

INSTITUTIONAL EFFECTIVENESS REPORT

Name of Program/Department:	Department of Biology
Year:	2016-2017
Name of Preparer:	Ann Stoeckmann, Ph.D.

Biology Department Mission

The mission of the Department of Biology is to produce scientifically literate graduates who display robust knowledge of biological principles from molecules to ecosystems. We train our undergraduate students to use their critical thinking skills and mastery of biological principles to perform inquiry into the biological world and effectively convey biological information. We are committed to experiential learning including laboratory, field, and research experiences. Students graduating from this program will be well prepared for a variety of professional careers or entry into graduate school programs.

Program Learning Outcomes:

The Biology Department prepares students who:

1. understand major concepts in the biological sciences.
2. think critically and apply scientific principles to reach conclusions.
3. use the scientific approach.
4. communicate cogently.

Executive Summary of Report

Presented in this report are the Biology Department's Mission, Program and Student Learning Outcomes, the assessment and results of each, and action items.

The department updated several components of our report this year. Our mission statement was revised last year and was approved by the University system and will be included in the 2017-2018 catalog.

Achievement of our senior biology majors on concept knowledge and critical thinking skills (SLO 1 and 2) was assessed with a cumulative exam administered in our Senior Seminar courses both semesters. The overall average on the exam increased slightly this year over last spring (about 2%) and the spring 2017 semester group met the target (SLO 1: 63.2%, SLO 2: 60.9%). In the fall the department examined the previous year's results by concept area and determined that more plant biology concepts and principles needed to be reinforced in the appropriate courses. The faculty enhanced their instruction in this area by devoting additional time in lecture or lab to review and reinforce plant biology concepts and the exit exam results in that area improved (53% in Spring 2016; 56.7% for the 2016-2017 year's average). The department added a questionnaire this year to better assess how completion of coursework was related to achievement results. Results confirmed that achievement was linked to course completion and was better when a higher proportion of students had completed all course work and the results met our target when this was the case. In order to get a better understanding of the level of achievement at which Francis Marion University biology majors begin the major curriculum, this year we also administered the Senior Exit Exam to students enrolled in the first course in the biology major. Although not the same cohort of students, the overall exam averages showed that students begin the major with an average achievement of 40.3% and by the time they are seniors they increase their achievement to 58.9%. The Biology Department is in the process of examining the 2016-2017 results by core area to determine where instruction needs to be enhanced to improve performance and are also discussing ways to improve our assessment methods for 2017-2018.

The Biology Department measured student achievement on use of the scientific approach and communication through student research project presentations and assignments in courses (SLO 3 and 4). The department developed and implemented a rubric this year as a more objective "direct measure" of Biology majors' competence in the application and communication of the scientific approach. The rubric was used in the Spring semester to evaluate student research presentations at our research symposiums (RED and PURE) and for assignments in two upper-level courses. For each category of presentations average student achievement met the target for one of the two sets of presentations. The department is currently discussing appropriate modifications to the rubric and development of additional rubrics for use evaluating other types of student activities that incorporate the use of the scientific approach and communication in 2017-2018.

Student Learning Outcomes

SLO 1.0: Biology majors will identify key concepts in the core areas of Plant Biology, Ecology, Cell and Molecular Biology, Genetics and Evolution at an overall average at or above the 60% level.

SLO 2.0: Biology majors will demonstrate competence in critical thinking and the application of the scientific approach at or above the 60% level.

SLO 3.0: Students will explain and demonstrate how to 1) ask a question, 2) generate a credible literature review, 3) generate hypotheses, 4) execute hypothesis testing procedures, 5) organize and analyze data or information, 6) draw conclusions, and 7) produce a report to cogently communicate results at or above the 3.25 level.

SLO 4.0: Students will communicate cogently about biology at or above the 3.25 level.

Assessment Methods

Student Learning Outcomes 1 and 2:

SLO 1.0: Biology majors will identify key concepts in the core areas of Plant Biology, Ecology, Cell and Molecular Biology, Genetics and Evolution at an overall average of 60% as measured by a common Biology Exit Exam.

SLO 2.0: Biology majors will demonstrate competence in critical thinking and the application of the scientific approach at the 60% level as evaluated by the Biology Exit Exam.

Performance on student learning outcomes 1 and 2 utilized a cumulative exam administered in the Senior Seminar course (BIO 499). Students take this course in one of their last two semesters at FMU. The exam (multiple choice format) was given at the end of each semester (Fall 2016 and Spring 2017).

