

**Program Review
The B.A. Biology Program
College of Arts and Sciences
Florida Gulf Coast University**

I. Mission

The B.A. Biology Program is housed in the Division of Science and Mathematics (which is one of five divisions in the College of Arts and Sciences). The biology program is designed to produce well-rounded members of the science community who can immediately function upon graduation in a broad array of careers. It is also viewed as a pre-professional program capable of preparing students for pre-med, pre-vet and pre-dental programs and also serves as a vehicle for possible graduate studies in biological sciences and science education. The program is also charged with producing quality undergraduates who possess a core liberal education, along with their technical expertise in biology. During 1998 the science faculty in the College of Arts and Sciences developed program goals for the science programs in CAS, the goals of the science and biology program are listed below.

II. Student Outcomes

Science Student Learning Goals (developed by the CAS science faculty in 1998)

1. All science students must demonstrate the ability to evaluate and to implement the scientific process, its application in different settings and, creative alternative problem solving approaches that are explored within the context of standard scientific conventions.
 - a. Students must demonstrate the ability to gather and critically evaluate information including library research skills, experimental design in laboratory or field settings, and the use of technology for gathering information.
 - b. Students must demonstrate the ability to analyze information.
 - c. Students must demonstrate the ability to synthesize information *via* the formation of hypotheses, the use of numerical and statistical techniques, the use of simulation models, and the ability to apply a system approach.
 - d. Students must demonstrate the ability to effectively communicate in a professional setting, including technical writing, oral presentations and use of available technology.
 - e. Students must be able to perform experiments.
2. Students must demonstrate knowledge of the interaction between science and society.
 - a. Students must demonstrate an awareness of the ethical aspects of science, their conduct as a scientist, and their conduct as a citizen.
 - b. An ability to understand and participate in the development and implementation of public policy.
 - c. Students must demonstrate the ability to solve problems in individual and group settings and incorporate a diversity of values and approaches.
3. Students must demonstrate the development of a knowledge base that includes the prevailing scientific paradigms. The historical nature of these paradigms, and the aesthetic considerations of that knowledge.
 - a. The origin of life on earth and the mechanisms of evolution that shape that life, including an emphasis on natural selection.
 - b. The origin of the earth and the processes that shape the globe including an emphasis on plate tectonics.
 - c. The origin of the universe and the mechanisms that control it.
 - d. The structure and organization of biotic systems from cells through the biosphere including an emphasis on the organization and

functions of the human organism.

Biology specific outcomes

Students in the biology major are expected to meet natural science student learning outcomes as well as student learning outcomes specific to the major. For example, students in the biology major are expected to demonstrate:

1. The ability to function effectively and safely in research settings.
2. Knowledge of biological systems from the molecular, cellular and organismal perspectives, including an historical view of their development.
3. A holistic understanding of organismal systems.
4. An understanding of ethical complexities of biological research.

III. Data Sources

To facilitate a review of the Biology Program, course syllabi for prerequisite and core Biology courses were examined and graduates from the Biology Program were interviewed. Faculty made the decision to collect this data relevant to the Biology Program Review during a Spring 2001 faculty meeting.

IV. Review of Selected Course Syllabi

An analysis of the syllabi for Bio I, Bio II and the core courses in the program was conducted. Upper division and special topics course syllabi were not reviewed because based on the opinion of the faculty that they had not been taught often enough (nor by sufficient numbers of faculty) to allow a comparison to be made. The same statement can be made for some of the core courses, but these were deemed sufficiently important that a preliminary survey and analysis was warranted.

The state of Florida has identified common prerequisites for all students with a Biology major. Those prerequisites include: two semesters of General Biology with lab (BSC 1010C and BSC 1011C), two semesters of General Chemistry with lab (CHM 1045C and 1046C) and two semesters of Organic Chemistry with lab (CHM 2210 and 2211). In addition the Biology Program at Florida Gulf Coast University requires 6 core courses (16 hours). The core includes: Genetics (PCB 3063), Cell Biology (PCB 3023), Vertebrate Form and Function (ZOO 3713C), Scientific Processes (ISC 3120C) Senior Project Research in Biology (BSC 4910), and Senior Project Presentation in Biology (BSC 4911). Course syllabi for lower division Biology courses serving as prerequisites and for core

Biology courses have been reviewed with the exception of Scientific Processes, Senior Project Research in Biology, and Senior Project Presentation in Biology. Scientific Processes is not reviewed because it is required of all students specializing in one of the scientific disciplines and is taught using a pre-determined syllabus. The Senior Project Research and Senior Project presentation are not reviewed because these courses are individually designed for specific research projects.

Course syllabi were specifically reviewed to determine

- that appropriate topics were presented
 - appropriate number of topics
 - no topics obviously missing
 - no inappropriate topics
- that a reasonable grading system was delineated in each one
 - an appropriate grading scale was used
 - an adequate number of evaluations were conducted
 - evaluation methods were diverse
- that course syllabi prepared by different teachers for different sections of the same course were comparable

Prerequisites

General Biology I

General Biology I was taught by three instructors during the 2001-02 academic year. Two of these instructors are full-time faculty and one is an adjunct. All instructors agreed to use a cooperatively developed syllabus. Use of a common syllabus facilitated insuring conformity among sections and streamlined the preparation of laboratory materials in a multi-section course. A review of the course syllabi submitted by each of the instructors demonstrated that this decision was adhered to with the exception of a minor difference in the grading system of one instructor. The course syllabus is revised using input from the instructors. The course syllabus delineated a reasonable and appropriate number of topics for an introductory course in general biology. No inappropriate topics are included. A reasonable grading system is presented. The standard 10 point scale is used with the grade determined as follows: four exams and a final (60%), a lab notebook—or a lab notebook and a separate report on human disease—(20%), a poster presentation (10%), and group projects and class participation (10%). Plus and minus grades may be assigned to more accurately reflect the numerical score.

General Biology II

General Biology II was taught by one instructor during the 2001-02 academic year. A review of the course syllabus suggested that the course included appropriate topics, an appropriate number of topics, and that no inappropriate topics were covered. The grading system was reasonable. A standard 10 point scale was used and the final grade was determined by four exams and a final (65%), quizzes, lab reports, and assignments (25%), and a group observational research project (10%). Because this course is a lower division prerequisite it is likely that it will be taught by other instructors and that multiple sections may be needed. If this occurs, the involved instructors will be encouraged to develop a common syllabus to insure conformity among sections.

