

# ANNUAL REPORT OF UNDERGRADUATE PROGRAM ASSESSMENT IN BIOLOGICAL SCIENCES (B.S. DEGREE)

November 2007

Student learning goals are divided into three main areas: scientific literacy, biological content knowledge and technical skills, and application of scientific process. Faculty development goals are designed to support laboratory research, enhancement of teaching and updating area of expertise.

## A. The goals of the Department of Biological Sciences at Marshall University are:

### I. Student Biological Literacy

A graduate of Marshall University Biological Sciences Department will be able to:

- critically evaluate the scientific literature by virtue of their **content knowledge** within the broad field of Biological science.
- effectively **communicate** biological concepts through writing, oral presentation and visual representations.
- be adept in the processes of **scientific investigation and critical thinking** through course-related laboratory exercises, independent research and capstone projects.

### II. Faculty Development

The faculty of Marshall University Biological Sciences Department will:

- maintain excellent quality of **research**.
- maintain excellence in **instruction**.
- maintain familiarity with developments in **specialty area**.

## B. Learning Outcomes/Data Collection:

### 1. Content knowledge.

Students are required to gain an understanding of concepts viewed across the discipline as basic to the biological sciences. We expect our graduates to be competitive on a national level and will set an acceptable performance for the MFT at, or above, the mean national scores, as reported annually by ETS. This year the test was administered in April, 2007, to twenty three graduating seniors randomly selected from BSC491 (Capstone Experience).

An up to date curriculum is necessary for student achievement in content knowledge. Curriculum initiatives are highly valued within the department. An active Undergraduate Program Committee will meet three times each semester to review effectiveness of current curricula for all five majors. As new faculty members are hired they are given the opportunity to offer courses within their expertise if there is a perceived need or interest.

### Assessment:

Our student achievement will be measured by administering the ETS Major Fields Test (MFT) in Biology. Data is also collected, when available, on student performance on national exams such as the biological sciences component of the MCAT and the biology GRE. Results are reported in Appendix A.

A continual monitoring of our curriculum (appropriate course offerings, current information, and qualified instructors) by the Undergraduate Program Committee will evaluate the need and effectiveness of new courses. In cooperation with faculty in Biomedical Sciences, Chemistry, and Integrated Science

and Technology, courses are cross listed so students will have an adequate offering of appropriate and current classes that support BSC majors. Faculty members are encouraged to first teach new courses as Special Topics offerings. The special topics courses taught during this assessment reporting period are listed in Appendix B.

## **2. Communication (oral and written) skills.**

All courses with lab components expect written lab reports, and writing assignments and oral presentations are routine in most upper-level courses. The scientific method is woven into all classes and is emphasized in problem-based laboratory exercises in the introductory and the core courses. Some upper-level courses employ analysis of the primary literature as a mechanism to explore the scientific method. The Capstone experience requires students to propose projects and articulate the underlying logic and the methodologies to be used. Students now submit their proposed Capstone projects on-line for faculty review. Undergraduate students who elect a research project as the Capstone or as an independent study are encouraged to present their data at local or national scientific meetings, and faculty are encouraged to include students as co-authors on published papers.

### **Assessment:**

Records of student publications and presentations will be kept on file. We expect 75% of research projects to result in presentations, either locally or nationally. Required Capstone papers, along with project directors' evaluations, will also be maintained for review by faculty. In addition an on-line exit survey of graduating seniors is used. The assessment tool was designed to measure student satisfaction with their educational experience at Marshall University, how they perceived the level of individual skills that they obtained, their confidence with broad-based and specific content knowledge of the biological sciences, and perceptions of future employment areas. The department expects a 70% satisfaction from seniors. This value was established based on previous year's results. (See Appendix C).

## **3. Scientific Investigation**

The scientific process is an outline for the discovery and critical assessment of new information. As such, it is both a vital skill and a learning tool for our students as they develop their own knowledge and critical thinking skills. We feel that the best way to learn the scientific method is through participation in laboratory experiments that become more challenging and more independently designed as a student progresses. Additionally laboratory equipment in teaching labs needs to be current. As the field of Biology progresses there has been an increased emphasis on technology that our curriculum must reflect.

### **Assessment:**

Accordingly, of the 43 regularly numbered BSC courses that are listed in the most recent undergraduate catalog, 35 (81%) have both lecture and laboratory meetings, or are associated lecture and laboratory courses. These courses are much more time consuming and expensive to design and deliver than lecture only courses, and the high number of such courses in the Biological Sciences indicates our level of commitment to active learning. BSC 120 and 121 laboratory exercises have been revised to include worksheets designed to foster critical thinking skills; these worksheets emphasize the steps and controls in the scientific method. The instructors and laboratory graduate teaching assistants review these worksheets after each laboratory exercise. As students progress, they are expected to take more control of their learning environment and experiences through independent study and capstone research experiences. For the reporting year (2006 - 2007) there were 17 students enrolled in independent study research projects, 16 in Capstone research, and 66 in Capstone shadowing. Most of the research projects resulted in poster presentations and all of the shadowing/internships require a summary paper. Class

content and requirements will be monitored by the Undergraduate Curriculum Committee. Student satisfaction will be assessed by the on-line survey for graduating seniors. We expect a 75% satisfaction rate for all skills. For results see Appendix C.

