

**MSU Microbiology Departmental Assessment Plan
and Report for AY 2012/2013**

Department: Microbiology

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Part I: Department of Microbiology Assessment Plan

Degree Objectives for the Microbiology Major

Microbiology is a diverse discipline with strong basic and applied aspects. Its basic aspects are concerned with understanding the life processes exhibited by microorganisms and with understanding how microbes evolved to carry out these processes. The basic aspects are also concerned with the interaction of microbes with other organisms, both microorganisms and macroorganisms, and with how these interactions impact the ecosystems where microbes are found and how pathogenic microorganisms interact with the immune system of the host. The applied aspects of microbiology include medical microbiology, environmental microbiology, and industrial microbiology/biotechnology. All three applied aspects involve controlling the activities of microbes for the purpose of improving the human condition.

Professional microbiologists are found in academic, private, and governmental institutions working as scientists and/or as educators. Some enter the profession with the baccalaureate degree, working as clinical laboratory scientists, technicians, and sanitarians. Others enter after obtaining further training in graduate or professional schools. In addition, an undergraduate degree in microbiology provides an excellent foundation for those interested in becoming physicians, dentists, employees of firms providing support services or products to professional microbiologists, and consultants or advisors to businesses and governmental agencies.

There are four major curriculum options within the microbiology major (General Microbiology, Medical Laboratory Science, Environmental Health and Biotechnology: Microbial systems); all four options provide the experiences and knowledge needed for most of the career options described above. The Department also offers a Premedical Curriculum (under the general Microbiology option) and a minor in Microbiology. In addition, the Montana Medical Laboratory Science (MMLS) Professional Program is housed in the Department of Microbiology. It is our aim to enable students to succeed in their chosen career path by supporting them in the following ways:

- Providing information and guidance regarding career opportunities in microbiology and related professions.
- Providing broad coverage of the discipline.
- Providing experiences that enable students to reach the competencies outlined below.

Assessment Plan

An assessment plan has been prepared which is in accordance with the Degree Objectives for the Microbiology Major. The Assessment Plan consists of: 1). establishment of Learning Objectives and identification of courses that satisfy the Learning Outcomes, 2). a method of assessment of these Learning Objectives, 3). a plan for implementation of this assessment and 4). Data collection and Analysis. The details of each of these components of the Assessment Plan are given below.

1. Learning Objectives (= Competencies)

Learning Outcomes have been defined and courses that satisfy each of these learning outcomes have been identified as listed below in Sections A and B respectively.

A). Learning Outcomes:

Learning Objective 1: Define, describe and use the fundamental terms and concepts of modern microbiology as evidenced by the ability to present, discuss and answer questions about a scientific article in the field of microbiology.

Learning Objective 2: Design an experiment to test a hypothesis or fundamental concept in microbiology

Learning Objective 3: Perform basic microbiological lab techniques

Learning Objective 4: Access and analyze bioinformatics data

Learning Objective 5: Verbally communicate about fundamental and modern microbiological concepts.

Learning Objective 6: Communicate in a written form about fundamental and modern microbiological concepts

B). Courses¹ which satisfy the identified Learning Outcomes:

Learning Outcome 1: BIOM 360; BIOM 494

Learning Outcome 2: BIOM 455

Learning Outcome 3: BIOM 360; BIOM 432

Learning Outcome 4: BIOM 450; BIOB 428

Learning Outcome 5: BIOM 494; BIOM 450; BIOM 497

Learning Outcome 6: BIOM 450; BIOH 405; BIOM 435, BIOB 410

¹Course Titles corresponding to Course numbers:

BIOM 360 – General Microbiology

BIOH 405 – Hematology

BIOB 410 – Immunology

BIOM 410 – Microbial Genetics

BIOB 428 – Molecular Evolution

BIOM 432 – Medical Bacteriology Lab

BIOM 435 – Virology

BIOM 450- Microbial Physiology

BIOM 455 – Research Methods in Microbiology

BIOM 494 – Seminar, Capstone

BIOM 497 – Educational Methods (Teaching)

2. Method of Assessment

A form has been created to assess student performance of these learning objectives in the different courses. On this assessment form, the Learning Objectives are given along with a scoring rubric to assess performance level of each Learning Objective. A threshold has been defined, such that if student performance falls below this threshold, some faculty action will be taken to improve the program. We intend to have other members from the Department, as well as faculty from other Departments where appropriate, participate in these Assessments. An example of the Assessment form is given below.

