

**Major Assessment Findings and Curricular Improvements**  
**Arts and Sciences/Department of Biology**  
**Undergraduate Program(s)**  
**AY2008-09 through AY2012-13**

**Assessment Measures**

The Department of Biology uses the following measures to assess departmental learning outcomes:

- Pass rates on senior comprehensive exams
- Grades and enrollment totals for senior (capstone) seminars
- Student Perception surveys

**Assessment Findings**

**Senior Seminar Discussion** (Attachment 1):

The Department of Biology analyzed course grades and enrollment data for BIOL 452 Senior Thesis Coordinating Seminar for a five-year period (Spring 2009 through Spring 2013). Because Biol 452 is a last semester senior course, a satisfactory grade of C- or better indicates a student's mastery of a variety of areas of biology in which they have been trained throughout multiple courses in our curriculum. To achieve a satisfactory grade, the students also need to have mastered the ability to make a professional oral presentation on complex scientific material, to answer wide-ranging and probing scientific questions, and to participate in a meaningful scientific discussion with their peers. During the period of data examination from this class, enrollment remained between eight and fifteen students. These students are divided into two sections to achieve a low student/faculty ratio and provide personal attention to the students. Each student presents two major seminars during the semester and has a faculty mentor in addition to the class instructor to guide them through the seminar process.

All but one student (55/57) who enrolled in the coordinating seminar displayed good to exceptional performance (B- to A+). The average grade in this course was 3.69 (B+/A-) over the five-year period with a range of 3.55 to 3.81 grade average per year during the data period. The course grade data support the conclusion that we are achieving our departmental learning goals for the undergraduate program such that students graduating with a Bachelor of Science, or a Bachelor of Arts, in Biology will:

1. Demonstrate proficiency in the body of knowledge provided in the core undergraduate curriculum in biology;
2. Demonstrate an understanding of the scientific process, including standard biological research methodologies;
3. Achieve basic competence in the conduct of laboratory procedures and investigations, and;
4. Communicate scientific information and analysis effectively in both written and verbal forms, including the achievement of basic competence in the use and evaluation of the scientific literature.

## Milestone Data (Attachment 2)

### UNDERGRADUATE COMPREHENSIVE EXAMINATION RESULTS

The Department of Biology analyzed the results from our comprehensive examinations for a five-year period (Spring 2009 through Spring 2013). During this time period the number of students taking the examination fluctuated between eight and fourteen. All of the students passed the examination except one student who was given the option of retaking the examination and did not take the opportunity to do so. Out of 54 students, 53 passed the exam (98%) indicating a mastery of the field of biology and an achievement of our departmental learning goals as listed above. Of the 54 students taking the examination, 47 of them (87%) received a “pass” grade and 6 of them (11%) received a “high pass”.

### Curricular Improvements

The Biology Curriculum Committee undertook a comprehensive curriculum review in 2009. We administered a written survey to sophomore, junior and senior undergraduates, surveyed the biology faculty regarding laboratory skills critical for students of biology, scrutinized syllabi from our required courses, and examined major requirements for biology majors at comparable institutions. We also inspected tracking sheets from all of the majors in Arts and Sciences to see distribution and major requirements in other B.A. and B.S. degrees. The data from these various sources was examined first by the committee and then discussed over the course of several biology faculty meetings. The outcome of all of these deliberations led to six major changes in the curriculum being adopted by the faculty in the fall of 2010. A major change in course content/sequence reflects the goal of having the students grow as scientists in a progressively more complex series of laboratory experiences from freshman to sophomore years. In addition, we wanted to remove some significant overlap in course content, to provide some flexibility to students in the pursuit of minors or study abroad experiences, and to emphasize the mathematical and inquiry-based pedagogy that has become the norm in higher science education. Here are the six changes:

