Institutional Effectiveness (IE) Report

Academic Year 2013-2014
Department of Biology

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Contents

Mission and Goals

The Department of Biology has seven core goals to support the mission of the Francis Marion University (FMU):

1) To provide all baccalaureate degree students with proficiency in the use of scientific methods in a particular discipline, including the ability to understand the core concepts and the expertise to apply the core methodologies of that discipline.

2) To offer programs of study that encourage students to think critically and creatively and to acquire the ability to access information.

3) To emphasize an individualized approach to education through personalized attention to academic advising and career development and to develop skills for more advanced study in professional or graduate schools.

4) To provide a learning-centered environment.

5) To support scholarly pursuits by students and faculty and promote academic development and intellectual stimulation.

6) To render academic assistance to regional schools and other organizations and build a more culturally enriched region

7) To engage in continuous evaluation of all its activities in order to improve quality and efficiency and to place the highest priority on excellence in teaching and learning.

Assessment Activities

<u>Faculty Academic Development (Scholarly Activities and Continuing Education):</u>

We divide academic development into four categories of scholarly activities and one combined category of continuing education. The questionnaire shown below was used to assess the extent to which members of the biology department are involved in academic development. Question 1, 2, 3 and 4 address the scholarly activities categories. Questions 5 and 6 together address continuing education. Scholarly activities and continuing education may sometimes overlap. Category results are listed in the Assessment Activities Results section under <u>Faculty Academic Development (Scholarly Activities and Continuing Education)</u>.

1) Are you (or have you been) involved in a research project during this current

academic year? Please list your projects and indicate whether they are new or continuing.

2) Are you a member of a professional society? Please list the relevant professional organizations to which you belong and indicate your level of activity.

3) Have you published any articles during this current academic year? Please list all publications and indicate whether they are peer-reviewed or not.

4) Have you made any presentations to professional groups in the current academic year? Please list the title and date of presentation.

5) Have you attended workshops, seminars, conferences etc. or taken a course to further your professional development this year? Please list those attended.

6) In the current academic year, have you engaged in discipline related self-study equivalent to a short course, seminar or workshop? Briefly explain.

Benchmark: 90 % of the full-time, biology faculty members do participate in at least 2 of the categories of academic development or 80% of the faculty do participate in at least 3 of the categories.

Faculty Community Service:

The extent of biology faculty participation in community service is assessed by gathering information from each faculty member’s annual report or from a questionnaire. Community service by biology faculty members have included many different kinds of activities such as participation in departmental and university committees, professional assistance to area schools and other local educational organizations, and service to statewide and regional scientific/educational organizations among others.

Benchmark: None this year. Benchmark is under re-evaluation.

Teaching Effectiveness and Student Ratings of Instructors:

Through the use of a campus-wide questionnaire, students rated instructors and courses at the end of each semester. There were thirteen questions addressing specific issue such as the ability to present materials clearly, ability to improve understanding of the subject, overall grading fairness in the course, etc. The rating scale was 1 = excellent, 2 = good, 3 = fair, 4 = poor.

Benchmark: 2.0 average on a scale of 1 to 4. A student's response to this questionnaire (or any other type of student evaluation of a faculty's teaching effectiveness) probably is a reasonably accurate indicator of how satisfied a student is with the instructor and the course. Are these responses or ratings truly a measure of teaching effectiveness? Do high ratings really indicate that meaningful learning took place? These are controversial questions and issues. Some instructors assume that a rating of 1 (i.e.," excellent") given by students indicate excellence in teaching. Others believe that most students lack the necessary experience, and therefore degree of understanding required to assess teaching effectiveness. A rating of 1 may instead be more of an indication that the course was easy or personally interesting to the student. Which among these (or other interpretations) is the most correct is an open question. Given the fact that experts in education research struggle with questions about what is effective teaching, as well as how to assess it, we more or less have arbitrarily decided that a 2.0 is a reasonable rating to choose as a benchmark with the understanding that lower or higher numbers may not necessarily indicate a "better" or "worse" performance by the instructor.

Assessment of General Education Requirements:

The Department of Biology offers courses that students can take to meet science-related goals of general education. In particular, our courses provide students with the opportunity to meet the following two goals:

1) The student will be able to apply scientific principles to reach conclusions.

2) The student will have an understanding of the natural world.

We teach four course (Biology 103, 104, 105 and 106) in which significant numbers of non-majors are enrolled for the purpose of meeting these two general education goals. To carry out an assessment of the student's success in meeting these goals, a course-specific cumulative quiz is given in the laboratory sections of usually two or more of these courses during the end of either Fall or Spring semester or both semesters. The quizzes are multiple-choice in format and designed to test the student's knowledge of biology and their ability to interpret data and reach conclusions. The average quiz score of the combined sections of each course and simple statistical parameters of the quiz results are calculated and tabulated by Academic Computer Services.