#### **4. Faculty Development**

Faculty development is a critical element in meeting the overall goals of the department. Our goal is for all BSC faculty members to be well informed in their specific disciplines and in modern pedagogical methods. The department regularly provides up \$1,000 per faculty member toward travel to professional meetings and workshops. In addition to these types of activities, our faculty need time to engage in research and incorporate new teaching techniques in their courses. Teaching loads for each faculty member have been reduced to 9 or less contact hours. This has been accomplished by increasing the number of graduate student contact hours in laboratory sections, and have scheduled lectures in larger classrooms when possible. Data from yearly annual reports will be collected to assess research, and instruction initiatives.

### **C: Results**

Students are achieving acceptable content mastery in all Biological sub-disciplines as measured by 2007 MFT. The exception is in the area of Population Biology/Ecology/Evolution. (See Appendix A Figure 5). The Undergraduate Program Committee will re-evaluate the requirements for our Ecology and Evolutionary Major and the courses represented by this sub-discipline. Since previous MFT assessments have not indicated a weakness in this area any devised action will not be put in place until a second measurement also indicates sub-standard mastery. The MFT in Biology will again be administered during Assessment Day.

Satisfaction with communication skills are viewed by graduating students at a lower than acceptable rate. (See Appendix C). The Undergraduate Program Committee will examine syllabi for courses that need to add more oral and written opportunities for students. The department has data regarding the number of courses requiring written and oral presentations but there is no measurement in place to determine improvement of skills in this area.

Better records of student presentations and publications will be culled from faculty Annual Reports to evaluate this goal.

Faculty development has proceeded with great success. The Biological Sciences faculty for the reporting year had eighteen peer-reviewed publications and thirty two presentations. In addition the department was judged excellent on nearly all aspects of faculty development for the College of Science criteria for Annual Reports. (See Appendix D).

The Department has a variety of opportunities to assess student learning and faculty development. A continued effort to assessment throughout the academic year is needed to bring new experiences to its students and faculty and strengthen existing practices in the department.

#### **BOT Initiative 3 Compliance**

Our Department is employing the ETS Major Fields Test as a post-test administered to randomly selected students enrolled in Capstone 491. Our 2007 sample had twenty three students. In Spring 2008 the department will again request students to take the Biology MFT during the University Assessment Day. Results will be compared to national norms and to previous years.

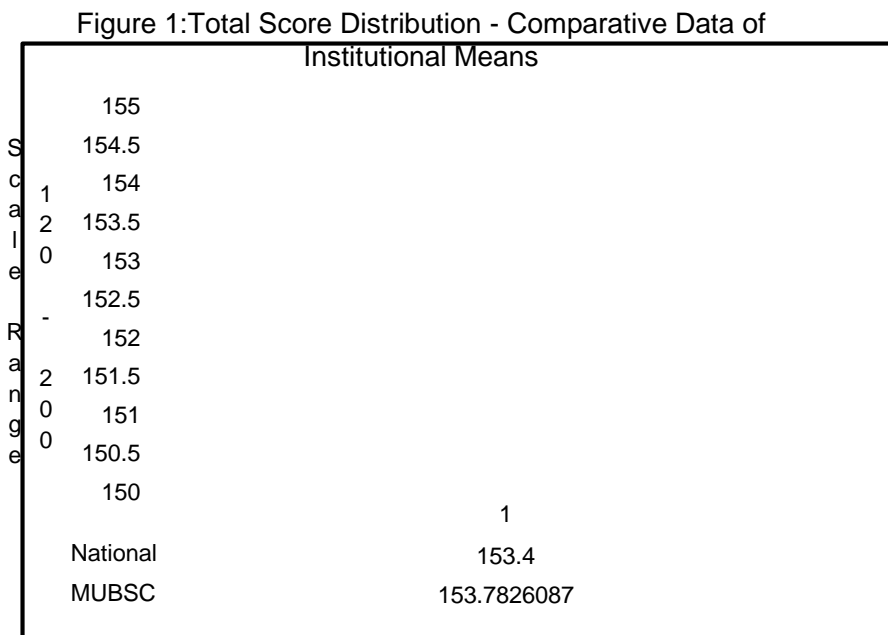
**Assessment for Biological Sciences 2006 – Student Component**

