

## Assessment Report for BGES Undergraduate Programs in BIOLOGY: 8 June, 2008

### 1. Goals

*Biology majors will possess a broad general knowledge of the fundamental facts and principles in all of the major areas of Biology by the end of their senior year, as well as advanced knowledge in the major areas of Biology, as defined by the GRE Advanced Biology subject test.*

This goal was developed by the Department: initially by the chair and associate chairs, undergraduate program directors, and the Undergraduate Committee on Curriculum & Academic Standards [UCCAS], then discussed and approved by a formal vote at a faculty meeting. The decision to use the subject areas based on the areas of the Graduate Record Examination was made in 1996, when the first steps in Departmental assessment evaluations were begun. No changes in the goals have been made since that time.

### 2. Outcomes

The Department decided to define outcome measures as *satisfactory improvement in performance on a standardized test from entry to completion of the program*. This outcome measure was adopted by the Department in the same way and at the same time as the determination of the goals.

### 3. Research Methods

The current testing procedure (since Fall, 2001) uses an objective exam of 100 multiple-choice questions (randomly selected from a test bank of 900 questions), divided into 6 areas in the following proportions: 17% Biochemistry & Cell Structure/Function; 17% Genetics & Molecular Biology; 17% Evolution; 16% Ecology; 18% Botany; 15% Zoology. The first two areas were further subdivided. The questions used in the pool were selected from faculty input and then subsequently approved by faculty in each area.

In the first versions of the exam (administered through WebCT), the random sampling from the pool of questions for each category was done for each student. Severe problems with system backup/recovery in older versions of WebCT, which resulted in significant losses of data, forced us to adopt a simpler approach. We now perform the random sampling from the test bank only once each semester, so that all students in a given semester write the same exam.

The exam is administered at three time points (entry, early, and late) in a student's career: at entry, operationally defined as the beginning of the first required course for majors (BIO 200, Introductory Biology I), at the end of the introductory sequence (BIO 202, Introductory Biology II), and just before graduation. The last point is administered by requiring all majors to complete before graduation a zero-credit course (BIO 499, Exit Evaluation) that consists solely of the assessment examination. In the introductory biology sequence (BIO 200 & BIO 202), students are exposed to concepts in each of the six major areas into which the exam is subdivided. This allows us to attempt to assess both overall outcomes and performance in each of the subject

areas.

All of these direct measures are collected as aggregate values for the entire set of students writing the exam in each semester.

In addition to these direct outcome measures, indirect evidence sometimes comes in the course of informal exit interviews that arise during the last meeting before graduation that each major has with the Biology Undergraduate Program Director [in the BGES Department, all Biology majors are advised by the same person]. The suggestion by the assessment review panel for us to consider *systematic* indirect measures (such as a simple student survey) now has been implemented. When students take the exit examination, they also complete an anonymous survey; in addition, they are provided the opportunity to write any comments they wish. This survey was modified at the end of 2006; the current survey instrument is attached to this document. Various changes in office staff have resulted in inconsistent collection of results and few systematic results to report at this time.

#### 4. Findings

A set of standard statistics are calculated for each set of data and appropriate comparisons are made. In particular, overall average scores always are compared among the entry, early, and late categories as new data accumulate each semester. The latest data (from Fall, 2001, through Spring, 2008) show an appropriate increase in average (percentage) score from 27.5 at entry (based on data for N = 1520 students), to 34.5 at the end of the introductory sequence (N = 792 students), and 49.2 at exit (N = 204). The distributions of scores for 2007-08 are plotted in the attached graphs along with the those over all years and averages by year. Both the increase from the beginning to the end of the introductory sequence, and from then until exit are statistically significant (at a 95 % confidence level). Scores for the 203 assessment show the most variability.

These results imply that there are measurable improvements in at least objective knowledge of biological facts and principles over the course of the introductory sequence, and that additional knowledge is acquired by Biology majors who graduate. Please note that the decrease in sample size at exit is a consequence of the fact that many students other than Biology majors *per se* take the introductory course sequence, while the exit exam is taken only by graduating Biology majors. Furthermore, there is non-trivial attrition of students from the first course in the introductory sequence to the second (a phenomenon that the Department is continuing to probe).

