Assessment of Student Learning Outcomes

Department of Biological Sciences,

Western Michigan University

Approved by Biological Sciences faculty and chair: **12 May 2003**
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Introduction:

Within the Department of Biological Sciences, 19 faculty members teach, advise and mentor 900 undergraduate majors distributed among 3 topic areas, and 70 graduates in one doctoral and two master's programs. In addition, we serve minors and both liberal and general education distributions throughout the university.

Assessment of our programs takes the form of how effectively we meet our intended student learning outcomes, and how we use this information to improve the design and implementation of our curricula and departmental infrastructure. We view assessment as a continual process of program design based on a clear mission with implementable goals, objectives and student learning outcomes. This plan is followed by application of assessment tools, followed by data collection and analysis that leads to program revision and redesign as illustrated in Figure 1.

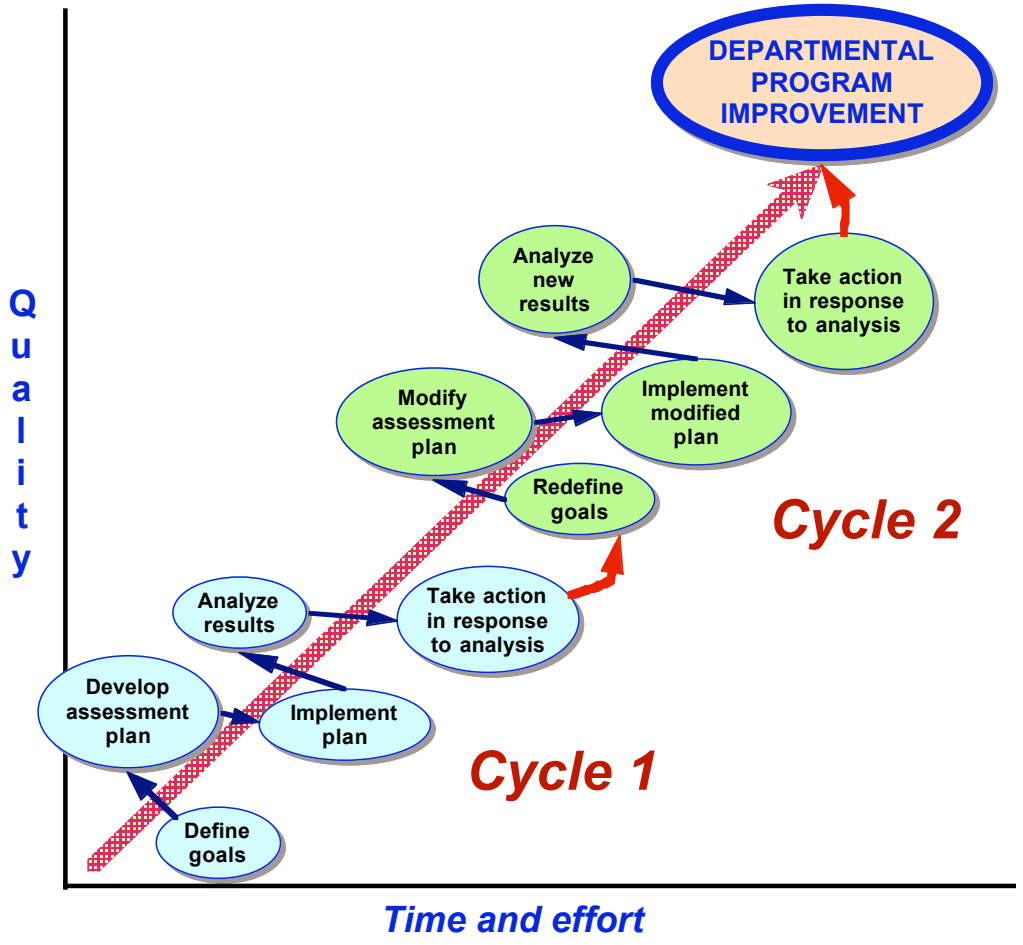

Figure 1. Assessment cycles leading to Departmental program quality improvement.

Our definitions of goals and objectives and their relationship to our mission are given in Appendix 1. In this plan we present our timeline for implementation of assessment tools

to measure the effectiveness of our student learning outcomes in both undergraduate and graduate programs.

Our three undergraduate majors with approximately 900 students are: **(1) Biology, (2) Biomedical Sciences and (3) Biology-Secondary Education.**

Our 70 graduate students are distributed among three programs: **(1) Master of Science in Biological Sciences, (2) Master of Science in Molecular Biotechnology, and (3) Doctor of Philosophy in Biological Sciences.**

This gives a total of six programs with student learning outcomes that are included in this assessment plan.