Core Courses

Genetics

Genetics was taught by one instructor during the 2001-02 academic year. A review of the course syllabus indicated that the course covered appropriate topics, an appropriate number of topics, and that no inappropriate topics were included. The grading system was reasonable. A standard 10 point scale was used and the final grade was determined by 4 exams (70%), lab (20%), and homework (10%). It is probable that this course will continue to be taught by the same instructor. Multiple sections are not anticipated in the near future.

Human Genetics (PCP3663) is taken by some students in the program as a substitution for Genetics. For this reason, the syllabus for this course was also reviewed. The syllabus review suggested that the course included appropriate topics, an appropriate number of topics, and that no inappropriate topics were covered. The grading system was reasonable. A standard 10 point scale was used and the grade was determined by 4 exams (50%), laboratory and worksheets (25%), project and presentation (12.5%), and group work and participation (12.5%).

Cell Biology

Cell Biology was taught by one instructor during the 2001-02 academic year. A review of the course syllabus suggests that the course included appropriate topics, an appropriate number of topics and that no inappropriate topics were covered. The grading system was reasonable. A standard 10 point grading scale with appropriate sub-divisions for plus and minus grades was used. The final grade was determined by: three exams and a final (64%), homework and laboratory assignments (20%), and a class project (16%). A different instructor taught this course during the previous year, but a comparison of course syllabi indicates the courses were comparable. Both used the same text and covered

similar topics. The only exception being that one instructor chose to skip the early introductory chapters of the text. Evaluation was similar. For the instructor teaching the course during the 2000-01 academic year, the final grade was determined by exams (50%), lab book (20%), presentation (20%), class participation (4%), portfolio (3%), and post quiz (3%). A standard 10 point scale was used. It is unlikely that multiple sections of this course will be required in the near future.

Vertebrate Form and Function

Vertebrate Form and Function was taught by a single instructor during the 2001-02 academic year. A review of the course syllabus indicates that the course covered appropriate topics, an appropriate number of topics, and that no inappropriate topics were included. The grading system was reasonable. A standard 10 point scale was used and the final grade was determined by three major exams and a final (70%) and quizzes, lab reports, and lab practicals (20%). It is unlikely that multiple sections of this course will be required in the near future.

V. Survey of Graduates

Each member of the Biology faculty submitted questions for inclusion in the Graduate Survey. Submitted questions were reviewed and duplicate questions were eliminated. With the exception of duplicate questions, all submitted questions were included in the Survey. Ultimately, some questions were modified slightly for students graduating in May 2002 to improve appropriateness. When completed, each of the two survey instruments included 16 qualitative questions. We attempted to survey all students graduating from the Biology Program between Fall 1998 and Spring 2002. The responses to the surveys are in the appendix.

Thirteen students have successfully completed the Biology degree program. Of these 6 graduated in May 2002 and seven graduated earlier. A total of 10 students were interviewed. These included 5/6 May 2002 graduates and 5/7 graduates from earlier.

Questions 1, 3, and 4 were designed to determine how students were using their degrees immediately following graduation, what their long-term career plans were, and whether their experiences at FGCU had encouraged them to undertake advanced studies. These questions were as follows:

May 2002 Graduates

1. What are your immediate plans regarding beginning a career or continuing your education following graduation from FGCU?
3. What are your future long-term educational and/or career plans?
4. Have your educational experiences at FGCU encouraged you to take advanced studies?

Earlier Graduates

1. Are you currently working in a field directly related to your degree or continuing your education in a field directly related to your degree in biology from FGCU? Explain.
3. What are your future long-term educational and/or career plans? I definitely plan to continue my education.
4. Did your educational experiences at FGCU encourage you to take advanced studies?

Three of the May 2002 graduates plan to immediately attend graduate school with two intending to enter Ph.D programs and one entering an MBA program. Of the two other students interviewed, one plans to attend nursing school, and one plans to teach. All of the May 2002 graduates indicated an intention to ultimately return to school for advanced training. Four of the students said their FGCU experiences encouraged them to attend graduate school and one was undecided because she always wanted to go to graduate school.

Of the five students who graduated prior to May 2002, two are working in their field, one entered a cardiovascular tech program at Edison Community College, one is busy as the mother of two, and one is working while his wife completes graduate school. All ultimately plan post-graduate work. Three of the five said their experience at FGCU encouraged them to undertake advanced studies and two said that it had always been their intention to continue their education beyond the bachelors level.

It is very interesting that all of the graduates interviewed indicated a desire for advanced degrees. We originally envisioned a program that would produce bachelor's levels graduates that might enter the workforce. Thus far, this is not the pattern leading us to ask whether we are teaching in ways that direct students towards graduate school, and whether this should be an intended goal. It is especially interesting seven of the ten interviewed students expressed that their experiences at FGCU encouraged them to continue their education. The remaining three said that post-graduate education had always been their ultimate goal.

Questions 2, 11, and 16 were designed to assess the students overall satisfaction with the Biology program. These questions were as follows:

May 2002 Graduates

2. Do you feel that your education at FGCU has appropriately prepared you to meet the professional challenges you will face in your future?
11. In terms of capability/performance and educational background, how do you feel you compare with colleagues who have come from universities/colleges other than FGCU?
16. Overall, how would you assess your satisfaction with the biology program at FGCU?

Earlier Graduates

2. Did your education at FGCU appropriately prepare you to meet the challenges you have faced?
11. In terms of capability/performance and educational background, how do you feel you compare with colleagues who have come from universities/colleges other than FGCU?
16. Overall, how would you assess your satisfaction with the biology program at FGCU?

All of the students were very positive concerning their degrees. All of the May 2002 graduates felt appropriately prepared and all were satisfied with the Biology Program. Three of the May 2002 graduates judged their preparation at least as good as that received by students from other universities and two ranked their preparation as better than that received by students at other universities. One felt less qualified.

Of the students graduating prior to May 2002, four felt appropriately prepared and one withheld her opinion because she had not yet used her degree. All were very satisfied with the Biology Program. All were confident that their educational preparation was at least equivalent to that received at other institutions with four expressing the opinion that their education was better than that received at other institutions.