Benchmark: Students are expected to achieve a score of 60% or higher. We regard the mean percent score of the quiz results of the laboratory sections of these courses to be a reasonable numerical assessment indicator of student-success in meeting the two science-related general education goals listed above.

Application of Technology:

Information about submissions and awards of grants potentially, or actually, resulting in the acquisition of equipment and software to improve teaching and research were gathered from the biology faculty. Information regarding current use of technology in the classroom was also gathered. However, because the use of technology in our classroom and labs is so diverse, categorization and quantitative analysis were not done. Similarly, we have elected not to report all the classroom and lab applications of technology currently in place.

Benchmark: None established because it is not practical to do so.

Support of Student Activities (Biology Student Organizations, Conferences, and Other Activities:

Various data regarding student activities are collected each year. These data usually include such things as level of participation and types of activities conducted by our student clubs, Ars Medica, Tri Beta, and the Ecology Club; seminar talks or other extracurricular presentations delivered by students; as well information about conferences that they may have attended.

Benchmark: 30 % of majors are members of biology student organizations. Benchmark have not established for the degree of student participation in conferences and other activities.

External Assessment Test:

The ETS Major Field Test in Biology was administered to the graduating or near-graduating seniors enrolled in our capstone course (Senior Seminar) during Spring semester 2008.

Benchmark: We have not established a quantitative benchmark for the ETS Major Field Test in Biology

Laboratory Skills Assessment:

A survey is conducted to determine the extent to which eight basic categories of necessary skills are taught. This information is used to assess the level and types of learning opportunities offered to students that support their development of skills in the use of scientific methods. The categories of skills are as follows:

1) Experiment design
2) Laboratory techniques
3) Lab data collection
4) Field data collection
5) Quantitative analysis of data
6) Data interpretation
7) Scientific report writing
8) Use of microprocessor technology

Benchmark: Students in the biology program will have the opportunity to learn at least three laboratory or field methods within each of the eight categories of skills.

Assessment Activities Results

Faculty Academic Development (Scholarly Activities and Continuing Education):

90 % of respondents (11 faculty members) were actively involved in a research project during the year In total 19 research projects were underway.

82 % of respondents participated in professional societies, one-third of which reported involvement in 2 or more societies.

18 % (2 respondents) have submitted or published peer-reviewed articles or book chapters.

65 % gave presentations to professional societies

Participation Level in Continuing Education:

90 % of respondents attended at least one professional meeting, conference, or workshop in the past academic year,

At least 25 % (3 respondents) were in involved in self-taught ("self-study") activities and learning outside of workshops, seminars, or courses, such as learning new lab techniques, new data analysis methods, and readings to further their knowledge in science beyond their immediate research specialty.

Evaluation of Academic Development:

The majority of the biology faculty participated in 3 out of the 6 categories (listed above) of academic development. We broadly define academic development as scholarly activities and continuing education. Our benchmark that 80 % of the full-time, biology faculty members will have participated in 3 of the categories of academic development (or 90% in 2 of the categories) was met this year.

Much of the research conducted by members of the biology faculty involves participation of students. This greatly increases individual attention given to students and significantly increases the teaching load of instructors to more than 18 contact hours per week (9 to 12 contact hours is the normal contracted teaching load).

The Wildsumaco Biological Station is a relatively new facility located at the Wildsumaco Wildlife Sanctuary in Ecuador. Several members of our department are actively involved in research and teaching at this station, one of them serving as director. The life and activities of the facility involve a multi-institutional partnership of faculty, students, and conservation professionals. Participating institutions are the University of North Carolina, Wilmington, Pontificia Universidad Católica del Ecuador, Wildsumaco Wildlife Sanctuary S.A. (Ecuador), and Francis Marion University (lead academic partner).

Furthermore, some members of our department are involved in writing grant proposals, which we do not document quantitatively but agree are very important. Proposals are submitted to on-campus funding committees yearly. This year was no exception and some were funded. But more notably, a major grant proposals was submitted (MRI: Acquisition of genetic analyzer to enhance research programs at Francis Marion University, a primarily undergraduate institution servicing rural South Carolina. Submitted to NSF January 2014) but, unfortunately, was not funded.

Some members of our department are involved in service oriented professional activities such as: 1) Regional Coordinator for USGS North American Amphibian Monitoring Program, 2) General Secretary of Consortium of South Carolina Herbaria, 3) judging student research papers at the South Carolina Academy of Sciences, 4) conducting professional development workshops for teachers at the EEASC meeting and 5) Director of Academic and Research Programs at Wildsumaco Biological Station.

Other members of our department are writing textbooks and laboratory manuals. For examples, a microbiology textbook is in press, and a book on snakes of South Carolina is in the final stages of completion.

