

WSU Five-Year Program Review
Self-Study

Cover Page

Department/Program: Department of Microbiology

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Self-Study Team Chair: Matthew J. Domek

Self-Study Team Members:

Daniel Clark
Matthew Crook
Michele Culumber
William Lorowitz
Karen Nakaoka
Craig J Oberg
Mohammad Sondossi

Contact Information:

Phone: 801-626-6950
Email: mdomek@weber.edu

Brief Introductory Statement

(Reference: Annual Report – description of contribution to the university as a whole)

The Department knows that microbiology is an excellent discipline for demonstrating the process of science and core concepts in life sciences. These fundamental ideas are taught in general education courses available to all students, at all levels. The Department also knows that microbiology impacts all people in fundamental ways through health, wellness, industry, food, and the environment, and that all students benefit from basic background understanding of the interactions between microorganisms and humans. The Department provides microbiology majors opportunities to engage in all areas of microbiology through core courses that emphasize the overarching themes in biology and through courses that focus on discrete aspects of microbiology (e.g. virology, industrial microbiology). The Department helps graduates to view themselves as scientific professionals and that they should develop significant scientific thinking skills to advance in careers and through further education. To meet this goal, students practice critical thinking, problem solving, and communication skills in their major's-level courses. Students of microbiology need to be well prepared in other scientific disciplines that support and complement the field of microbiology, including (but not limited to) chemistry, mathematics, zoology, and botany. The Department provides support courses for Departments within the College of Science and for the College of Health Professions. The Department also offers interdisciplinary courses with the Geosciences Department and the History Department. The Department offers general education service courses for the university. Students also benefit from courses taken outside of the College of Science, especially those that broaden their world-view and prepare them to be informed citizens. The Department recognizes faculty scholarship, especially when it provides meaningful student research experiences. The Department supports K-12 education through outreach activities, teacher professional development, science fair mentoring and judging, and participation with the Center for Science and Math Education. Students of the Department participate in a variety of community service activities. The Department is a community leader in the field of microbiology; we serve as a resource for the community on microbiological issues.

Standard A - Mission Statement

The Department of Microbiology seeks to provide a quality undergraduate education to students of Weber State University in both general education and discipline-specific courses. We strive to provide our graduates with a solid academic foundation in microbiology for further educational opportunities, and the knowledge and skills for career opportunities upon graduation. We seek to integrate into student's program of study the development of skills including critical thinking, problem solving, teamwork, written and oral communication, and laboratory research techniques. The Department provides opportunities for research and other scholarly activities for both faculty and students. The Department and its graduates serve as an important resource for the campus and the state of Utah in the area of microbiology. We attempt to inspire life-long learning and teach students the broad range of disciplines in microbiology. We also believe that a more knowledgeable public will be able to make more informed decisions with regard to scientific issues that impact their lives.

Values Statements

Access:

- The Department knows that microbiology is an excellent discipline for demonstrating the process of science and core concepts in life sciences. These fundamental ideas are taught in general education courses available to all students, at all levels. The Department also knows that microbiology impacts all people in fundamental ways through health, wellness, industry, food, and the environment, and that all students benefit from basic background understanding of the interactions between microorganisms and humans.

Learning:

- The Department values providing microbiology majors opportunities to engage in all areas of microbiology through core courses that emphasize the overarching themes in biology and through courses that focus on discrete aspects of microbiology (e.g. virology, industrial microbiology).
- The Department knows that graduates of the Department should view themselves as scientific professionals and that they should develop significant scientific thinking skills to advance in careers and through further education. To meet this goal, students practice critical thinking, problem solving, and communication skills in their major's-level courses.
- Students of microbiology need to be well prepared in other scientific disciplines that support and complement the field of microbiology, including (but not limited to) chemistry, mathematics, zoology, and botany. Students also benefit from courses taken outside of the College of Science, especially those that broaden their world-view and prepare them to be informed citizens.
- The Department values providing the students with flexibility to choose coursework that will best fit their goals, while ensuring that core skills and concepts are mastered.
- The Department knows that scholarship is vital to both faculty and students and the Department will recognize faculty scholarship, especially when it provides meaningful student research experiences. The Department will support research efforts, to the extent possible, by providing funding, space, time and equipment.

Community

- The Department is a community leader in the field of microbiology; we serve as a resource for the community on microbiological issues.
- The Department supports K-12 education through outreach activities, teacher professional development, science fair mentoring and judging, and participation with the Center for Science and Math Education.
- Students of the Department participate in a variety of community service activities.
- The Department values diversity in our faculty staff and students.

Standard B - Curriculum

Overview

Curriculum planning and review are a part of our mission and our strategic planning.

The Department of Microbiology has a strong, comprehensive curriculum that balances teaching basic microbiological concepts with training in the most rapidly expanding areas of the discipline. The Department's curriculum, including courses in medical microbiology, cell culture, microbial ecology, environmental microbiology, immunology, global public health, industry microbiology and tropical diseases, are assessed thoroughly to ensure courses prepare graduates for employment, graduate school, and professional programs. The curriculum aligns closely with the curriculum guidelines of the American Society for Microbiology.

In Fall 2018, the Department submitted materials to the University Curriculum Committee to update the catalog offerings to include three degree emphases:

1. Microbiology (BS) with emphasis in Public and Environmental Health
2. Microbiology (BS) with emphasis in Medical Microbiology
3. Microbiology (BS) with emphasis in Biotechnology and Industrial Microbiology

Each emphasis is a specific collection of required and elective courses that help students focus their interests in microbiology.

In addition, we offer general education courses that introduce the microbial world to a wide range of students, including early college students. This includes the new *WSU 1680 Microbes Rule!* An interdisciplinary general education course that explores how microorganisms have influenced human history. In this course, students earn general education credit in both life science and social science.

Degrees Offered

1. Microbiology Major (BS)
2. Microbiology Minor
3. AS in Biology (proposed, see below)

General Education Courses

1. LS 1113 Introductory Microbiology
2. LS 1153 Elementary Public Health
3. LS/SI 2054 Principles of Microbiology
4. WSU 1680 Microbes Rule!