1. Biology Major (BIO): 32 hours of BIOS courses with cognates in chemistry, physics and mathematics. Biology courses include 2 introductory, 4 intermediate level, 2 advanced interest courses and a capstone experience.

Undergraduate Catalog (2001-2003): *"The Biology Major explores the broad spectrum of the life sciences with opportunities to study botany, zoology, ecology, and physiology. Students completing this major should be prepared for one or more of the following goals: (1) graduate study toward an advanced degree in the Biological Sciences, i.e. M.S., or PhD.; (2) employment in state or federal government service, industry, laboratory or technical work; (3) advanced study at the professional level."*

2. Biomedical Sciences Major (BMS): 34 hours of BIOS courses with cognates in chemistry, physics and mathematics. Biology courses include 2 introductory, 4 intermediate level, 2 advanced interest courses and a capstone experience.

Undergraduate Catalog (2001-2003): *"The Biomedical Sciences Major is designed to explore the human, molecular, and cellular aspects of the life sciences, with the opportunity to study cell biology, genetics, microbiology, molecular biology, neurobiology, and physiology.*

The specific objectives of the Biomedical Sciences major include: (1) providing basic training for employment in clinics and basic research laboratories, industrial laboratories, as well as state and federal agencies; (2) producing highly qualified students for advanced training at the graduate-professional levels, i.e. M.S., Ph.D., M.D., D.D.S., D.O.M., D.P.M., or D.V.M.; and (3) pre-professional training for such clinical areas as physician assistant, pharmacy, and physical therapy."

3. Biology Major – Secondary education curriculum (SED): 36 hours of BIOS courses, including 2 introductory, 6 intermediate level, 1 advanced interest course and a capstone experience.

4. Master of Science in Biological Sciences: through either thesis or non-thesis options with 33 hours of course work, including 3 out of 6 core courses and a colloquium requirement (11 h), electives (16h) and research (6h).

Graduate Catalog (2002-2004): *"The Master of Science in Biological Sciences enhances students' ability to plan, conduct, analyze, and report original research. Course work increases students' scientific preparation and supports their research. Through the advice of the student's major advisor, efforts are made to choose courses to meet individual needs and interests. The degree may serve as preparation for continued graduate or professional study or for positions in the private or public sector. Thesis and non-thesis options are offered.*

5. **Master of Science in Molecular Biotechnology**: (High throughput screening option) 33 hours of course work with 11 h of required courses in biology, chemistry and statistics, 16 h of electives and 6h of research including an internship.

Graduate Catalog (2002-2004): *"The Master of Science in Molecular Biotechnology is designed to provide students with training and experience in areas of biology and health sciences that require cross-disciplinary skills due to the large volumes of information collected during research. The High Throughput Screening Option provides training and experience in concepts and methods from molecular and cellular biology, chemistry, instrumentation, and statistics to rapidly screen vast chemical libraries for biological activities. This process is an important component of pharmaceutical and biotechnology research and development.*

6. **Doctor of Philosophy in Biological Sciences**: 61 hours of course work, including 4 out of 6 core courses (12h), electives (9h), a colloquium requirement (3h), laboratory rotations (3h), teaching experience (4h) and research (30h).

Graduate Catalog (2002-2004): *"The Doctor of Philosophy in Biological Sciences at Western Michigan University offers a unique combination of traditional research experience, breadth of course work, and training in effective communication of scientific concepts. This program is specifically designed for students who wish to pursue careers in the biological sciences that require excellence in both teaching and research. In addition, the pedagogy requirements also provide excellent training for careers in government and industry.*

1. Departmental Mission Statement:

Our mission is to provide the best possible education in the biological sciences that emphasizes breadth of student learning through the evaluation, analysis and application of comprehended knowledge. We intend that our students will become productive and informed participants in society and that they will be appreciated for their skills and ability to understand and communicate the significance of biological concepts, techniques and applications.

Departmental Goals:

(a) To generate a strong appreciation for:

- research and scientific methodology
- the nature of living organisms
- mechanisms of life function
- interactions among organisms and with their environments

(b) To promote understanding of:

- hierarchical levels of organization
- diversity
- evolutionary change

(c) To develop:

- critical thinking
- skills necessary for continued intellectual growth
- desire for lifelong learning

2. Program quality objectives:

Students completing degree programs in Biological Sciences at WMU will have basic knowledge of factual and conceptual information in biology, and they will know how to critically interpret that information with the help of the "scientific method." Students will also learn how to retrieve and evaluate scientific information and to keep abreast of new sources of information being made available by advancing technology. These skills will be used to develop the ability to communicate the biological sciences effectively through oral, written and visual media in both informal and formal settings.

