites and their	X					
Lab CLO: Identify (in laboratory practical exams and weekly pre-lab quizzes)	X					
BIOL 387/388-Hematology/Lab	A		A			
CLO (& Assignment): Explain developmental, physiological, and medical aspects of	X					
CLO (& Assignment): Conduct experiments and lab analyses related to			X			
BIOL 392/393-Oceanography/Lab	A		A		A	
CLO: Understand the complex interactions between land, sea and air relative to	X					
CLO: Demonstrate scholarly appreciation of the physical, chemical and biological	X					
CLO: Recognize the factors of global climate change that affect marine populations	X				X	X
CLO: Become proficient in collecting, analyzing and managing data, interpreting	X		X			
CLO: Improve the ability to review and critically appraise writings on marine issues	X				X	X
BIOL 398-Readings for Advanced Undergraduates	A				A	
CLO: Evaluate the primary scientific literature related to a specific topic and	X				X	
BIOL 405-Molecular Medicine	A	A			A	A
CLO: Understand how drugs function and how new drugs are discovered and deve	X	X				
CLO: Understand the many obstacles a new drug must overcome to be approved					X	X
CLO: Explain both specific and general genetic factors underlying efficacy and toxic	X				X	
CLO: Assess the value of phenotyping and genotyping in guiding drug therapy of in	X				X	
CLO: Provide examples of genetic polymorphisms that affect the metabolism and	X				X	
BIOL 420-Molecular Biology	A				A	
CLO (& Assignment): Describe and diagram gene structure and expression in	X					
CLO (& Assignment): Provide examples of how intracellular signals may lead to	X					
CLO (& Assignment): Diagram and describe DNA replication (lecture exams).	X					
CLO (& Assignment): Appreciate how knowledge of biology at the molecular level	X					
CLO (& Assignment): Describe a number of experimental approaches used in	X					
CLO (& Assignment): Suggest an experiment, or set of experiments, to address a	X					
CLO (& Assignment): Demonstrate the ability to understand and evaluate primary	X				X	
BIOL 422/423-Bioinformatics	A	A	A		A	
CLO (& Assignment): Develop testable questions (projects).	X	X				
CLO (& Assignment): Collect and analyze data to evaluate scientific questions	X	X	X			
CLO (& Assignment): Present scientific data in written and oral reports (projects,					X	
BIOL 443/444-Immunology/Lab	A	A	A		A	M
CLO (& Assignment): Diagram and label the cells and molecules involved in innate	X					
CLO (& Assignment): Explain the process of hematopoiesis; lymphocyte	X					
CLO (& Assignment): Diagram and label each of the five classes of antibodies, and	X					
CLO (& Assignment): Describe how knowledge of cellular and molecular	X					
CLO (& Assignment): Provide examples of B cell, T cell, and macrophage functions	X					
CLO (& Assignment): Appreciate the complexities of cell function yet recognize the	X					
CLO (& Assignment): Understand and evaluate scientific immunological literature	X				X	
CLO (& Assignment): Explain the theory of antibody – antigen interactions and	X	X	X			
BIOL 485/486-Molecular Genetics and Biotechnology/Lab	A	A	A			A
CLO (& Assignment): Demonstrate a keen understanding of the structure, function	X					
CLO (& Assignment): Distinguish and diagram DNA-based structures: nucleoside,	X					
CLO (& Assignment): Be able to independently carry out techniques in DNA	X	X				

CLO (& Assignment): Be able to describe a range of methods used in the	X	X	X		
CLO (& Assignment): Perform calculations and design graphs, applying statistical	X		X		
CLO (& Assignment): Gain an appreciation of the importance of accurate			X		
CLO (& Assignment): Understand that our knowledge of molecular biology is key	X				
CLO (& Assignment): Demonstrate an understanding of the biotechnology industry	X				X
BIOL 498-Research for Advanced Undergraduates	A	A	A	A	
CLO: Conduct original research, including formulating hypotheses, collecting and	X	X	X	X	
BIOL 598-Thesis Research for Biology Honors Program	A	A	A	A	
CLO: Conduct original research, including formulating hypotheses, collecting and	X	X	X	X	
BIOL 599-Thesis Writing for Biology Honors Program	A			A	
CLO: Prepare a written assessment of original research.	X			X	
Key:					
I = Introductory					
A = Advanced					
CLO = Course Learning Outcome					