Service Courses (General education and upper-division courses commonly taken by other majors)

1. LS 1113 Nursing (no longer required), Dental Hygiene, Respiratory Therapy, Medical laboratory Sciences
2. LS 2054 Medical Lab Sciences, pre-medicine, pre-dentistry, pre-physical therapy, pre-veterinary, pre-physician's assistant, Botany, Zoology, Biology Composite Teaching
3. MICR 2600 Biology Composite Teaching, Chemistry, Botany, Zoology (cross-listed course)
4. MICR 3203 Medical Laboratory Sciences (no longer required), pre-medicine, pre-dentistry, pre-physical therapy, pre-veterinary, pre-physician's assistant, Zoology
5. MICR 3484 Botany, Biology Composite Teaching, pre-agriculture, pre-horticulture, Applied Environmental Geoscience emphasis
6. MICR 3603 Medical Laboratory Sciences

7. MICR 4252 Pre-professional
8. MICR 4554 Pre-professional
9. MICR 4154 Biochemistry (option)
10. MICR 4054 Biochemistry (elective)

New Biology Associates Degree

In Utah many students start taking college credits in high school through concurrent enrollment or early college courses, but they often choose courses that will not lead to a BS in Microbiology or any degree in the COS. This Fall we submitted a proposal for an A. S. of Biology degree with the Botany and Zoology Departments. Having an AS in Biology would bring students to COS for course work (and advisement) sooner and would help give them the right path to their goal of a BS degree. The AS degree also brings students into contact with COS student clubs and other COS retention activities prior to starting a major. The AS puts a Biology Program in the WSU catalog and online materials. It will assist with recruitment and ultimately retention of 2 yr students as, having completed critical foundational coursework, they stay at WSU to pursue degrees in one of the life sciences or a related program. Furthermore, the AS was designed with advising in mind as students are guided to choose general education courses, science electives, and CHEM, PHYS, and MATH courses that will lead to degree in the COS. We anticipate that this will also be an attractive option for early college students, particularly those at NUAMES who can take a selection of classes at WSU.

Comparison of Program and General Education SCHs

Approximately 35% of our SCHs in Fall and Spring semesters are from upper division courses (only online lower division courses are offered in the summer). This has remained constant over many years. Unlike other majors within the College of Science we do not have big general education courses that are required for other degrees (e.g. Chemistry 1210, Physics 1010, Math 1050). While this benefits our majors, it has limited our overall growth in SCHs because upper division courses are generally lower enrollment because of laboratory capacity. If our major grows much beyond its current sizes faculty time will need to be redirected to more upper division courses and general education courses will likely rely on more adjunct faculty.

Upper division and Lower Division (including MICR 2054) SCH 2017-18

Year	Upper division	Lower division	Total	% Upper division
Fall 2017	1105	2025	3130	35.3%
Spring 2018	1036	1912	2948	35.1%
Summer 2018	193	713	906	21.3%
Fall 2018	938	1661	2599	36.1%

Online Courses

One strategy we have implements to improve general education enrollments has been a steady increase in the number of online offerings. We have seen a dramatic increase in our online enrollments in MICR 1113, and a steady increase in MICR 1153 and MICR 3603. The only decline has been in MICR 3203,

Immunology for Health Professionals, because this course is no longer required for the Medical Lab Sciences Degree.

Microbiology Online Course Enrollments

Year	MICR 1113	MICR 1153	MICR 3203	MICR 3603
2017-18	516	250	85	166
2016-17	505	243	71	147
2015-16	453	200	117	147
2014-15	436	253	159	157
2013-14	402	226	174	157

Adequacy of resources for courses

Space

The new Tracy Hall Science Center has provided better teaching classrooms and laboratories. However, most of the classrooms in the new building are not large enough to accommodate our biggest courses, and we are in competition with other Departments for classroom space. In addition, we lost lecture hall space when NUAMES took over classrooms in Lind Lecture. Some of our upper division courses are running at capacity of our laboratory space (32 students/room). While we like to see those classes fill, we will not be able to add more spaces to the class without adding additional laboratory sections. Currently this is not possible due to faculty schedules and teaching loads.

Funds

In 2017/18 we began to collect data on how much is spent per laboratory course. This is difficult because supplies bought for a course may be split across several courses or may last more than one semester. Regardless, this data should help us better predict our resource needs on an annual basis for our primary courses and help us anticipate where lab fees are needed. One course that is extremely difficult to anticipate is the MICR 4800 Directed Research. Many students apply for grants through Office of Undergraduate Research, and this money helps support our undergraduate research efforts. However, students who do not apply for research still need funding for their project supplies. The Department has absorbed much of this by using supplies left over from the other lab classes or by doing relatively inexpensive projects. As projects become more sophisticated, or as more students undertake research projects, the Department will have fewer resources to support them.

Time

Student research is time and labor intensive for faculty, but is now necessary for students to be competitive for graduate and professional school positions. Unfortunately, research credits are only 0.25 TCH/student/credit, which provides little incentive or support faculty who mentor students, while trying to teach other courses in their normal load. A well-defined workload model for the College that addresses the value of undergraduate research might help promote more undergraduate research. Regardless, our department remains committed to finding ways to include as many students as possible in undergraduate research.

Lab fees

We have historically tried to keep our lab fees low because we do not think that the majority of the burden for financing the labs should be on the students. However, because of some new initiatives to include more advanced molecular techniques in labs, and because of increasing lab sizes, lab fees were either increased by about \$5 or new fees were added (\$10 to *Microbial Ecology* for microbiome sampling and \$10 for *Directed Research*).

Course Information

General Education Courses

The Department teaches three general education courses, MICR 2054, Principles of Microbiology; MICR 1113, Introductory Microbiology; and MICR 1113, Elementary Public Health. The general education designation was renewed for all three courses in 2016. Each course meets the Natural and Life Science learning outcomes (listed below) set by the University and the Life Science General Education Committee.

Introductory Microbiology is a general microbiology course with an emphasis on the microbial impacts on humans. The student population is diverse, but this course is a service course for students in nursing, health professions, and the sciences.

Elementary Public Health is a life science general education course for all students. It focuses on personal and community health issues, policies, and interventions.

WSU 1680 Microbes Rule! An interdisciplinary general education course that explores how microorganisms have influenced human history. In this course, students earn general education credit in both life science and social science. This course attracts about 90 students per semester.

Principles of Microbiology is an overview of microbiology and cell biology. Students in this course generally include science majors, biology composite teaching majors, and pre-professional students. This course often serves as a life science general education course for students in the physical sciences.

Each course meets the learning outcomes uniquely and contain content specific for the student population. The general education designation of each course was renewed in 2016.

Natural Science Learning Outcomes

Nature of science. Scientific knowledge is based on evidence that is repeatedly examined, and can change with new information. Scientific explanations differ fundamentally from those that are not scientific.

Integration of science. All natural phenomena are interrelated and share basic organizational principles. Scientific explanations obtained from different disciplines should be cohesive and integrated.

