Institutional Effectiveness (IE) Report

Academic Year 2010-2011
Department of Biology

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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. 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 was given during the end of the semester in the laboratory sections of each of these courses. The quizzes were 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 were 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

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.

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

Participation Levels in Scholarly Activities:

92% of respondents were actively involved in a research project during the year (50% reported involvement in 3 or more projects).

92% of respondents participated in professional societies.

33% reported publishing peer-reviewed articles.

17% respondents gave at least one professional presentation.

Participation Level in Continuing Education:

58% of the respondents attended at least one professional meeting, conference or workshop.

17% engaged in discipline-related self-study, such as learning new research techniques and data analysis methods to further their knowledge in specific areas.

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 do participate in 3 of the categories of academic development (or 90% in 2 of the categories) was met.

Much of the research conducted by members of the biology faculty does involve 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 in the classroom or lab per week (9 to 12 contact hours is the normal contracted teaching load). At least 13 students were involved in research projects through our directed/independent study, internship or honors thesis courses (Biol 497, 498, Biol 491-499 or Women and Minorities in Science program).

Collaboration between our biology faculty members and scientists from other colleges and universities is notable. For example, one of our faculty members began collaboration this year with a scientist at the USC School of Medicine in a study that investigates the role of mitochondria in temporal lobe epilepsy. In addition two of our department members have continued to collaborate with scientists at Simon Fraser University in Vancouver. Another two are collaborating with a scientist at Humboldt

State University on conservation biology projects in Ecuador's tropical Andes.

Furthermore, some members of our department are involved in writing grant proposals, which we do not document quantitatively but agree are very important. Some also regularly submit grant proposals to on-campus funding committees each year and sometimes submit major grant proposals to external granting agencies. Most notably, a $1.5 million SC INBRE grant was awarded to three of our faculty members in September 2010.

Other scholarly activities funded by on-campus funds include support from the Women and Minorities in Science grant of research projects conducted by professors and students and their travel expenses.

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

- Stress response in Drosophila
- DNA damage repair in Daphnia
- Radio-telemetry study of snakes in wetland areas
- Diamondback Terrapins research in the North Inlet of Winyah bay
- Amphibian and reptile diversity and succession of disturbed habitats in the Pee Dee
- Community ecology of lotic larval midges in the Lynches River
- Effects of zinc, calcium, reactive oxygen species on liver and brain mitochondria
- Role of mitochondria in temporal lobe epilepsy
- Cell cycle regulation in relation to cancer
- Mammal inventory, flagship species, and conservation in Ecuador's tropical Andes and foothills

FMU is primarily an undergraduate teaching institution and 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 that we have 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:	98-9	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
To Francis Marion University	100	93	100
To other schools	75	57	67
To organization	88	78	67
To enhance culture	63	72	58

Evaluation of Service Activities:

All members of the biology faculty have participated in service activities at Francis Marion University. Sixty-seven percent of our faculty provided services to local schools and 67 % provided services to various local organizations. Fifty-eight percent participated in the enhancement of culture in the Pee Dee region of South Carolina. We recently have decided to re-evaluate our benchmark for this category. Currently there is no benchmark. The trend over the past several years suggests that the decrease in community service activities that has occurred during those years is correlated with an increase in research/scholarly activities. In any event, given our high level of participation in scholarly activities, as described above, and our relatively heavy teaching load, we are satisfied with the quality and level of our participation in community services, which we hope to continue at a reasonable level in the future.

<u>Teaching Effectiveness and Student Ratings of Instructors</u>:

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 only reflect the student's degree of satisfaction with the instructor and the course, or their perception of teaching effectiveness. 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) 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 order to challenge students who are willing to learn to their fullest potential? 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 what we are teaching effectively when the students are satisfied?

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 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.

Assessment of General Education Requirements:

Listed below are the results and other relevant information about course-specific cumulative quizzes that were given during the end Spring semester 2010 in the lab sections of courses in which significant numbers of non-majors are enrolled (Biol 105, 103 and 106). The quizzes were given for the purpose of assessing how successful the students were in meeting the two science-related goals of general education as described in Section I. Approximately 70 to 160 students were tested among 5 to 9 lab sections per course.