Our specific objectives for all majors and graduate programs are:

1. Provide knowledge content across the full range of biology.
2. Generate understanding of concepts in biology.
3. Integrate knowledge across biological sub disciplines.
4. Understand and use scientific methodology.
5. Foster critical thinking.
6. Propose ways to advance knowledge in biology *(graduate only).*
7. Rewarding career development and interest in lifelong learning.

Descriptions of our objectives:

1. Provide knowledge content across the full range of biology.

Biological Sciences majors and graduate students will be knowledgeable about molecular, cellular, physiological, behavioral, ecological and evolutionary levels of biological organization. Knowledge emphases will be relevant to each of the six programs in Biological Sciences.

2. Generate understanding of concepts in biology.

Students will understand the concepts that structure our understanding of biological function within this organizational hierarchy. Our students will also garner a perspective for the historical development of understanding through the investigative use of science.

3. Integrate knowledge across biological sub disciplines.

Through our curriculum structure we intend that our students will make links among classes to understand how knowledge can be used to promote application, analysis, synthesis and evaluation of concepts towards deeper appreciation for the nature of life on earth.

4. Understand and use scientific methodology.

Biological Sciences students will have a fundamental understanding of how to apply the ***Scientific Method*** of investigation to hypothesis generation, testing, analysis and communication, and develop basic laboratory or field skills in their area of interest or expertise. Students will be expected to communicate effectively in oral, written and visual forums with use of writing, speaking and technological techniques. Students will be expected to be able to communicate syntheses of biological materials as well as critiques and the results of their own investigations.

5. Foster critical thinking.
Biological Sciences students will be expected to develop problem-solving skills through the use of critical thinking, quantitative measurement and analysis in seminar classes, laboratory classes, writing exercises in lecture classes, and in mentored research experiences.

6. Propose ways to advance knowledge in biology.
Students in our graduate programs will be expected to be able to write research proposals to fund new research or develop new programs that apply biological concepts and knowledge. Our students will also be encouraged to appreciate ownership of their own intellectual property through recognition of their abilities and efforts to generate ideas, research, concepts and knowledge.

7. Generate rewarding career development and interest in lifelong learning.
Graduates of both our undergraduate and graduate programs will be expected to use their learning to develop a rewarding career with an emphasis on some aspect of biology and an interest in continued learning throughout their lives.

3. Student learning outcomes:

Our student learning outcomes have been developed based on Bloom's hierarchical taxonomy of the cognitive domain as summarized in Appendix 2.

Using this structure we have developed a classification of our learning objectives and expected outcomes that are common to all of our six programs (Table 1).

These objectives and their learning outcomes have then been used to generate course matrices for our undergraduate and graduate programs as shown in Appendix 3. These matrices help us to identify redundancies or duplications in our learning programs.

Table 1. Goals/objectives, expected outcomes and level of knowing. Objectives are ordered according to increasing levels of Bloom's cognitive hierarchy.

Goal/objective	*Expected outcome*	*Level of Knowing*
1. Provide knowledge content across the full range of biology	1. Demonstrated knowledge of form, function, mechanism, organization, scale, hierarchy, diversity and evolution	1. Knowledge
	2. Ability to retrieve information from databases	1. Knowledge 2. Comprehension
2. Generate understanding of concepts in biology	1. Ability to use knowledge foundation to illustrate concepts and compare examples.	2. Comprehension 3. Application 4. Analysis
	2. Ability to communicate knowledge and concepts both in writing and orally.	1. Knowledge 2. Comprehension 3. Application

3. Integrate knowledge across biological sub disciplines.	1. Ability to make links among classes and sub disciplines so that information can be used for deeper comprehension.	2. Comprehension 3. Application
4. Understand and use scientific methodology	1. Ability to interpret observations through the creation, testing, analysis and communication of parsimonious hypotheses.	4. Analysis
	2. Ability to design both laboratory and field experiments	1. Knowledge 2. Comprehension 3. Application
	3. Ability to perform Good Laboratory Practice.	2. Comprehension 3. Application 4. Analysis
	4. Ability to inspect data and apply basic statistics to their analysis and communication.	1. Knowledge 2. Comprehension 3. Application 4. Analysis
	5. Appreciation for ethical conduct in science.	1. Knowledge 2. Comprehension 3. Application 4. Analysis 5. Evaluation
	6. Promote familiarity with a range of methods and techniques relevant to application of the biological sciences.	1. Knowledge 2. Comprehension 3. Application
	7. Ability to reflect upon and discuss the nature of biology as a science and its historical, philosophical and ethical impact on humanity and the environment.	5. Synthesis 5. Evaluation
5. Foster critical thinking	1. Ability to determine the veracity and value of published information	5. Evaluation
6. Propose ways to advance knowledge in biology	1. Ability to write proposals to fund research or develop new programs that apply biological concepts and knowledge	5. Synthesis
	2. Foster ownership of ideas, research, concepts, knowledge and effort.	5. Evaluation

