

**The Citadel Department of Biology
Annual Assessment Report
Academic Year 2006-2007**

Departmental Mission Statement

The primary mission of the Department of Biology is to offer training, courses, and degrees in the Life Sciences to five groups of Citadel students: 1) undergraduates fulfilling the science requirement in the college's core curriculum; 2) undergraduate Biology majors; 3) Health and Physical Education students enrolled in the department's two service courses; 4) graduate students working toward the Master of Arts in Biology degree; and 5) graduate students working toward the Master of Arts in Teaching degree (Biology specialization). In addition, the department contributes to the discipline through scholarly and professional activity, and to the state and local community through participation in various service related activities.

1. Biology Core Curriculum Courses

Mission Statement

The Biology Department contributes to the core curriculum of the college by offering a two semester long, eight credit hour sequence of General Biology lecture and laboratory courses (BIOL 101/111; BIOL 102/112). The primary goal of this sequence is to enhance the preparation on non-majors for their future lives as consumers, parents, voters, citizens, and professionals.

Current Assessment Tools and Goals

The Biology Department has developed a set of objectives to be met in each semester of General Biology lecture. The objectives are reviewed and discussed by the faculty at the start of each semester and changed as necessary. Student performance is assessed using a pre-test/post-test strategy. Each instructor generates a pre-test that is given during the first week of the semester. This test is then administered as part of their final exam for the semester. The department's goal is that there will be a significant increase in performance on the post-test. This is the fourth year that the department has used this assessment method, and we have not yet generated enough data to establish a more specific gain in student performance as our goal.

In addition to the content area objectives, the General Biology sequence addresses the following stated core curriculum objectives:

Written Communication--

Yes X How? Students in these courses develop written communication skills through several assignments including writing synopses of newspaper and magazine articles and writing of laboratory reports.

No _____ Why not?

Critical Thinking--

Yes X How? Critical thinking skills are fostered by encouraging students to apply the information that they gain in the course to real world situations such as environmental problems and genetic engineering. In addition, students are exposed to the scientific method and are encouraged to use this method for problem solving both in and outside of the course.

No _____ Why not?

Logical Reasoning--

Yes X How? The use of the scientific method to perform experiments in the laboratory fosters logical reasoning. Lecture material is presented in such a way as to present the logic behind the conclusions that lead to our current understanding of biological systems.

No _____ Why not?

Resource and Reference Usage--

Yes X How? Some instructors require reference usage in written laboratory reports, but this is not a requirement in all sections of the laboratory.

No _____ Why not?

Assessment Results for the 2006-2007 Academic Year

This is the fifth year that the department has used this method to assess student performance in the General Biology courses. In both semesters of General Biology in the 2006-2007 academic year there was a significant increase in student performance on the post-test compared to the pre-test (Tables 1a and 1b). Student performance increased for all content area objectives, and the mean increase for the year was 27.5%. The mean post-test score of 67.1% for all 24 objectives is still lower than desired, but is 6.0% better than in the 2005-2006 academic year.

Table 1a: Student Performance on General Biology I Pre-test and Post-test

Objective #	Pre-test % Correct*	Post-test % Correct*	Change
1	55.8	71.8	+16.0
2	43.6	63.4	+19.8
3	35.4	52.1	+16.7
4	38.4	70.0	+31.6
5	40.1	67.4	+27.3
6	32.4	64.9	+32.5
7	28.6	53.5	+24.9
8	30.8	66.8	+36.0
9	30.4	69.1	+38.7
10	26.1	51.5	+25.4
11	34.8	65.8	+31.0
12	30.3	59.1	+28.8
Mean	35.7	63.0	+27.4

*Average percentage of correct answers for the group of questions related to that particular objective.

Table 1b: Student Performance on General Biology II Pre-test and Post-test

Objective #	Pre-test % Correct*	Post-test % Correct*	Change
1	57.1	69.7	+12.6
2	45.8	71.1	+25.3
3	48.7	75.3	+26.6
4	35.7	70.7	+35.0
5	39.7	68.8	+29.1
6	37.0	68.5	+31.5
7	38.6	77.5	+38.9
8	40.3	74.9	+34.6
9	41.2	66.6	+25.4
10	43.9	69.6	+25.7
11	47.8	73.1	+25.3
12	47.2	66.9	+19.7
Mean	43.6	71.1	+27.5

*Average percentage of correct answers for the group of questions related to that particular objective.