1. Make the sophomore required course Biol 207--Genetics a 3-credit course without a laboratory. Replace the 1-credit laboratory with a new 3-credit sophomore laboratory course (see #3 below).
2. Remove Biol 210/218--Molecular and Cell Biology from the curriculum since it significantly overlaps with the content of Biol 105/106--Mechanisms of Life.
3. Add a two-semester sophomore lab sequence: Biol 217--Molecular Genetics and Protein Engineering (3 credits) and Biol 317--Investigations in Molecular Cell Biology (4 credits). The innovation with these courses is multi-fold. The content emphasizes quantitative aspects of biology. The experiments are progressively more sophisticated cutting-edge biology where the students have some freedom in deciding what to investigate and how to design the experiments. There is significant emphasis on developing problem-solving, writing, and oral presentation skills, as well as teaching the students how to critically interpret the primary scientific literature. All of these skills are assessed in our Biology senior comprehensive examinations.
4. Remove the two “Science and Biology Electives” in the BA/BS degrees and add two “Free Electives”. All other Arts and Sciences degrees do not include

distribution requirements for the area in which a student is majoring (e.g. Psychology students do not have a social science distribution requirement). These added free electives provide flexibility for our majors to pursue minors and allow them to meet their language requirements without incurring excess courses if they do not test into the intermediate level of the language.

5. Make Biol 518--Physiology a biology elective and not a required course. Students who are interested in going to medical school as well as students who are not interested in independent research are advised to take this course. No specific biology courses are required in spring of junior year providing a study abroad possibility.

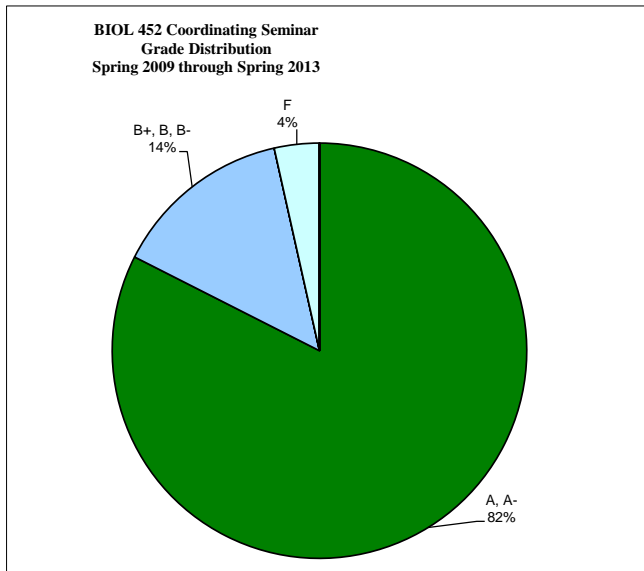
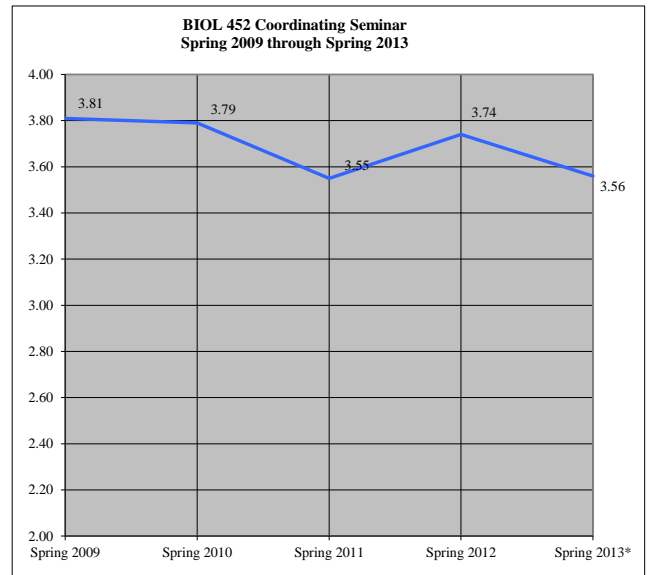
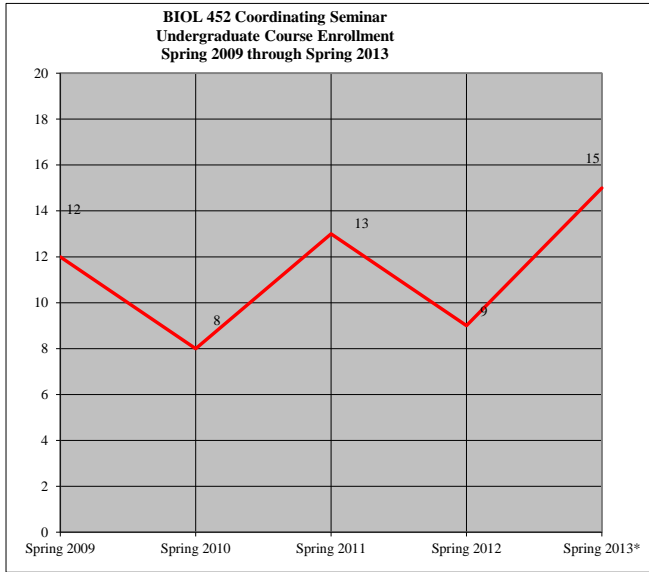
6. Allow exceptional students to take Research Problems in Biology for a third semester. This course provides our students with practical, real-world experience in original biology research. Students work on independent projects in faculty laboratories and are able to develop their scientific skills by experimentation, reading journal articles, working closely with the laboratory community of graduate students, and presenting their work in written and oral formats. Students who are making significant progress on their research would be allowed to receive credit for a third semester of this course sequence.