Microbiology Assessment Form Scoring Rubric

Course: _____ Semester _____

Evaluator: _____

Dept. of Evaluator _____

Type of Learning Activities(s) Assessed:

i.e. written examination, written assignment, in class activities (role play, class discussion, presentations), out of class activities (projects)

Learning Objective Assessed: (i.e. answer 1-6 below) _____

Learning Objective Assessed: *Evaluate all that apply*

Learning Objective	Performance Level				
1. Students will demonstrate use of knowledge of the fundamental terms & concepts of microbiology to present, discuss and answer questions about a scientific article in the field of microbiology	1	2	3	4	5
2. Design an experiment to test a hypothesis or microbiological concept	1	2	3	4	5
3. Perform basic microbiological lab techniques	1	2	3	4	5
4. Access & analyze bioinformatics data or large datasets	1	2	3	4	5
5. Verbally communicate about fundamental & modern microbiological concepts	1	2	3	4	5
6. Communicate in written form about fundamental & modern microbiological concepts	1	2	3	4	5

1 = Not Done

❖ **2 = Performed but with poor execution – threshold level (see note below)**

3 = Adequate Performance; Met Expectations

4 = Performance Well Executed; Exceeds Expectation

5 = Performance Excellent; Exceeds Expectations Plus

❖ **threshold level:** if student performance falls below this threshold faculty action will be taken to improve the program.

3. Implementation of Assessment of Learning Outcomes: Proposed Plan

Assessment of the Learning Outcomes will be implemented according to the following schedule:

Program: Microbiology – General Microbiology Option

Learning Outcomes	Assessment Year				Target course(s) for Assessment Data ¹
	2011-12	2012-13	2013-14	2014-15	
1. Use knowledge of the fundamental terms & concepts of microbiology	x				BIOM 494(F/S)
2. Design an experiment to test a hypothesis or microbiological concept		x			BIOM 455(S)
3. Perform basic microbiological lab techniques		x	x		BIOM 360(F/S) BIOM 432(S)
4. Access & analyze bioinformatic data or large datasets	x	x			BIOM 450 (F)
5. Verbally communicate about fundamental and modern microbiological concepts			x x	x	BIOM 450(F) BIOM 494 (F/S) BIOM 497 (F)
6. Communicate in written form about fundamental & modern microbiological concepts	x	x	x	x	BIOH 405 (F) BIOB 410 (F) BIOM 435(F) BIOM 450 (F)

¹ - courses designated as offered in the Fall Semester (F), Spring Semester (S) or Fall and Spring (F/S) semesters.

BIOM 360 – General Microbiology
BIOH 405 – Hematology (Lecture)
BIOB 410 – Immunology
BIOB 411 – Immunology Lab
BIOM 410 – Microbial Genetics
BIOB 428 – Molecular Evolution
BIOM 432 – Medical Bacteriology Lab
BIOM 435 – Virology
BIOM 450 – Microbial Physiology
BIOM 455 – Research Methods in Microbiology
BIOM 494 – Seminar, Capstone
BIOM 497 – Educational Methods (Teaching)

4. Data, Collection, Analysis and Use:

Assessments were begun in the Spring 2012. The Seminar Capstone Course (BIOM 494) was assessed collecting data on approximately 25% of the students (=4/12). Results of the preliminary assessment were used in developing and fine-tuning this current plan. Assessments of courses with larger students numbers (30-40 students) are planned for the Fall 2012 semester. These collective assessment data will be collated and analyzed at the end of the Fall semester. Analysis of subsequent assessment forms will then be conducted at the end of each semester. The Undergraduate Committee will review analysis of the assessment and the results will be shared with the full Department during regularly scheduled Departmental Meetings.