1.1. Demonstrated knowledge of form, function, mechanism, organization, scale, hierarchy, diversity and evolution

This learning outcome is based on knowledge content within each of our six programs. Each program varies according to this knowledge base and so assessment will be program-specific.

1.2. Ability to retrieve information from databases.

Information Retrieval: Student abilities to find and evaluate information are an integral part of preparing scientific papers and seminars. This skill will be assessed as part of the writing-intensive classes (BIOS 301, 319 or 350) and with an information literacy test prepared in collaboration with the Waldo Library.

2.1. Ability to use knowledge foundation to illustrate concepts and compare examples.

This learning outcome is based on the integration of knowledge content to develop and illustrate biological concepts.

2.2. Ability to communicate knowledge and concepts both in writing and orally.

Student progress in communication skills will be assessed by instructors in the designated writing intensive courses at the sophomore/junior level (highlighted 300-level courses in Appendix 3) and again at the senior level (senior seminar). Oral communication skills will be assessed by incorporating a public presentation component into the capstone experience that will be evaluated by faculty.

3.1. Ability to make links among classes and sub disciplines so that information can be used for deeper comprehension.

This learning outcome is an important reflection of curriculum structure. We think it is important to integrate information, concepts and applications across classes to promote deeper comprehension and synthesis.

4.1. Ability to interpret observations through the creation, testing, analysis and communication of parsimonious hypotheses.

Will be assessed with course-embedded measures and surveys of employers and alumni once students use their expertise in employment or graduate school.

Student, Alumni, and Employer Surveys: To further assess our objectives, we will administer surveys to beginning students to determine their goals and aspirations. The students will be surveyed again at the time of graduation to determine their perception of how the biological sciences major curriculum has advanced them toward their goals. After students graduate, we will also survey their employers/major advisors following graduation to assess their perception of our graduates.

4.2. Ability to design both laboratory and field experiments.

Will be assessed with course-embedded measures.

4.3. Ability to perform "Good Laboratory Practice."

Will be assessed with course-embedded measures.

4.4. Ability to inspect data and apply basic statistics to their analysis and communication.

Will be assessed with course-embedded measures.

4.5. Appreciation for ethical conduct in science.

Will be assessed with course-embedded measures.

4.6. Promote familiarity with a range of methods and techniques relevant to application of the biological sciences.

Will be assessed with course-embedded measures.

4.7. Ability to reflect upon and discuss the nature of biology as a science and its historical, philosophical and ethical impact on humanity and the environment.

Will be assessed with comparison of senior seminars, capstone course evaluation, analysis of writing-intensive classes, and portfolio evaluation.

5.1. Ability to determine the veracity and value of published information.

Will be assessed with portfolio evaluation.

6.1. Ability to write proposals to fund research or develop new programs that apply biological concepts and knowledge.

Will be assessed with portfolio evaluation and capstone course evaluation.

6.2. Foster ownership of ideas, research, concepts, knowledge and effort.

Will be assessed with portfolio evaluation.

Our 7th objective of ***"rewarding career development and interest in lifelong learning"*** does not depend upon student learning outcomes directly. Instead this objective depends upon how students have applied what they have learned in our programs and so assessment of this objective involves surveying our graduates, and their employers, as they pursue their careers and life experiences.

Assessment measures of expected outcomes:

For each of the expected outcomes we propose to implement assessment tools as outlined in table 2.

Table 2. Objectives, outcomes and measurement tools for all 3 majors and graduate programs in Biological Sciences.

