The Citadel Department of Biology
Annual Assessment Report
Academic Year 2004-2005

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 Education degree; and 5) graduate students working toward the Master of Arts in Teaching degree. 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 pretest-posttest strategy. Each instructor generates a pretest 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 posttest. This is the third 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 2004-2005 Academic Year

In both semesters of General Biology in the 2004-2005 academic year there was a significant increase in student performance on the posttest compared to the pretest (Tables 1a and 1b). Student performance increased for all content area objectives, and the mean increase for the year was 21.5%. This is the third year that the department has used this method to assess student performance in the General Biology courses. Although students performed better on the posttest for all objectives, the mean posttest score of 54.4% for all 24 objectives is lower than desired.

Table 1a: Student Performance on General Biology I Pretest and Posttest

Objective #	Pretest % Correct*	Posttest % Correct*	Change
1	54.7	65.7	+11.0
2	40.4	55.8	+15.4
3	30.5	42.5	+12.0
4	31.8	42.9	+11.1
5	31.1	62.7	+31.6
6	37.4	58.1	+20.7
7	26.7	45.4	+18.7
8	28.2	51.8	+23.6
9	24.9	52.8	+27.9
10	23.8	48.0	+24.2
11	28.3	55.3	+27.0
12	22.3	34.1	+11.8
Mean	31.7	51.3	+19.6

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

Table 1b: Student Performance on General Biology II Pretest and Posttest

Objective #	Pretest % Correct*	Posttest % Correct*	Change
1	42.8	66.9	+24.1
2	35.2	50.2	+15.0
3	38.0	59.2	+21.2
4	38.5	66.4	+27.9
5	31.7	58.0	+26.3
6	34.3	56.0	+21.7
7	31.9	47.9	+16.0
8	30.3	51.0	+20.7
9	32.6	52.4	+19.8
10	27.2	58.4	+31.2
11	35.1	62.8	+27.7
12	32.2	60.2	+28.0
Mean	34.2	57.5	+23.3

*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 three 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. **Pretest-Posttest Performance:** Biology faculty members are beginning to employ the pretest-posttest method to assess student performance in their courses for biology majors. This year five courses were assessed in this way.

Assessment Results for the 2004-2005 Academic Year
Standardized Testing:

Ten biology majors took the MCAT during the 2004-2005 academic year. Of these, five scored at or above the national average on the Biological Sciences section of the test.

As of this date no biology majors have reported GRE scores to the department.

Seven graduating senior biology majors took the Biology Major Field Test during the Spring 2005 semester. Results are presented in Table 2a and Table 2b. Scores for Citadel biology majors were at the national average in all assessment categories. This is the third year that the Biology Department has used the Major Field Test as an assessment tool and results indicate that we are continuing to reach our stated goal.

Table 2a: Major Field Test Total and Subscore Results (Mean ± SD)

	The Citadel	**National***
Total test	146.0 ± 12.4	154.2 ± 13.0
Subscore 1	50.5 ± 09.5	55.9 ± 12.5
Subscore 2	46.7 ± 09.3	55.2 ± 12.3
Subscore 3	47.9 ± 12.8	52.4 ± 13.8
Subscore 4	52.1 ± 13.7	54.2 ± 13.8

National scores for tests administered in 2000 – 2003 (latest available comparative data)
Total test score scale = 0 – 200; Subscore scale = 0 – 100
Subscore 1: Cell biology
Subscore 2: Molecular biology and genetics
Subscore 3: Organismal biology
Subscore 4: Population biology, evolution, and ecology

Table 2b: Major Field Test Assessment Indicator Results (Mean ± SD)