Part II: Assessment Report: Academic Year 2012/13

A brief summary of assessment efforts in academic year (AY) 2012/2013 is included in Section A below. A summary of the department Assessment outcomes is listed in Table 1. In addition assessments from the Montana Medical Laboratory Science (MMLS) Professional Program has been included in our assessment efforts as this program is housed in the Microbiology Department and a significant number of undergraduates (about 80) in the department are in the Medical Laboratory Science option (curriculum). Some will enter the MMLS program (10-16/year) while others will seek clinical training elsewhere. The MMLS has multiple methods for evaluation including program, instructor and student evaluations. Results of these assessments are included in Section B below.

A. Assessment Efforts for Microbiology Department in AY 2012/2013: Assessment data were planned to be collected for General Microbiology (BIOM 360), Microbial Physiology (BIOM 450) and Research Methods in Microbiology (BIOM 455). However given BIOM 455 was revised and the revised version offered for the first time in 2012/2013, it was decided to delay assessment of this course until AY 2014/2015. Result of assessment of BIOM 360 and BIOM 455 are summarized below.

1. General Microbiology (BIOM 360) -Assessment exercises are currently incorporated into BIOM 360 and hence these embedded assessments are being used for Assessment. Collection and analysis of this data is in process. BIOM 360 is taught in Fall and Spring Semesters, and data is being collected from both semesters, with approximately 50 student assessments anticipated.

2. Research Methods in Microbiology (BIOM 455)- Assessments were collected in Fall 2012. Three Microbiology Faculty assessed this course. Several problems were encountered in the Assessment of BIOM 450. Specifically, faculty members were inconsistent in their evaluations in the detail they provided regarding their evaluation and the criterion they used in the determination of Performance Level. Hence changes to the evaluation forms were suggested and are planned for AY 2013/2014, as noted in Section 5 below.

Table 1 - Assessment Summary (AY 2011-2013)

Academic Year	Course Assessed	Number of Students Assessed	Percentage of Students in Course Assessed	Outcome of Assessment ¹
2011-2012	Seminar, Capstone (BIOM 494)	4	25%	Met Expectations (Avg. Score =4.2)
2012-2013	Microbial Physiology (BIOM 494)	12	10%	Met Expectations (Avg. Score = 3.8)
	General Microbiology (BIOM 360)	~50 (anticipated)	10%	Assessments In Process

¹Assessment of students Performance Level was determined on a scale of 1-5, with 5 = Excellent Performance and 2 = Performed with poor execution and defined as the threshold level, as defined on the Evaluation Form. The average score was determined and an Assessment Outcome determined to fall into one of the three following categories as follows: Meet Expectations (score of 3-4); Below Threshold (score of ≤ 2) or Exceeded Expectations (score of 4-5).

B. Assessments from the MMLS Program

The Montana Medical Laboratory Science Professional Program has multiple methods for evaluation and improvement. The methods for evaluation include program evaluation; instructor evaluation, especially during the summer semester; and student evaluations by faculty in the summer and supervisors and education coordinators during the clinical rotations. The following table lists the type of evaluation being done in each category, by whom and how often it is done.

	By Whom	Type	How often	
Program Evaluation:	Students	1. Focus group	2008-2009 only	
	Students	2. Exit Interviews	end of summer	
	Students	3. Clinical rotations/ Training program	end of training	
	Clinical affiliates:	4. Evaluation form	end of spring	
	Ed. Coordinator/ Lab. Manager	5. Site visit interview	fall & spring	
	Rural rotation affiliates	6. Evaluation form	end of rotation	
	National exams	ASCP-BOC exams	after training completed	
	Employers	informal/formal survey	2013	
	Faculty	Retreat	fall	
	Advisory committee	meeting	fall or spring	
	Instructor Evaluation:	Students	7. MMLS evaluation form	end of summer course
Students		8. MSU evaluation form	end of summer course	
Peer evaluation by Director or others		Observations of instruction & activities	once during summer	
Self Evaluation		Reflections & changes	end of summer course	
Student Evaluation:	MMLS faculty	Exams/ activities/ performance	end of each course in summer, fall & spring	
	Supervisor in each clinical rotation	9. Performance & affective assessments	after each rotation	
	Rural rotation supervisors	10. Assessment form	after rural rotation	
	MMLS faculty	11. Site visits	fall and spring	
	Education Coordinator	12. Evaluation form	end of training	
	MMLS faculty	Final comp. exam	end of training	
	MMLS faculty	ASCP-BOC exam	end of training	