Objective	*Expected outcome*	*Measure*
1. Provide knowledge content across the full range of biology	1. Demonstrated knowledge of form, function, mechanism, organization, scale, hierarchy, diversity and evolution	1. National content test. 2. Pre-test/Post-test evaluation.
	2. Ability to retrieve information from databases	3. Course-embedded measures. 4. Information literacy test (Waldo library).
2. Generate understanding of concepts in biology	1. Ability to use knowledge foundation to illustrate concepts and compare examples.	5. Analysis of writing-intensive classes. 6. Portfolio evaluation
	2. Ability to communicate knowledge and concepts both in writing and orally.	5. Analysis of writing-intensive classes. 6. Portfolio evaluation 7. Capstone course evaluation
3. Integrate knowledge across biological sub-disciplines.	1. Ability to make links among classes and sub disciplines so that information can be used for deeper comprehension.	1. National content test. 6. Portfolio evaluation. 8. Student surveys.
4. Understand and use scientific methodology	1. Ability to interpret observations through the creation, testing, analysis and communication of parsimonious hypotheses.	3. Course-embedded measures. 9. Employer surveys. 10. Alumni surveys.
	2. Ability to design both laboratory and field experiments	3. Course-embedded measures.
	3. Ability to perform Good Laboratory Practice.	3. Course-embedded measures.
	4. Ability to inspect data and apply basic statistics to their analysis and communication.	3. Course-embedded measures.
	5. Appreciation for ethical conduct in science.	3. Course-embedded measures.

	6. Promote familiarity with a range of methods and techniques relevant to application of biological sciences.	3. Course-embedded measures.
	7. Ability to reflect upon and discuss the nature of biology as a science and its historical, philosophical and ethical impact on humanity and the environment.	5. Analysis of writing-intensive classes. 6. Portfolio evaluation. 7. Capstone course evaluation.
5. Foster critical thinking	1. Ability to determine the veracity and value of published information	6. Portfolio evaluation.
6. Propose ways to advance knowledge in biology	1. Ability to write proposals to fund research or develop new programs that apply biological concepts and knowledge	6. Portfolio evaluation
	2. Foster ownership of ideas, research, concepts, knowledge and effort.	6. Portfolio evaluation

1. National content test:

Commercially available Major Fields Assessment Examination (Educational Testing Services (ETS), Princeton) that will have the advantage of allowing comparison with other institutions that also administer the exam. We have successfully applied this test as part of our existing assessment program.

National content tests will be used to assess student mastery of basic biological knowledge in each undergraduate major. A comprehensive exam will be administered to a sample of beginning students and again to graduating seniors. The first testing will be part of the BIOS 150/151 introductory sequence and the second will be part of the capstone course BIOS 497- senior seminar.

2. Pre-test/Post-test evaluation:

Pre-test/post-test evaluation with local tests of knowledge content at the start and end of a course or course sequence.

3. Course-embedded measures:

We intend to encourage all of our faculty to use their own assessment tools within every course for which they bear responsibility. This tool will include the identification of specific course objectives with learning outcomes and their evaluation on Likert scales (1-5, low to high) for students to complete at the end of a course. This will generate student feedback about how important each course objective and learning outcome is and how well these objectives and outcomes were satisfied by the instructor.

Note: Our intent here is to focus on student learning and to ensure that data collected from this, or any other, assessment tool are used only for this purpose. Union concerns about the use of such data to influence faculty tenure and promotion decisions are not seen as relevant. In addition, our departmental Assessment Committee will recommend that all data collected for assessment of student learning outcomes will only be used for program improvement within the assessment cycle illustrated in Figure 1. We will also

recommend that our departmental policy statement is amended to ensure that assessment data are not available for tenure and promotion decisions.

4. Information literacy test (Waldo library).

This test will be prepared in collaboration with Dr Barbara Cockrell of the Waldo Library to assess student appreciation for information diversity, veracity and status. This test is in development as part of the Waldo Libraries assistance with writing-intensive classes.

5. Analysis of writing-intensive classes.

Student progress in written communication skills will be assessed by instructors in the designated writing intensive courses at the sophomore/junior level (BIOS 301, 319 or 350) and again at the senior level (senior seminar). Sample bibliographies from term papers and other writing assignments are being analyzed by Dr Cockrell of Science reference in the Waldo Library.

6. Portfolio evaluation.

We propose to implement a new requirement for students in all undergraduate and graduate programs to maintain a portfolio of their collected works, products and activities. This will be developed as a digital web-based activity and will; be a requirement for graduation. Implementation of this requirement is planned for the end of the first 3-year assessment cycle (see section 5 on "Timeline for Data Collection" below). The portfolio will be completed as part of new capstone course requirements.

7. Capstone course evaluation.

The undergraduate capstone course will be amended to include completion of the portfolio. Instructors of this course will be responsible for both portfolio evaluation and capstone course evaluation. Rubrics will be developed to use this course to provide assessment information for use in program revision and improvement.

8. Student surveys:

To further assess our objectives, we will administer surveys to beginning students to determine their goals and aspirations. The students will be surveyed again at the time of graduation to determine their perception of how the biological sciences major curriculum has advanced them toward their goals.