Environmental Biology (Biol 103):

- Mean percentage score was 62.19 with a standard deviation of 1.82 from the mean score of 7.46 out of 12.0 total points.

Introduction to Biological Sciences (Biol 105):

- Mean percentage score was 59.13 with a standard deviation of 2.70 from the mean score of 8.87 out of 15.0 total points.

Organismal Biology (Biol 106):

- Mean percentage score was 67.37 with a standard deviation of 1.92 from the mean score of 10.11 out of 15.0 total points.

Evaluation of Student Success in Meeting General Education Goals:

The mean percentage score of the laboratory sections combined for each particular course was above our benchmark of 60 % with the exception of Biology 105, which was about 1% point less than 60. The score for each course was not significantly different than last year's scores. To the best of our knowledge, there are no reliable and widely accepted quantitative benchmarks that we can use as references. Consequently, our benchmark was chosen somewhat arbitrarily.

Because inclusion of a pre-test is more expensive and time-consuming, we have elected to give one test (cumulative quiz) only at the end of the semester. Pre- and post-testing using similar quizzes in the past have revealed that the mean score of our students typically is 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. The students 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.

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 other than the acquisition of data analysis and plotting software purported to be widely useful for teaching and research efforts in our department.

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.

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:

At least 13 students were involved in research projects mentored by at least 5 faculty members in our department.

Attendance at Conferences:

At least 5 students reported research results at conferences. At least 10 attended conferences.

Scholarship Assistance:

The most notable success among this type of support effort was the assistance given to a student in support of his application for a Merck/UNCF Undergraduate Science Research Scholarship. This student was awarded the scholarship (worth $25,000), which was among only 15 that were granted nationwide this year. In addition to this particular success story, many of our department members routinely help students in their attempts to secure internships, or other scholarships, that are also highly competitive. For example, assistance was given to a student to enter a summer internship program in toxicology (SURF) at a major university out of state.

Club activites:

Quantitative data was not gathered this year on student club activities. However, as in the past, 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.

Laboratory Skills Assessment 2010-2011

The following pages detail 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 2010-2011

1. Experimental Design

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

Department	*Course*	*Professor*	*Term*	*Comments*
Biology	105	All professors	Sum., Fall, Spring	First lab on scientific method and experimental design, Students write at least 3 lab reports emphasizing the scientific method.
Biology	106	All professors	Sum., Fall, Spring	Students write lab reports emphasizing the scientific method and experimental design.

Biology	301	Slone, Shannon	Sum., Fall, Spring	Design experiments to characterize earthworm blood, and/or determine activity for alkaline phosphatase.
Biology	308	Rae	Fall	Experimental design for plankton sampling.
Biology	401	Camper	Sum., Fall, Spring	Dihybrid crosses of *Drosophila*.
Biology	402	Steinmetz	Fall	Design independent project.
Biology	407	McCumber	Spring	Scientific method, Use of controls.
Biology	411	Rae	Spring	Design of Field Studies.

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

Department	*Course*	*Professor*	*Term*	*Comments*
Biology	103	All professors.	Spring	A lab specifically on scientific method & experimental design, Water pollution, Plant transpiration. Non-majors course.
Biology	104	All professors.	Fall	First lab specifically on scientific method and experimental design.
Biology	220	Eaton	Fall	Students helped design a research plan to clone a gene for bioluminescence and transfer this into another organism.
Biology	311	McCumber, Pryor.	Summer, Fall, Spring	Scientific method, Use of controls.
Biology	410	King	Spring	All students do a research project: develop a hypothesis and test it by collecting data and analyzing results.