The program has forms that were developed and used to obtain the preliminary information for improvement in the second year of the program and they have been used in subsequent years to determine if additional changes would be beneficial. The faculty has had five retreats that are conducted in the fall. At each retreat we have assessed the previous summer teaching cycle for curriculum content and changes; reviewed our admission criteria; reviewed academic policies and procedures; reviewed our fall and spring curriculum; and planned our goals and strategies for the upcoming year. Any relevant programmatic issues are discussed as well as program improvements based on what we learned from our assessments. We believe this retreat to be important for our program and it will continue every year.

As part of instructor evaluations, each of the faculty was observed during their didactic teaching and laboratory activities during the summer. The Director made observations of each instructor's teaching methods and provided any positive feedback and helpful hints for improvement. Each faculty member also does a self evaluation at the end of their course to reflect on what worked and what needs improvement. At our third retreat each faculty member decided to try one new active learning strategy and determine its effectiveness. The students were asked about the strategy during their exit interview at the end of the summer and this information was shared with each faculty member during our subsequent retreat. Each faculty will either keep the strategy, improve on it or abandon it for another strategy. We will continue to develop these strategies in years to come.

An advisor meeting was held in the spring of 2011. The MMLS faculty and education coordinators from several clinical sites, members from the other allied health groups, lab managers, faculty advisors from each university, physician and a cooperate member reviewed our program progress and gave us advise about future program improvements. Site visits to the hospital affiliates are conducted by MMLS faculty twice a year to meet with the education coordinator and/or laboratory manager and students to assess student progress and potential problems. This is also an opportunity to listen to clinical supervisors and laboratory managers to learn about our program. As part of our continued evaluation of the program, a survey will be developed to help us learn what the employers, especially those who have our graduates for several years, think about our program and give us feedback for improvements. So far we have had only an informal survey of lab managers and all of them like our students and have hired them for continued employment in multiple types of positions.

Outcome Measures

Table 1 is a summary of the Board of Certification (BOC) results from four classes who have

Table 1

Montana Medical Laboratory Science Training Program - Summary of BOC mean scores 2009-2012