Science and society. The study of science provides explanations that have significant impact on society, including technological advancements, improvement of human life, and better understanding of human and other influences on the earth's environment.

Problem solving and data analysis. Science relies on empirical data, and such data must be analyzed, interpreted, and generalized in a rigorous manner.

Life Science Learning Outcomes

Levels of organization: All life shares an organization that is based on molecules and cells and extends to organisms and ecosystems.

Metabolism and homeostasis: Living things obtain and use energy, and maintain homeostasis via organized chemical reactions known as metabolism.

Genetics and evolution: Shared genetic processes and evolution by natural selection are universal features of all life.

Ecological interactions: All organisms, including humans, interact with their environment and other living organisms.

Action points for general education improvement:

1. Implement the new General Education Learning Outcomes (GELOs) and add Big Questions and Signature Assignments to all general education courses.
2. Modify content or delivery to improve success (especially in MICR 1153) on some learning outcomes.
3. Develop additional WSU course offerings.
4. Gather support from Continuing Education, to offer additional sections of general education courses online or at distance campuses.
5. Work with the NUAMES administration and teachers to make courses available for early college students through improved scheduling and/or additional offerings.

Progress:

1. Big questions and signature assignments have been added to *Principles of Microbiology*, *Introductory Microbiology*, and some sections of *Elementary Public Health*.
2. Additional practice quizzes and assignments have been developed for *Elementary Public Health* to address weak learning outcomes.
3. Another WSU course *The Story and The Cell* (LS/HU) was proposed to the Curriculum Committee in Fall 2018.
4. All general education courses (except WSU 1680) are offered year-round, including a summer section of *Principles of Microbiology*, which serves both general education and majors.
5. We have increased our online offerings significantly in the past five years.

Program courses**Courses for Microbiology Majors demonstrate the consistency between curriculum and program mission.**

Students who take the appropriate course work are prepared for graduate programs, medical school, dental school, physician assistant programs, pharmacy school and optometry school. This is demonstrated by their acceptance to graduate and professional schools across the country. Our students also enter the workforce as microbiologists in variety of skilled positions in biotech, medical device, food technology and essential oil companies regionally. Lists of student acceptances to professional schools, and industries that have hired our graduates is located in the Appendix D.

We are currently in the process of updating our major's emphases and hope to have them completed for the 2019-2020 catalog. These will include emphases in Public and Environmental Health, Medical Microbiology, and Biotechnology and Industrial Microbiology. Students choosing an emphasis area will have additional required courses and some prescribed electives, although their total credit requirements will stay the same.

In addition to microbiology course work, most microbiology majors earn a minor in Chemistry. Many of our students are electing to also complete the Chemical Technician AAS degree. Microbiology students take support and elective courses in Mathematics, Zoology, and Botany.

Faculty strive to provide the best and most engaging courses and are committed to student success. Faculty teaching our major's courses use a variety of innovative teaching practices and have sought out professional development opportunities for learning new methods and gaining new teaching skills. Some

examples are group projects, case studies, classroom response technology, research-based labs, and presentations. These strategies help student learn content and fundamental skills including communication, teamwork and problem solving.

Our courses are offered on a regular bases to ensure students are able to complete graduation requirements in a timely manner.

We are purposeful in our course offering so that students can graduate in a timely manner. We offer all of our courses at least once a year. Three of the five core courses are offered both fall and spring. It would require additional resources to offer all five core courses each semester. We are enrolling very near to the capacity of our labs and may need to find ways to offer more sections of our required courses (e.g MICR 4054 and 4154). When we moved to the new building, we were deliberate in our request for larger teaching labs, and in most of our upper division courses the labs fill with 32 students.

Table of Enrollments in Required Core Microbiology Courses

Year	MICR 2054	MICR 3053	MICR 3154	MICR 4054*	MICR 4154*
2017-18	185	56	53	40	51
2016-17	196	58	50	56	51
2015-16	205	62	55	61	63
2014-15	196	74	60	44	52
2013-14	227	64	60	36	44

* Only offered one semester per year.

The Math, Chemistry, Physics and Zoology Departments offer support courses in a timely way to support our students. However, sometimes the support courses fill to capacity or there are course conflicts between other required courses. Departments make efforts to avoid such conflicts. The College of Science (and the University) is requiring wait lists to help determine if there are bottlenecks. The data is important since Microbiology cannot grow without the support courses.

Action points for Microbiology Curriculum

1. Review and update curriculum (e.g. emphases, new courses)
2. Improve scheduling/space to accommodate more majors and improve retention and graduation rates
3. Develop new courses in state of the art microbiology (e.g. bioinformatics, microbiome science)
4. Develop a support network (e.g tutoring or SI) to help student succeed in difficult courses
5. New equipment & space to teach labs more effectively

Progress

1. Hired two new faculty (1 new, 1 replacement) in host-pathogen interactions and systems microbiology (plant-microbe symbiosis), their specialties add new experience in microbial physiology, genetics, bioinformatics, and symbiosis.
2. Proposed a new Biology AS degree
3. Moved to new building facilities in 2016 with bigger, safer labs and additional equipment
4. Hired a new lab manager to facilitate lab preparation and manage supplies and equipment

5. Geoscience hired a geomicrobiologist, which allows the Geomicrobiology course to be taught every year.
6. Offer latter afternoon labs for MICR 3053 to help accommodate student schedules
7. Offer *Principles of Microbiology* during 7-week summer block (24-32 students/summer)
8. Offer multiple sections of *Principles of Microbiology* lecture in Fall
9. Reviewed prerequisites for upper division coursework
10. Updated emphases in catalog so they can be included on transcripts
11. Developed a new course, MICR 3012, *Global Public Health*, which supports the Public and Environmental Health emphasis
12. Developed graduation maps for major