Assessment Indicator	The Citadel	National*
1	30.0 ± 18.6	43.2 ± 7.8
2	61.9 ± 05.8	59.5 ± 8.1
3	40.2 ± 08.7	46.6 ± 7.4
4	41.5 ± 16.4	48.7 ± 7.6
5	46.8 ± 15.3	58.8 ± 8.5
6	49.3 ± 11.7	48.6 ± 7.4
7	43.6 ± 13.4	48.6 ± 9.9
8	51.9 ± 15.1	49.2 ± 8.8
9	39.8 ± 08.7	48.6 ± 8.1

National scores for tests administered in 2000 – 2003 (latest available comparative data)
Assessment indicator score scale = 0 – 100
Assessment indicator 1: Biochemistry and cell energetics
Assessment indicator 2: Cellular structure, organization, and function
Assessment indicator 3: Molecular biology and molecular genetics
Assessment indicator 4: Diversity of organisms
Assessment indicator 5: Animal structure and function (organismal)
Assessment indicator 6: Plant structure and function (organismal)
Assessment indicator 7: Population genetics and evolution
Assessment indicator 8: Population, community, and ecosystem ecology
Assessment indicator 9: Analytical skills

Student Satisfaction

Nine out of eleven graduating biology majors responded to the on-line survey ("The Citadel Experience"). Eight of these were "Satisfied" or "Very Satisfied" with the instruction in their major program, and all nine "Agreed" or "Strongly Agreed" that their major curriculum prepared them to use the methodologies of their discipline. Eight graduating seniors "Agreed" or "Strongly Agreed" that their biology professors were interested in their progress as students, were accessible, and had enthusiasm for the subject matter. However, despite the apparent satisfaction with the biology major and the biology faculty, only five out of the nine respondents indicated that they would choose the same major again.

Course Specific Objectives

In the 2004-2005 academic year the department reached its goal in 90.9% of the stated course specific objectives (Table 3).

Table 3: Performance on Course Specific Objectives

Course#	Obj. 1	Obj. 2	Obj. 3	Obj. 4	Obj. 5	Obj. 6	Obj. 7
130	76.8	70.4	77.6	79.8	81.7		
140	71.2	70.5	75.3	73.7	72.9		
205	73.0	69.0	70.0	68.0	75.0		
209	88.0	89.0	93.0				
302	82.9	83.7	83.2	77.7	85.0		
308	80.8	92.9	88.9	93.1			
401	80.0						
403	77.4	76.0	72.0	71.8	80.0		
406	81.3	65.3					
410	68.8	76.0	83.0	80.5			
421	84.0	82.3	84.0	80.6	93.5		

Pretest-Posttest Performance

During the 2004-2005 academic year five courses were assessed using the pretest-posttest method. Student performance (class mean) is presented in Table 4. Student performance on the posttest was higher than on the pretest in all courses assessed in this way.

Table 4: Pretest-Posttest Performance

Course #	Pretest	Posttest	Difference
130	43.0	77.9	+33.9
205	44.0	67.0	+23.0
209	62.4	74.4	+12.0
403	36.0	71.8	+35.8
406	50.1	57.1	+7.1

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.

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 2004-2005 Academic Year

This is the second year in which the department has taught a yearlong integrated course in Human Anatomy and Physiology. The department met its goal in 14 out of 16 (87.5%) course specific objectives for both the Human Anatomy and Physiology I and II courses (Table 5).

Table 5: Performance on Course Specific Objectives

Course#	Obj. 1	Obj. 2	Obj. 3	Obj. 4	Obj. 5
317	80.4	66.9	80.0	72.2	72.2
318	81.0	84.5	79.3	75.7	69.8
327	73.4	76.0	72.0		
328	71.2	87.0	78.4		

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.

4. Master of Arts in Education (MAEd) in Biology

Mission Statement

The Department of Biology offers the degree of MAEd in Biology. Students must complete 24 credit hours of graduate course work in Biology and an additional 9 credit hours in Education and/or Psychology, for a minimum total of 33 credit hours. The primary objective of the MAEd 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 MAEd in Biology program is currently assessed through an alumni survey that focuses on satisfaction with quality of instruction, breadth of coursework available, and effectiveness of the program in providing opportunities for professional and intellectual growth. The department's goal is that 100% of recent alumni (within four years of graduation) were "Satisfied" or "Very Satisfied" with the quality and breadth of coursework and "Agree" or "Strongly Agree" that their program provided opportunities for professional and intellectual growth.