Student Outcome	Person or Office Responsible	Assessment Tool or Approach	Standards/Benchmark	Results/Analysis	Action Taken
Maintain content knowledge	Undergraduate Program Committee	MFT – Biology  Exit survey of graduating seniors monitors student satisfaction with program	At or above mean national scores.	Overall dept. mean met. Subscores met with exception of Population Biology/Ecology/Evolution.	Re administer MFT in Spring 2008. Evaluate Ecology/Evolutionary major requirements.
Communication (oral and written) skills.	Undergraduate Program Committee All Faculty	In classroom written assignments, oral presentations and discussions. Students are encouraged to participate in undergraduate research and present their work. Shadowing Capstone projects require a written paper. Exit survey of graduating seniors monitors student satisfaction with program	All courses offered by the department should have written requirements, oral presentations, or both.	Currently all courses have some associated writing. Data needs to be gathered on all assignments in all BSC courses.	Program committee will establish measurement instrument. Course syllabi need to outline all such student assignments.
Scientific Investigation skills	Departmental Faculty	Students are encouraged to participate in undergraduate research and present their work. Data sheets emphasizing problem based investigation are now used in all introductory course labs. Many upper-level lab exercises need to be experimental rather than “cook-book”. Exit survey of graduating seniors monitors student satisfaction with program	Embedded MFT assessment indicators need to be above average.	Student analytical skills (as measured by the MFT) were slightly above 50%. Cooperation of departmental faculty is needed to ensure consistency in lab exercises.	Better records will be kept. Assessment of graduating seniors is needed to determine if our students are productive in a scientific field.

## Appendix A

### Major Fields Test - Results from April 2007.

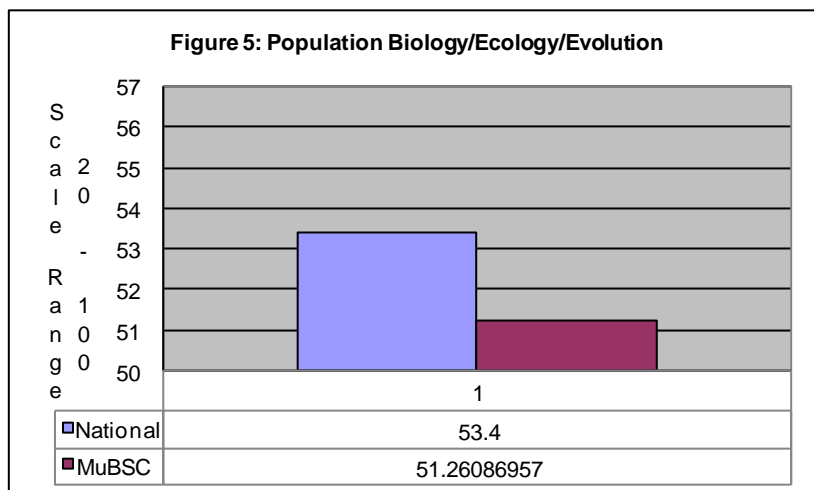
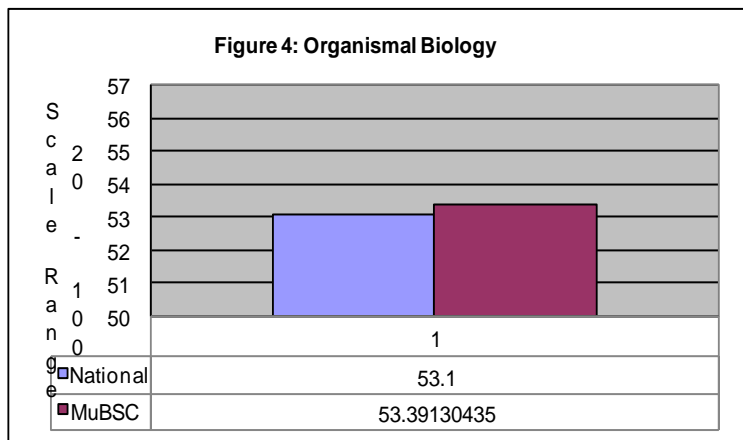
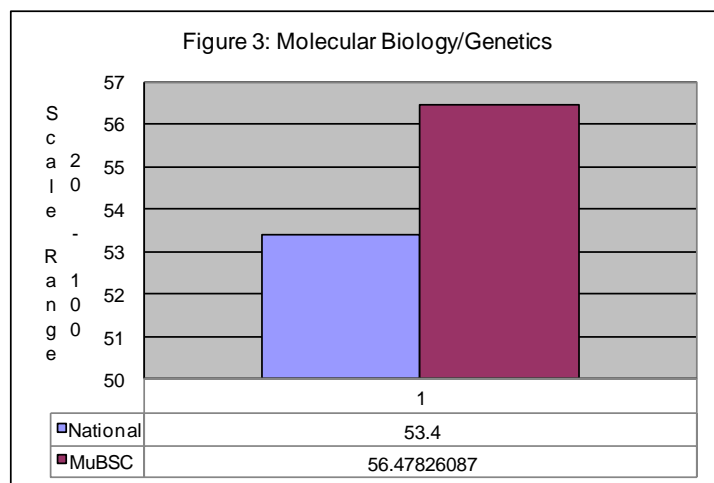
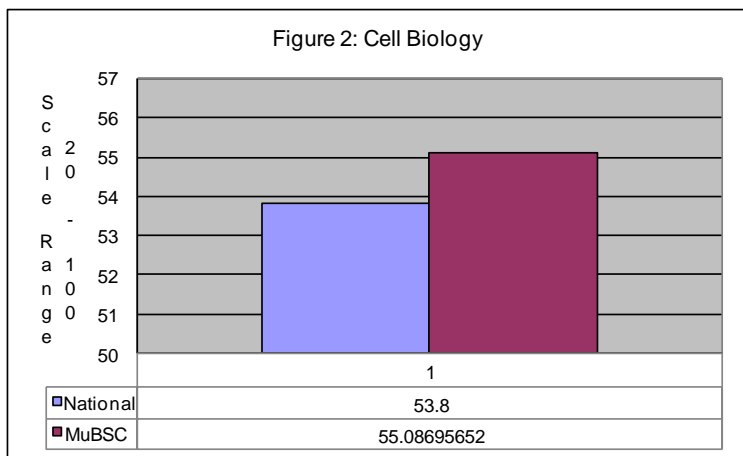
According to the ETS Web site ([www.ets.org/hea/mft/](http://www.ets.org/hea/mft/)), the “Major Field Tests are innovative undergraduate and MBA outcomes assessments designed to measure the basic knowledge and understanding achieved by students in a major field of study. Test results enable academic departments to better assess and refine curricula, gauge the progress of students compared to others in the program and those in similar programs at schools throughout the country.” From this data we are able to assess our graduates’ abilities in the Biological sciences as compared with other institutions across the country. Educational Testing Service publishes cumulative data on institutional and individual means for Total Scores (content), and also on subscores and assessment indicators.