Graduation Maps are available at <https://apps.weber.edu/gradmaps/>

Bachelor of Science in Microbiology – Major Requirements

Prerequisites	Course	Course Title
Microbiology Major Required Courses (19)		
CHEM 1210 or 1200	MICR 2054 (4)	Principles of Microbiology
MICR 2054 and MATH 1050 or 1080 or 1210	MICR 3053 (3)	Microbiological Procedures
MICR 2054	MICR 3154 (4)	Microbial Ecology
MICR 2054 and completion or concurrent registration in CHEM 3070	MICR 4054 (4)	Microbial Physiology
MICR 2054, CHEM 3070 recommended	MICR 4154 (4)	Microbial Genetics
Microbiology Elective Courses (20) from Category A, B, and C		
Category A (8 credit hours minimum)		
MICR 1113 or 1153 or 2054	MICR 3012 (2)	Micro and Global Public Health
MICR 2054	MICR 3254 (4)	Immunology
MICR 3254, or approval	MICR 3305 (5)	Medical Microbiology
MICR 2054	MICR 3403 (3)	Tropical Diseases
MICR 2054	MICR 3484 (4)	Environmental Microbiology
MICR 1113 or 2054	MICR 3502 (2)	Environmental Health
CHEM 1210 or instructor approval	MICR 3753 (3)	Geomicrobiology
MICR 2054	MICR 3853 (3)	Food Microbiology
MICR 2054 or BTNY 2104 and 2121	MICR 4252 (2)	Cell Culture
MICR 2054, CHEM 2310 or 3070 MICR 3053 recommended	MICR 4354 (4)	Industrial Micro and Biotechnology
MICR 2054	MICR 4554 (4)	Virology
Category B		
	MICR/CHEM 2600 (1)	Laboratory Safety
	MICR 2920 (1)	Short Courses, Workshop
Approval of Instructor and minimum of 6 credits of upper division microbiology course work	MICR 4800* (1-2) *Maximum 3 credits	Directed Research
Approval of Instructor and minimum of 6 credits of upper division microbiology course work	MICR 4830* (1-2) *Maximum 2 credits	Directed Readings
	MICR 4920 (1)	Short Courses, Workshop
Previous upper division microbiology courses	MICR 4991 (1)	Microbiology Seminar
Category C (8 credit hours maximum)		
BTNY 2104 & 2114 or MICR 2054	BTNY 3504 (4)	Mycology
BTNY 2104 & 2114 or MICR 2054 or ZOO 4480	BTNY 3514 (4)	Algology
ZOO 1110 & CHEM 1110 & 1120 or CHEM 1210 & 1220	ZOO 3200 (4)	Cell Biology
ZOO 1110 & MATH 1050 BTNY 2104 or MICR 2054 & CHEM 1050 or 1120 or 2310 and MATH 1050 or 1080	ZOO 3300 (4) or BTNY 3303 (3)	Genetics or Plant Genetics
Required Support Courses (32-35 credit hours)		
MATH 1010 or equivalent and CHEM 1200 or dept. approval	CHEM 1210 (5)	Principles of Chemistry I
CHEM 1210	CHEM 1220 (5)	Principles of Chemistry II
CHEM 1220	CHEM 2310 (4) and CHEM 2315 (1)	Organic Chemistry I and Organic Chemistry I lab
CHEM 2310 and 2315	CHEM 3070	Biochemistry I
MATH 1010 or ACT score of 23 or higher or placement test	MATH 1050 or	College Algebra or
MATH 1010 or ACT score of 23 or higher or placement test	MATH 1080 or	Pre-Calculus or
MATH 1050 & 1060 or 1080, or placement test	MATH 1210	Calculus I
MATH 1060 PHYS 2010 co-req. MATH 1210 PHYS 2210, co-req. MATH 1220	PHYS 1010 (3) or PHYS 2010 (5) or PHYS 2020 (5) or PHYS 2210 (5) or PHYS 2220 (5)	Elementary Physics or College Physics I w/lab or College Physics II w/lab or Physics for Scientists and Engineers I w/lab or Physics for Scientists and Engineers II w/lab
Life Science Course Electives (6) (choose minimum of 6 credit hours from two Life Science courses)		
See catalog for specific course prerequisites.	BTNY 1203, 2104, 2114, 3105, 3204, 3214, 3454,3473, 3523, 3624	See catalog for titles.
See catalog for specific course prerequisites.	ZOO 1010, 1110, 2100, 2200, 3450, 3470, 3500, 3720, 3730, 4050, 4100, 4120, 4210, 4220, 4250, 4300, 4470, 4480, 4490, 4500, 4640, 4650, 4670, 4680	See catalog for titles.

Curriculum Map: Required and Elective Courses for the Microbiology Major

	Core Concepts					Fundamental Skills							
	Model systems for Basic Biology	Integral role in Disease and Human Health	Ubiquitous in nature	Vital Role – Integration of Science and Society	Indispensable role in Environment and Ecology	Nature of Science	Laboratory Skills	Critical thinking	Data Analysis	Problem Solving	Communication	Cooperation	Values
Required Courses													
2054, Principles of Microbiology	1, A	2	2, A	1	2, A	1	3, A	1	1	1	1	2	1
3053, Microbiological Procedures	2, A					3, A	3, A	3	3	3	3	3	
3154, Microbial Ecology	2, A	2	3, A	2	3, A	3, A	3, A	3, A			2, A	2, A	2
4054, Microbial Physiology	3, A	2	3, A	2	3, A		3, A		3, A			3, A	3
4154, Microbial Genetics	3, A		1	2	3, A	2	3, A	2, A	2, A	2	3, A	3, A	2
Elective Courses (min. 8 credits required)													
3012, Global Public Health		3, A		3, A	2			2, A	3, A		3, A		3, A
3254, Immunology		3, A		3, A			3, A				3, A		3, A
3305, Medical Microbiology		3, A		3, A		3, A	3, A	3, A	3, A	3, A	3, A	3, A	2
3403, Tropical Diseases		3, A		3, A		3, A	3, A	3, A		3, A	3, A	3, A	3, A
3484, Environmental Microbiology	3, A	3, A		3, A	3, A	3, A	3, A	3, A		3, A	3, A	3, A	
3502, Environmental Health		2	3		3			2		2			3
3753, Geomicrobiology	2		3, A		3, A	2	3, A	3, A		2, A	2	2	
3853, Food Microbiology	1, A	2, A	1	3, A	1			3, A	3, A	3, A			
4252, Cell Culture	3, A	2	2	2	2	2	3, A	2	3, A	3	2	3, A	
4354, Industrial Microbiology				3, A		3, A	3, A	3, A	3, A				
4554, Virology	3, A	3, A	3, A	3, A	3, A	3	3, A	3	3, A	3	3	3, A	
High Impact Courses													
4800, Directed Research	3	3	3			3	3	3	3		3, A		
4830, Directed Readings	3	3	3								3, A		
4991, Microbiology Seminar								3	3		3, A		

Note: Define words, letters or symbols used and their interpretation; i.e. 1= introduced, 2 = emphasized, 3 = mastered, A = Assessed Comprehensively;

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Standard C – Student Learning Outcomes and Assessment

Microbiology Program Learning Outcomes

1. Upon graduation, Microbiology majors should have a thorough knowledge and understanding of the core concepts in the discipline of Microbiology. Microbiology students will be able to:
 - i. Describe how microorganisms are used as **model systems** to study basic biology, genetics, metabolism and ecology.
 - ii. Identify ways microorganisms play an **integral role** in disease, and microbial and immunological methodologies are used in disease treatment and prevention.
 - iii. Explain why microorganisms are **ubiquitous in nature**; inhabiting a multitude of habitats and occupying a wide range of ecological habitats.
 - iv. Cite examples of the **vital role** of microorganisms in biotechnology, fermentation, medicine, and other industries important to human well being.
 - v. Demonstrate that microorganisms have an **indispensable role** in the environment, including elemental cycles, biodegradation, etc.

