Biology Department Assessment Update May 23, 2011

I. As mentioned in Step 4 of the Assessment Plan we submitted in 2009-2010, we have begun to collect **information on our recent graduates**.

In our report in May 2010, we presented data on 120 of our 168 majors who were graduated from 2007-2009 (71%; mostly from a Facebook survey).

**New info for May 2011**:

**1. For our 54 majors who were graduated in 2010**, we have learned of the current activities of 37 (68.5%)of them*:* Direct Facebook messaging contact was made with 23 (43%) and the status of other alums was determined using Facebook profile information (5, 10%), from the records of Marikay Dobbins, pre-health professions coordinator (3, 5%), from other sources (roommate, 1), and least reliably from a survey filled out in April 2010 (5, 9%).

The majority of our 2010 biology alumni are furthering their educations. Medically-related professions figure conspicuously. Of the 37 respondents,

9 (24%) are in various graduate programs, including those that will lead to degrees in architecture, business, marine biology, medical sciences, and public health

7 (19%) are in medical school (MD or DO programs)

3 (9%) are in dental school

8 (22%) are in chiropractic, nursing, physical therapy, physician assistant, or veterinary

medicine programs

7 (19%) of the respondents are employed in fields directly related to biology, including working

in research labs, clinical labs, or in quality control where lab analysis skills are important

3 (9%) of the respondents are working in non-biology-related fields and/or taking courses in

preparation for applying to professional schools

**2. Preliminary info for 53 of our 54 majors who were graduated in May 2011 (based on survey given on the last day of classes, April 28, 2011)**:

5 (9%) will be entering various graduate programs, including those that will lead to degrees in

education, law, and medical sciences

7 (13%) will be entering medical school (MD or DO programs)

1 (2%) will be entering dental school

7 (13%) will be entering nursing, physical therapy, physician assistant, or veterinary medicine

programs

10 (19%) will be employed in fields directly related to biology, including working in research

labs, clinical labs, or in quality control where lab analysis skills are important

3 (6%) will be working in non-biology-related fields and/or taking courses in preparation for

applying to professional schools

20 (38%) are unemployed; of this group, 10 are waiting to hear from graduate or professional schools or from employment or internship opportunities

9 (17%) from the group of students who will be employed or unemployed above plan to apply

to graduate or professional school for Fall 2012 (take one year off)

II. We continued to give the ETS Major Field Test (MFT) in Biology to all majors and minors in their last Spring semester at Albion (if a student plans to graduate a semester early, he or she must take the exam the previous spring).

In 2011, the Biology exam was changed to a form (Biology 4GMF) different from that given to our seniors in the past four years (2007-2010, Biology 4BMF). Therefore, we cannot compare the data of 2011 with those from earlier years. We will be giving the new exam (4GMF) to some incoming first-year students in Fall 2011, and we will be giving this same exam to seniors over the next four years (through Spring 2015). Thus, we should get comparison of seniors with first-year students, including some of the same individual students in Fall 2011 and Spring 2015.

Data from all our seniors (majors and minors) who took the exam in 2011 are shown in Table 1.

Table 1.  ETS Major Field Test (Biology 4GMF) Scores for Albion Senior Biology Majors and Minors, 2011.

Total scores and subscores are reported as scaled scores; scores for assessment indicators are reported as mean percent correct.  Comparative data with percentiles are not yet available on ETS Web site.