We note the strong affirmation of program quality implied by these responses and recognize the importance of future assessments of perceived program quality as our graduates obtain more experience.

Questions 5, 7, and 13 were designed to identify perceived strengths in the Biology Program

May 2002 Graduates

5. What part of your training at FGCU accomplished as a result of our Biology program do you think will be most valuable to you in meeting professional responsibilities?
7. What biology/science courses that you took at FGCU have been especially meaningful to you? What was it about these courses that caused you to single them out as especially meaningful?
13. What areas of your education at FGCU outside of the Biological Sciences do you feel were most useful in your professional training? Why?

Earlier Graduates

5. What part of your Biology degree do you find most valuable and why?
7. What biology/science courses that you took at FGCU have been most beneficial to you? What was it about these courses that you think was especially beneficial?
13. What areas of your education at FGCU outside of the Biological Sciences do you feel were most useful in your professional training? Why?

Answers to these questions were highly individualized for both May 2002 and earlier graduates and appeared closely correlated with their personal areas of interest. Four of five May 2002 graduates did list lab work, hands on experiences, or scientific processes as the most valuable part of their degree training. Three of five May 2002 students also listed Vertebrate Form and Function as a course that was especially meaningful to them.

Of the five interviewees graduating prior to May 2002, two identified the Senior Research Project as especially valuable, two identified the IDS courses as especially valuable, and one liked how the curriculum was set up with required courses providing a good foundation and extensive hands-on lab work.

Questions 6 and 14 were designed to identify perceived weaknesses in the Biology Program. The questions were as follows:

May 2002 Graduates

6. What part of your training at FGCU accomplished as a result of our Biology program do you think will be least valuable and why?
14. What areas of your education at FGCU outside of the Biological Sciences do you feel were least useful in your professional training? Why?

Earlier Graduates

6. What part of your Biology degree do you find least valuable and why?
14. What areas of your education at FGCU outside of the Biological Sciences do you feel were least useful in your professional training? Why?

There was no clear pattern in the answers to these questions. Three of the five students graduating prior to May 2002 and one of the May 2002 graduates identified the IDS classes as the least valuable part of their degree .

Questions 8,9,10, and 15 were designed to determine how students would change their degree program. The questions were the same for both May 2002 and earlier graduates and were as follows:

2. What courses or areas within the biological sciences and available at FGCU do you now wish you had taken to enhance your preparation?
3. What courses or areas within the biological sciences that were not available at FGCU do you now wish had been available to enhance your preparation?
4. What would you change about your educational experience in the biology program at FGCU?
15. In what areas outside of the biological sciences do you wish you had had more course work as part of your professional training?

Again there was no clear pattern in the answers to these questions. Three of the five May 2002 students listed Mammalogy as a course they wish they had taken and two listed Evolution.

Question 12 was asked to determine the student's perspective of the Senior Research Project. The undergraduate research program is expensive and time consuming, so faculty were especially interested in the value students placed upon the experience. The question for both May 2002 and earlier graduates was as follows.

12. Did you find the senior project research and presentation to be a valuable part of your education? Why or why not? Should we continue this practice for future graduates?

Student responses to this question were extremely positive. Four of the five May 2002 students considered the Research Project valuable. The lone dissenting student made the additional comment that it would be valuable if you intended to attend graduate school.

All of the students graduating prior to May 2002 considered the Senior Research Project valuable. Two of the students believe that there should be more control because of high variation in the amount of effort individual students put into projects.

The high degree of satisfaction among our graduates with regards to the Senior Research Project certainly helps justify the time and energy expended on this aspect of the Biology Program.

Conclusions:

The survey of graduates indicated a high degree of satisfaction with the Biology Program. The majority of students enjoyed their educational experience and judged their preparation as good, if not better than students from other universities. Student responses were highly variable concerning both strengths and weaknesses in the program. Differences in courses and experiences deemed highly valuable by students appeared correlated to individual interests and circumstances. There was no pattern evident in discerned weaknesses suggesting that there are no clear weaknesses within the program. Specific comments concerning weaknesses do provide indicators for areas within the program that may need further consideration.

All but one of the students surveyed considered the Senior Research Project a valuable aspect of their degree program. Comments were extremely positive.

Both the Colloquium and the IDS courses were mentioned by many of the students. Some listed them as among the most valuable parts of their degree and others listed them as among the least valuable aspects of their degree. Larger sample sizes are needed to clearly determine student perceptions of these classes.

One unexpected trend identified by the survey was the number of students intending to pursue further studies. All of the graduates surveyed included

additional schooling as part of their long-term career goals. It is important that we continue to monitor this trend to assist in program planning.

It will clearly be valuable and informative to continue to monitor the opinions of both these graduates and future graduates to assist in an ongoing assessment of the Biology Program. As the number of graduates increase it will be important to include a quantitative component to the survey instrument.

VI. Swot analysis

Strengths

The following strengths have been identified for the FGCU Biology Program:

- A strong teaching faculty with diverse interests
- Use of varied and innovative teaching techniques
- Small class sizes and a program that accents individualized instruction and experiential learning.
- A required undergraduate research experience
- Dedicated support personnel to assist in delivering a quality laboratory experience
- Qualified technology support personnel to assist with problems in using instructional technologies
- Excellent physical facilities including modern classrooms with state-of-the-art technology to support teaching and well-equipped teaching laboratories
- Financial support from the Whitaker foundation to hire faculty to support development of a program in biotechnology.
- An endowed Eminent Scholar faculty line.

The Biology Program at FGCU has been fortunate in recruiting faculty members dedicated to providing a quality education to undergraduate students. Faculty are interested in teaching and dedicated to exploring innovative teaching methods to improve the undergraduate learning experience. Hands-on learning and involvement of undergraduates in research are cornerstones of the program. Students interviewed as part of the Biology Program Review expressed strong satisfaction with the degree program frequently citing the opportunity for hands-

on learning and an undergraduate research experience as important and valuable parts of their training.

The Biology Program is also fortunate to have outstanding support personnel who do an excellent job in maintaining laboratories and laboratory equipment as well as preparing materials for undergraduate lab activities. The efforts of these individuals save the faculty many hours of preparation time making it possible to provide the extensive use of hands-on experiences that exemplify the instructional methods used by faculty within the program.