Listed below are some examples of the wide-variety of ongoing research projects conducted this academic year by our faculty:

- Studies on over-expression of Acid Ceramidase in prostate cancer cells
- Pine-barrens tree frog genetic diversity
- Microscopic analysis of tumor biopsies
- Designing and correlating K-12 biology labs with next generation science standards (NGSS).
- Study of the effects of termite exclusion on species composition
- Herpetology survey of Sumaco Ecuador
- Seasonal changes of call patterns of birds
- Cloning the cDNA of the putative member of the p53 superfamily in D. pulex.
- Cloning the promoter putative member of the p53 superfamily in D. pulex
- Survey of the flora of Sandhills State Forest.
- Potential effects of an invasive zooplankton, *Daphnia lumholtzi*, on South Carolina lakes
- DNA damage repair in Daphnia

- Radio-telemetry study of snakes in wetland areas

- Amphibian and reptile diversity and succession of disturbed habitats in the Pee Dee

- Temperature regulation of Artemisia tridentate leaves: the role of leaf hairs

- Changes in community structure of two invasive bivalves in Lake Erie

- Mammal inventory, flagship species, and conservation in Ecuador's tropical Andes and foothills

- Phylogenetic analysis of microsporidians

- Empathy-like behavior in rats

- In vitro transcription using fluorescently-labeled nucleotides

FMU is primarily an undergraduate teaching institution. In our department nearly all courses and labs above the freshmen level are prepared and taught by faculty alone without the aid of student assistants. Given this and our relatively high teaching load, we are satisfied with the quality and quantity of scholarly activities achieved this academic year. We will attempt to continue equivalent or greater efforts in the future as well.

Faculty Community Service:

A survey was sent out to all Biology faculty asking about their participation in service in four different areas: 1) to Francis Marion University (faculty governance, for example), 2) to other schools (a talk to an elementary class, for example), 3) to organizations (serving as an officer in a professional organization, for example), or 4) to enhance the cultural life of the community (playing in the local community orchestra, for example).

67 % of the 21 (includes part-time) faculty members responded. Table 1 below shows the response of those faculty members and indicates the level of faculty participation in service activities of those that responded.

Table I

Biology Faculty Participation in Service Activities (1998-2010) in percentages

Year:	98-99	99-00	00-01	01-02	03-04	04-05	05-06	07-08
To Francis Marion University	100	100	100	100	100	100	100	100
To other schools	87	75	92	77	77	75	92	53
To organizations	100	100	100	100	100	88	69	93
To enhance culture	60	53	69	92	77	56	69	66

Table I (continued)

Year:	08-09	09-10	10-11	12-13	13-14
To Francis Marion University	100	93	100	100	100
To other schools	75	57	67	98	85
To organization	88	78	67	85	79
To enhance culture	63	72	58	54	57

Evaluation of Service Activities:

All members of the biology faculty have participated in service activities at Francis Marion University. Eight-five percent of our faculty provided services to local schools and 79 % provided services to various local organizations. Fifty-seven percent participated in the enhancement of culture in the Pee Dee region of South Carolina. We recently have decided to re-evalua benchmark possibilities for this category. Currently there is no benchmark. The trend over the past14 years suggests that a small decrease in community service activities may have occurred. This may simply reflect the fact that there has been an increase in research/scholarly activities over thos years. In any event, given our high level of participation in scholarly activities, as described above, and relatively heavy teaching load, we are satisfied with the quality and level of our participation in commu services, which we hope to continue at a reasonable level in the future.

Teaching Effectiveness and Student Ratings of Instructors:

The students gave most biology instructors and their courses a **rating between 1.0 (excellent) and 2.0 (good)** for all categories of evaluation.

Evaluation of Teaching Effectiveness:

Overall we received ratings that are considered very high (close to excellent). But we realize that these ratings most likely reflect the student's degree of satisfaction with the instructor and the course in a way that is mostly subject rather than an objective assessment of teaching effectiveness based on knowledge and experience (which of course they lack). Furthermore, we acknowledge that there is no agreement among us (and the academic community at large) about the degree to which student evaluations of instructors truly represent an instructor's teaching effectiveness in the classroom or laboratory. We also feel that there is no consensus among the community of college biology educators at large as to what constitutes effective teaching and how to meaningfully measure it.

Because all of us were students, and have experience in scientific research, and are college-level teachers, and continue to develop professionally, we have a pretty clear understanding of the nature and level of scientific knowledge and problem-solving skills students with baccalaureate degrees must have in order to successfully achieve further training in graduate/professional programs and then succeed beyond that. We probably have a lesser understanding of the knowledge level and problem-solving skills required in the wide variety of workplaces where baccalaureate degree students find employment. But we do know that even at the most rudimentary level scientific knowledge and problem-solving skills are not easily mastered. Furthermore, skilled laboratory technicians in research labs and good science teachers in high schools, for example, do not, and should not, consider themselves to be laypersons in science or with regard to their jobs.