Summary results of the scores in each of eight subject areas (and also grouped by the six GRE categories as well as three broader categories) for the last three academic years are given in the attached spreadsheet. Exit test results for 204 Biology seniors who graduated in the last four academic years indicate that the lowest percentage scores (39.0 % correct) occur in questions related to Animal Biology [Zoology], and the next poorest performance (42.3% correct) is in the area of Plant Biology [Botany]. In general, graduating seniors performed more poorly (42.3%) on questions related to Organismal Biology than on those related to Ecology & Evolution

(50.3%) and Cell & Molecular Biology (55.0%). The disparities for this year were smaller due to increases in organismal scores but also to decreases in cell and molecular scores (51%, 45%, and 51% for cell and molecular, organismal, and ecology/evolution, respectively).

Summary results of the first ten questions on the anonymous exit surveys are attached. Note that only 9 surveys were completed; we are not confident that these are representative and the scores are lower than in previous years with better response rates. On the five questions that attempt to solicit performance ratings, the mean values indicate that these graduating Biology seniors give the best ratings (2.22 and 2.22, respectively closer to good than adequate ) to their own perceived knowledge and to their instructors abilities. The lowest rating (2.56 between good and adequate ) was given to the quality of laboratory exercises. Of possible improvements, more hands-on research was first or second choice of 6; more modern or exciting lecture courses was noted by 4.

Anonymous comments were not collected for biology students this year; for unknown reasons, the sheet was not included with the exit survey. Comments in previous years ranged from observations about individual instructors (both good and bad) to the general comment that one student got a better education at CSU than Ohio State. Suggestions for improvement included having more night courses, more summer classes, more laboratory courses, and independent study should be required.

## **5. Review**

Results of the data analysis are reviewed each Fall by the Undergraduate Program Director, Associate Chairs, and Chair, as well as by members of the Department's undergraduate committee (UCCAS). Any significant findings are reported to the faculty generally for discussion and action. Furthermore, all faculty receive copies of this report annually.

## **6. Actions**

The results of both the direct and indirect assessment of student outcomes initially (in the early years of the Department's assessment program) suggested a general performance weakness in the area of genetics. After discussion within the UCCAS, the Department discussed and adopted a curricular change involving the creation of two new courses (BIO 310, Genetics, and BIO 311, Genetics Recitation) that now (since Fall, 2004) form part of the allowable core requirements for Biology majors.

An effort was made this summer to add another summer course from the group of second year core courses. Enrollment was encouraging although just over the College minima. Some students have taken the opportunity to use the summer to take two such courses, which may not be advisable for all but the best students. The department will monitor performance. Similarly, introductory courses and the core courses are routinely offered both evening and day on at least a two-year cycle. Efforts to add to the evening offering of electives will continue. College

requirements for minimum enrollments hamper this effort.

Anticipated difficulties in ensuring student compliance with taking the outcome assessment exam just before graduation resulted in the creation of the Exit Evaluation course requirement for the major, adopted in Fall, 2002 [after reluctant approval by the Arts & Sciences Curriculum Committee]. We now have very good compliance, and assessment instruments are administered routinely.

The newest finding from last year, that of possible weaknesses in the areas of animal and plant biology, will remain a subject for continuing faculty review and discussion. Results from this year show less of a deficit compared to the two other areas. Possibly this difference is just a question of lower student interest for the more than half of our students with a preprofessional or cell and molecular focus and the paucity of higher level courses in botanical and other organismal areas that students typically take closer to the exit exam. Since the death of Dr. Mal, the sole faculty member with training and a research focus on plants, the department has identified a replacement in plant biology as a key need. Similarly, perhaps some attention should be devoted to a focused review of laboratory exercises. For many students, participation in faculty research, often as part of the biology honors program, is a major part of their biology training and this does give them deep experience in lab methods that are important for jobs or further education but may not show up as a significant increase in the general assessment test scores. Addition of a new upper-level course in animal cell culture was well-received by students and serves a similar function: it is not quite hands-on research but certainly hands-on exposure to modern techniques.

Several problems with the assessment routine itself involved maintaining routine administration of the exit survey. This problem is partly linked to the departure of our long-time departmental secretary in early 2007 with no overlap to train her replacement; unfortunately, the same problem reoccurred with the sudden departure of her replacement in early 2008. This aspect will be addressed as part of the discussion of this report and addressed with the training of the new secretary starting this summer in order to more consistently collect exit survey data.

Much focus this year was devoted to planning, paperwork, and preparation for the new GenEd08 courses. No additional specific actions were taken in Academic Year 2007-2008.