2. Upon graduation, Microbiology majors should have mastered a set of fundamental skills, which would be useful to function effectively as professionals and to their continued development and learning within the field of Microbiology. These skills include the following:
 - i. **Nature of Science and Scientific Inquiry:** Microbiology majors should be able to discuss science and scientific methodology as a way of knowing. Microbiology majors should make observations, develop hypotheses, and design and execute experiments using appropriate methods. They should be able to explain how the nature of science is applied to every day problems.
 - ii. **Laboratory Skills:** Microbiology students should master the following laboratory skills: aseptic and pure culture techniques, preparation of and viewing samples for microscopy, use appropriate methods to identify microorganisms, estimate the number of microorganisms in a sample, and use common lab equipment. They should practice safe microbiology, using appropriate protective and emergency procedures.
 - iii. **Data analysis skills:** Microbiology majors should be able to systematically collect, record, and analyze data, identify sources of error, interpret the results, and reach logical conclusions. They should be able to appropriately format data into tables, graphs, and charts for presentation and publication.
 - iv. **Critical Thinking Skills:** Microbiology majors should be able to (1) differentiate between fact and opinion, (2) recognize and evaluate author bias and rhetoric, (3) develop inferential skills, (4) recognize logical fallacies and faulty reasoning, and (5) make decisions and judgments by drawing logical conclusions using sound quantitative and statistically-based reasoning.
 - v. **Problem-Solving Skills:** Microbiology majors should be competent problem-solvers. They should be able to assess the elements of a problem and develop and test a solution based on logic and the best possible information. Microbiology students should be able to analyze and interpret results from a variety of microbiological methods, and apply these methods to analogous situations. They should use mathematical and graphing skills and reasoning to solve problems in microbiology.

- vi. **Communication Skills:** Microbiology majors will demonstrate competence in written and oral communication.
- vii. **Cooperation/Social Responsibility:** Microbiology majors should understand and appreciate the value of cooperating and working effectively with peers and be able to demonstrate a commitment to the process of developing such skills.
- viii. **Values:** Microbiology majors should identify and discuss the ethical issues and responsibilities of doing science.

Five-year Assessment Summary

Annual assessment reports for each of those years can be found at http://weber.edu/oie/Department_results.html.

The Department has a complete learning grid for the program objectives. Our past 5-year assessment plan has ended, and developing a new plan is our goal for 2019. Several of our upper division courses demonstrated attainment of the learning outcomes during the last five years. We will be working on developing new Departmental assessment tools for each of our upper division courses. Faculty have been experimenting with alternative assessment techniques, but may need additional training to develop and use the tools that are currently available for assessment.

The general education designation was renewed for all three courses in 2016. Each course meets the Natural and Life Science learning outcomes set by the University and the Life Science General Education. The general education courses need to have a standardized assessment to use between sections to make reporting our outcomes more efficient.

Results:

- Our current 5-year assessment plan was finalized in 2012-13 and a new assessment plan will be developed in 2019.
- All general education courses passed renewal in 2016, assessment grids are in the Appendix G.
- The following courses met stated program objectives during the last 5 years of assessment (see grid):
 - 2054
 - 3154
 - 3254
 - 4054
 - 4554
- Assessment of other courses was not reported due to unforeseen Departmental factors and personal illness (report of 2016-17 only reported Gen Ed data; report for 2017-18 was not completed)
- We've been experimenting with alternative assessment techniques (Canvas Rubrics, Concept Inventories, Signature Assignments, etc.), but haven't found a straight forward way to assess across multiple sections.

Action plan:

1. Department will update assessment plan, focusing on major's courses, and present that in the 2019 assessment report.
2. Assessment of general education courses will be standardized across instructors, and find better ways to administer assessments to students in online and face-to-face sections.
3. Implement more rubric-graded assignments to assess learning outcomes that are difficult to assess with traditional exams.
4. A published concept inventory will be used as part of the assessment for *Principles of Microbiology* (currently only 1 semester of data is available).

5. Develop more standardized assessment techniques for upper division courses
6. Assessment of the curriculum will be aligned with the AAAS Vision and Change Document. The strategic plan outlines a regular assessment process for the microbiology courses.
7. Continue assessment of graduating students through exit interviews.

Assessment of Graduating Students

The Department of Microbiology has graduated 31% of the College of Science graduates over the past five years (Appendix F). An important aspect of our program mission is to prepare our student for careers in the work force and graduate and professional schools. We also strive to help students graduate in a timely manner.

Each semester graduating microbiology students fill-out an university exit interview which includes questions about career choices and job placement. Data is also collected on College of Science students who are applying to professional schools (Medical, Dental, Physician Assistant etc). It is important to note some students are already working microbiology laboratory jobs before they graduate. We have included tables of several years of data regarding job placement and application/acceptance to professional programs. The data is incomplete because it is mostly based on self-reporting. The summary for placement over the past 5 years is summarized below.

Graduating Microbiology Student Placement (self-reported)	
Placement	Number of students
Medical/Osteopathic School	17
Dental School	17
Physician Assistant	6
Pharmacy School	1
Graduate programs (MA or Ph.D.)	12
Job in microbiology/biotechnology related industry	21

Exit interviews also reflect that students are highly satisfied with their degree and the quality of their experiences in Microbiology.

Standard D - Academic Advising

Advising Strategy and Changes

We do not have mandatory advising at Weber State University. However, for a student to declare their major, they have to meet with a Department advisor. This process often starts with University or College of Science advisor or sometime directly through the Department. Regardless of how the process starts, the student is directed to meet with a Departmental advisor. This gives the student a point of contact within the Department.

The College of Science has additional advisors for pre-medicine and pre-dental as well as other pre-professional programs of study. New students entering Weber State are encouraged to go through an orientation and if they express interest in any of the life sciences, they meet with a College of Science advisor. During their orientation they have opportunity to meet with a microbiology faculty member for an introduction to the Department. The Department contacts all new students that declare a major in

Microbiology and encourages them to meet with a Microbiology Department advisor. The students now have access to their progress toward their degree through the CatTracks advising program. We make additional efforts to monitor students' progress toward graduation and send emails encouraging them to come in for advising if needed.