In addition to the improvements detailed above, we also introduced a new Master's in Biotechnology program in the fall of 2010. Because our upper-level (500) courses fulfill both undergraduate as well as undergraduate degrees, we have a number of new courses for our undergraduates to take. In addition the program will allow students who are successfully completing all of the requirements for a B.S. or B.A. in Biology to earn an M.S. in Biotechnology by taking additional courses during junior and senior years plus one additional year of coursework. The new courses are Biol 579 Principles and Practice of Biotechnology, Biol 580 Entrepreneurial Biotechnology, Biol 581 Essentials of Biotechnology Project Management, Biol 589 Introduction to Nanobiotechnology, Biol 593 Rational Drug Design, and Biol 596 Computational Genomics. These courses provide more options for our students to explore advanced biology in depth as they meet their biology electives requirement for their degree.

Attachment 1

COURSE SUMMARY DATA: DEPARTMENT OF BIOLOGY  
BIOL 452 Coordinating Seminar

Term	Undergraduate Course Enrollment	Course Grade		Course Grades						Course Evaluation Results						
		Avg.	StDev.	Grade Distribution						Course Eval.		Instructor Rating		Course Rating		
				A, A-	B+, B, B-	C	F	W	I	#	%	Avg.	StDev.	Avg.	StDev.	
Spring 2009	12	3.81	0.33	10	2						0	0.00%				
Spring 2010	8	3.79	0.40	6	2						0	0.00%				
Spring 2011	13	3.55	1.08	12			1				0	0.00%				
Spring 2012	9	3.74	0.43	7	2						0	0.00%				
Spring 2013*	15	3.56	1.04	12	2		1				0	0.00%				



**SCHOOL OF ARTS AND SCIENCES  
DEPARTMENT OF BIOLOGY  
COMPREHENSIVE EXAMINATION RESULTS  
AY2008-2009 to AY2012-2013**

	Fail		Pass		High Pass		Pass w/Honors		TOTAL
	#	%	#	%	#	%	#	%	
AY2008-2009		0.00%	10	83.33%	2	16.67%		0.00%	<b>12</b>
AY2009-2010	1	12.50%	7	87.50%	0	0.00%		0.00%	<b>8</b>
AY2010-2011		0.00%	12	100.00%		0.00%		0.00%	<b>12</b>
AY2011-2012		0.00%	5	62.50%	3	37.50%		0.00%	<b>8</b>
AY2012-2013		0.00%	13	92.86%	1	7.14%		0.00%	<b>14</b>
<b>TOTAL</b>	<b>1</b>	<b>1.89%</b>	<b>47</b>	<b>87.04%</b>	<b>6</b>	<b>11.11%</b>	<b>0</b>	<b>0.00%</b>	<b>54</b>

Note:

- 1) Milestone outcomes were included in the categories High Pass and Pass with Honors if these designations were explicitly indicated in the students' milestone record.
- 2) Category "High Pass" includes both "High Pass" and "Pass with distinction".
- 3) The count in this table is based on the exam outcomes of all attempts in an academic year.