2. Laboratory Techniques

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

Department	*Course*	*Professor*	*Term*	*Comments*

Biology	105	All professors	Sum., Fall, Spring	Microscopy, Mass and volume measurements, Gel electrophoresis, Colorimetric chemical assays, DNA isolation, Bacterial transformation.
Biology	106	All professors	Sum., Fall, Spring	Sterile technique (Gram staining), Microscopy, Dissection, Animal behavior analysis.
Biology	206	Long	Fall	Dissecting scopes, taxonomic keys.
Biology	207	Long	Spring	Dissecting scopes.
Biology	301	Slone, Shannon	Sum., Fall, Spring	Microscopy, Differential Centrifugation, Gel electrophoresis of proteins.
Biology	301	Slone	Fall	Detergent/aqueous phase partitioning.
Biology	301	Shannon	Summer, Spring.	Western blotting, Enzyme assays, Use of plate reader, Fluorescent microscope.
Biology	303	Long	Spring	Compound & dissecting microscopes to learn histological & reproductive details of plants.
Biology	305	Camper	Spring	Dissection of shark & cat.
Biology	308	Rae	Summer, Fall.	Organism identification, Dissection, microscopes.
Biology	313	Long	Spring (alternate)	Compound and dissecting microscopes.
Biology	401	Bauer, Camper	Sum., Fall, Spring	PCR, Gel electrophoresis, Restriction digests, DNA fingerprinting.
Biology	401	Bauer.	Spring, Fall	Transformation, Plating, Plasmid DNA isolation.
Biology	407	McCumber	Spring	IEP, Ouchterlony, RIA, RID, ELISA, Cytology, Precipitation, Agglutination, Western, Northern & Southern gels, Gel Filtration, Ion exchange.

Biology	409	Camper	Spring	PCR, Gel electrophoresis, Restriction digests, DNA fingerprinting.
Biology	411	Rae	Spring	

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

Department	*Course*	*Professor*	*Term*	*Comments*
Biology	103	All professors.	Spring	Vernier Probes, Serial dilutions.
Biology	104	All professors.	Fall	DNA isolation, DNA fingerprinting, Dissection, Use of microscope. Electrophoresis.
Biology	204	Stoeckmann	Spring, Summer	Microscopy, Dissecting, Organism Identification.
Biology	205	Barbeau, Turner, Stoeckmann.	Summer, Fall, Spring	Dissection. Study of anatomical models.
Biology	209	Rae	Fall	Insect identification, dissection and collection, Dissecting microscope.
Biology	220	Eaton	Fall	Restriction digests, Bacterial culture, Aseptic technique, Bacterial transformation, Gel electrophoresis.
Biology	302	Bauer	Fall	Reproduction using sea urchin gametes, Protein expression during early development in *Drosophila*.
Biology	311	McCumber, Pryor.	Summer, Fall, Spring.	Sterile technique – Loops & pipettes, Agar streak plates, Serial dilution, Heat resistance, Disk diffusion testing for antibiotics, Pour plates, Dilution calculations, Autoclave, Pasteurization, Coliform tests, Biochemical testing, MPN analysis, Staining techniques.

Biology	406	Dineley, King, Malaiyandi.	Fall, Spring	Digital data collection, Blood pressure, EKG, Electrophoresis, Fitness test, Pulmonary function, Urinalysis, Blood glucose determination.
Biology	410	King	Spring	Digital data collection, Blood pressure, EKG, Electrophoresis, Pulmonary function, Urinalysis, Blood glucose determination, Respirometry.

3. Lab Data Collection

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

Department	*Course*	*Professor*	*Term*	*Comments*
Biology	105	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.
Biology	301	Slone, Shannon	Sum., Fall, Spring	Protein gel electrophoresis. Western blotting.
Biology	301	Slone	Fall	Biological Image Capture; Investigative project on earthworm blood
Biology	301	Shannon	Spring, Summer	Enzyme kinetics.
Biology	401	Camper	Sum., Fall, Spring	Dihybrid crosses of *Drosophila*.
Biology	407	McCumber	Spring	Gathering, analysis, & presentation of data.
Biology	411	Rae	Spring	Collect data from computer simulation.

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

Department	*Course*	*Professor*	*Term*	*Comments*

Biology	103	All professors.	Spring	Abiotic shrimp response, Population estimates, Plant transpiration, & photosynthesis.
Biology	104	All professors.	Fall	Digital data collection, Graphing – tables etc., Blood pressure, Written reports.
Biology	311	McCumber, Pryor.	Summer, Fall, Spring.	Unknown analysis & Identification.
Biology	406	Dineley, Eaton, King, Malaiyandi.	Fall, Spring	Digital data collection of physiological data, e.g. EKG, Oxygen consumption, Force generated by muscle contraction.
Biology	410	King	Spring	Digital data collection of physiological data, e.g. EKG, Oxygen consumption, Force generated by muscle contraction.