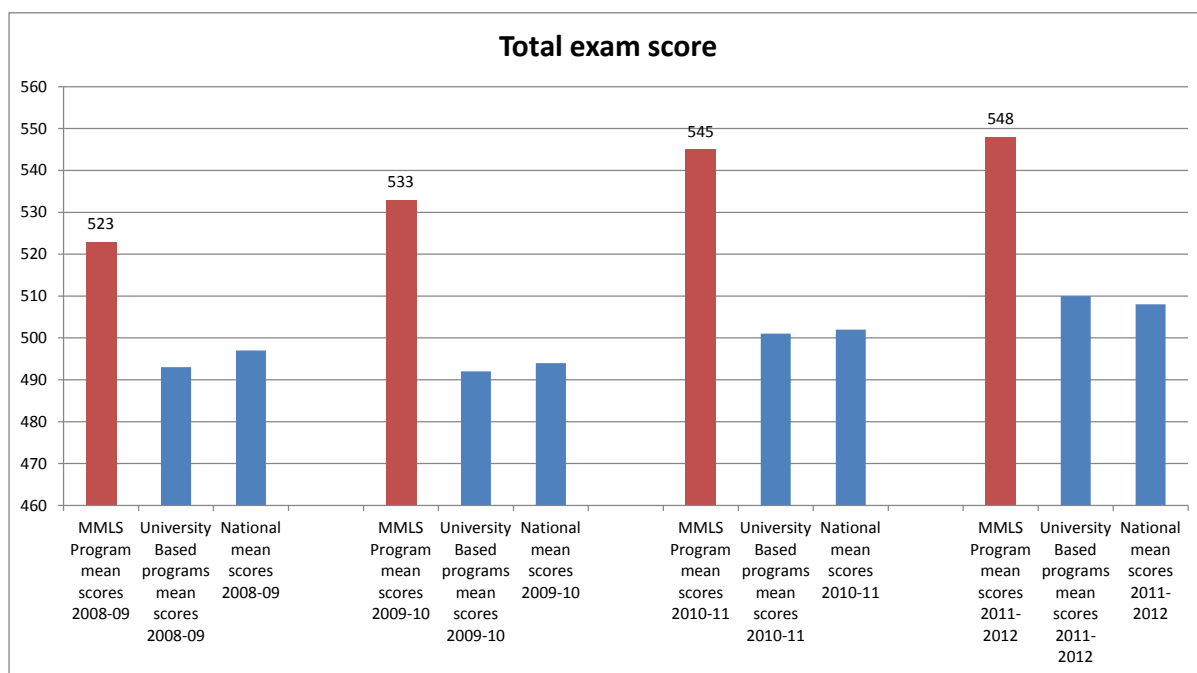
	Total exam score	BBNK	CHEM	HEMA	IMMU	LO	MICRO	UA
MMLS Program mean scores 2008-09	523	536	467	534	513	517	558	536
University Based programs mean scores 2008-09	493	490	478	491	482	499	486	477
National mean scores 2008-09	497	492	488	501	485	512	491	491
MMLS Program mean scores 2009-10	533	561	502	546	487	535	551	528
University Based programs mean scores 2009-10	492	495	492	496	488	518	487	485
National mean scores 2009-10	494	494	495	498	490	519	487	493
MMLS Program mean scores 2010-11	545	546	526	570	507	647	528	547
University Based programs mean scores 2010-11	501	499	501	512	494	518	499	494
National mean scores 2010-11	502	499	502	510	496	522	498	502
MMLS Program mean scores 2011-2012	548	573	522	600	528	579	526	488
University Based programs mean scores 2011-2012	510	518	506	519	494	527	506	504
National mean scores 2011-2012	508	512	507	517	493	534	503	503

completed the program. This exam is a national exam that students must pass in order to become licensed as a professional MLS. People must be nationally certified to work in Montana

labs and anywhere in the nation. We had 12 students in 2009 who passed this national certifying exam, 15 students who passed their BOC exam in 2010 and 14 out of 15 students who passed the BOC in 2011. The 15th person took an alternative registry exam and passed (American Medical Technology). In 2012 all 15 passed the BOC exam. **The total overall mean score for each area of examination is 80 to 150 points higher than the passing mark for the exam which is 400.** Table 1 shows our overall mean score for the program has increased each year of the program and is currently 548 or 30-40 points higher than the national mean scores. Table 1 also includes scores in each of the four years by discipline. The four disciplines of greatest interest are blood banking (immunohematology), chemistry, hematology and microbiology. Many of the disciplines have up and down results while clinical microbiology has had a slight downward trend but still higher than the national average. All disciplines show a significantly higher rate than the minimum score of 400 to pass the exam. This data overall reflects our commitment to improved quality instruction in our summer program and quality curriculum delivered electronically to our students while in their clinical rotations.

Figure 1 is a graph showing the MMLS training program as compared to the other University based programs and the national mean score. The four years of the program are illustrated. Data from Table 1 and the graph show that we have had a continuing increase in the total mean score of the program over that last four years. Total scores increased from 523 in 2009 to 548 in 2012, a 4.5% increase. When compared to other university based programs we have continually had a mean score of ~40 points greater than other university programs. The same results can be seen with national mean scores as our students on average score ~40 points higher than other students in the nation. We believe our recruitment of the best and brightest students from three universities in the state.