The following issues and questions are often discussed among members of our department in our attempts to find some universal direction that would lead to better teaching:

1) In order to challenge students who are willing to learn to their fullest potential, should we, especially in a major's course, teach in a style and academic level that probably will alienate unwilling students, many of which probably will fail? In this case, it seems likely that our students with the best attitudes about learning will learn a great deal more than if taught otherwise and will be well prepared for the workplace and for graduate/professional training. However, this probably will represent less than 20 percent of the students.

2) Instead, should we, in hopes of engaging a large majority of students, even in a major's course, try to teach in a style more comfortable to those students wanting or willing only to achieve a layperson's understanding of science? Perhaps no student will feel estranged and many will be engaged in learning at a level akin to a National Geographic Science documentary. In this case, it is likely that most students will be satisfied, but won't have achieved the level of knowledge and skill required for the workplace or for graduate/professional training programs. Many most likely won't even be aware of this deficit. Also many high achievers, who are willing to accept the challenges and responsibilities to learn at a more proficient level, may not do so on their own when not required, or when guidance is not provided in that direction.

3) Can we teach effectively with a style and level more in the middle ground? This may on the surface seem like a solution. But depending upon the level of preparedness of the students entering college, which varies widely among different universities, what may seem to be an intermediate teaching style and level to a college professor may still be far too demanding for the majority of students. Consequently, instructors who primarily take this approach might rely far too heavily on the course evaluations when making decisions about course content and depth.

4) Should student performance (GPA and/or standardized exit exam results, for example) dictate the teaching style and level of expectation?

5) Does a high GPA indicate meaningful learning? What about high test scores on standardized tests--do they?

6) What do we do when GPA and performance on standardized test are inconsistent? Should we challenge students with greater expectations so they hopefully will achieve higher standardized test scores? Will this lower their GPA and result in more failing grades (some instructors are convinced that it will), but raise the average scores on exit exams? Will this lower graduation rates; and if so, is it a necessary consequence of a solution that might work? Or do we simply develop a

teaching style that results in high student ratings of faculty on the assumption that students are satisfied because effective teaching had occurred?

7) Is there a way to convert non-willing students into students willing to learn above the layperson's level so that they will be prepared for the work place or further training?

8) Is it possible to stimulate student interest in the subject matter without bringing it down too much to a layperson's level in the style of delivery, content, and learning expectations?

9) Does the linear way of presenting information, such as typically done in PowerPoint presentations, lend itself well to explaining interacting components of complex processes?

10) The design and relationships of biological structures, processes, and the interactions of organisms with their environment are complex phenomena that pose major learning challenges. Students often express the desire to somehow learn biology without having to learn these difficult things. Can we somehow convince our students that fascination or interest in the beauty or complexity of an organism is just the starting point of a new adventure and only scratches the surface of meaningful knowledge about biology, and that understanding what lie beneath requires intelligence and hard work?

11) Can we somehow convince students that a willingness to learn difficult concepts and principles is a choice that they have to make if they want to understand biology and be prepared for the next phase of their educational or professional development?

12) Do we over-simplify teaching biology to the point where it is closer to a layperson's level of understanding--that is, at far less depth than what is described and explained in the textbooks that are required for the courses? If so, is this appropriate? Do we have doable alternatives?

13) What areas of biology should we offer courses in? Which courses should be core courses and which should be electives?

14) What skills should they learn in the laboratory and in the field?

With the exception of question 13) and 14), we struggle with what seems to be an endless number of questions with no clear-cut answers. For nearly all of these issues and questions, there are no widely accepted models to serve as possible guides or solutions. We have met our benchmark, but because of these unanswered questions, we are *not* confident that this or other teaching effectiveness benchmarks have convincing value. As always, we strive to improve our teaching effectiveness. But the changes that we make to improve our teaching are, for the most part, based on instinct and anecdotal evidence garnered from our diverse experiences and trial and error. It is also guided by the tradition of academic freedom.

<u>Assessment of General Education Requirements</u>:

The science-related goals of general education at Francis Marion University are as follows:

1) The student will be able to apply scientific principles to reach conclusions.

2) The student will have an understanding of the natural world.

Non-majors and majors take one or more of the following freshmen-level biology courses: Environmental Biology (Biol 103), Human Biology (Biol 104) or Introduction to Biological Sciences (Biol 105). On the whole more non-majors are enrolled in these course. We assess how successful students are at meeting these two science-related, general education goals by having them take a cumulative quiz consisting mostly of questions covering fundamental facts and principles common among the subject matter of these courses. A specific quiz is used for each course, but each quiz consists mostly of similar overlapping questions.