The Biology Program has also been strengthened by the financial support of the Whitaker Foundation. Strong support from that foundation enabled the University to construct Whitaker Hall. Whitaker Hall includes state of the art classrooms, teaching laboratories, research space, and faculty offices. The Whitaker foundation has also endowed a position for an Eminent Scholar within the Biology Program bringing a senior faculty member into the program. Lastly the Whitaker Foundation has provided funds to hire five faculty members to support a program in biotechnology, providing the opportunity for the University to become a center for excellence in the teaching of biotechnology.

Weaknesses

The following weakness have been identified for the FGCU Biology Program:

- Excessive reliance on adjuncts
- Insufficient number of quality students
- A lack of faculty to support the delivery of organism based courses such as Invertebrate Biology, Vertebrate Biology, Herpetology, and field oriented botany.
- Lack of large classrooms to facilitate instruction of large numbers of students
- Lack of research space

One of the most serious weaknesses within the Biology Program is uneven instruction caused by excessive reliance on adjuncts. The current faculty is not large enough to teach all of the different classes and sections of classes needed to meet the needs of the student body. Because of this the program relies on the services of numerous adjuncts. Finding appropriately trained and skilled adjuncts is an ongoing problem. While the biology program has been fortunate in hiring a number of good adjuncts, others have lacked the ability to effectively interface with students and many teach only a single semester before moving on

to better paying, more secure positions. The resulting transient nature of adjunct positions makes it difficult to control the quality and consistency of courses within the biology program.

Furthermore, while many excellent students are enrolled in courses within the biology program, there appears to be an overall lack of highly motivated and qualified students—a problem exacerbated by the large number of students who are trying to both work and go to school full time. As FGCU becomes more established and better-known, efforts to recruit quality students whose primary emphasis is on obtaining an education should become more successful.

Financial support from the Whitaker Foundation is making it possible to increase the number of faculty within the Biology Program. The new faculty will, however, all be focused on supporting the development of a program in biotechnology. This will skew the balance within the faculty exacerbating the shortage of faculty working at the level of the organism. It is important that the Biology Program have faculty able to teach courses such as evolution, vertebrate biology, herpetology, plant systematics, and plant ecology not only for students within the Biology Program, but also to meet the needs of students within Ecological Studies. The lack of a botanist who has expertise with the unique flora of South Florida ecosystems is an especially acute weakness.

While the completion of Whitaker Hall has greatly ameliorated the shortage of teaching and research space that previously plagued the Biology Program, space still remains a looming weakness. Most classrooms are small, accommodating a maximum of 30 students. As the University has grown, it has become increasingly clear that some courses will need to be offered in larger lecture halls where students are then broken into smaller groups for discussion, hands-on, and laboratory activities. Few large classrooms are available to meet this need. In addition laboratory research space is already limited. The anticipated hiring of five faculty members to support a program in biotechnology within the next year will likely create a serious shortage of space.

Opportunities

The startup of the biotechnology program in Fall 2003 will provide a large boost to certain aspects of the biology program:

- More biology faculty will become available to teach lower division biology courses, in particular, Human Systems and Bio I, which will otherwise proliferate into numerous sections requiring the hiring of many adjuncts.
- There will be a great deal of cross-fertilization with existing biology faculty, doubtless leading to an increase in research projects available for

undergraduates, external funding submissions, more equipment and space from the planned biotech labs.

- More diverse offerings on the molecular side of biology will become available.

Threats:

The following threats to the Biology Program at FGCU have been identified:

- Competition with the College of Health Professions for students, especially pre-professional students.
- Competition for students with Edison Community College and International College.

The College of Health Professions has a science program in the division of Environmental, Health, Molecular, & Clinical Sciences (EHMCS). It was originally envisioned that this program would serve as a training ground for clinical workers in hospital labs, and EHMCS still retains this core mission. At one point it was decided by the College of Health Professions faculty and leadership that there would be insufficient numbers of students in the core program to keep it viable in the long term, so they decided to add a “pre-professional” track to their program.

The pre-professional track is billed as education for pre-medical students and as a spring-board to graduate study in biology. Unfortunately, these are traditional CAS missions that the biology program was fulfilling and the biology program now finds itself in direct competition for students and resources with the College of Health Professions.

The following have become stress points between the two programs:

1. CAS biology faculty carry a large burden in educating lower division and general education science courses, their morale is affected when they see colleagues in CHP teaching very small upper division classes. The morale issue is exacerbated when it is noted that upper division classes are canceled in the biology program when enrollments are low but similar sized classes are retained by CHP. Further, biology faculty must take turns in teaching the few electives that are available. Biology needs a commitment from CHP to help staff large lower division classes, a suitable rotation program and offering of fewer upper division electives by CHP.
2. One initial (neutral) point of contact for Pre-med advising is needed so the students can choose which program to enter without engendering

confusion in the student ranks or feelings of ill-will from “poaching” of students. We need to work out the details of an agreement where the programs compete for pre-med students without denigrating each other’s efforts.

3. Some of the CHP courses are cross-listed with biology but this tends to lower the frequency with which biology can offer their own electives. Cooperation in course scheduling between both groups becomes critical in this environment
4. CHP and CAS both have budgets for lab supplies used in shared lab spaces, negotiations are needed to clarify the budgetary aspects of sharing.
5. There are real “cultural’ differences between the discovery based , innovative, problem solving , constructivist curricula favored by CAS and an approach to teaching and learning which go along with a more applied and vocational outlook to science education. The differences lead to friction amongst faculty when joint curricular design is attempted. A solution may be to not attempt this and let growth cure the problems by letting each group go its own way.

Competition for students with other local institutions of higher learning such as Edison Community College and International College is a potential problem— both in decreasing the number of students enrolled in our program and in decreasing our control over the quality and education of our graduates. Recognizing that the abundance of educational institutions in Southwest Florida may be a boon to students in many ways, it also creates difficulties in maintaining program quality. The movement of FGCU degree-seeking students from one institution to another can result in students completing the courses needed for graduation, but still not completing a cohesive program of study.