To address the issue of course completion prior taking the exam, we administered a questionnaire to collect information about which courses students had completed.

To get an indication of how students entering the biology major perform, the cumulative exam was administered to those students in Biological Sciences I Laboratory (BIO 115L) who were taking the biology majors lecture and laboratory courses for the first time. This course is required of all biology majors. The exam was administered on the first laboratory class day within the first two weeks of the beginning of each semester (Fall 2016 and Spring 2017).

Students are expected to achieve a score of 60% or higher on the exit exam. We regard the mean percent score of the exam results to be a reasonable indicator of student-success in meeting the learning outcomes.

Student Learning Outcome 3 and 4:

SLO 3.0: Students will explain and demonstrate how to 1) ask a question, 2) generate a credible literature review, 3) generate hypotheses, 4) execute hypothesis testing procedures, 5) organize and analyze data or information, 6) draw conclusions, and 7) produce a report to cogently communicate results at or above a score of 3.5 for student presentations at RED and PURE and 3.25 for student presentations as a course assignment as measured by a rubric developed by Biology Department used to evaluate student presentations.

SLO 4.0: Students will communicate cogently about biology at or above a score of 3.5 for student presentations at RED and PURE and 3.25 for student presentations as a course assignment as measured by a rubric developed by Biology Department used to evaluate student presentations.

Students apply the process of science (SLO 3) and build communication skills (SLO 4) in courses in our Biology curriculum. There are opportunities to apply the process of science and to build communication skills with assignments and exercises in the laboratory portions of courses and through research projects outside of class. Students may complete independent research projects (SLO 3) and receive credit (e.g., Bio 497, Honor's Thesis) or they may take part in projects and not receive credit but receive a stipend (e.g., Biology Research Experience Program Fellows (BREP) that are supported by our INBRE grant and REAL, the University's quality enhancement program).

After completing their project students may write a report, a thesis, or a paper on their work or they may produce a poster or do an oral presentation (SLO 3 & 4). FMU has two venues on campus for presentations. One is PURE, the Biology Department's research symposium held once per semester. Another is the campus-wide Research and Exhibition Day held every spring.

To evaluate student competence in application and communication of the scientific approach, the Biology Department developed a more objective "direct measure" of Biology majors' competence in the application and communication of the scientific approach (Appendix 1). The rubric was implemented four times in the spring semester. It was used in evaluation of student projects presented as posters at the campus-wide Research and Exhibition Day and oral presentations at the department's PURE Symposium, oral presentations given in Genetics (BIO 401), and written assignments in Ecology (BIO 411). Biology Department faculty not involved with the research independently evaluated each RED poster (4 faculty) and PURE oral presentation (9-10 faculty) utilizing the evaluation rubric. Each oral presentation in Genetics and each paper in Ecology was assessed by the instructor of record.

Because participation in RED and PURE is optional, we expect students to perform quite well on average. As such, we set a target this first year of scores of 3.5 out of 4.0 in all hybrid areas. Unlike RED and PURE work, student assignments in Genetics (BIO 401) and Ecology (BIO 411) were not self-selecting in that everyone in the course participated. Given that, we set a target of 3.25 points in each hybrid category for the course assigned work.

Assessment Results

Student Learning Outcomes 1 and 2:

SLO 1.0: Biology majors identified key concepts in the core areas of Plant Biology, Ecology, Cell and Molecular Biology, Genetics and Evolution at an overall average of 60% as measured by a common Biology Exit Exam. Since our goal was 60%, this target was achieved.

SLO 2.0: Biology majors demonstrated competence in critical thinking and the application of the scientific approach at the 60% level as evaluated by the Biology Exit Exam. Since our goal was 60%, this target was achieved.

Tables 1 and 2 summarize the results for each learning outcome and include the questions in the exam that pertain to each learning outcome. Table 1 summarizes the results for the seniors in BIO 499 and includes the results from Spring 2016 for comparison because the exam was revised only for Spring 2016. Table 2 summarizes the results for students entering the major (BIO 115L).

The Spring semester overall mean on the exam met the target (60%). The year's average increased slightly, about 2% (from 56.5% to 58.9%). Achievement this year in the separate areas of content and critical thinking improved by about 2% when compared to last year's Spring results.

In fall semester, the department examined the breakdown of results by area. The breakdown of the results suggested a need to enhance instruction in the area of Plant Biology and the department worked to reinforce concepts in that area primarily in the spring. Student performance improved in that area by the spring semester when more reinforcement had been incorporated.