The department has not directly assessed how well it meets each of the stated core curriculum goals. However, as these skills help determine overall student performance in these courses, it appears that the department is successful in achieving the core curriculum goals.

2. Biology Major

Mission Statement

The Department of Biology offers an undergraduate major leading to the degree of Bachelor of Science in Biology. The program provides a strong background of required courses coupled with the flexibility of free electives to allow each student to achieve a broad training in biology and at the same time focus his/her studies according to their interests and goals. The primary objective of the program is the preparation of students for entry into health profession and graduate schools, and for entry-level employment in the biological sciences.

Current Assessment Tools and Goals

The Department of Biology currently uses four tools to assess the effectiveness of the BS in Biology program:

- 1. Standardized Testing:** Students graduating with a BS degree in Biology should exhibit breadth and depth in their knowledge of biology. A measure of attainment of this would be a score at or above the national average on the Biology Major Field Test or Biological Sciences section of the Medical College Admissions Test (MCAT), or a score at or above the 50th percentile in the Biology Subject Test of the Graduate Record Exam (GRE). The department's goal is that 100% of students taking these tests meet or exceed this level of achievement.
- 2. Student Satisfaction:** It is important that graduates of the BS in Biology program perceive that they have received a solid and useful education. Such data can be gleaned from the Citadel Experience Survey, and from exit interviews with each graduating class. The department's goal is that 100% of graduates are "Satisfied" or "Very Satisfied" with

the instruction in their major program, and “Agree” or “Strongly Agree” that their major curriculum prepared them to use the methodologies of their discipline, that they would choose the same major again, and that their biology professors were interested in their progress as students, accessible, and had enthusiasm for the subject matter.

3. **Course Specific Objectives:** Courses taken by Biology majors should have defined goals and measurable objectives, and students are expected to achieve these objectives in each course. All Biology major courses have defined goals and measurable objectives on file in the Biology Department office. Goals and objectives are modified at the discretion of the individual faculty members. Success in meeting course goals and objectives is measured by the instructor through exam questions, laboratory exercises, written and oral presentations, and other assignments. The department’s goal is that students in each course have an average class mark of 70% on the relevant measurable objectives.
4. **Pre-test/Post-test Performance:** Several biology faculty members employ the pre-test/post-test method to assess student performance in their courses for biology majors. This year five courses were assessed in this way.

Assessment Results for the 2006-2007 Academic Year

Standardized Testing:

During the 2006-2007 to date, five biology majors took the MCAT. Of these, two scored at or above the national average on the Biological Sciences section of the test. As of this date no scores are available for the GRE.

Because of continuing concerns with the low number of graduating students volunteering to take the test and a lack of incentive for doing well, the Major Field Test was not administered to graduating biology majors during the 2006-2007 academic year.

Student Satisfaction

Twelve out of fourteen graduating biology majors responded to the on-line survey (“The Citadel Experience”). All of these were “Satisfied” or “Very Satisfied” with the instruction in their major program, and all “Agreed” or “Strongly Agreed” that their major curriculum prepared them to use the methodologies of their discipline. All twelve of the graduating seniors “Agreed” or “Strongly Agreed” that their biology professors were interested in their progress as students, and eleven of them “Agreed” or “Strongly Agreed” that their professors were accessible, and had enthusiasm for the subject matter. Only one out of the twelve respondents indicated that he/she would choose a different major if possible. This indicates an increased satisfaction with the major compared to the last few years in which nearly half of the respondents indicated that they would have pursued a different major if they had the chance to do so.

Course Specific Objectives

In the 2006-2007 academic year the department reached its goal in 86.1% of the stated course specific objectives (Table 2). It is interesting to note that seven of the ten objectives that were not met occurred in the two introductory courses (BIOL 130 and 205) that focus heavily on molecular and cellular aspects of biology.

Table 2: Performance on Course Specific Objectives

Course#	Obj. 1	Obj. 2	Obj. 3	Obj. 4	Obj. 5	Obj. 6	Obj. 7	Obj.8
130	91.7	83.8	83.4	78.1	56.3	80.0	53.6	61.9
	Obj. 9	Obj. 10	Obj. 11	Obj. 12	Obj. 13	Obj. 14		
	75.8	85.3	64.9	64.9	64.9	47.5		
140	70.5	76.8	88.7	76.2	71.8			
205	65.0	82.0	88.0	68.0	52.0	80.0	80.0	73.0
206	78.0	89.0	85.0	100.0	100.0			
302	83.0	91.0	84.0	90.0	82.0	90.0	100.0	
308	84.0	85.0	78.0	80.0	85.0	90.0		
401	76.0	77.0	91.0	93.0	91.0	84.0		
403	83.0	79.6	80.2	74.9	97.8	83.5		
406	81.9	72.0						
407	77.0	90.0	83.0					
419	83.9	90.0						
421	84.5	77.3	76.0	85.8	87.0			
426	95.8	84.9	96.2					