VII. Appendix

- Program Sheet for the Biology Major
- Summary of responses to Surveys of Graduates



**BIOLOGY
BA LIBERAL
STUDIES**
College of Arts and Sciences
(239) 590-7150

The Liberal Studies Degree

The Liberal Studies degree program in the College of Arts and Sciences integrates the traditional major in a discipline with a required core of issues-based interdisciplinary courses, called the Collegium of Integrated Learning. During the first 60 credit hours of study, students complete lower division courses, including general education requirements and common prerequisites. At the upper division, students complete coursework in the major or individualized program of study (30-36 hours), the Collegium of Integrated Learning (12 hours), and the University Colloquium (3 hours). Additional electives may be required to reach a minimum of 120 credit hours for the baccalaureate degree. At least 48 of the 120 hours must be at the upper division (courses numbered 3000 and above.)

Biology Major

The field of biology encompasses living systems across several levels from molecular to ecological systems. In the biology major students will have the opportunity to explore the biological sciences across these levels. Students will gain an understanding of interactions between organisms and their environments (including especially biomedical and evolutionary perspectives). Ethical complexities of biological research are integrated throughout the curriculum. Pedagogically, emphasis is on lab-centered, hands-on learning rather than the traditional lecture format.

Laboratories are designed to include the latest computer technology and to allow collaborative experimental experiences. Instructors use active learning techniques to allow students to experience and understand biological principles. The biology major includes an emphasis on undergraduate research. Students will learn the process of science, and in doing so will learn how to learn. Students in the biology major will be prepared for entry-level positions and for graduate study in biological sciences, including the various biomedical fields (medical, dental, veterinary, optometry, biochemistry, physiology, microbiology, anatomy, etc.).

Students in the biology major are expected to meet natural science student learning outcomes as well as student learning outcomes specific to the major. For example, students in the biology major are expected to demonstrate:

- The ability to function effectively and safely in research settings.
- Knowledge of biological systems from the molecular, cellular and organismal perspectives, including an historical view of their development.
- A holistic understanding of organismal systems.
- An understanding of ethical complexities of biological research.

Common Prerequisites

BSC 1010C	General Biology with Lab I (4) Acceptable substitutes: PCB X101, X011, X021, X131, BSC X040, 2012
BSC 1011C	General Biology with Lab II (4) Acceptable substitutes: ZOO X010C, BOT X010C, BSC X041C, BOT X013C
CHM 1045C	General Chemistry with Lab I (4)
CHM 1046C	General Chemistry with Lab II (4)
CHM 2210C	Organic Chemistry with Lab I (4) Acceptable substitutes: PHY X043/X043L, X048/X048L, X049/X049L or equivalent
CHM 2211C	Organic Chemistry with Lab II (4) Acceptable substitutes: PHY X053/X053L, X048/X048L, X049/X049L, or equivalent
MAC x311	Calculus I (4) Acceptable substitutes: MAC 2233, 2253, X281
MAC x312	Calculus II (4) Acceptable substitutes: STA 2122, 2014, 2023, 2024, 2321 or equivalent, MAC 2234, 2254, 3282

NOTE: All combined lecture and laboratory courses (marked with C) are equivalent to taking the lecture and laboratory separately as two courses.

Coursework in the Major

Core courses (16 hours):

PCB 3063C	Genetics (3)
PCB 3023C	Cell Biology (3)
ZOO 3713C	Vertebrate Form & Function (3)
ISC 3120C	Scientific Process (3)
BSC 4910	Senior Project Research in Biology (2)
BSC 4911	Sr Project Presentation in Biology (2)

Plus two of the following (2 hours):

BSC 4933	Current Topics (1)
EVR 4920	Current Topics (1)
ISC 4930	Current Topics (1)

Plus 18 hours of electives from the following:

Molecular Biology

BCH 3023C	Biochemistry (3)
BCH 3025C	Analytical Biochemistry (3)
BOT 4504C	Plant Molecular Biology (3)
BSC 4422C	Methods in Biotechnology (3)
PCB 4522C	Molecular Genetics (3)
PCB 4783C	Cell Membrane Physiology (3)

Cellular Biology

- MCB 3020C Microbiology (3)
- MCB 4507C Virology, Mycology & Parasitology (3)
- MCB 4203C Pathogenic Microbiology (3)
- PCB 4233C Immunology (3)

Organismal Biology

- PCB 3253C Developmental Biology (3)
- PCB 3414C Behavioral Ecology (3)
- PCB 3703C Human Physiology (3)
- PCB 4674C Reptile-Amphibian Evolution (4)
- ZOO 4436C Evolution of the Mammals (3)
- ZOO 4472C Ornithology (3)
- ZOO 4485C Mammalogy (3)
- ZOO 4743C Neuroscience (3)
- ZOO 4753C Histology (3)

Other Electives

- BSC 4900 Dir Indep Study/Research Biology (3)
- BSC 4930 Special Topics in Biology (3)
- BSC 4940 Internship in Biology (3)
- EVR 4605C Environmental Toxicology (3)
- PCB 4673 Evolutionary Biology (3)
- XXX 3-4000 Upper division elective from the Environmental Studies or Earth Systems Science Majors

Collegium of Integrated Learning

The Collegium of Integrated Learning consists of a core of courses designed to create a community of inquiry. Students must complete 12 credits with a grade of C or better in each course and must meet the following distribution requirements:

Complete one of the following (3 hours):

- IDS 3301 Issues in Culture and Society (3)
- IDS 3305 Issues in Media, Literature, and Arts (3)

Plus one of the following (3 hours):

- IDS 3302 Issues in Politics and Economics (3)
- IDS 3304 Issues in Ecology and Environment (3)

Plus both of the following (6 hours):

- IDS 3303 Issues in Science and Technology (3)
- IDS 4910 Integrated Core Senior Seminar (3)

Additional Requirements

- IDS 3920 University Colloquium (3)

Additional electives may be required to reach a minimum of 120 credit hours for the baccalaureate degree. At least 48 of the 120 hours must be at the upper division (courses numbered 3000 and above.)

Academic Advising

Students must meet with a College of Arts and Sciences advisor prior to entrance into any of the programs and prior to beginning coursework for an individualized program of study. A signed advising contract, which serves as a check sheet of requirements, is required. The academic advisor will assist students in preparing an academic plan that incorporates university, college, and program requirements including general education, CLAST (College Academic Skills Test), foreign language, Gordon Rule writing and computation, and Eagles Connect-Service Learning. Service learning activities provide structured learning experiences in community settings and

are designed to fulfill specific undergraduate learning goals and outcomes, reinforce and enhance classroom learning, and meet community needs.

