one ecologist, one anatomist, two physiologists (one is teaching half-time), a botanist, and an animal behaviorist. Almost all (89%) have Ph.D.s in their special areas and have training to be able to provide backup for at least one other area as well as the skills to teach in more general freshman level courses. The curriculum has been divided into the following study tracks:

- Traditional Biology
  - Pre-Professional Preparation
  - Secondary Education
  - Environmental Biology
- Allied Health Preparation
  - Pre-PT/OT
  - Pre-Med Tech
- Cellular/Molecular Biology

These tracks prepare students for careers in almost any area of biological research, molecular/cellular research, medicine, dentistry, veterinary medicine, environmental biology, high school teaching, physical therapy, occupational therapy, and medical technology. The department advises and provides biological training of 151 (average) majors and annually graduates an average of 28 students. The largest area of specialization for students is Pre-Professional and Allied Health tracks. In addition to providing training for our majors, the department services about 50 pre-nursing majors and 40 exercise science majors by providing courses in anatomy and physiology. We also teach an average of 15 sections of MPSL laboratory science classes per year.

Student learning in biology requires an extensive exposure to methods and examples of life situations. This is accomplished to a great extent through the hands-on-experience in the laboratory. Our new building has been designed to provide ample laboratory space for the various biological areas listed in departmental goal #2. At maximum, teaching labs can accommodate 16-20 students; these small numbers enable us to give each student personal attention. This personal

data personally collected or analyzed by the student. The following rubric has been used to evaluate how well the student used logic and critical thinking in their work.

	Excellent (5 points)	Adequate (3-4 pts)	Nominal (1-2 pts)
Format	Paper in proper scientific form, with all standard categories Tables and figures correctly constructed with good legends Standard use of grammar and spelling. Fewer than one error per two pages Logical organization Literature appropriately used and cited	Section(s) missing, or some material in wrong section Same data presented more than once, or inappropriate figures used Some grammar errors and spelling errors (Fewer than one per page) Some literature used, but inadequate or improperly cited	Non-scientific form Data not presented, or raw data presented One or more grammatical and spelling errors per page. Poorly organized Little or no literature used
Design	Key variables considered Appropriate Experimental Design with testable hypothesis Alternate hypotheses considered Design adequate to test hypotheses Appropriate use of data analysis Includes Control, Experimental groups testing one variable	Design only partially addresses foreseeable variables Alternative hypotheses not eliminated Design insufficient to test hypotheses Incorrect use of data analysis	Poor design, does not separate variables Hypothesis not testable, or design does not test primary hypothesis No use of data analysis
Conclusions	Accurately reflect data presented Correct use of logic Fit study into broader context Adequate summary of paper. Considers where the work should go from here	Some conclusions not based on results Contains faulty logic Study weakly related to broader context	Many conclusions not related to data Poor use of logic No attempt to fit study into broader context

Goal #4, research report and evaluation, will be the culminating experience of graduating biology students. It will consist of the following components:

Selection of an appropriate research topic.

A thorough search of relevant research using primary literature.

Collaborative wet-bench research with a member of the faculty or critical analysis of existing literature on the topic. The culmination of this will be the development of a well-supported position (hypothesis) on the topic.

Presentation of this position consists of an oral presentation before faculty and peers, a poster display similar to those presented at scientific meetings, and a scientific paper patterned after current research literature.

As the curriculum map indicates, this goalo0m1 r

limited need for allied students to do research, we have not required wet bench research of all students to satisfy this goal. We have included the option of researching the primary literature in biology in order to meet this goal. Senior Seminar gives our students the opportunity to present their analyses and conclusions in a formal setting. Evaluation of the poster and oral presentation have been based on guidelines presented in the following rubrics. The scientific paper has been evaluated using the rubric for goal #3.

	Emphasis on student testable, novel hypothesis that would extend research in the field.
	All required components included (Abstract, Introduction, Methods and Materials, Results, Discussion, Acknowledgements, Literature Cited) with correct and necessary information included in each section.
	Rigorous experimental data and appropriate statistics presented with emphasis on student interpretation of data.

RED LIGHT –

Goal #1 - Little or no improvement between pre and post-tests, or little retention of concepts. Less than 75% of syllabi for majors courses show direct relationship of evolutionary concepts.

Goal #2 – More than 10% of students do not complete one or more of content areas, or more than 15% must repeat courses to achieve C- or better.

Goal #3 - Fewer than 3 papers in the folio, with an average evaluation score of less than 9.

Goal #4 - Average oral presentation score for seniors is below 18 and average poster score is less than 13.