For the 2013 – 2014 academic year, the Biol 105 quiz was used to test both Human Biology (Biol 104) and Introduction to Biological Sciences (Biol 105) students. Unlike previous years, the biology department's institutional effectiveness coordinator took the liberty of just testing the students in his course sections and only using one quiz version. The Biol 105 quiz had the greatest number of questions addressing fundamental facts and principles common to both courses, so it was chosen. Our benchmark was an average score of 60 %. The assessment was conducted on students in classes offered during Spring, 2014. The results are shown in the following table:

Course Type	Total number of students tested	Mean percentage score
Introduction to Biological Sciences (Biol 105)	128	64.62
Human Biology (Biol 104)	46	69.15

Evaluation of Student Success in Meeting General Education Goals:

Both groups of students scored higher than the benchmark of 60 %. Interestingly, students in Human Biology scored higher than those in Biology 105. The main difference academically among these students was that most in Human Biology were not science majors. Nearly all the students in Biol 105, however, were natural science or natural science-related majors (biology majors and pre-nursing students). Although the sample size was fairly large, it is possible that there is no real difference between the two means. And the important fact is that they both scored substantially higher than the benchmark.

Because pretesting consumes extra time and resources, we have elected to give one test (a cumulative quiz) only at the end of the semester. Pre- and post-testing (using similar quizzes) of Biol 105 students in the past have revealed that the mean score was typically around 40 % on pre-tests and 60 to 70 % on post-tests. Consequently, we made the assumption that the mean score of our students would have been approximately 40 % on pre-tests had they been tested at the beginning of the course. Our students in Biol 105 met the benchmark of 60 % on the cumulative quiz, and we feel that a score of 60% indicates that at least a minimally significant degree of learning had occurred.

To the best of our knowledge, there are no reliable and widely accepted quantitative benchmarks or standards that we can use as references. Consequently, our benchmark was chosen somewhat arbitrarily.

Application of Technology:

Most Notable New Application of Technology:

Major new acquisitions and installations of equipment and technology were not reported this year by members of our department. A great deal of our acquisitions and installations of new technology occurred during the previous 5 years. Currently those technologies are meeting our needs satisfactorily.

As mentioned in the ***Assessment Methods*** section, categorization and quantitative analysis were not done because the diversity of technological applications implemented within our department is extensive and not amenable to analysis.

Evaluation of Application of Technology:

Given our high level of participation in scholarly activities, community service, and our relatively heavy teaching load, we are satisfied with the quality and level of our "grantsmanship" in acquiring information technology and modern lab equipment to enhance laboratory and classroom teaching as well as faculty and student research. We are also very satisfied with quality and level of applying technology in labs and classrooms. We plan to continue an equivalent level of activity in the future, especially with regard to system updates and acquisition of new and useful technology.

Support of Student Activities (Research, Conferences, and Other Activities):

Research:

Twenty students were involved in research projects mentored by 9 faculty members in our department.

Attendance at Conferences:

At least 11 students (see underlined names below) reported research results at professional Conferences:

American Society for Cell Biology Annual Meeting, New Orleans, LA, December 14-18, 2013.

Relationship between acid ceramidase expression and cortisol production in adrenal cortex cells. Abstract #877. Lorianne Stehouwer Turner, Krissy Smith, Lenton Holley, Christopher Johnson, Timothy Prince, and Heather Yancey

American Society for Gene and Cell Therapy Annual Meeting, Salt Lake City, UT, May 15-18, 2013.

Targeting Lysosome Integrity as a Method to Restore Sensitivity to Ceramide-induced Cell Death. Abstract #660. Lorianne Stehouwer Turner, Krissy Smith, Lenton Holley, Christopher Johnson, Timothy Prince, and Heather Yancey

SYNAPSE conference:

An investigation of pro-social behavior in female rats, Latiffa Smith, Brittany Nelson, Shayna Wrighten.

Dominant and subordinate aspects of play fighting in juvenile male and female rats. Navjot Kaur, Jackson McRae, Brittany Martin, Adrian Tucker, Teresa Herzog, Shayna Wrighten

Association of Southeastern Biologists, Spartanburg, SC (Apr. 2014):

Changes in community structure of two invasive bivalves in Lake Erie. Sarah Rawlins

Program for Undergraduate Research Experiences (P.U.R.E.):

P.U.R.E. is avenue for undergraduate students to present their research project results to an audience of students and faculty at FMU. Six students, Kayla Stevenson, Carli Mapes, Emory Altman, Sarah Rawlins, Morgan Soulantikas, and Chris Donaldson presented research results at 9th Annual P.U.R.E. Symposium, Spring 2014

Club activites:

Quantitative data was not gathered this year on student club activities. However, as in past years, guest speakers representing professionals in biology, health related careers, medical, dental and graduate schools, gave presentations to ARS Medica (our health careers-related student organization) and these sessions were well attended by students. Student participation in Tri Beta was also significant.