Summary of Responses to Surveys of Graduates

Summary of Response to the Survey of May 2002 Graduates

1. What are your immediate plans regarding beginning a career or continuing your education following graduation from FGCU?
 - **I plan to go to graduate school in the spring to work on a Ph.D in marine mammal taxonomy and systematics**
 - **I am starting an MBA at FGCU this summer to prepare for a career in pharmaceuticals.**
 - **Entering a Ph.D program at Oregon State University in the fall.**
 - **I plan to take courses in the fall at Edison and then enter the nursing program at FGCU.**
 - **I plan to teach.**
2. Do you feel that your education at FGCU has appropriately prepared you to meet the professional challenges you will face in your future?
 - **I think it has although I could have used more organism-level courses. I do feel that I am prepared for how to do college. I have the necessary skills.**
 - **Certainly. On a scale of 1-5, I would rate my preparation a 4.**
 - **Yes**

- Yes
 - Yes.
3. What are your future long-term educational and/or career plans?
- **Ph.D in marine mammals and then conduct research through a private institution, university, or maybe the Navy.**
 - **Finish my MBA and start work in a large pharmaceutical company or something similar like a large hospital lab. I am hoping for a management position where I will be able to apply both my degree in Biology and in Business**
 - **Career as a University Professor and research scientist.**
 - **Nurse Practitioner**
 - **I Plan to continue teaching and at sometime in the future return to school for a Masters degree.**
4. Have your educational experiences at FGCU encouraged you to take advanced studies?
- **Hard to say because I have always wanted to go to graduate school.**
 - **Yes**
 - **Absolutely**
 - **Yes**
 - **Yes.**
5. What part of your training at FGCU accomplished as a result of our Biology program do you think will be most valuable to you in meeting professional responsibilities?
- **Scientific Processes because it opens you up to what will be expected of you professionally.**
 - **Genetics because I learned that that was not what I wanted to do.**
 - **The literature survey done for Scientific Processes. Writing a proposal. Individual presentations.**
 - **Presentations and lab work—hands on experience.**

- **Hands on learning aspect of class work.**
6. What part of your training at FGCU accomplished as a result of our Biology program do you think will be least valuable and why?
- **Too much emphasis on biology at sub-organism level.**
 - **Liked all classes, considered everything valuable.**
 - **Classes that didn't involve at least 30% individual participation.**
 - **Classes not specifically relevant to major.**
 - **Couldn't think of anything that wasn't valuable. Nothing really.**
7. What biology/science courses that you took at FGCU have been especially meaningful to you? What was it about these courses that caused you to single them out as especially meaningful?
- **Vertebrate Form and Function and Evolutionary Biology because they inspired me to make decision regarding a career.**
 - **Vertebrate Form and Function because I really like that subject and once considered being a veterinarian. Scientific Processes because I learned about how science works.**
 - **Analytical Biochemistry because it taught me to work independently, but at the same time to contribute to a group project. Helped develop analytical skills.**
 - **Neuroscience and cell biology because they were relevant to major.**
 - **Vertebrate Form and Function, Evolutionary Biology. I found content particularly interesting and challenging.**
8. What courses or areas within the biological sciences and available at FGCU do you now wish you had taken to enhance your preparation?
- **Mammalogy**
 - **Mammalogy because I am very interested in learning about animals. Environmental courses because I am interested in them. I couldn't take these things because they were not required and other things were.**
 - **Molecular Genetics and Physics I and II.**
 - **Evolutionary Biology**

- **Mammalogy. It wasn't offered for a long time and then, when it was finally offered, I couldn't fit it into my schedule.**
9. What courses or areas within the biological sciences that were not available at FGCU do you now wish had been available to enhance your preparation?
- **More organism level courses like mammalogy. It was offered my last semester, but by then I couldn't take it.**
 - **I was very happy with the variety of courses offered. They offered a lot more than my school in India. Maybe more biochemistry and biotechnology courses, but they are starting to get these now.**
 - **Evolution –not available since I have been here.**
 - **More clinical classes.**
 - **I think there should be more organismal level courses offered such as herpetology. There are not enough Biology faculty. This limits course offerings. The department seems to be moving in the direction of clinical lab sciences and biotechnology at the expense of Biology. Suggests that it is misleading to claim to have a Biology program and suggests changing the name to reflect this emphasis. Suggested changing the department or program name to Biotechnology.**
10. What would you change about your educational experience in the biology program at FGCU? Not really anything.
- **I would not have taken microbiology and I would like to have taken more courses dealing with organisms.**
 - **I would take more of the courses I wanted and fewer of the pre-clinical lab sciences courses I used as electives.**
 - **Wish I had spent all four years here instead of just two.**
 - **Offer more classes—both more sections and a wider range of subjects.**
 - **Wish I had gotten more involved in research experiences.**
11. In terms of capability/performance and educational background, how do you feel you compare with colleagues who have come from universities/colleges other than FGCU?
- **On par. I have a good friend that graduated from Lehigh University and I think I am comparative with him.**

- **On a scale of 1-5, I would rate my preparation as a 4. I feel my preparation was pretty much as good as anywhere. I feel that I have been prepared so that I will be able to survive no matter where I end up.**
- **Among the best and as proof, I was accepted to 3 out of the five Ph.D programs that I applied to.**
- **More well-rounded because of taking IDS courses.**
- **Feel that I am not as qualified. I attended the University of Florida for a while and felt the professors were more demanding. There was also a lot more research activity there. FGCU however offers more opportunities for hands on learning.**

12. Did you find the senior project research and presentation to be a valuable part of your education? Why or why not? Should we continue this practice for future graduates?

- **Absolutely. It gives you early exposure to research and provides you with a jump- start. Helps you understand the process of proposal—research—presentation.**
- **No. I did not like it. I had to change my project twice and I spent way too much time on it. I think it is worth too many hours. On the positive side, if you want to go to graduate school, it would be very valuable. For me it wasn't that useful.**
- **Very valuable. It taught me and prepared me to understand what it takes to be successful as a researcher. I learned that it required dedication and managerial ability. It was very realistic—real science.**
- **Yes, it was a learning experience. Especially having to apply for Institutional Review Board. Yes, we should continue the research project and presentation.**
- **Yes because it offered the opportunity to work closely with a faculty member and to put together something that might be publishable.**

13. What areas of your education at FGCU outside of the Biological Sciences do you feel were most useful in your professional training? Why?