In addition, overall results for all seniors (Table 1, BIO 499) were 18% higher than the students entering the major (Table 2, BIO 115L) showing overall achievement by biology students by the time they are seniors.

Table 1. Summary of results of the cumulative exam given to seniors in BIO 499 in Fall 2016 and Spring 2017.

Learning Outcome	Assessment (Exam question that pertains to each learning outcome)	Results (Mean percent correct)			
		Spring 2016	Fall 2016	Spring 2017	Year
1. Biology majors will identify key concepts in the core areas of Plant Biology, Ecology, Cell and Molecular Biology, Genetics and Evolution at an overall average of 60 as measured by a common Biology Exit Exam.	Concepts: 1, 2, 5-7, 9, 10, 12, 14-17, 20-23, 26, 28, 32, 34-36, 41, 43, 47-49	57	56.6	63.2	59.9
a. Plant Biology	5, 16, 22, 27, 29, 31, 39, 47	53	51.7	61.6	56.7
b. Ecology	3, 11, 12, 40, 44, 48	59	59.6	65.9	62.8
c. Cell and Molecular Biology	2, 7, 9, 10, 18, 20, 21, 25, 26, 28, 30, 33, 32, 36, 37,41, 42, 49, 50	58	55.4	61.7	58.6
d. Genetics and Evolution	11, 17, 22, 23, 39, 46	55	48.1	59.6	53.9
2. Biology majors will demonstrate competence in critical thinking and the application of the scientific approach as evaluated by the Biology Exit Exam.	3, 4, 8, 11, 13, 18-19, 24, 25, 27, 29-31, 33,27, 28, 40, 42, 44-46, 50	56	54.8	60.9	57.9
Number of students		40	52	41	46.5
Overall Exam Mean		56.5	55.7	62.1	58.9

Table 2. Summary of results of the cumulative exam given to students in BIO 115L in Fall 2016 and Spring 2017 taking the course for the first time.

Learning Outcome	Assessment (Exam question that pertains to each learning outcome)	Results (Mean percent correct)		
		Fall 2016	Spring 2017	Year
1. Biology majors will identify key concepts in the core areas of Plant Biology, Ecology, Cell and Molecular Biology, Genetics and Evolution at an overall average of 60 as measured by a common Biology Exit Exam.	Concepts: 1, 2, 5-7, 9, 10, 12, 14-17, 20-23, 26, 28, 32, 34-36, 41, 43, 47-49	41.2	37.7	39.5
a. Plant Biology	5, 16, 22, 27, 29, 31, 39, 47	29.9	27.4	28.7
b. Ecology	3, 11, 12, 40, 44, 48	51.8	49.1	50.5
c. Cell and Molecular Biology	2, 7, 9, 10, 18, 20, 21, 25, 26, 28, 30, 33, 32, 36, 37, 41, 42, 49, 50	41.1	34.7	37.9
d. Genetics and Evolution	11, 17, 22, 23, 39, 46,	42.0	27.5	34.8
2. Biology majors will demonstrate competence in critical thinking and the application of the scientific approach as evaluated by the Biology Exit Exam.	3, 4, 8, 11, 13, 18-19, 24, 25, 27, 29-31, 33, 27, 28, 40, 42, 44-46, 50	44.4	37.7	41.1
Number of students		157	106	132
Overall Exam Mean		42.8	37.7	40.3

Several factors may be responsible for the fall exam mean results being below the target. One potential issue is with administering the exam in the Senior Seminar course. Students are allowed to take the Senior Seminar course where the exam is administered in one of their last two semesters prior to graduation. Thus, they may be taking the exit exam a semester before the one they are going to graduate and therefore they may not have completed all their course work at the time of the exam.

To better assess how completion of coursework impacted achievement results, we administered a questionnaire to the seniors in BIO 499. Results show that in the fall, fewer students had completed ecology and genetics and evolution courses at the time they took the exit exam (Table 3). In addition, less than half of the students in the fall (40%) stated they had completed all the course work whereas in spring 71% had completed all the courses. In the spring a higher proportion of students had completed all the core courses and achievement in all areas met the target, or was extremely close to it.

Table 3. Summary of results of the questionnaire given to seniors in BIO 499 in Fall 2016 and Spring 2017.