Course Specific Objectives: Courses taken by MAEd 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 MAEd in Biology program. Options include the GRE Biology Subject Test and the Biology Major Field Test.

Assessment Results for the 2004-2005 Academic Year

Student Satisfaction

Recent alumni surveys have shown that the department is meeting its stated goals for the MAEd in Biology program. Some alumni have expressed concern with the limited number of courses available. New faculty hires have improved the number and diversity of courses offered.

Course Specific Objectives

During the 2004-2005 academic year the department met its stated goal in all MAEd 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
508	92.1	90.5	88.4	98.8			
510	95.0	95.0	91.0	85.0			
502	89.8	93.4	89.7	93.8	90.4		
531	89.0						

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 2004-2005 Academic Year

During the 2004-2005 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 2004-2005 academic year biology faculty members performed the following scholarly and research activities:

Grants funded:

The Citadel Foundation Research Grant Program (6)
The Citadel Foundation Presentation of Research Grant Program (2)
The Citadel Foundation Faculty Development Program (2)
The Citadel Foundation Publication of Research Grant Program (1)
South Carolina Department of Natural Resources (1)
South Carolina Sea Grant (3)
National Science Foundation (2)
Howard Hughes Medical Institute (1)

Publications:

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

Presentations:

Biology faculty members presented nineteen papers at scholarly meetings.

7. Service Activities

During the 2004-2005 academic year biology faculty members performed the following service activities:

Discipline related community service:

Academic Magnet High School
Ashley Hall School
Charleston Natural History Society
College of Charleston Marine Science Program
Cooper River Forum
Federal Breeding Bird Survey
Georgia Birding Festival
Kiawah Island
Medical University of South Carolina
Moultrie Middle School Women in Charge Program
National Ocean Science Bowl
Palm Key Resort
See Wee Visitors Center
South Carolina Department of Natural Resources
United States Forest Service

Scientific society service:

American Society for Microbiology
Society for Ecotoxicology and Environmental Safety
Society for Environmental Toxicology and Chemistry
Society for Integrative and Comparative Biology

Journal and grant review:

American Journal of Botany
Environmental Toxicology and Chemistry
International Journal of Plant Sciences
Journal of Ecology
Journal of Ecotoxicology and Environmental Safety
Journal of Environmental Toxicology and Chemistry
Journal of Microbiology Education
National Atmospheric and Oceanographic Administration
National Science Foundation
Photochemistry and Photobiology
The Chat

8. Major Goals and Objectives for Academic Year 2005-2006

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 pretest-posttest method has enabled the faulty 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.

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. Several instructors have begun to use a pretest-posttest methodology in their biology major courses. This assessment technique gives an additional measurement of student achievement and faculty members will be encouraged to increase their use of it during the upcoming academic year.

The department has now used the Biology Major Field Test for three years as an assessment tool. Our data thus far show that graduating seniors fall at or around the national average in all content areas on the test, indicating that no major adjustments in the biology major curriculum are necessary at this time. There is concern about the voluntary nature of the administration of the test. Not all graduating seniors take the time to take the test and there is no incentive for them to do well on it. Short of making passing the test a graduation requirement, something that the faculty are hesitant to do, it will be difficult, but necessary for the faculty to improve the rate of participation and the effort that students put into the test.

Health and Physical Education Service Courses

In the two 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 in Education (MAEd) in Biology

The MAEd in Biology program will be replaced by a Master of Arts (MA) in Biology program beginning in the 2005-2006 academic year. 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. In addition, the number of students graduating from the program each year is small and may not provided meaningful data.

Master of Arts in Teaching (MAT) in Biology

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