9. Employer surveys:

After students graduate, we will also survey their employers/major advisors following graduation to assess their perception of our graduates (see appendix 4 for a sample questionnaire).

10. Alumni surveys:

After students graduate, we will also survey their employers following graduation to assess their perception of our graduates (see appendix 4 for a sample questionnaire).

Program-specific assessment tables:

Major-specific objectives:

A. Biology major (BIO)

1. Provide knowledge content with an emphasis in organismal biology.
7. Rewarding career development in biology and interest in lifelong learning.

B. Biomedical Sciences major (BMS)

1. Provide knowledge content with an emphasis in molecular, cellular and human biology.
7. Rewarding career development in biomedical science and interest in lifelong learning.

C. Secondary Education (SED)

The SED program has a set of program outcomes that reflect requirements of the State of Michigan as interpreted by the College of Education at Western Michigan University. These outcomes use the language described below, but where they coincide with our departmental learning outcomes, we intend to use our own interpretation of how to assess the outcome.

1. **A sense of professional understanding.**
2. *A sense of diversity in the school environment.*
3. *Ability to understand learners from a student-centered perspective.*
4. *Use assessment appropriately.*
5. *Demonstrate best teaching practices.*
6. **Self-development and life-long learning.**

Within the Biological Sciences Assessment Plan we propose to assess only outcomes 1 and 6 (in bold) because they are provided by our curriculum and represent our faculty expertise. The pedagogical outcomes 2-5 (in italics) will be assessed by the College of Education as part of their State accreditation process that reflects their faculty expertise and mission.

We interpret outcomes 1 and 6 as equivalent to our departmental objectives 1 and 7: thus our objective 1 to *"provide knowledge content across the full range of biology"* has a similar intent to educational outcome 1 – *"a sense of professional understanding."* Similarly, our objective 7, to *"generate rewarding career development and interest in lifelong learning"* has the same intent as educational outcome 6 – *"self development and life-long learning."*

Major-specific objectives:

Biology Major:

Goal/objective	*Expected outcome*	*Level of Knowing*	*Measure*
1. Provide knowledge content with an emphasis in organismal biology	1. Demonstrated knowledge of form, function, mechanism, organization, scale, hierarchy, diversity and evolution	1. Knowledge	1. National content test. 2. Pre-test/Post-test evaluation.
7. Generate rewarding career development in biology and interest in lifelong learning	1. Entry into a graduate program (MS or PhD).	3. Application	9. Employer surveys 10. Alumni surveys
	2. Employment in government, industry or commerce.	3. Application	9. Employer surveys 10. Alumni surveys

Biomedical Sciences Major:

Goal/objective	*Expected outcome*	*Level of Knowing*	*Measure*
1. Provide knowledge content with an emphasis in the biomedical sciences	1. Demonstrated knowledge of human, molecular, and cellular biology	1. Knowledge	1. National content test. 2. Pre-test/Post-test evaluation.
7. Generate rewarding career development in biomedical science and interest in lifelong learning	1. Entry into a graduate program (MS, PhD, MD, DDS, DOM, DPM, DVM)	3. Application	9. Employer surveys 10. Alumni surveys
	2. Employment in clinics and basic research laboratories, industrial laboratories and federal agencies.	3. Application	9. Employer surveys 10. Alumni surveys
	3. Pre-professional training for entry into clinical areas such as physician assistant, pharmacy, & physical therapy.	4. Application	9. Employer surveys 10. Alumni surveys

Graduate-specific Objectives:

All graduate programs:

Goal/objective	*Expected outcome*	*Level of Knowing*	*Measure*
6. Propose ways to advance knowledge in biology	1. Ability to write proposals to fund research or develop new programs that apply biological concepts and knowledge	5. Synthesis	6. Portfolio evaluation
	2. Foster ownership of ideas, research, concepts, knowledge and effort.	5. Evaluation	6. Portfolio evaluation

4. Targeted students:

From our approximately 900 majors we will sub sample student learning outcomes with a systematic sample of the 7 lowest, 7 intermediate and 7 highest students registered in BIOS classes based on their current GPA. Samples will be taken from introductory, intermediate and advanced courses within each major. These sample sizes will be increased or decreased according to the ratio of standard deviation to the mean using standard sampling methods.

The targeted students are identified according to level and assessment tool in the following section on the timetable for data collection.