Major changes to advising since the last review:

1. The College now has two general advisors that assist beginning students, and students beginning pre-professional tracks. This has helped students identify the correct person to contact within their Department and helped students outline general education courses more effectively.
2. The pre-professional advisors for Pre-Physicians Assistant, Pre-Medical, and Pre-Dental PA, are no longer faculty within the Department.
3. The Department decided to have a second advisor, in addition to the Department chair, to facilitate more advising appointments. Advisors hold regular appointment times for advising.
4. Department has developed Graduation Maps for General Microbiology majors and for Pre-Professional students.
5. CatTracks is used to track student progress and develop graduation plans for each student. Advisors leave notes in CatTracks for reference.
6. Students are now required to make an advising appointment when they declare Microbiology as a major.
7. Advisors have received some training in Starfish.
8. Advisors attend regular meetings of College of Science advisors (COS Advising Team) to improve communication between the advising office and departments.

Advising Process:

1. Attend University orientation session, new students
2. Meet with a College Advisor for general education advising and referral to Department and pre-professional advisor
3. Meet with a Department Advisor prior to registration
4. Meet with pre-Professional Advisor – if appropriate
5. Students are reminded in their introductory courses to make an appointment for advising and the College advisors visit introductory classes.
6. In their upper level courses, students are reminded of important deadlines such as registration and graduation and are encouraged to meet with an advisor well before their graduation date to ensure they will complete their degree as expected.

Effectiveness of Advising

The biggest improvement in advising within the department has been the scheduling of advising appointments times. With the help of the department administrative assistant, scheduling appointments has become more efficient. The addition of advisors within the College of Science has also improved the effectiveness of advising, saving students time and presenting a more coordinated message, especially to new students.

On exit surveys, students report that they find the advising provided by the Microbiology Department excellent (58%) or Good (27%) (exit survey 2016-2018). This is about higher than the rating they give to University advising. We expect to see improvements in student time to graduation as we continue to improve the advising process.

Future Recommendations

We have made important and effective changes to improve advising within the Department and the College. Our next goal is to address retention and graduation issues by using the advising tools that are available. Starfish can help identify struggling students and all faculty should have some basic training in this tool. Other metrics, such as the Semester to Semester Enrollment Comparison data can be used to identify students who have not yet registered for a given semester due. The advisors in the Department need more training on using these tools to identify students before they stop attending.

Other than the Department Chair, faculty involved with advising do so as a service to the department, without release time from other responsibilities. At some point, as the number of majors grows, this will become unsustainable and either other faculty will need to be involved as advisors, or release time will need to be provided. This will be discussed as a department going forward.

Standard E - Faculty

Programmatic/Departmental Teaching Standards

Departmental teaching standards are those used by the College of Science, specifically in the teaching evaluation section of the Tenure Document and those stated in the Promotion and Tenure evaluation criteria in the PPM section 8-11. Faculty members are made aware of teaching expectations when they are hired and during annual interviews with the department chair. Tenured faculty are also evaluated through a formal post-tenure review process (PPM 8-11).

Faculty Demographic Information

The Department of Microbiology has eight tenured or tenure-track faculty members: six full professors and two assistant professors. Two members of the faculty are women. Appendix E contains C.V.'s of the faculty.

The Department currently has two adjunct faculty teaching general education courses. Resumes or curriculum vitae for adjuncts are available in the Department chair's office.

Department of Microbiology Tenured and Tenure-Track Faculty (current)

<u>Name</u>	<u>Rank</u>	<u>Tenure Status</u>	<u>Ph.D. granted by</u>	<u>Research and Teaching emphasis</u>	<u>WSU Start Date</u>
Matthew B. Crook*	Assistant Professor	Track	Brigham Young University	Microbial systems and Genetics	July, 2017
Daniel Clark**	Assistant Professor	Track	Brigham Young University	Medical Microbiology and Host-Parasite interactions	July, 2018
Michele Culumber	Professor	Tenured	University of Wisconsin	Microbial Ecology and Microbial Genetics	July, 2004
Matthew J. Domek	Professor	Tenured	Montana State University	Microbial Physiology and Virology	July, 2004
William Lorowitz	Professor	Tenured	University of Oklahoma	Industrial Microbiology and Biotechnology	July, 2000
Karen G. Nakaoka	Professor	Tenured	The Ohio State University	Medical Microbiology and Immunology	March, 1994
Craig J. Oberg	Professor	Tenured	Utah State University	Microbial Genetics and Food Microbiology	September, 1983
Mohammad Sondossi	Professor	Tenured	Wayne State University	Environmental Microbiology and Microbial Ecology	July, 1991

*Hired Fall 2017

**Hired Fall 2017 as a one-year faculty member. Hired Fall 2018 as an assistant professor to replace Jason Fritzier who left Summer 2017.

Department of Microbiology Adjuncts (current)

<u>Name</u>	<u>Tenure Status</u>	<u>Highest Degree</u>	<u>Area of Expertise</u>	<u>WSU Start Date</u>
Evan W. Call	Adjunct	MS	Microbiology	July, 2017
Lisa Wiltbank	Adjunct	Ph.D	Microbiology	October, 2018

Department of Microbiology Staff (current)

<u>Name</u>	<u>Job Title</u>	<u>WSU Start Date</u>
Karen Mann	Lab Manager	January, 2017
Katie Nelson	Administrative Assistant	April, 2017

Faculty Qualifications (current academic year)

	Tenure and tenure-track	Contract	Adjunct
Number of faculty with Doctoral degrees	8		1
Number of faculty with Master's degrees			1
Number of faculty with Bachelor's degrees			
Other Faculty			
Total	8		2

Faculty Scholarship

In the Department of Microbiology faculty scholarship is closely associated with student success through the high impact practice of undergraduate research. All Faculty in the department mentor undergraduate research in MICR 4800 (research) or 4830 (readings) courses. Most faculty conduct research in the summer and almost always involve students in this work. Each year students mentored by microbiology faculty have presented at local, regional, national or international conferences. The list below shows evidence of faculty scholarship over the last five years.