Figure 1 – Comparison of MMLS Program Mean Scores with National Mean Scores



During the students last week of training and before they receive a certification of graduation from our program, we administer a comprehensive exam. It is a 200 point exam with

components from each of the disciplines and is modeled after the BOC (20% microbiology, 20% chemistry, etc). A passing score of 70% must be obtained. Over the past three years five students out of the 57 we have trained have failed certain sections of the exam. After one week they could retake the sections they failed and all five passed.

Review of Graduation and Placement Rates

Table 2 is a summary of the graduation and placement rates for students in the Montana Medical Laboratory Science Training Program. It includes students from the first four years of our program – 2008 to 2012. All students have graduated from one of the three universities who affiliate with the program – Montana State University, University of Montana and Montana state University – Billings. It also shows that all 57 of our students completed the training program after 12 months. 56 students took the Board of Certification exam (ASCP exam in 2009) and one student took the AMT exam . All 57 have passed their exams, although 5 had to take it twice. Montana has a licensure law and therefore, in order to work as an MLS in a clinical lab, students must secure a national certification through the BOC or AMT exam before they can be licensed to work in a clinical lab.

All students have obtained employment soon after they completed their exam. They are working throughout Montana in hospital labs and clinics. They were well sought after when their training was completed and many were employed in the lab where they trained. Some are working evening and night shifts as well. The students who sought employment out of state are working in many different states across the US. We have kept in contact with all but two students who have moved several times and all like their jobs and seem to be doing well as witnessed by conversations with their employers. After two years of working, two students are seeking a further education and plan on attending medical school. Our program has as its mission to educate students to work in all types of clinical facilities in Montana. Since we are a rural state, this means rural facilities which currently have an acute shortage of personnel. We have 10 of the 57 employed in rural communities in Montana. Another part of our program assessment will be to contact these students and their employers to provide us information about their training in our program.

The results from this analysis show that we are training our students well as we have excellent pass rates and employment rates of our students. We will always seek ways to improve but a 100% pass rate of the BOC or AMT exam and 100% employment indicates our training program has had success in its first three years of existence.

Table 2

Year of Program	2008-2009	2009-2010	2010-2011	2011-2012
Class size	12	15	15	15
Number Graduating From University	12	15	15	15
Number Completing Program	12	15	15	15
Number Passing ASCP-BOC Exam or AMT exam	12	15	15	15
Placement – First Job	11 in state 1 out of state	12 in state 3 out of state	10 in state 5 out of state	13 in state 2 out of state

C. Modifications to Assessment Plan for AY 2013/1014:

As a result of these experiences the committee determined the following changes be made to the Department Assessment Plan:

1. A more detailed assessment form is needed in order to collect more meaningful assessment data and provide a finer degree of resolution of Assessment of our Program.
2. Faculty conducting assessments need to be given more instruction and more information about the assignment they are assessing.
3. A larger number of student assessments need to gathered to provide better data. This will be accomplished in part by using embedded course assessments. The Undergraduate Committee plans to work with individual faculty to help facilitate this process.

D. Assessment Plans for AY 2013-2013:

1. The Undergraduate Committee will complete analysis of the embedded assessments from BIOM 360 during the Fall Semester 2013.
2. Modifications to the Assessment forms will be done early in the Fall Semester (September) and these modified Assessment forms used for Courses scheduled for assessment in AY 2013/2014.
3. Assessments on the following courses will be collected:
 - General Microbiology (BIOM 360) – Fall & Spring Semesters (2nd year of assessment)
Institution of yearly assessment of course
 - Microbial Physiology (BIOM 450) – Fall Semester (2nd Assessment of Course)
 - Seminar, Capstone (BIOM 494) – Fall & Spring Semesters (2nd year of assessment)
Institution of yearly assessment of course
 - Educational Methods (BIOM 497) – Fall Semester (1st Assessment of Course)

 - Virology (BIOM 435) – Fall Semester (1st Assessment of Course)