How we might meet the goals of the department:

Goal #1 – We developed three different versions of the pre-post test and have used each, improving it. The first version had no material from BI 108, and two of the questions used did not directly relate to evolution. The second version, which included concepts from BI 108 ended up being too long, requiring a whole class period to complete, and also had quite a few questions that were only tangentially related to evolution. The final version (Appendix A) is what we will use from Fall 2007 on at the beginning and end of BI 105, Ecology and Evolution, at the end of the second semester in BI 108 and at the beginning of their senior seminar course BI 481 or 482. Faculty efforts to incorporate evolution into their courses will be judged by the course syllabus. All syllabi should contain specific examples of how evolution will be used, and will be assessed by department chair.

Goal #2 – The first step in completing this goal was to develop a list of courses that provide meaningful exposure to the six areas of emphasis in Biology (shown in Appendix B). We submitted our curricular changes to the Division of Natural Sciences and Mathematics and to the College of Arts and Sciences for approval in November 2006, and began to use the new requirements for biology majors entering in the Fall of 2007. We have developed a check sheet to be included in the advising folder of each student. It will be the annual responsibility of the advising professor to check the progress of advisees to be certain they are in compliance both for exposure and grades. The number falling into the C- or below category will be used to assess our effectiveness in giving the students the exposure they need.

Goal #3—During the spring semester of 2006, we collected and evaluated the writing of seniors in the Senior Seminar course BI 482. We used the results to determine the appropriate standard that students should meet in order to deem our teaching efforts acceptable. We began collecting papers from BI 155 in the fall of 2005, will ask for course research papers beginning with this class of students for junior and senior project classes, and will have data in spring of 2009 to compare freshman, junior, and senior papers. These papers will be evaluated by the senior seminar instructor using the writing rubric for Goal #3 and placed in their student folders.

Goal #4 – The senior seminar instructor evaluates the performance of seniors in the seminar course BI 482 using the evaluation rubrics on oral presentations, posters, and papers.

Goal #1 *Understand and be able to apply the concepts of evolution and natural selection*.

Summary of the Evolution assessments for 2007/2008

When we gave the test to EE students early in the semester, 17 students took the exam, averaging 8.82 out of 25. At the end of the semester, 15 students took it, and averaged 15.3.

Neither AOL instructor gave the assessment during BI 108, so those data are lacking for 2008.

The 30 seniors who took the assessment in 2007/8 senior seminars averaged 15.3 of 25.

The data from all three years have similar trends, showing that the students do not have

BI 323 Animal Behavior	Robertson	Yes
BI 324 Ornithology	Horn	Yes
BI 330 Microbiology	McQuistion	Yes
BI 404 Evolution	Matthews	Yes
BI 414 Human Side of Medicine	Handler	Yes

For Goal #2 *Have exposure to the following general areas of biology: ecology, taxonomy, morphology, function, molecules/cells and genetics/ reproduction.*

The Biology Department determined which courses best cover the six general areas of biology, with one course fitting into no more than two categories. Each student must choose which of the two categories that course will satisfy. After a review of transcripts of 20 recent graduates in the three general tracks, we found that our Allied Health students were often not taking courses that cover ecological concepts. Because their programs are

Neurobiology	BI 322	16	0
Animal Behavior	BI 323	6	2
Ornithology	BI 324	9	1
General Microbiol	BI 330	19	1
Evolution	BI 404	11	1
Humanistic Med.	BI 460	7	0
Senior Seminar	BI 482	22	2
		144	10
Percent Below Cutoff Grade of C-			6.94%