4. Field Data Collection

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

Department	*Course*	*Professor*	*Term*	*Comments*
Biology	106	All professors	Sum., Fall, Spring	Ecology lab
Biology	206	Long	Fall	Collected & identified specimens from the field.
Biology	207	Long	Spring	Collected & identified specimens from the field.
Biology	308	Rae	Summer, Fall	Collect water chemistry and organisms.
Biology	402	Steinmetz	Fall	Plant & animal sampling, Animal behavior observation, GPS/GIS.
Biology	411	Rae	Spring	Two projects: litter insects and plant diversity.

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

Department	*Course*	*Professor*	*Term*	*Comments*

Biology	103	All professors.	Spring	Population studies (survivorship curves), Species/area curve, Conifer needle length.
Biology	202	Knowles	Spring	Bird identification, Herpetology identification, Fish & mammal identification.
Biology	204	Stoeckmann	Summer, Spring	Organism identification, Water chemistry and Organism collection techniques.
Biology	210	Knowles	Fall	Quadrat sampling. Data collection and mapping with GPS units.

5. Quantitative Analysis of Data

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

Department	*Course*	*Professor*	*Term*	*Comments*
Biology	301	Slone, Shannon	Sum., Fall, Spring	Protein gel electrophoresis.
Biology	301	Slone	Fall	Computer assisted image analysis.
Biology	301	Shannon	Spring, Summer	Enzyme assays.
Biology	308	Rae	Fall	Plankton analysis.
Biology	401	Bauer, Camper	Sum., Fall, Spring	Analysis of quantitative traits, Maize genetics, Dihybrid crosses of *Drosophila*, Chi square, Pedigree analysis.
Biology	402	Steinmetz	Fall	Statistical analysis, GIS, Individual projects.
Biology	407	McCumber	Spring	Molecular weight analysis on SDS gels, Gel filtration, RID analysis.
Biology	409	Camper	Spring	Quantitative traits, Maize genetics, Chi square.
Biology	411	Rae	Spring	Class projects e.g. Demography, Litter insect communities, Vegetation Analysis.

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

Department	*Course*	*Professor*	*Term*	*Comments*
Biology	103	All professors.	Spring	Many labs: also graphing.
Biology	104	All professors.	Fall	Statistical analysis of data. Contrasting means using t-tests in Excel (new lab since 2005), Written reports.
Biology	210	Knowles	Fall	Species richness, Diversity indices (Shannon-Weaver, Simpson's).
Biology	220	Eaton	Fall	Analysis of transformants.
Biology	311	McCumber, Pryor.	Summer, Fall, Spring.	Most probable number analysis.
Biology	410	King	Spring	Research project involves analysis of data collected by students to test their hypothesis.

6. Data Interpretation

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

Department	*Course*	*Professor*	*Term*	*Comments*
Biology	105	All professors	Sum., Fall, Spring	Most lab experiments.
Biology	106	All professors	Sum., Fall, Spring	Several lab experiments.
Biology	206	Long	Fall	Id specimens sing taxonomic keys.
Biology	207	Long	Spring, Summer.	Id specimens using taxonomic keys.
Biology	301	Slone, Shannon	Sum., Fall, Spring	Gel electrophoresis.
Biology	301	Slone	Fall	Biological Image Analysis
Biology	301	Shannon	Spring, Summer	Enzyme assay, Microscopic analysis.
Biology	308	Rae	Fall	Plankton analysis.
Biology	310	Stroup	Spring	Individual projects.
Biology	401	Bauer, Camper	Sum., Fall, Spring	DNA fingerprinting.
Biology	402	Steinmetz	Fall	Forest comparisons, GIS, Behavioral data, Individual projects.
Biology	407	McCumber	Spring	Molecular weight analysis on SDS gels, Gel filtration RID analysis.
Biology	409	Camper	Spring	DNA fingerprinting.