                                                                                                           2011

**Number of Albion students tested (majors/minors)**               57/24

**Total Mean Score** (range 120-200) for Albion BIOL Majors     152.6

 Total Mean Score for Albion BIOL Minors                                   154.9

**Subscores** (range 20-100) for Albion BIOL Majors

Cell Biology                                                     52.8

Molecular Biology & Genetics              54.2

Organismal Biology                                      50.3

Pop. Biology/Ecology/Evolution                            54.7

**Assessment Indicators** for Albion BIOL Majors and Minors shown as mean percent correct

1 Biochemistry & Cell Energetics                                   49

2 Cell Structure, Organization, and Function          52

3 Molecular Biology & Molecular Genetics                 51

4 Diversity of Organisms                                        42

5 Organismal – Animal Structure and Function           41

6 Organismal – Plant Structure and Function             31

7 Population Genetics & Evolution                       52

8 Ecology: Population, Community, Ecosystem         51

9 Analytical Skills                                                           48

# majors/minors with scores > 175 (past cutoff for 95th percentile) 1/0

# with scores 171-175 (90-94%)                                           6/1

# with scores 166-170 (80-89%)                                           1/2

#with scores 161-165 (70-79%)                                             7/5

% of majors/minors with scores of at least 70%                   26/33

# majors/minors with scores < 151 (past cutoff for lowest 35%) 24/6

% of majors/minors with scores in lowest 35%                       42/25

We cannot assess the scores until the comparative data with percentiles for exam Biology 4GMF are posted on the ETS website. As a group, our seniors have varied in their average overall score, depending on the test version. For the test version that was given Spring 2001- Spring 2006, the overall institutional average of our senior majors ranged from the 67th - 75th percentile (as compared with seniors at other institutions). For the test version that started being given in Fall 2006 (Biology 4BMF, given Fall 2006-Spring 2010), the overall institutional average of our senior majors ranged from the 35th - 55th percentile. We are quite certain that our teaching did not decline significantly in that time (as compared to 2001-2006) and that our students did not change that dramatically. Rather, we know that the test changed, and we do not specifically teach to the test. We are interested in general trends from year-to-year within some specific areas for any given test.

We emphasize to students that we do want them to take the exam seriously, rather than rushing through it. This year, we had one student fail to answer more than 50% of the questions, so his scores were not included by ETS in analysis.

III. As described in our assessment document from Fall 2009, we have decided to focus on **Assessment Indicator 9, Analytical Skills,** from the ETS Major Field Test. This particular assessment indicator ties in with several of our learning goals for students, including:

Content Goal 3. Our students will acquire scientific investigation skills in laboratory and field

courses necessary to apply the methods that biologists use to answer biological questions.

Process Goal 1. Our students will develop enhanced critical thinking skills.

To ensure a focus on analytical skills, all faculty members in the department were asked to work on interpretation of figures (graphs) or tables with students in at least one class and to include interpretation of a figure or table on an exam.

The results for each class are listed below. In future years, we plan to continue these types of exercises on figures and tables, including pre- and post-course examples.

**BIOL 195 (Skean)**

Which of the following statements is true about the figure below? Results

A. Oysters live longer than *Hydra*. 30/32 correct (94%)

B. *Hydra* and humans have parallel life spans. 2/32 incorrect (6%)

C. Humans and oysters have similar life spans.

D. Humans have relatively low mortality rates late in life.

**E.** Oysters have relatively high mortality rates early in life.



**BIOL 210 (Saville)**

Students were given a figure showing a Southern blot of chromosome ends from dividing cells. Some of the cells expressed telomerase and some of them did not. Those cells expressing telomerase had larger bands on the Southern blot indicating longer chromosome ends.

Students were asked to describe the conclusion of the figure itself (i.e., that the chromosome ends were longer in cells expressing telomerase) and what would be the effect on the cell (the cell would divide more times/live longer). Of 30 students, 16 (53%) answered correctly on both parts, 11 (37%) were partially correct (one part), and three (10%) were incorrect on both parts.

**BIOL 240 (Lyons-Sobaski)**

Students were given a figure from a paper from the primary literature that they read. The figure consisted of four graphs and students were asked to interpret the figure. Of 21 students, 11 (52%) students interpreted the graphs correctly (6 students) or were very close to interpreting them correctly (5). Ten (48%) students understood the main idea but made a misinterpretation when integrating all the figures.

**BIOL 248 (Kennedy)**

Students were asked to interpret the pattern of data in a figure that they had been sent ahead of time (they had not discussed that particular figure). Of 15 students, 10 (67%) interpreted the figure correctly. Most other students (4, 27%) identified the major issue/topic that the figure dealt with, but they did not explain the pattern indicated by the data in the figure. One (7%) failed to identify the main topic of the figure.

**BIOL 289 (Badtke)**

Students were given a table of several different chemicals and how they compared to DEET in number of days that they repelled mosquito landings. Based on data provided in the table, students had to interpret which chemical would be most effective in repelling mosquitoes. Of 13 students, 12 (92%) interpreted the data correctly, 1 (8%) incorrectly.

**BIOL 321 (Schmitter)**

Students were given a 4-point question about graph interpretation. Of 16 students, 7 (45%) received 4 points, 4(27%) received 3 points, and 5 (28%) received 1 or 2 points.

**BIOL 324 (Albertson)**

Microarrays are a technique used in developmental biology to compare genome-wide differential gene expression in two or more populations of cells. Students were given a figure of microarray data for three populations of cells: 1) Normal cells at an early developmental stage, 2) Normal cells at a late developmental stage, and 3) Cells with abnormal development (cancer cells). Students were then asked to identify:

A gene that is upregulated during normal development.