- **IDS courses. I think I am unusual in thinking this, but they help make you well-rounded and will apply whether you want them to or not.**
- **Composition because it helped me learn how to write.**

- **Most of my courses were in the Biology Program. Guess IDS courses were helpful, but only because I took them when I first got here so they were a valuable introduction to the school. Otherwise they would not have been valuable.**
 - **Colloquium because it put me in tune with area around me. IDS courses because they taught me a different way of looking at things because teachers outside the specific area taught them. For example an English teacher teaching Science and Technology.**
 - **I think the issues courses might prove useful. I also found the environmental courses I took to be useful. I have a double major in Biology and Ecological Studies. These courses were useful because they were relevant to my career goals.**
14. What areas of your education at FGCU outside of the Biological Sciences do you feel were least useful in your professional training? Why?
- **Styles and Ways of Learning because of how it is put together. It focuses on listening, note taking, stuff like that. It seems like college students should already have these basic skills. After all there has already been a selection process. It seems like the people who don't like school and don't have these skills wouldn't be in college.**
 - **Art history, Issues classes, ethics classes, capstone class. They were all a total waste of time. They did not help one bit. Science and Technology was ok because it was about drugs which interested me, but it was still not very useful.**
 - **Colloquium was a waste of time for a Biology major. Too much fluff and not enough content.**
 - **Environmental Biology classes because they weren't relevant to my major**
 - **Nothing in particular comes to mind.**
15. In what areas outside of the biological sciences do you wish you had had more course work as part of your professional training?
- **More statistics. A lot of the things I needed for my senior project I had to learn on my own. Also a business class because no matter what you do you need to understand how business works.**
 - **Physics and Math. Also business because that is what I am going to need.**
 - **None, not enough time for that.**

- **None**
- **Nothing in particular.**

16. Overall, how would you assess your satisfaction with the biology program at FGCU?

- **Good experience. Would like to have more diversity in professors cause it is not good to get just one view. I realize this is because it is a new school, but would like to have more diversity in courses and professors to select from.**
- **4/5**
- **I feel very well prepared and well satisfied because I can say with confidence that I will be a successful scientist and educator directly because of the experiences at FGCU.**
- **It was good, but it could be better. Need to offer more sections of each course and more variety in course offerings. Offering that feel requirements are too limited.**
- **Satisfied but thinks Biology Program needs more faculty and more course offerings, especially organismal courses.**

Summary of Response to the Survey of Graduates Prior to May 2002

1. Are you currently working in a field directly related to your degree or continuing your education in a field directly related to your degree in biology from FGCU?
Explain.
 - **Yes, I am working as an Ophthalmic Assistant. This is a temporary job until my wife completes her graduate work and I can return to school.**
 - **No, I am in Tallahassee while my wife completes her Masters degree then I am going to graduate school at the University of Florida.**
 - **I am continuing my education in the Cardiovascular Tech Program at Edison.**
 - **Yes, I am with the Department of Environmental protection.**
 - **No. I am a mom. I have a two year old and another on the way.**
2. Did your education at FGCU appropriately prepare you to meet the challenges you have faced?
 - **Yes.**
 - **Yes, I believe so.**
 - **Yes, definitely.**
 - **Oh yes, definitely.**
 - **I don't really know yet. I plan to use my degree later.**

3. What are your future long-term educational and/or career plans? I definitely plan to continue my education.
- **I plan to either attend Optometry School or go on to graduate school with the intention of getting a Ph.D and teaching at the college level.**
 - **I plan to get a Masters degree in PA at the University of Florida after my wife completes graduate work at FSU.**
 - **Complete the CVT program at Edison and work in a hospital and continue to try to get into medical school.**
 - **I plan to work for a year or so to better determine my focus and then to return to graduate school—probably for a masters degree.**
 - **I plan to return to school for a masters degree in education and teach high school chemistry and biology.**
4. Did your educational experiences at FGCU encourage you to take advanced studies?
- **Yes, I miss school.**
 - **Not in particular because I knew what I wanted to do before I started college.**
 - **Not really, I wanted to go to medical school.**
 - **Yes**
 - **Yes**
5. What part of your Biology degree do you find most valuable and why?
- **Being encouraged to do research. The Senior Research Project developed skills that I use in my life.**
 - **The Issues classes because they diversified my learning and looked good on my transcript. I think they will help me get a job.**
 - **The way the curriculum is set up. The required courses provide a good foundation and hands on lab work is extensive.**
 - **I think the most valuable part of my degree was taking courses related to my interest in marine science. Also my Internship which helped me get a job and my Senior Research which got me some publications and gave me research experience and got me excited and focused on graduate work.**

- **I started out in a BS program and transferred into a BA program. It was a change. The IDS courses helped me realize that I wanted to teach instead of staying in straight science.**
6. What part of your Biology degree do you find least valuable and why?
- **Vertebrate Form and Function because it spends too much time dealing with extinct forms.**
 - **I was upset because they let me take advanced courses without the pre-requisites. When it was time to graduate, I had to go back and take the pre-requisites even though I had gotten an A in each of the more advanced classes.**
 - **Everything was valuable and contributed to my education.**
 - **Every part was valuable, but I did have some courses from a professor that I didn't get much from. But overall every course was valuable. The IDS courses were the least valuable.**
 - **Nothing**
7. What biology/science courses that you took at FGCU have been most beneficial to you? What was it about these courses that you think was especially beneficial?
- **Anatomy and Physiology I and II and Neuroscience because they are directly applicable to my work.**
 - **Pathogenic microbiology, Introduction to Health Professions, Genetics. After taking these courses, I felt that I had more than doubled my knowledge.**
 - **Microbiology course, Immunology, Virology and Parasitology. They gave me a lot of background, covered a lot of material, and provided a lot of hands on lab work.**
 - **Oceanography because it involved a lot of actual research and I learned how to use some equipment. Biogeology because I developed my senior research thesis from it. Ornithology because I learned a lot. Vertebrate Form and Function because even though there were some things I didn't like about it, I gained a lot of knowledge that I hadn't been exposed to in any other class. It was directly related to my field and this information was nowhere else.**
 - **Biochemistry because it integrated Biology and Chemistry for me. Until then I did not really understand why I took chemistry as part of a biology degree.**