Pre-test/Post-test Performance

During the 2006-2007 academic year seven courses were assessed using the pretest-posttest method. Student performance (class mean) is presented in Table 3. Student performance on the post-test was higher than on the pre-test in all courses assessed in this way. The average increase was 34.2%

Table 3: Pre-test/Post-test Performance

Course #	Pre-test	Post-test	Difference
130	41.6	70.9	+28.6
140	32.5	74.6	+42.1
205	36.0	77.0	+41.0
403	36.8	77.4	+40.6
406	69.7	81.9	+12.2
421	47.8	81.0	+33.2
426	50.0	91.4	+41.4

3. Health and Physical Education Service Courses**Mission Statement**

The Department of Biology offers service courses in Human Anatomy and Physiology for students pursuing the Health and Physical Education major in the Department of Health, Exercise and Sports Science. The goal of these courses is to provide students with a level of knowledge about the structure and function of the human body that is appropriate for their intended careers.

Current Assessment Tools and Goals

The Department of Biology uses instructor defined goals and objectives to assess its Human Anatomy and Physiology I (BIOL 317/327) and II (BIOL 318/328) courses. The specific goals and objectives are kept on file in the departmental office. The department's goal is for all

students to achieve an average score of 70% or better on all individual course objectives. This year the lecture components of the courses (BIOL 317 and 318) were also assessed using a pre-test/post-test method.

In addition to the content area objectives, the Human Anatomy and Physiology sequence addresses the following stated core curriculum objectives:

Written Communication--

Yes _____ How?

No X Why not? The development of written communication skills is not material to these particular courses. Emphasis in these courses is placed on providing the student with a level of knowledge in human structure and function that is appropriate for their intended careers.

Critical Thinking--

Yes X How? Critical thinking skills are developed through in-class Discussion Activities. Approximately once per week, students are presented with a critical thinking question during lecture. These questions require that the student apply the current lecture material to an applied situation. The students have 5 minutes to discuss the question in groups of 2 or 3, then 5 minutes to write their own answer to the question, which is then graded.

No _____ Why not?

Logical Reasoning--

Yes X How? Logical reasoning skills are developed in several different ways. First, logical reasoning is necessary to answer multiple choice and matching quiz and exam questions. Second, students are required to complete “Review Questions” following each laboratory exercise. In order for these questions to be answered correctly, the students are required to use logical reasoning.

No _____ Why not?

Resource and Reference Usage--

Yes X How? Students are required to complete “take-home” quizzes (usually twice per semester) in both lecture and laboratory. These quizzes contain terminology that is not discussed (or defined) in their textbook. In order to complete this assignment, students must use other resources (textbooks, journals, internet, etc.) in Human Anatomy and Physiology. In addition, students can gain limited extra credit in the both courses by finding and summarizing journal articles that pertain to relevant topics in Human Anatomy and Physiology.

No _____ Why not?

Assessment Results for the 2006-2007 Academic Year

This is the third year in which the department has taught a yearlong integrated course in Human Anatomy and Physiology. The department met its goal in eight out of eleven (72.7%) course specific objectives for both the Human Anatomy and Physiology I and II courses (Table 4).

Table 4: Performance on Course Specific Objectives

Course#	Obj. 1	Obj. 2	Obj. 3	Obj. 4	Obj. 5	Obj. 6
317	82.1	66.8	75.7	69.1	59.6	95.7
318	76.1	75.5	72.0	72.4	97.5	

The department has not directly assessed how well it meets the stated core curriculum goals. As these skills help determine overall student performance in these courses, it appears that the department is successful in achieving the core curriculum goals.

Pre-test/Post-test Performance

The pre-test/post-test results are presented in Table 5. Student performance increased in both courses with an overall increase of 34.8% for the year.

Table 5: Pre-test/Post-test Performance

Course #	Pre-test	Post-test	Difference
317	35.6	68.6	+30.0
318	30.2	68.0	+37.8

4. Master of Arts (MA) in Biology

Mission Statement

The Department of Biology offers the degree of MA in Biology. Students must complete 32 credit hours of graduate course work in Biology (up to 3 courses may be from allied areas such as psychology, chemistry, education, and earth science). The primary objective of the MA program is to provide an opportunity for career advancement and/or professional and intellectual growth for mature students.