5. Timeline for data collection:

3-year cycle based on the fall-spring academic year (item numbers refer to assessment measures from Table 2):

Fall 2003

1. National content test to seniors (21 students in each major = 63 students).
2. Pre-test/post-test evaluation in BIOS 150/151 sequence (21 students)
3. Start to implement course-embedded measures (all students)

Spring 2004

4. Develop and implement information literacy test (with Waldo library – 21 students).
5. Analysis of writing-intensive classes (3 classes = 63 students)

Fall 2004

6. Initiate portfolio requirement (all majors)
7. Capstone course evaluation

Spring 2005

8. Start student surveys
9. Start employer (and graduate school) surveys
10. Start alumni surveys

Fall 2005

1. Prepare report of analyzed data and recommendations
2. Design curriculum changes

Spring 2006

1. Implement curriculum changes
2. Evaluate assessment program

6. Planned uses of assessment information:

As indicated in Figure 1 and our timetable, we plan to take action in response to our analyses of the data we gather. The assessment program will be implemented by a permanent assessment committee that will also be responsible for data analysis and subsequent recommendations. Recommendations will be made to both the departmental chair and to the departmental curriculum committee. Data analysis will be used to identify both successfully implemented learning outcomes and learning outcomes that require improvement or increased effort.

The curriculum committee will design curriculum changes for review and approval by the faculty followed by implementation of the changes and modification of the assessment plan to measure change effectiveness.

Assessment information will also be used to make recommendations to our unit chair and College Dean for areas where additional faculty and staff are required to implement our mission, goals, objectives and learning outcomes to maximum effect.

7. Assessment responsibilities:

The assessment committee will be a permanent departmental committee of 3 faculty plus the undergraduate and graduate advisors. The committee will prepare written recommendations to the departmental chair and departmental curriculum committee based on their analyses of collected data. Membership of the committee will be for 2 years and will cycle among faculty to ensure faculty ownership and overlap with the 3-year cycle of assessment implementation.

The 2003-2005 committee consists of:

Stephen Malcolm	chair
William Cobern	Director, Mallinson Institute for Science Education
John Geiser	
Tammi Hoevenaar	Undergraduate advisor
John Spitsbergen	Graduate Advisor

8. Evaluation of assessment plan:

Effectiveness of our assessment plan will be evaluated according to our overall assessment timetable (section 5 above) at the end of the 3-year cycle (throughout the last semester of the cycle). Evaluation will consist of answers to the following questions:

1. Do identified learning outcomes adequately address program objectives?
2. Do assessment tools measure the intended outcomes?
3. Are the data sufficient to determine the quality of learning outcomes?
4. Is the assessment program sufficiently comprehensive?
5. Is the student sampling sufficient to generate valuable data?
6. Are there ways to improve the program?

Answers to these questions will be used to refine the assessment program ready for the start of the next 3-year cycle of assessment and curriculum review.

Appendix 1: Assessment Dictionary

Goals and objectives:

(1) Goal: ("a limit, boundary or finishing point")

Ultimate aim or purpose – e.g. the purpose of soccer is to win. *Express results in general terms.*

So this is "**what**" we are all about.

(2) Objective: ("the point to which the operations are directed")

One or more ways to achieve your goal – the objective of soccer is to put the ball in the net more times than the opponent. *Express results in precise terms.*

So this is "**how**" we achieve our goal – how we win.

Objectives are measurable and can be broken down into a series of objectives. So in soccer objectives could target playing tactics and strategies as well as player health and strength and fan club support and facilities etc.

For example for the Biomedical Sciences Major we might suggest these objectives much as stated in the catalog:

(1) Provide basic training for employment in:
   a) clinics and basic research laboratories
   b) industrial laboratories
   c) state and federal agencies
(2) Provide advanced courses and experiences to prepare students for advanced training within graduate programs (M.S., Ph.D., M.D., D.D.S., D.O.M., D.P.M., or D.V.M).
(3) Provide pre-professional training for such clinical areas as physician assistant, pharmacy, and physical therapy.

However, we need to develop these objectives with sets of outcomes in mind. So if we provide basic training what do we expect in terms of student learning outcomes? This means that each objective would have a set of outcomes associated with it.