	Fall 2016 (percent)	Spring 2017 (percent)	Year (average percent)
Course completed			
a. Plant Biology	90	88	89.1
b. Ecology	75	83	79.0
c. Cell and Molecular Biology	83	95	88.9
d. Genetics and Evolution	56	85	71.5
All courses completed	40	71	56

A second issue is that some questions in both learning outcomes assessed by the exam may cover content from courses that the student may have completed early in their course progression or are based on material in a subject area that is not reinforced in subsequent upper level courses (e.g., plant biology, animal diversity). In addition, results show that students performed better on the content-based questions (SLO 1) than they did on the critical thinking questions (SLO 2). However, that is not unexpected as critical thinking questions are more difficult. Additionally, poor performance on the critical thinking questions may be exacerbated if a critical thinking question combines content not yet covered or is from an early course and is not reinforced later.

Student Learning Outcome 3 and 4:

SLO 3.0: Students will explain and demonstrate how to 1) ask a question, 2) generate a credible literature review, 3) generate hypotheses, 4) execute hypothesis testing procedures, 5) organize and analyze data or information, 6) draw conclusions, and 7) produce a report to cogently communicate results at or above a score of 3.5 for student presentations at RED and PURE and 3.25 for student presentations as a course assignment as measured by a rubric developed by Biology Department used to evaluate student presentations. In each presentation category, our goal was met by one of the two sets of students evaluated

SLO 4.0: Students will communicate cogently about biology at or above a score of 3.5 for student presentations at RED and PURE and 3.25 for student presentations as a course assignment as measured by a rubric developed by Biology Department used to evaluate student presentations. In each presentation category, our goal was met by one of the

In Spring 2017, a rubric developed by Biology Department was used to evaluate student presentations. It was used to evaluate poster presentations at Research and Exhibition Day (RED, Table 4), oral presentations at PURE symposium (Table 5), oral presentations done in student pairs in the Genetics class (Table 6). It was also used as a trial to evaluate written projects done in an Ecology class (Table 7). Scoring results were averaged for questions that fit into the same broad category (“Hybrid”).

Research Exhibition Day saw 13 biology students present their work at this campus-wide event. Francis Marion Biology faculty (2-4) not involved with the research, independently evaluated each poster using the rubric. Of the 13 posters, 12 posters had at least two evaluators visit them. Those data are found below (Table 4):

Table 4: Aggregated Research Exhibition Day evaluations (n = number of faculty evaluators per poster, STD = Standard Deviation). Individual scoring results were averaged for evaluators and for questions that fit into the same broad category (“Hybrid”).

Poster number	n	Hybrid Scientific Thought Score	STD	Hybrid Scientific Method Score	STD	Hybrid Communication Score	STD
1	2	3.33	0.47	3.10	0.63	3.30	0.66
4	4	3.31	0.87	3.70	0.66	3.50	0.61
6	4	3.58	0.64	3.45	0.58	3.61	0.45
7	4	3.58	0.49	3.50	0.67	3.85	0.39
10	3	2.67	0.99	3.40	0.71	3.40	0.64
11	3	3.78	0.47	3.27	0.77	3.60	0.64
12	4	2.67	0.76	2.95	0.75	2.50	1.04
15	4	2.84	0.82	3.15	0.84	2.61	1.29
17	4	3.08	0.64	3.00	0.97	2.78	1.17
18	3	2.89	1.30	3.42	1.05	3.77	0
19	2	3.60	0	3.50	0.70	3.56	1.05
30	4	3.17	0.80	3.10	0.96	3.20	0.93
Average		3.21	0.69	3.29	0.77	3.31	0.74

Although the averages in each area were below the 3.5 target, they did all fall within one standard deviation of that number. Furthermore, individual students were able to meet and even surpass the goal of 3.5 in any given category and several students met the target in each hybrid category.

At the spring 2017 P.U.R.E symposium, four biology students presented their faculty-mentored work by giving 12 minute oral presentations about their research. Between nine and ten biology faculty evaluated each of these talks with the evaluation rubric developed by the department. Those data are found below (Table 2):

Table 5: P.U.R.E symposium evaluations (n = number of faculty evaluators per presentation, STD = Standard Deviation).

Talk number	n	Hybrid Scientific Thought Score	STD	Hybrid Scientific Method Score	STD	Hybrid Communication Score	STD
1	10	3.77	0.46	3.82	0.37	3.85	0.37
2	10	3.30	0.66	3.20	1.01	3.34	0.81
3	10	3.70	0.60	3.62	0.63	3.6	0.51
4	9	3.41	0.69	3.37	0.71	3.53	0.66
Average		3.54	0.60	3.50	0.68	3.60	0.59

Averages in each hybrid category for the PURE presentations met or exceeded the score of 3.5 target.