Biology	411	Rae	Spring	Class projects e.g. Demography, Litter insect communities, Vegetation Analysis.

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

Department	*Course*	*Professor*	*Term*	*Comments*
Biology	103	All professors.	Spring	Many labs.
Biology	104	All professors.	Fall	Interpret graphs and tables, Standardize physiological data in an index, Social implications of scientific advances.
Biology	210	Knowles	Fall	Compare/contrast species richness/diversity in longleaf pine versus pine plantation.
Biology	311	McCumber, Pryor.	Summer, Fall, Spring.	Most probable number analysis.
Biology	401	Bauer, Camper.	Spring	Molecular biology exercise, Nucleotide sequence analysis.
Biology	406	Dineley, Eaton, King, Malaiyandi.	Fall, Spring	Data analysis involved in many labs, ie. EKG reading, blood pressure, urine analysis.
Biology	410	King	Spring	Data analysis involved in many labs, ie. EKG reading, blood pressure, urine analysis and research projects.

7. Scientific Report Writing

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

Department	*Course*	*Professor*	*Term*	*Comments*
Biology	105	All professors	Sum., Fall, Spring	At least 3 reports.
Biology	105H	Shannon	Fall	Poster presentation on library research (genetic disease).
Biology	106	All professors	Sum., Fall, Spring	At least 3 reports.

Biology	301	Shannon	Summer, Spring	Poster presentation on library research (cancer proteins), Written report on inquiry lab.
Biology	308	Rae	Summer	Taught writing a scientific paper, students wrote a critique of a paper.
Biology	308	Rae	Fall	Taught writing & students wrote two reports (Population Growth; Plankton).
Biology	310	Stroup	Fall, Spring	Written report; oral presentation.
Biology	401	Bauer, Camper	Sum., Fall, Spring	At least two reports, Presentation on a genetic disease.
Biology	402	Steinmetz	Fall	Students write two lab reports, one final project report, one article critique and interpret data on exams, Oral presentations.
Biology	409	Camper	Spring	One lab report.
Biology	411	Rae	Spring	Students write several lab reports using CBE style.

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

Department	*Course*	*Professor*	*Term*	*Comments*
Biology	103	All professors.	Spring	Many labs.
Biology	104	All professors.	Fall	Instruction on scientific report writing.
Biology	210	Knowles	Fall	Major literature review paper in scientific format.
Biology	220	Eaton	Fall	Students maintained research notebook.
Biology	406	Dineley, Eaton, King, Malaiyandi.	Sum., Fall, Spring	Review peer reviewed research paper.
Biology	410	King	Spring	Submit a report for a research project. Review peer reviewed research paper.

8. Use of Microprocessor Technology

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

Department	*Course*	*Professor*	*Term*	*Comments*
Biology	301	Slone	Fall	Biological Image Capture and Analysis
Biology	301	Shannon	Spring, Summer	Plate reader, Fluorescent microscopy.
Biology	308	Rae	Summer, Fall	Oxygen meter, Ecobeaker simulation labs.
Biology	401	Bauer, Camper	Sum., Fall, Spring	Ecobeaker-sickle cell, Biology Labs online – FlyLab, Students give PowerPoint presentations.
Biology	402	Steinmetz	Fall	GPS, GIS, PowerPoint, Excel.
Biology	409	Camper	Spring	Ecobeaker: Selection, Sickle cell, DNA sequence analysis.
Biology	411	Rae	Spring	Computer simulations, Prism, Excel, Word.

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

Department	*Course*	*Professor*	*Term*	*Comments*
Biology	103	All professors.	Spring	Vernier probes for photosynthesis.
Biology	104	All professors.	Fall	Use equipment & computers to gather data. Run statistical analysis (Excel).
Biology	210	Knowles	Fall	Ecobeaker computer simulations: quadrat sampling, island biogeography, metapopulation analysis. Geographic information systems lab.
Biology	406	Dineley, Eaton, King, Malaiyandi.	Spring, Fall, Summer	Use Vernier equipment & computers to gather data. Use computer simulation.
Biology	410	King	Spring	Use Vernier equipment & computers to gather data. Use computer simulation.