8. What courses or areas within the biological sciences and available at FGCU do you now wish you had taken to enhance your preparation?
- **None in particular**
 - **Chemistry**
 - **I think I took everything I needed.**
 - **Mammalogy because I heard it was fantastic. Organic chemistry even though I know I wouldn't want to take it.**
 - **Human Anatomy. I took Vertebrate Form and Function and then a bunch of classes in clinical lab sciences where everyone else had taken two semesters of Human Anatomy. They knew what I needed to know, but didn't learn in Vertebrate Form and Function. I ended up taking all those clinical lab science courses because there weren't many other options. The school was really new.**
9. What courses or areas within the biological sciences that were not available at FGCU do you now wish had been available to enhance your preparation?
- **Physics course in optics although that is not really in biology.**
 - **More science courses related to medicine. I wanted to do my senior research project on a project related to medicine, but there was not a faculty member available to assist me.**
 - **I am happy with what was available, but scheduling was sometimes a problem. Two things I needed would be offered at the same time.**
 - **More classes in vertebrate biology like mammalogy. Animal biology classes. There are lots of environmental classes and lots of molecular classes, but hardly any organismal classes.**
 - **Higher level chemistry. I would loved to have taken a course in polymer chemistry**
10. What would you change about your educational experience in the biology program at FGCU?
- **No real Pre-Optometry program. It is listed in the catalog, but they don't really have it. I was able to get all of the required pre-requisites, but these were only the basics. I also think there needs to be tighter control of adjuncts or less reliance on them. Sometimes they don't do a good job.**

- **There should be a grade forgiveness policy. When I first started, I made foolish mistakes leading to an F in each of four courses. Despite retaking each of these courses and earning an A, my GPA remained negatively impacted.**
- **I would not change anything. I enjoyed my degree work except I did not like some of the FGCU requirements such as the IDS courses.**
- **I wouldn't change anything. I am extremely pleased.**
- **My senior research project. It was too involved. It took me five semesters.**

11. In terms of capability/performance and educational background, how do you feel you compare with colleagues who have come from universities/colleges other than FGCU?

- **Compare very well. Don't feel short-changed in any way. Some other institutions may be more prestigious, but I have been surprised by how many people have heard of FGCU even here in Bloomington, Indiana.**
- **Equivalent to top 10-15%. I learned more at FGCU than at any other institution I attended (Duquesne University, Edison Community College, and Tallahassee Community College).**
- **Definitely equivalent. I feel confident in my abilities. Maybe even better prepared because I have had the benefit of small classes and one on one interaction with faculty that is often not possible at larger schools.**
- **Came out way better—I have more experience. I not only know the basics, but I know how to do things. I have a friend from another school and she has never even seen some of the equipment I have learned to use.**
- **I think we are better. I spent two years at the University of Miami and there was no comparison. I thought going to FGCU was going to be a piece of cake. I was arrogant and very wrong. FGCU was much more demanding. Until I came to FGCU all of my tests had been multiple choice and my classes had been huge.**

12. Did you find the senior project research and presentation to be a valuable part of your education? Why or why not? Should we continue this practice for future graduates?

- **Positively yes. It is beneficial regardless of whether you go to work or to graduate school. It gives you the opportunity to get your feet wet so that you are less intimidated when faced with conducting another research project.**
- **Yes it was valuable. In observing my wife in graduate school, I can see that it is especially important in helping to prepare for success in graduate school. Also taught me to manage my time and dedicate myself to a research project. My own project was not very successful (data not very useable) and I didn't present my findings, but I still felt that it was beneficial. I believe that FGCU should continue to have a senior research project.**
- **I did find it valuable. I drew from many of the courses I had already taken to formulate my project. I learned a lot about real science and research. I think the requirements need to be more uniform. Lot of variation in the amount of effort students put into the research.**
- **Absolutely, yes. Probably one of the best things. I got publications, made contacts, learned how to design and carry out a project and write up and present the results.**
- **It was valuable as designed. If you are going to be a scientist, you need to do science. Needs more control though. My project was unreasonable in scope.**

13. What areas of your education at FGCU outside of the Biological Sciences do you feel were most useful in your professional training? Why?

- **Speech because it prepared me for public speaking which I have to do all the time and which I expect I will have to do even more of in the future.**
- **Issues courses and College of Health Professions.**
- **Colloquium. You bring in your own concentration and point of view and then see the topics from the perspectives of others.**
- **The environmental edge present in all classes. There is a lot of environmental work in this area and knowing a lot about the environment is a big help in getting a job.**
- **Colloquium because of papers and environmental knowledge. I definitely needed the practice writing papers and presenting.**

14. What areas of your education at FGCU outside of the Biological Sciences do you feel were least useful in your professional training? Why?
- **The IDS courses like Issues in Arts, Media, and Literature. They had zero impact on me. I feel they are a total waste and didn't advance my education at all.**
 - **Definitely the University Colloquium. Too much reading and forced opinions.**
 - **IDS classes were just not relevant.**
 - **The IDS courses. I waited an extra semester to graduate so I would only have to take three IDS courses instead of five. I was able to fill the two spaces with Ornithology and Geobiology which were much more useful to me. I had most of my courses outside of FGCU because I transferred in with an AA degree.**
 - **I did not do my general education program at FGCU, but I found many of these classes—like British Literature and Styles and Ways of Learning—useless.**
15. In what areas outside of the biological sciences do you wish you had had more course work as part of your professional training?
- **Physics, anything dealing with physics.**
 - **Medically related courses, chemistry**
 - **Nothing really**
 - **None**
 - **Composition classes. My writing skills were very weak when I started college and I needed courses like this to improve.**
16. Overall, how would you assess your satisfaction with the biology program at FGCU?
- **Very satisfied anxious to continue my education.**
 - **Thinks the teachers are doing a great job. Loved the class size and dedication of the teachers. There were not enough sections of courses offered. Some required courses were offered only once a year making it difficult to get the courses you needed. There were also few choices of times making it difficult to work out a schedule with the courses needed for graduation.**

- **Very happy. I enjoyed the experience and it prepared me for what I want to do.**
- **It was fantastic. I couldn't have asked for better. One of the main reasons it was so great were the small and focused classes. Made it possible to work one on one with professors and to develop friendships with them.**
- **I would rank my satisfaction as 4/5. My only complaint was my very drawn out senior research project.**