Evaluation of Support for Student Activities:

We do not have a quantitative benchmark for evaluating the level and quality of support we provide for student activities. Practical and logistical difficulties are encountered when attempting to establish such a benchmark. Our evaluation is primarily based on anecdotal and common sense observations. Nevertheless, we are more than satisfied with the level and quality of support that we provide.

External Assessment Test:

ETS Major Field Test in Biology was not conducted this year.

Issues of Concern and Actions Taken:

Issues of Concern 2013-2014	Actions Taken
Hire replacement faculty projected to be needed starting 2014-2015 academic year.	This matter was discussed extensively and plans were made to request and advertise new hires during Fall of 2014.
Enhance field biology teaching: Young native tree species were planted in 2012. Control burning of weeds and invasive plants species, will have to be implemented in the Fall or Spring of the 2014 – 15 academic year to promote native tree growth.	Action on this matter will be taken during Fall Semester 2014
External assessment test (ETS Major Field Test) results are too low.	A committee will be appointed to study this problem. Action on this matter is still pending as of 2013-2014 academic year.

Laboratory Skills Assessment 2013-2014

Appended to this report in detail of the laboratory skills taught by instructors and used by students in the Biology Department. We feel that there are eight basic categories of skills necessary for a biologist to master. Within these categories there are many skills taught depending on the course and instructor. For each of the eight basic categories, the courses are split into “Required Courses” and “Elective Courses.” Within the “Required Courses” grouping, all listed sections of these required courses guarantee the instruction and use of the listed skills. Additionally, however, several courses are listed in this category that are options that fill a basic requirement of the degree, such as a botany or ecology course. Not every student will take each of these courses. “Elective Courses” listed are courses that majors will take, fulfilling the requirement of taking two elective courses. Not every student will take each of these courses. Additionally, all non-major courses are listed in this section.

Laboratory Skills Assessment 2013 -2014

Required Courses *(guaranteed for all sections of each course taught this year)*

Department	Course	Professor	Term	1. Experimental Design Comments	2.Laboratory Techniques Comments
Biology	115	All professors	Sum., Fall, Spring	Lab on scientific method and experimental design, Students write lab reports emphasizing the scientific method.	Microscopy, Mass and volume measurements, Gel electrophoresis, Colorimetric chemical assays, DNA isolation, Bacterial transformation.
Biology	106	All professers	Sum., Fall, Spring	Design experiments with flatworms, Betta fish and Pill bugs	Sterile technique (Gram staining), Microscopy, Dissection, Animal behavior analysis.
Biology	206	Lang	Fall		Dissecting scopes, taxonomic keys.
Biology	207	Lang	Spring		Dissecting scopes.
Biology	301	Slone, Shannon	Sum., Fall, Spring	Design experiments to characterize earthworm blood.	Microscopy, Differential Centrifugation, Gel electrophoresis of proteins. (Slone only) Detergent/aqueous phase partitioning (Shannon only) Western blotting.
Biology	302	Bauer	Fall		Protein expression during early development in *Drosophila* and oogenesis in chicken, eye pigment production in *Drosophila*.
Biology	303	Lang	Not Offered		Compound and dissecting microscopes to learn histological and reproductive details of plants.
Biology	308	Rae	Summer, Fall		
Biology	310	Stroup	Fall, Spring		
Biology	313	Lang	Spring (alternate)		Compound and dissecting microscopes.
Biology	401	Bauer, Camper	Sum., Fall, Spring	Dihybrid crosses of *Drosophila*.	PCR, Gel electrophoresis, Restriction digests, DNA fingerprinting, Transformation, Plating, Plasmid DNA isolation.
Biology	402	Steinmetz	Fall	Design independent projects.	
Biology	407	McCumber	Spring	Scientific method, Use of controls.	IEP, Ouchterlony, RIA, RID, ELISA, Cytology, Precipitation, Agglutination, Western, Northern & Southern gels, Gel Filtration, Ion exchange.
Biology	411	Rae	Spring	Design Field and Laboratory Studies.	Grow duckweed.

Elective Courses *(also for unique sections of core courses & non-major courses)*