Examples from other universities:

Here are some outcomes for the Department of Biological Sciences at Southern Illinois University at Edwardsville (they have been using assessment tools for about 20 years, coordinated by Dr Douglas Eder who is in their Department of Biological Sciences):

Baccalaureate students in Biology will:

1. have acquired conceptual knowledge in the core biology courses.
2. have demonstrated specialized knowledge in one or more areas of basic or applied biology pertinent to premedical science, medical technology, biology education, genetic engineering, ecology/evolution/environment, or disciplines of advanced biology, and their methods and techniques.
3. have demonstrated supporting knowledge in statistics, chemistry, physics, and/or mathematics, especially as it applies to methods, techniques, and instrumentation used in basic or applied biology.
4. satisfy requirements for admission to area graduate programs in biology, or admission to professional (medical, dental, veterinary, podiatric, etc.) school, or ASCP certification as medical technologist, or certification for teaching secondary biology or U.S. Civil Service Biologist grade GS-7.
5. be able to retrieve information on a general or specialized biological topic and acquire knowledge on this topic on one's own.
6. be able to communicate orally and in writing general or specialized biological knowledge.
7. be encouraged, as far as departmental and university resources will allow, to participate in departmental and university teaching and research.
8. be encouraged to become cognizant of cultural, social, historical, ethical, and economic impacts and aspects of biology, both basic and applied.

Mission:

Goals and objectives are the statements of how to implement a mission.

So the mission of our soccer team is to be the best team possible that provides the best career and playing experience for its players and staff and the best entertainment for its fans and viewing public.

For our departmental assessment we should probably focus on objectives as being the most tangible way to be objective about what we wish to achieve for our majors.

Notes from other sources:

Goals and objectives:

"Goals [for the most part] are usually used to express intended results in general terms. Objectives are used to express intended results in precise terms. By using the language that is more comfortable to them, many faculty sidestep the distinction between goals and objectives. Some refer instead to indicators or competencies, and others refer to learning skills and sub skills. The exact language faculty use is not important. It is important that faculty reach agreement about what graduates of their programs are expected to know and be able to do and express these intended results with enough precision to guide the selection of assessment instruments" (Palomba and Banta, 1999).

The assessment site at George Mason University (http://assessment.gmu.edu/AcadProgEval/guide.shtml) says:

"Whatever terms one uses, it is important that what is to be assessed is stated as clearly and as specifically as possible. The purposed of creating learning goals are many. It helps faculty achieve consensus about the purposes of an academic program; the goals themselves can become the standards for what is expected of graduates of a program. Keep in mind that program goals are dynamic and change as the program changes and as assessment information is used as feedback.

There are different types of learning goals; some are knowledge-based, others related to skills, and yet others concerned with attitudes about learning. For example, a knowledge-based goal for a speech program might be "Students will identify the major phonemic and phonetic variants of Eastern American, Appalachian English, Southern American, and Black English dialects." A skill-based goal for a social science program might be, "Students will be able to identify a problem, construct hypotheses, identify variables, construct operational definitions, create a research design, carry out statistical analyses and write a research report." An attitude goal for an art program might be, "Students will attend art shows and visit galleries independent of a course assignment and discuss their experiences in class and outside of class."

The three goals cited here are all measurable. Faculty may wish to include some goals that are not so easily measured because they reflect the values of their program and they wish to convey that message to students. The important point is to create goals that reflect the curriculum and that students have opportunities to master. For example, in the social science program goal noted above, students would have to be given the opportunity to design a research project and present their results."

References:

Palomba, Catherine and Banta, Trudy. 1999. Assessment Essentials. Jossey-Bass.

Appendix 2: Bloom's Hierarchical Taxonomy of the Cognitive Domain

Level	*Definition*	*Sample verbs*	*Sample behaviors*
1. KNOWLEDGE	Student recalls or recognizes information, ideas, and principles in the approximate form in which they were learned.	Write List Label Name State Define	The student will define the 6 levels of Bloom's taxonomy of the cognitive domain
2. COMPREHENSION	Student translates, comprehends, or interprets information based on prior learning.	Explain Summarize Paraphrase Describe Illustrate	The student will explain the purpose of Bloom's taxonomy of the cognitive domain.
3. APPLICATION	Student selects, transfers, and uses data and principles to complete a problem or task with a minimum of direction.	Use Compute Solve Demonstrate Apply Construct	The student will write an instructional objective for each level of Bloom's taxonomy.
4. ANALYSIS	Student distinguishes, classifies, and relates the assumptions, hypotheses, evidence, or structure of a statement or question	Analyze Categorize Compare Contrast Separate	The student will compare and contrast the cognitive and affective domains.
5. SYNTHESIS	Student originates, integrates, and combines ideas into a product, plan or proposal that is new to him or her.	Create Design Hypothesize Invent Develop	The student will design a classification scheme for writing educational objectives that combines the cognitive, affective, and psychomotor domains.
5. EVALUATION	Student appraises, assesses, or critiques on a basis of specific standards and criteria	Judge Recommend Critique Justify	The student will judge the effectiveness of writing objectives using Bloom's taxonomy.

Synthesis and evaluation are likely to be equivalent levels of difficulty at the top of the hierarchy (like creativity and criticism).