A gene that is downregulated during normal development.

A gene that is not expressed in cells during normal development.

A candidate gene that specifies cell fate during development.

A candidate gene for a tumor suppressor and a candidate for an oncogene.

For each of the above questions, students had to briefly explain WHY they choose that gene (to determine whether students understood the questions or just guessed correctly).

Of 15 students, 8 (53%) interpreted the info correctly (or had very minor errors), 4 (27%) had moderate errors indicating that they did not fully understand the figure, and 3 (20%) had major errors indicating they had very little understanding of the figure.

**BIOL 332 (Olapade)**

Students were asked to interpret a figure that showed the antibody concentrations in blood titers of an infected individual collected over a period of 50 days during the illness. They were asked: (1) based on epidemiology, explain what is likely to have happened or the state of health of the individual during each of Day 0, Day 25, and Day 50 of the infection; and (2) to deduce whether the host’s antibodies are in response to a common-source**,** to a host-to-host antigen/epidemic, or to both types. Students were asked to justify answers with examples. Of 32 students, 26 (81%) interpreted the info correctly and 6 (19%) interpreted the info partially.

**BIOL 368 (McCurdy)**

Students were asked to interpret a figure from a paper in American Scientist (an article about the adaptive significance of lion manes in terms of three things: (1) explain a series of curves (indicate what a series of graphs about temperature and mane size were telling the reader); (2) comment about the graphs in a broader adaptive context (this required more interpretation and piecing together what was in the figure with what was in the text of the article; and (3) propose an alternative hypothesis to the one the authors argued was supported by the results in the graph (this required students to synthesize new arguments - hopefully using the tools and thought-processes covered in the course).

Of 17 students, 16 (94%) met the first objective (basic explanation of the graph), 14 (82%) met the second objective (interpretation of graph using the paper), and 12 (71%) met the third objective met (synthesis of new ideas based on the results shown in the graph).

Students who failed to complete more basic objectives also failed to complete more advanced objectives (in other words, the one student who didn't meet the first objective also failed to meet the second and third objectives, etc.)

**BIOL 369 (Lyons-Sobaski)**

Students were asked to interpret two graphs of normally distributed data regarding number of individuals and petal length for wild radish as well as number of individuals and flowering time for the same species.

Of 25 students, 4 (16%) correctly interpreted the graph, 13 (52%) did a very good job interpreting the graph in that they understood the main idea, but lacked some depth including that the data were normally distributed, 3 (12%) did a good job but lacked more depth, and 5 (20%) did not interpret the graph correctly or made incorrect assumptions about the data.

IV. Connections to real-world problems. Several of our courses have connections to real research and real problems. As an example, in Spring 2011, students in Conservation Biology (BIOL 240) worked to raise awareness of conservation concerns about Orange Roughy, a fish served by the Albion College Dining Services. As a result of the work done by students in the class, taught by Sheila Lyons-Sobaski and with guest lectures from Jeff Carrier, Dining Services has removed Orange Roughy from the menu. See <http://www.albion.edu/news/archives/2010-11-archives/albion-view/1414-conservation-biology-students-get-roughy-of-albions-menu> for an article about this work.

In addition, students in Conservation Biology have to perform a service project that relates to conservation education. Some students arranged to get a variety of students on campus to help remove Autumn Olive, an introduced species, from areas of Whitehouse Nature Center.

V. In Fall 2009, we began discussing a return to a three-course introductory sequence. We would retain our first two courses (BIOL 195: Ecology, Evolution, and Biodiversity, and BIOL 210: Cell and Molecular Biology) but would modify some material in BIOL 210. Our third introductory course would be a 200-level Genetics course (without lab). We consider an understanding of genetics to be critical to all areas of biology, and becoming increasingly so with an increase in areas of genetics related to both molecular biology and to population and conservation biology.

Based on scores of our students in several areas, including subscore in Molecular Biology & Genetics and Assessment Indicators 2 and 3, we are strongly interested in pursuing a required course in Genetics for all of our majors. We anticipate that almost all of our Cell and Molecular Biology minors would take such a course as well. We would still offer a 300-level Genetics course with lab for students who want more work in this area.

We will return to our discussions of revising our introductory sequence in Fall 2011, with the hopes of having a proposal for C&RC to review during this academic year for implementation in Fall 2012.