Department	Course	Professor	Term	1. Experimental Design Comments	2.Laboratory Techniques Comments
Biology	103	All professors	Spring	Lab on scientific method & experimental design, Water pollution & LD50, Plant transpiration.	Pasco Probes, Serial dilutions.
Biology	104	All professers	Fall	Two labs on scientific method experimental design, and analytical methods. Students write lab reports emphasizing the scientific method.	DNA isolation, DNA fingerprinting, Dissection, Use of microscope. Electrophoresis. Calorimetry and enzyme kinetics.
Biology	201	Rae	Fall		Dissect invertebrates.
Biology	202	Steinmetz	Spring	Design field studies.	
Biology	204	Stoeckmann	Spring		
Biology	205	Barbeau, Stoeckmann	Sum. Fall, Spring		Dissection.
Biology	210	Knowles	Fall		
Biology	236	Turner, Wrighten	Fall, Spring	Scientific Method, Use of controls	Digital data collection, Blood pressure, EKG, Electrophoresis, Pulmonary function, Urinalysis. Blood glucose monitoring. Pipetting, Dilutions & concentrations, Statistical analysis.
Biology	305	Krebs	Spring		
Biology	311	McCumber, Pryor	Summer, Fall, Spring	Scientific method, Use of controls	Sterile technique – Loops & pipettes, Agar streak plates, Serial dilution, Heat resistance, Autoclave, Pasteurization, Coliform tests, Biochemical testing, MPN analysis, Staining techniques.
Biology	312	Camper	Spring		
Biology	406	Mahalyandi, Eaton, Turner	Fall, Spring, Summer	All students complete a lab research project which includes developing a hypothesis and testing the hypothesis (E.g by collection and analysis of data).	Digital data collection, Blood pressure, EKG, Electrophoresis, Pulmonary function, Urinalysis. Blood glucose monitoring. Pipetting, Dilutions & concentrations, Statistical analysis.

Required Courses *(guaranteed for all sections of each course taught this year)*

Department	Course	Professor	Term	3. Lab Data Collection Comments	4. Field Data Collection Comments
Biology	115	All professors	Sum., Fall, Spring	Every lab exercise involves observation and data collection to some extent.	
Biology	106	All professors	Sum., Fall, Spring	Data collection in these experiments: fungal growth, *Planaria* and earthworm response to stimuli, Potometer experiment, Pillbug taxis, *Betta*agonistic behavior.	Quadrat sampling and Biodiversity comparison.
Biology	206	Long	Fall		Collected & identified specimens from the field.
Biology	207	Long	Spring		Collected & identified specimens from the field.
Biology	301	Slone, Shannon	Sum., Fall, Spring	Protein gel electrophoresis. Western blotting. (Slone only) Biological Image Capture; Investigative project on earthworm blood.	
Biology	302	Bauer	Fall		
Biology	303	Long	Not Offered		
Biology	308	Rae	Summer, Fall		Collect water chemistry and organisms.
Biology	310	Stroup	Fall, Spring		
Biology	313	Long	Spring		
Biology	401	Bauer, Camper	Sum., Fall, Spring	Dihybrid crosses of *Drosophila*. Monohybrid, test crosses and dihybrid crosses in corn [chi square].	
Biology	402	Steinmetz	Fall	Data collection in numerous lab activities and forest survey, squirrel forging, plant competion, herpetological survey, independent project, long leaf survey.	Plant & animal sampling.
Biology	407	McCumber	Spring	Gathering, analysis, & presentation of data.	
Biology	411	Rae	Spring	Collect survivorship data and duckweed growth data.	Class projects.

Elective Courses *(also for unique sections of core courses & non-major courses)*

Department	Course	Professor	Term	3. Lab Data Collection Comments	4. Field Data Collection Comments
Biology	103	All professors	Spring	Species diversity/area curve, Abiotic shrimp response, Population estimates, Plant transpiration, & photosynthesis.	Population studies (survivorship curves), Species diversity vs. area curve.
Biology	104	All professors	Fall	Digital data collection, Graphing – tables etc., Blood pressure.	
Biology	201	Rae	Fall		
Biology	202	Steinmetz	Spring		Bird identification, Herpetology sampling, Fish & mammal identification. Mammal collection.
Biology	204	Stoeckmann	Spring		Collected and identified specimens from the field. Collecting methods.
Biology	205	Barbeau, Stoeckmann	Sum, Fall, Spring		
Biology	210	Knowles	Fall		Quadrat sampling. Data collection and mapping with GPS units.

Required Courses (*guaranteed for all sections of each course taught this year*)					
Department	**Course**	**Professor**	**Term**	**5. Quantitative Analysis of Data Comments**	**6. Data Interpretation Comments**
Biology	115	All professors	Sum., Fall, Spring		Most lab experiments.
Biology	106	All professors	Sum., Fall, Spring		Several lab experiments.
Biology	206	Long	Fall		
Biology	207	Long	Spring		Id specimens using taxonomic keys.
Biology	301	Slone, Shannon	Sum., Fall, Spring	Protein gel electrophoresis. (Slone only) Computer assisted image analysis.	Gel electrophoresis. (Slone only) Biological Image Analysis
Biology	302	Bauer	Fall		
Biology	303	Long	Not Offered		
Biology	308	Rae	Summer, Fall	Duckweed data and Plankton analysis.	Plankton analysis and Duckweed data analysis.
Biology	310	Stroup	Fall, Spring		
Biology	313	Long	Spring		
Biology	401	Bauer, Camper	Sum., Fall, Spring	Analysis of quantitative traits, Maize genetics, Dihybrid crosses of *Drosophila*.	DNA fingerprinting, Gel electrophoresis. Molecular biology exercise, Nucleotide sequence analysis.
Biology	402	Steinmetz	Fall	Statistical analysis lab, analysis of numerous lab data. Individual projects.	Forest comparisons, squirrel forging, plant competion, herp survey, long leaf survey. Independent projects.
Biology	407	McCumber	Spring	Molecular weight analysis on SDS gels, Gel filtration, RID analysis.	Molecular weight analysis on SDS gels, Gel filtration, RID analysis.
Biology	411	Rae	Spring	Class projects.	Class projects.