Faculty publications by year (faculty in **bold**, student co-authors in *bold, italics*)

2018

M. Griesmann, Y. Chang, X. Liu, Y. Song, G. Haberer, **M. B. Crook**, B. Billault-Penneteau, D. Laouressergues, J. Keller, L. Imanishi, Y. P. Roswanjaya, W. Kohlen, P. Pujic, Y. Song, K. Battenberg, N. Alloisio, Y. Liang, H. Hilhorst, M. G. Salgado, V. Hocher, H. Gherbi, S. Svistoonoff, J. J. Doyle, S. He, Y. Xu, S. Xu, J. Qu, Q. Gao, X. Fang, Y. Fu, P. Normand, A. M. Berry, L. G. Wall, J.-M. Ané, K. Pawlowski, X. Xu, H. Yang, M. Spannagl, K. F. X. Mayer, G. K.-S. Wong, M. Parniske, P.-M. Delaux, S. Cheng. 2018. "Phylogenomics reveals multiple losses of nitrogen-fixing root nodule symbiosis." *Science*, 361 (6398): 11 pp. DOI 10.1126/science.aat1743

P. Estrada de los Santos, M. Palmer, B. Chávez-Ramírez, C. Beukes, E. T. Steenkamp, L. Briscoe, N. Khan, M. Maluk, M. Lafos, E. Humm, M. Arrabit, **M. Crook**, E. Gross, M. F. Simon, F. B. Dos Reis Jr., W. B. Whitman, N. Shapiro, P. S. Poole, A. M. Hirsch, S. N. Venter, E. K. James. 2018. Whole genome analyses suggests that *Burkholderia sensu lato* contains two additional novel genera (*Mycetohabitans* gen. nov., and *Trinickia* gen. nov.): Implications for the evolution of diazotrophy and nodulation in the *Burkholderiaceae*. *Genes*, 9 (8): 389. DOI 10.3390/genes9080389

2017

Culumber, M. D., D. J. McMahon, F. Ortakci, **L. Montierth**, B. Villalba, J. R. Broadbent, and **C. J. Oberg**. 2017. Hot Topic: Geographical distribution and strain diversity of *Lactobacillus wasatchensis* isolated from cheese with unwanted gas formation. *Journal of Dairy Science* 100 (11):8764-8767.

Call, E., R. Jones, K. DeMonja, J. Burton, S. Jellum, A. Bernkopf, and **C. Oberg**. 2017. "The elastic limit": Introducing a novel concept in communicating excessive shear and tissue deformation. *WCET Journal* 37:16-20.

Call, E., T. Hetzel, C. McLean, J. Burton, and **C. Oberg**. 2017. Off-loading wheelchair cushion provides best case reduction in tissue deformation as indicated by MRI. *Journal of Tissue Viability* 26:172-179.

Evan Call, Brian Bill, Chad McLean, Nathan Call, Allyn Bernkopf, and **Craig Oberg**. 2017. Hazardous drug contamination of drug preparation devices and staff: A contamination study simulating the use of chemotherapy drugs in a clinical setting. *Hospital Pharmacy* 52:551-558.

2016

Truong, A., M. Sondossi, and J.B. Clark. 2016. Genetic identification of *Wolbachia* from Great Salt Lake brine flies. Symbiosis DOI 10.1007/s13199-016-0446-3

Oberg, C. J., T. S. Oberg, **M. D. Culumber**, F. Ortakci, J. R. Broadbent and D. J. McMahon. 2016. *Lactobacillus wasatchensis* sp. nov., a non-starter lactic acid bacteria isolated from aged Cheddar cheese. Int. J. System. Evol. Microbiol. 66:158-164

2015

Thi Thanh My Pham, Mohammad Sondossi and **Michel Sylvestre**. 2015. The metabolism of doubly para-hydroxy and para-hydroxychlorobiphenyls by bacterial biphenyl dioxygenases. Environ. Microbiol. July 2015 vol. 81 no. 14 4860-4872.

Ortakci, F., J.R. Broadbent, **C.J. Oberg**, and D.J. McMahon. 2015. Growth and gas formation by *Lactobacillus wasatchensis*, a novel obligatory heterofermentative nonstarter lactic acid bacterium, in Cheddar-style cheese made using a *Streptococcus thermophilus* starter. Journal of Dairy Science 98:7473-7482.

Ortakci, F., J.R. Broadbent, **C.J. Oberg**, and D.J. McMahon. 2015. Late blowing of Cheddar cheese induced by accelerated ripening and ribose and galactose supplementation in presence of a novel obligatory heterofermentative nonstarter *Lactobacillus wasatchensis*. Journal of Dairy Science 98:7460-7472.

Oberg, E.N., **C.J. Oberg**, M.M. Motawee, S. Martini, and D.J. McMahon. 2015. Increasing stringiness of low-fat mozzarella string cheese using polysaccharides. Journal of Dairy Science 98:4243-4254.

Ortakci, F., J.R. Broadbent, **C.J. Oberg**, and D.J. McMahon. 2015. Growth and gas production of a novel obligatory heterofermentative Cheddar cheese nonstarter lactobacilli species on ribose and galactose. Journal of Dairy Science 98:3645-3654.

2014

Emma Bentley, Craig Oberg and **Karen Nakaoka**. 2014. Microbial screening potable water sources in Guatemala: A potential source of disease transmission. Awarded (Best Paper in Biology) The Journal of the Utah Academy of Sciences, Arts, and Letters 91:43-60.

2013

Jason Bass, David Hintze, **Craig Oberg**, **Karen Nakaoka** and Joel Bass. 2013. Determination of Microbial Populations in a Synthetic Turf System. The Journal of the Utah Academy of Sciences, Arts, and Letters 90:19-29

Faculty Presentations to Professional groups, National and International by year (faculty in bold, student co-authors in bold, italics)

2018

C. Oberg, D. Hoffman, M. Domek. 2018. Rapid Method for Measuring the Effect of Prebiotics on Probiotic Bacteria Growth. Weber State Univ., Ogden, UT. American Society for Microbiology MICROBE (National Conference) Atlanta, GA. June 1-6, 2018

C. Oberg, I. Green, M. Domek. 2018. Effect of Organic Acids on Suppressing Growth of *Lactobacillus wasatchensis* Wdc04. Weber State Univ., Ogden, UT. American Society for Microbiology MICROBE (National Conference) Atlanta, GA. June 1-6, 2018

C. Oberg, G. McKay, M. Culumber, E. Walker. 2018. Microbial Degradation of Art-Waste Solvents. Weber State Univ., Ogden, UT. American Society for Microbiology MICROBE (National Conference) Atlanta, GA. June 1-6, 2018

C. Oberg¹, S. Overbeck¹, M. Culumber¹, I. Martineau¹, D. McMahon². 2018. Bio-Protective Lactic Acid Bacteria Cultures that Inhibit *Lactobacillus wasatchensis*. ¹Weber State Univ., Ogden, UT, ²Utah State Univ., Logan, UT. American Society for Microbiology MICROBE (National Conference) Atlanta, GA. June 1-6, 2018

S. Cannon, J. Stai, L. Ren, **M. B. Crook**, J.-M. Ané, J. J. Doyle. (2018) "Genome evolution in the legumes: Common patterns, exceptions, and a candidate for the "ur-legume" genome." Presented at the 7th International Legume Conference.