Paired oral presentations were assigned in Genetics (BIO 401) and were assessed using our evaluation rubric. A total of 23 presentations were assessed using this rubric. Each paired oral presentation was assessed by the instructor of record only, so these data are averaged for the entire class in order to generate statistics related to class performance. Those data are found below (Table 6):

Table 6: Genetics oral presentations (n = 23 assignments, evaluated one time each)

Hybrid Scientific Thought Score	STD	Hybrid Scientific Method Score	STD	Hybrid Communication Score	STD
2.62	0.76	2.55	0.87	2.64	0.86

All students in the Genetics course were required to participate in this activity, so we used the 3.25 point target. Averages in this course failed to meet our target in every category.

Written laboratory assignments in Ecology (BIO 411) were assessed using the evaluation rubric for eight groups of 2-3 students. Each paper was assessed by the instructor of record only, so these data are averaged for the entire class in order to generate statistics related to class performance. Those data are found below (Table 7):

Table 7: Ecology written laboratory assignments (n = 8 assignments, evaluated one time each)

Hybrid Scientific Thought Score	STD	Hybrid Scientific Method Score	STD	Hybrid Communication Score	STD
3.42	0.70	3.38	0.94	3.58	0.70

On average, our students in Ecology (BIO 411) met and exceeded the target of 3.25 in each category, however significant room for improvement exists as a number of presentations scored lower than that target.

Action Items

To address the concerns below we are developing an action plan to be implemented during the next academic year.

Student Learning Outcomes

SLO 1.0: Biology majors will identify key concepts in the core areas of Plant Biology, Ecology, Cell and Molecular Biology, Genetics and Evolution at an overall average of 60% as measured by a common Biology Exit Exam.

SLO 2.0: Biology majors will demonstrate competence in critical thinking and the application of the scientific approach at the 60% level as evaluated by the Biology Exit Exam.

SLO 1 and 2:

1. To better assess how course completion was related to achievement results, the department developed and administered a questionnaire completed by students taking the cumulative exit exam about course completion. Results show that course completion may have a large impact on the achievement results, as we expected. We will continue to explore alternative possibilities for the timing of administering and scoring the exit exam to determine how we can better assess only students in the semester in which they are graduating and so therefore would have completed all relevant course work.
2.
 1. In the Fall 2016, a breakout of the results from 2015-2016 into four core areas (Plant Biology, Ecology, Cell and Molecular Biology, Genetics and Evolution) suggested a need to enhance instruction in the area of Plant Biology. In order to improve performance in this area, the Biology faculty reinforced certain core principles and concepts in this area in upper level classes where plant biology principles was included (taught in 2016-2017: Bio 206 Fall Flora, Bio 207 Spring Flora, Bio 306J Plant Evolution and Diversity, Bio 308 Aquatic Ecology, Bio 303 Plant Kingdom, Bio 307 Plant Structure and Function, Bio 317 Marine Ecology, Bio 411 Ecology). Spring 2017 results showed improvement in the area of Plant Biology.

The breakout of the 2016-2017 results into the four core areas showed that student achievement decreased the area of Genetics and Evolution. In Fall 2017, the Biology Department will ensure that certain core principles and concepts in that area reinforced in upper level courses where this material is included in the 2017-2018 academic year (to be taught in 2017-2018 including but not limited to: Bio 105 and 106 Biological Sciences I and II, Bio 401 Genetics, Bio 409 Evolutionary Biology) .

2. The department evaluated the exam question types (critical thinking and application of science questions) and for balance between each core area and content vs critical thinking. However, the process was not completed fully this academic year. This objective will be carried over the 2017-2018 academic year.
3. The Biology Department began its investigation of validated questions from Concept Inventories to be used on our exams, however, the process was not completed fully this academic year. This objective will be carried over the 2017-2018 academic year.

SLO 3.0: Students will explain and demonstrate how to 1) ask a question, 2) generate a credible literature review, 3) generate hypotheses, 4) execute hypothesis testing procedures, 5) organize and analyze data or information, 6) draw conclusions, and 7) produce a report to cogently communicate results.

SLO 4.0: Students will communicate cogently about biology.

SLO 3 and 4:

The Biology Department developed and implemented a scoring rubric in Spring 2017 to be used primarily for presentations. The rubric was also used on one set of written assignments. This was the first year the rubric was implemented.