Current Assessment Tools and Goals

Student Satisfaction: The MA in Biology program does not have any formal assessment of student satisfaction at this time. As the program has only been offered for a short time, it is too early to produce an alumni survey; however, in the near future this will be done.

Course Specific Objectives: Courses taken by MA in Biology students should have defined goals and measurable objectives, and students are expected to achieve these objectives in each course. All courses have defined goals and measurable objectives on file in the Biology Department office. Goals and objectives are modified at the discretion of the individual faculty members. Success in meeting course goals and objectives is measured by the instructor through exam questions, laboratory exercises, written and oral presentations, and other assignments. The department's goal is that students in each course have an average class mark of 70% on the relevant measurable objectives.

Standardized Testing: The department is considering how to incorporate standardized testing into the assessment of the MA in Biology program. Options include the GRE Biology Subject Test and the Biology Major Field Test.

Assessment Results for the 2006-2007 Academic Year

Student Satisfaction

Current students report that they are pleased with the switch from the MAEd to the MA degree. Student evaluations of courses are very positive and we are seeing an increase in enrollment in the program. Once sufficient numbers of graduates are available, an alumni survey will be sent out.

Course Specific Objectives

During the 2006-2007 academic year the department met its stated goal in all MA courses (Table 6).

Table 6: Performance on Course Specific Objectives

Course#	Obj. 1	Obj. 2	Obj. 3	Obj. 4	Obj. 5	Obj. 6	Obj. 7	Obj. 8
502	95.0	96.0	91.0	94.0	87.0	93.0	100.0	
505	71.1	100.0	78.0	80.0	100.0	98.0		
519	83.9	90.0						
612	80.0	91.5	92.0	79.0	76.0	94.0	92.0	93.0

5. Master of Arts in Teaching (MAT) in Biology

Mission Statement

The Department of Biology, in conjunction with the Program in Education, contributes significantly to the MAT degree in Biology. Specifically, MAT students must pass a minimum of three graduate level Biology courses in addition to filling any required transcript deficiencies at the undergraduate level. The MAT in Biology program leads to initial secondary school teacher certification in South Carolina. Within the context of this program, the mission of the Biology component is to provide certification candidates with content area knowledge sufficient to teach secondary school subjects such as General Biology, College Prep Biology, Honors, and Applied Biology and Chemistry.

Current Assessment Tools and Goals

The MAT in Biology program is currently assessed in two ways:

1. Standardized Testing: Candidates for certification must successfully complete the PRAXIS® Assessment Examination in the area of Biology and General Science prior to beginning their professional internship. The department's goal is 100% success.
2. Professional Internship Evaluation: In the course of the student's professional internship the supervising teacher (Citadel regular or adjunct faculty) and the collaborating teacher (faculty mentor at the collaborating school) should determine, through classroom observation, that the student has subject area competence in the subject(s) for which certification is sought. The department's goal is for all candidates to be rated competent by both evaluators.

Assessment Results for the 2006-2007 Academic Year

During the 2006-2007 academic all students in the MAT program in Biology took and passed the PRAXIS® Assessment Examination in Biology and General Science. Both their supervising and collaborating teachers rated all students completing their professional internships as competent. No changes in assessment are planned at this time.

6. Scholarly and Research Activity

During the 2006-2007 academic year biology faculty members performed the following scholarly and research activities:

Grants funded:

The Citadel Foundation Research Grant Program (10)

The Citadel Foundation Presentation of Research Grant Program (5)
The Citadel Foundation Faculty Development Program (1)
The Citadel Foundation Publication of Research Grant Program (2)
Department of the Navy (1)
Howard Hughes Medical Institute (1)
National Fish and Wildlife Foundation (1)
National Oceanographic and Atmospheric Administration (1)
National Science Foundation (2)
South Carolina Department of Natural Resources (1)
South Carolina Sea Grant (1)

Publications:

Biology faculty members published ten articles in peer-reviewed journals.

Presentations:

Biology faculty members presented twenty nine papers at scholarly meetings.