Elective Courses (*also for unique sections of core courses & non-major courses*)					
Department	**Course**	**Professor**	**Term**	**5. Quantitative Analysis of Data**	**6. Data Interpretation Comments**
Biology	103	All professors	Spring	Many labs: also graphing.	Many labs.
Biology	104	All professors	Fall	Statistical analysis of data. Contrasting means using t-tests in Excel.	Interpret graphs and tables, Standardize physiological data in an index, Social implications of scientific advances.
Biology	201	Rae	Fall		
Biology	202	Steinmetz	Spring		Interpretation of sampling data.
Biology	204	Stoeckmann	Spring		Marine habitat comparisons.
Biology	205	Barbeau, Stoeckmann	Sum, Fall, Spring		
Biology	210	Knowles	Fall	Species richness, Diversity indices	
Biology	236	Turner, Wrighten	Fall, Spring		Data analysis involved in many labs, ie. EKG reading, blood pressure, urine analysis and research projects.
Biology	305	Krebs	Spring		
Biology	311	McCumber, Pryor	Summer, Fall, Spring	Most probable number analysis.	Most probable number analysis.
Biology	312	Camper	Spring		
Biology	406	Malaiyandi, Eaton, Turner	Fall, Spring, Summer	Research project involves analysis of data collected by students to test their hypothesis, t tests.	Data analysis involved in many labs, ie. EKG reading, blood pressure, urine analysis and research projects.

Required Courses (*guaranteed for all sections of each course taught this year*)

Department	Course	Professor	Term	7. Scientific Report Writing Comments	8. Use of Microprocessor Technology Comments
Biology	115	All professors	Sum., Fall, Spring	At least 3 reports.	
Biology	115H	Shannon	Fall	At least 3 reports, Poster presentation on library research (genetic disease).	
Biology	106	All professors	Sum., Fall, Spring	At least 3 reports.	
Biology	206	Long	Fall		
Biology	207	Long	Spring		
Biology	301	Slone, Shannon	Sum., Fall, Spring	Poster presentation on library research (cancer proteins).	Data manipulation. (Slone only) Biological Image Capture and Analysis
Biology	302	Bauer	Fall		
Biology	303	Long	Not Offered		
Biology	308	Rae	Summer	Taught writing, students wrote a critique of a paper.	Oxygen meter, Ecobeaker simulation labs.
Biology	308	Rae	Fall	Taught writing & students wrote two reports.	
Biology	310	Stroup	Fall, Spring	Written report, oral presentation.	
Biology	313	Long	Spring		
Biology	401	Bauer, Camper	Sum., Fall, Spring	At least two reports.	Ecobeaker-sickle cell, Biology Labs online – FlyLab.
Biology	402	Steinmetz	Fall	Students write two major lab reports a final research paper.	GIS Software, Graphes and Prism
Biology	407	McCumber	Spring		
Biology	411	Rae	Spring	Students write several lab reports.	Computer simulations (Ecobeaker).

Elective Courses (*also for unique sections of core courses & non-major courses*)

Department	Course	Professor	Term	7. Scientific Report Writing Comments	8. Use of Microprocessor Technology
Biology	103	All professors	Spring	Many labs. Write ups.	Pasco probes for photosynthesis, GMO foods lab-Use PCR (micropipette).
Biology	104	All professors	Fall	Instruction on scientific report writing. Write 2 lab reports.	Use computers (Excel) and internet.
Biology	201	Rae	Fall		
Biology	202	Steinmetz	Spring		GIS Software
Biology	204	Stoeckmann	Spring		Eco Beaker computer simulations
Biology	205	Barbeau, Stoeckmann	Sum, Fall, Spring		
Biology	210	Knowles	Fall	Major literature review paper in scientific format.	Ecobeaker computer simulations: quadrat sampling, island biogeography, metapopulation analysis. Geographic information systems lab.
Biology	236	Turner, Wrighten	Fall, Spring		Use Vernier equipment & computers to gather data. Use computer simulation.
Biology	305	Krebs	Spring		
Biology	311	McCumber, Pryor	Summer, Fall, Spring		
Biology	312	Camper	Spring		
Biology	406	Malaiyandi, Eaton, Turner	Fall, Spring, Summer	Submit lab report, write abstract, assemble powerpoint presentation.	Use Vernier equipment & computers to gather data. Use computer simulation.