1. The department will continue to utilize the rubric in evaluation of senior projects in RED and PURE.
2. The department is making appropriate modifications to the rubric to improve it.
3. Given our rubric was designed primarily for presentation-based assignments, a number of individual questions were not applicable to written assignments. Therefore, in fall 2017 the department will develop other rubrics for use evaluating other types of student assignments. We will develop and utilize separate rubrics for separate types of assignments (e.g. one for oral presentations, one for poster presentations, and one for in-class laboratory assignments in appropriate upper-level courses).
4. We will also discuss the feasibility of using this rubric to increase consistency in common courses and lab sections.
5. We will discuss the feasibility of an evaluation committee to score in-class presentations

and written laboratory reports to allow for repeat measures of assignments that would otherwise only receive one evaluation from the instructor of record.

6. We will continue discuss ways to incorporate more assignments that require students to apply the process of science into our courses.
7. We will continue to discuss ways to encourage faculty to mentor students in research projects outside of the classroom.
8. Notification of students of research opportunities: We will continue to use the *Research Opportunities* section of the bulletin board outside the biology office where faculty post projects and will ensure frequency of updating of our website section on research is updated at the minimum each semester

SLO 4: The Biology Department worked on designing a writing assignment program likely using a scaffolding approach to be used in the freshman course sequence. We made progress but this objective will be carried over to the 2017-2018 academic year.

SLO 1, 2, 3, and 4: We will develop indirect methods for assessing our students. We began work on this objective but it is not complete and it will be continued in the 2017-2018 academic year.

Appendix 1 – Presentation Rubric

Project: _____ (poster number)

What was most impressive about this project/presentation?

What change could most improve this project/presentation?

Low → High

SCIENTIFIC THOUGHT

Degree to which the student clearly states a thoughtful question. 1 2 3 4

Degree to which the student clearly state their research hypothesis or purpose 1 2 3 4

Is the significance of this research clear in terms of the 'big picture?' 1 2 3 4

SCIENTIFIC METHOD

Is the method of investigation appropriate to the problem? 1 2 3 4

Is the information sufficiently documented? 1 2 3 4

Has the student collected sufficient data to justify the conclusions made? 1 2 3 4

Has the student analyzed the data in a way to justify the conclusions made? 1 2 3 4

Is the student's own work clearly reflected in the project? 1 2 3 4

COMMUNICATION

Does the presentation (display) represent a complete story or concept? 1 2 3 4

Is the presentation (display) self-explanatory? 1 2 3 4

Do the text, charts, and diagrams aid in the understanding of the project? 1 2 3 4

COMMUNICATION (In person only)

Does the presenter give a clear and concise description of the project? 1 2 3 4

Does the presenter communicate effectively in oral responses to questions? 1 2 3 4

RATING GUIDELINES
 Low → High
 1 – Fair
 2 – Good
 3 – Excellent
 4 – Superior

Presentation type
 Poster presentation
 Course assignment (BIO _____)
 Other _____

Additional Comments may be place on the reverse

**Adapted from Sigma XI Student Research Conference Template*

Appendix 2 – Senior Seminar Survey

Internal Exit Exam for Graduating Seniors Name:

Instructions: Read each question carefully and compete. We will begin with seven (7) non-graded questions that will allow us to assess the demographics of the current senior seminar student population.

1. Which of the following required core areas have you **NOT YET** completed? Mark all that apply.

- a) Cell biology, immunology, or development
- b) Genetics, or evolution
- c) Plant biology
- d) Ecology

2. Of the following, which (if any) have you **completed** as an elective? Mark all that apply.

- a) Invertebrate zoology
- b) Vertebrate zoology
- c) Microbiology
- d) Physiology (human or general)
- e) Anatomy (human or comparative vertebrate anatomy).

3. Of the following, which (if any) have you **completed** as an elective? Mark all that apply.

- a) Additional cell biology, immunology, or development
- b) Additional genetics, or evolution
- c) Additional plant biology
- d) Additional ecology

4. Of the following, which (if any) have you **completed** as an elective? Mark all that apply.

- a) Special studies, or independent studies (Bio 497)
- b) Biology of sex
- c) Conservation biology
- d) Research methods

5. Upon graduation, my overall G.P.A. will be:

- a) 2.0 – 2.49
- b) 2.5 – 2.99
- c) 3.0 – 3.49
- d) 3.5 – 4.0

6. By graduation, my degree will have taken _____ years to complete.

- a) Less than 4
- b) 4
- c) 4.5
- d) 5
- e) More than 5