7. Service Activities

During the 2006-2007 academic year biology faculty members performed the following service activities:

Discipline related community service:

Academic Magnet High School
ACE Basin National Estuarine Research Reserve
Ashley Hall School
Boy Scouts of America
Charleston County Library
City of Mount Pleasant
College of Charleston Environmental Sciences Program
College of Charleston Marine Science Program
Cooper River Forum
International Center for Birds of Prey
Medical University of South Carolina
Mepkin Abbey
Moultrie Middle School Women in Charge Program
The Nature Conservancy
Palm Key Resort
See Wee Visitors Center
South Carolina Aquarium
South Carolina Department of Natural Resources
West Ashley Middle School

Scientific society service:

American Society for Microbiology
Association of Southeastern Biologists
Carolinas Society for Environmental Toxicology and Chemistry
Society for Environmental Toxicology and Chemistry
South Carolina Native Plant Society

Southeastern Estuarine Research Society

Journal and grant review:

Academy of Science of the Czech Republic

Biochemical Genetics

Canadian Journal of Botany

Comparative Biochemistry and Physiology

Crop Science

Environmental Toxicology and Chemistry

Estuarine, Coastal and Shelf Science

Evolutionary Ecology

General and Comparative Endocrinology

International Journal of Plant Science

Journal of Applied Ecology

Journal of Avian Biology

Journal of Botany

Journal of Conchology

Journal of Ecology

Journal of Ecotoxicology and Environmental Safety

Marine Biology

Microbiology Education

Molecular Ecology

Molecular Vision

National Ocean Service

National Science Foundation

Restoration Ecology

Rhode Island Sea Grant

The Ibis

United States Environmental Protection Agency

8. Major Goals and Objectives for Academic Year 2007-2008

Biology Core Curriculum Courses

Over the last several years the Biology faculty members have had informal discussions concerning the structure of the core curriculum General Biology courses. We recognize the importance of giving students a good content base in biology; however, it is equally important to make the material relevant to the students' personal life and show them how this content can be used in their future decision making. Faculty members have increasingly taken an approach that places content into the appropriate context. No radical redesign of the courses has been necessary, as was previously thought. Rather, a change in faculty approach has brought about the needed changes. Assessment of these subtle changes in the courses has been difficult to quantify. The use of content specific objectives and the pre-test/post-test method has enabled the faculty to better assess students' grasp of course material. However, the ability to assess how students make use of the content in decision making is something that is not easily done within the time frame of the course or even a students' entire academic career. The biology faculty members will continue to discuss how to assess this goal of the core curriculum courses. As part of this process, the department has hired Dr. Erick Snellman who will be joining the faculty in

the Fall 2007 semester. One of his duties will be to help the department take a critical look at the structure and delivery of the core curriculum General Biology courses.

Biology Major

The current use of course-specific objectives appears to be a valid way of assessing student performance in individual biology courses, and student satisfaction surveys paint a good picture of the major. More and more instructors are using a pretest-posttest methodology in their biology major courses. This assessment technique gives an additional measurement of student achievement and the results are positive

The Biology Department used the Biology Major Field Test for three years as an assessment tool. Although the data we gathered was positive we have not administered the test for two years due to low participation. We will address this again during the upcoming year and try to devise a strategy for getting more meaningful data from this test, if possible

Our current sequence of courses for freshman biology majors uses a commonly used sequence in which the first semester focuses on molecular and cellular biology and genetics, and the second semester focuses on organismal biology, evolution, and ecology. There is some concern that the material in the first semester is too difficult, particularly as the students are also taking the chemistry course that supports the biology course content, and these two courses are not always synchronized. A change in the sequence of the content areas of the biology courses so that students focus more on organismal biology during the start of the fall semester before going on to the molecular and cellular biology, would allow students to gain adequate knowledge of basic chemistry prior to applying it in the biology course. The Biology faculty will look carefully at this issue to see if we can implement these changes for the 2009-2010 academic year.

Health and Physical Education Service Courses

In the three years since the biology department redesigned these courses into integrated Human Anatomy and Physiology courses we have continued to use course specific objectives, and there are no plans to alter this method of assessment.

Master of Arts (MA) in Biology

Course specific objectives will continue as the major method of assessment. The faculty members have considered using the Biology Major Field Test as an assessment tool for graduating students. However, we have similar concerns with the administration of the test as outlined above for undergraduate biology majors. In addition, the number of students graduating from the program each year is small and may not provide meaningful data. As 2005-2006 was the first year in which the MA in Biology was offered, it is premature to use an alumni survey to assess student satisfaction, but this will be considered in future years.

Master of Arts in Teaching (MAT) in Biology

There are no plans to alter the assessment of this program.