### DEPARTMENTAL SUMMARY OF ASSESSMENT INDICATORS

Assessment Indicator Number	Assessment Indicator Title	Mean Percent Correct
1	Biochemistry and Cell Energetics	47
2	Cellular Structure, Organization, Function	56
3	Molecular Biology and Molecular Genetics	53
4	Diversity of Organisms	45
5	Organismal - Animals	62
6	Organismal - Plants	46
7	Population Genetics and Evolution	49
8	Ecology	57
9	Analytical Skills	55

The subscore disciplines are reflective of the specialized Biological Sciences majors, Cell/Molecular Biology; Biomedical Sciences, Microbiology; and Ecology and Evolutionary Biology. Use of the Major Fields Test will greatly enhance the department's power to monitor the success of our revised individual majors, not only by the subscores, but also from the embedded assessment indicators.



## Appendix B - Special Topics Courses

<b>Fall 2006</b>	
	Microbial Genetics
	Biosystematics
<b>Spring 2007</b>	
	Intermediate Biochemistry
	Introductory Biochemistry Lab
	Advanced Biochemistry
	Recent Advances in Hominid Evolution
	DNA Cloning
	Advanced Microscopic Techniques
	Issues in Modern Malacology
	Biomonitoring

## Appendix C - On-line Survey of Graduating Seniors (2006 - 2007)

### I - Student Satisfaction with Biology Curriculum - Skills

	<b>% of maximum response</b>
Solving problems	73
Writing papers	68
Designing lab experiments	72
Finding trends in data	69
Critically reviewing articles	73
Working effectively with others	79
Giving oral presentations	61

n = 33 for 34% compliance.

### I - Student Satisfaction with Biology Curriculum - Diversity

	<b>% of maximum response</b>
Understanding biological complexity	81
Understanding scientific method	81
Understanding cellular approach to Biology	81
Understanding molecular approach to Biology	76
Understanding organismal approach to Biology	78
Understanding ecological principles	70

n = 33 for 34% compliance.

## Appendix D

### Faculty Development – Departmental Averages of Overall Comprehensive Ratings Determined by College of Science Faculty Annual Report and Evaluation Policy

<b>Faculty Roles</b>	
Professional development	4.38
Teaching	27.6
Research	17.1
University service	4.15
Professional service	14.58
Community service	3.2

A value of 4 is equivalent to excellence.