Goal #3

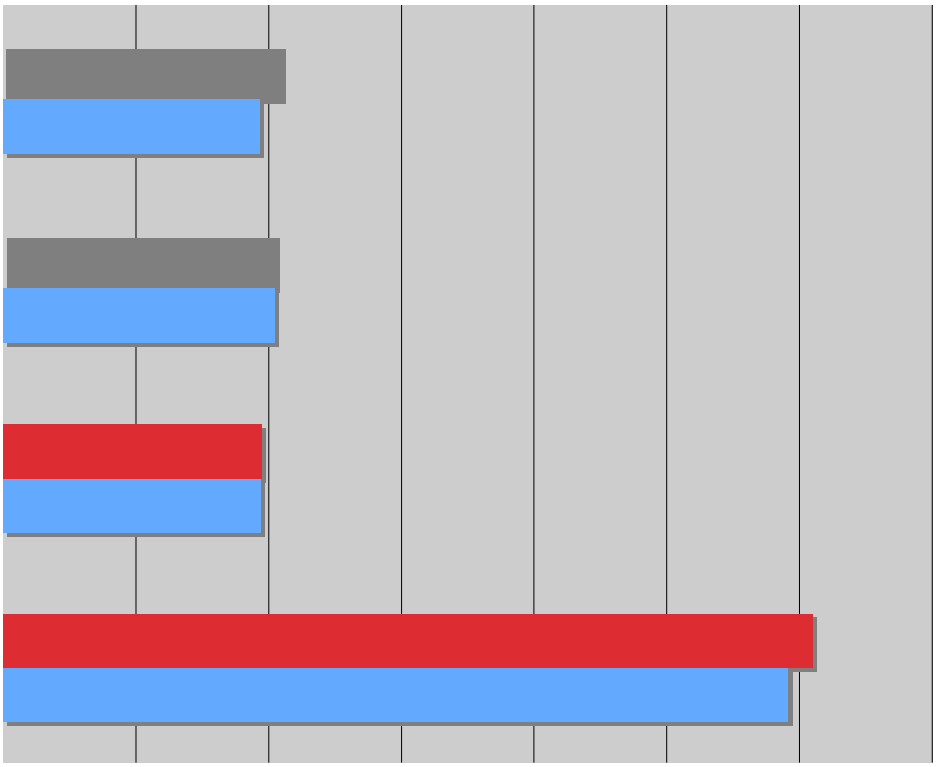

Figure 1. The mean scores for written reports required for senior seminar in biology. Data were only available from rubrics for Spring 2006 and Fall 2007.

We did not have papers from the same students from BI 105 and the course that included a research project to make comparisons and analyze changes. We will be able to do that starting in the Fall of 2008. Papers from senior seminar were not evaluated according to the same rubric in Fall of 2006 and Spring of 2007, as faculty were not satisfied with the rubric. We modified the rubric, and used it in fall of 2007. That rubric will be used to evaluate three papers from each student from BI 155, an upper level course with a required student project, and the senior seminar paper, once the student completes senior seminar. The full assessment, including improvement in individual writing proficiencies, will be assessable beginning in fall 2008.

Goal #4. *Be able to present in oral or written form a completed research project, using testable hypotheses, logical arguments and appropriate methodologies and equipment.*

This goal is assessed by means of a poster and an oral presentation in the Senior Seminar Course. Students are required, using either personally conducted wet bench research or using published literature, to develop a testable hypothesis and then proceed to develop a logical argument supporting or falsifying that hypothesis. This is often easier to do with experiments actually performed by the student. Twenty students were evaluated during the spring semester 2006, 13 in Fall 2006, and ten in fall 2007 (Fig. 2).

Figure 2. Mean scores for different areas of oral evaluation, from a total of the five areas, for spring and fall of 2006 and fall of 2007. In the new rubric, points possible for content changed from 5-10 in 2007, and visual aids and aesthetics were combined for only 5 points. For 2006 comparisons, content scores were doubled. For 2007, the same score is compared for visual aids and for aesthetics. The total score remains 25. Only semesters for which the rubric was used are included.

Prior to their oral presentations, students constructed and displayed a poster using guidelines appropriate for a national meeting. The average score of 17 for the students in Spring 2006 is above the minimum average score of 16 set by the department at the beginning of the study, but averages in falls of 2005, 2006, and 2007 were below the standard. Since fall 2007 when we began requiring that students use a poster template for an electronic poster, poster quality has improved (Attachment C and D). Mean scores on the posters fell below 15, or 75%, only in fall of 2006 (Fig. 3).

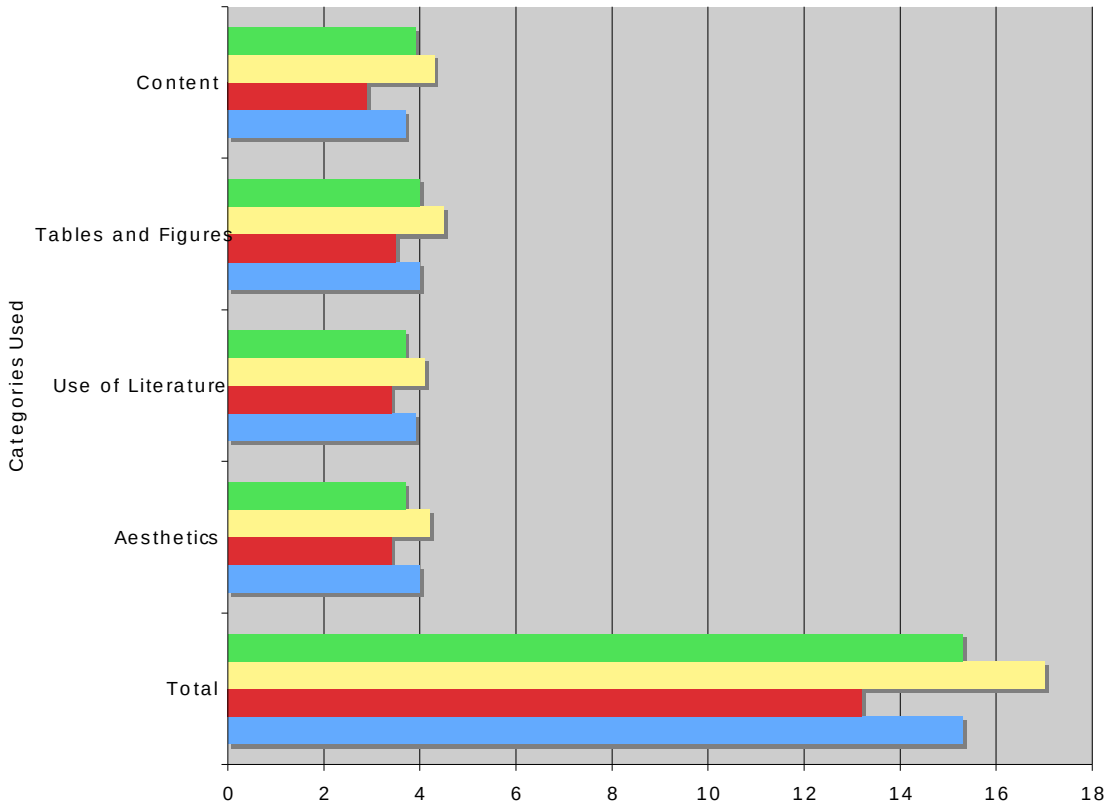

Figure 3. Mean poster evaluations scores for each area of evaluation and totals for fall 2005, spring 2006, fall 2006, and fall 2007, when the rubrics were used.

Overall it appears that we have set realistic goals and that progress is being made toward achieving these goals.

Goal 1. Freshmen students demonstrated a more than 25% improvement, from 8.82% to 61.2%, in their knowledge of evolutionary principles. From the test results of graduating seniors, this knowledge appears to be retained fairly well. Seniors performed very similarly to the students who had freshly studied evolutionary principles, 60%. Green light.

Biology faculty are successfully showing how evolution is incorporated into their majors courses, with over 80% demonstrating how courses directly relate to evolutionary concepts. Green to yellow light.

Goal 2. In the fall of 2007, biology majors took 123 upper division classes that meet the criteria for goal #2, with 112, or 91%, earning a C- or above. In the spring of 2008, 144 upper level classes were taken, with 134, or 93%, earning a C- or above. There were 32 seniors, two of whom did not successfully complete the requirements for graduation. Three additional students graduated without having successfully completed an ecology content area course. Although we will not require the 6 content areas of students who are juniors and seniors at this time, we are monitoring each student folder to keep track of distribution of courses and grades. This responsibility needs to be completed by faculty advisors, but is not at this time. Green to Yellow light.

Goal 3. Results assessing the critical skills of our students using scientific reports show that our seniors have developed the skills we feel are necessary for them to succeed in their future career. The average score for evaluating paper format, design and conclusions was 12.2 out of 15 for fall 2007. This exceeds the minimum cutoff value of 10 which indicates we are providing satisfactory instruction for students to succeed in this area. In spring 2008, average grade for the papers was 85.9%, the equivalent of 12.9 of 15. We collected BI 155 papers from all 2005-06 freshmen to put in their portfolio folders, and will ask them to include a research paper when they take a course requiring a project. These papers will be evaluated with the rubric at the time of their senior seminars. Yellow light, as the group for whom we started collecting the papers will not take senior seminar until 2008/2009.

Goal 4. Average oral presentation scores for the ten students in fall 2007 were 19.2, just below the cut off value we established of 20 for a "green light". The twenty students in senior seminar spring 2008 averaged 90.5% on their presentations, equivalent to 18.1 of 20. Oral presentation grades averaged 87% for 16 students in spring 2007. Although the rubric

APPENDIX B

Biology Content Category Courses

Fall 2007 revised 1

Complete **One** from Each Category with "C-" or better. (Does **Not** Include First Year Core Courses)
Complete at least ONE with embedded research project OR take research (BI 391/392)

Each course may count for only one category.
(e.g., if Vert. Bio. is taken for Taxonomy, then it cannot be counted for Function or any other category

Ecology	***Taxonomy***	***Morphology***	***Function***	***Molecules/ Cells***	

	Ecological Journey	Neurobiology	Immunology		
	BI 404 Evolution	**BI 326*** Plant Biology	**BI 322** Neurobiology		
			BI 325* Vertebrate Biology		
			BI 328 Ornithology		
			BI 413 Advanced Cell Biology		

***Courses with student/designed research projects students must take at least one of these courses**

Appendix C. Examples of posters.