2017

Culumber, M. 2017. Developing interrupted case studies to increase student interactions with real data and primary literature sources. "MicroBrew" session. 24th Annual American Society for Microbiology Conference for Undergraduate Educators. 27-30 June 2017. Denver, CO.

Barker, S., Culumber, M., Fritzler, J., Domek, M., Nakaoka, K. 2017. Vibrio isolated from hypersaline waters of the Great Salt Lake., June 2017. New Orleans, LA.

Barker, S., Culumber, M., Fritzler, J., Domek, M., Nakaoka, K., 2017. Vibrio isolated from hypersaline waters of the Great Salt Lake., June 1-7 2017. Microbe 2017 (American Society for Microbiology National Conference), New Orleans, LA.

Domek, Matthew J. 2017., "An Interdisciplinary Laboratory Experience for Microbiology and Physics Students", Microbrew presentation at American Society for Microbiology Conference for Undergraduate Educators, Denver, CO July 2017 .

Oberg, C. 2017. Advances in nonstarter microbiology related to gassy defect in cheese. American Dairy Science Association Annual Meeting. June 25-28, 2017, Pittsburgh, PA.

M. Culumber, T. Oberg, T. Allen, F. Ortakci, **C. Oberg**, and D. McMahon. 2017. Selective primer development for rapid detection of the gas-producing non-starter bacterium *Lactobacillus wasatchensis*. American Dairy Science Association Annual Meeting. June 25-28, 2017, Pittsburgh, PA.

C. Oberg, **A. Lavigne**, S. Smith, **I. Bowen**, and D. McMahon. 2017. Effect of bio-protective lactic acid bacteria cultures on *Lactobacillus wasatchensis*. American Dairy Science Association Annual Meeting. June 25-28, 2017, Pittsburgh, PA.

C. Oberg, **M. Culumber**, F. Ortakci, T. Oberg, B. Villalba, J. Broadbent, and D. McMahon. 2017. *Lactobacillus wasatchensis* is a causative agent of late gas defect in aged cheese. 12th International Symposium on Lactic Acid Bacteria. August 27-31, 2017. Egmond aan Zee, Netherlands.

T. Oberg, **C. Oberg**, J. Broadbent, **M. Culumber**, D. McMahon, R. Ward, and J. Steele. 2017. Comparative genomics of *Lactobacillus curvatus* dairy and meat isolates. 12th International Symposium on Lactic Acid Bacteria. August 27-31, 2017. Egmond aan Zee, Netherlands.

C. Oberg. 2017. *Lactobacillus wasatchensis* and late gas defect in ripening cheese. 12th International Symposium on Lactic Acid Bacteria. August 27-31, 2017. Egmond aan Zee, Netherlands.

Oberg, C. 2017. Update on *Lactobacillus wasatchensis* as a NSLAB causing slits and gassy cheese. Global Cheese Technology Forum. October 24-26, 2017. Reno, NV.

Oberg, C. 2017. Late gas production by non-starter lactic acid bacteria. University of Limerick. August 7, 2017, Limerick, Ireland.

Oberg, C. 2017. Novel non-starter lactic acid bacteria. Teagasc/Morepark Research Inc., August 8, 2017, Cork, Ireland.

2016

Culumber, M., Oberg, C., Allen, T., Rodriguez, B.T., McMahon, D. 2016. Characterization of *Lactobacillus wasatchensis* from aged cheeses showing late-gas defects. ADSA ASAS Joint Annual Meeting. Salt Lake City, UT. 19-23 July.

Oberg, C.J., Walker, M.* Culumber, M.D., McMahon, D.J. 2016. Determination of antagonism between NSLAB strains and *Lactobacillus wasatchensis* WDC04 using the agar-flip method. ADSA ASAS Joint Annual Meeting. Salt Lake City, UT. 19-23 July.

Domek, M.J., G. Ward, M.D. Culumber. 2016. Detection of Halophilic Bacteriophage in Soils Near the Great Salt Lake. ASM Microbe, ASM 2016 Boston 16-20 June, Boston.

C. Oberg, M. Walker, M. Culumber. 2016. Determination of Antagonism between NSLAB strains and *Lactobacillus wasatchensis* WDC04 using the agar-flip method ASM Microbe, ASM 2016 Boston 16-20 June, Boston.

Bowen, I., C. Oberg, M. Culumber. 2016. Determination of treatments to reduce late gassy defect in cheese due to *Lactobacillus wasatchensis* WDC04 contamination. ASM Microbe, ASM 2016 Boston 16-20 June, Boston.

2015

Monterieth, L., C. Oberg, M. Culumber, F Ortakci, and D. McMahon. 2015. Novel *Lactobacillus* associated with late gas production in aged cheese. American Society for Microbiology Meeting. May 30-June 3, 2015. New Orleans, LA.

M. J. Domek, T. Allen, R. Olson, C. Oberg. 2015. Salt Concentration and pH Alter Infectivity of Bacteriophages Isolated from the Great Salt Lake. Department of Microbiology, Weber State University, Ogden, UT Poster Presentation: American Society for Microbiology General Meeting in New Orleans, LA on June 1st, 2015

C. Oberg, C., K. Blackford, T. Allen, J. Oberg, H. Thomas, and **M. Domek.** 2015. Method to Survey Seasonality of the Great Salt Lake Virosphere. Department of Microbiology, Weber State University, Ogden, UT. American Society for Microbiology Meeting. May 30-June 3, 2015. New Orleans, LA.

Hendricks, J., C. Oberg, M. Culumber, T. Oberg, J. Broadbent, and D. McMahon. 2015. Sequencing and annotation of novel plasmids in *Lactobacillus curvatus*. American Society for Microbiology Meeting. May 30-June 3, 2015. New Orleans, LA.

Ortakci, F., J. Broadbent, **C. Oberg,** and D. McMahon. 2015. Growth and gas formation by a novel obligatory heterofermentative nonstarter lactic acid bacterium in cheese made using a *Streptococcus thermophilus* starter. American Dairy Science Association Meeting. July 12-16, 2015. Orlando, FL.

Ortakci, F., J. Broadbent, **C. Oberg,** and D. McMahon. 2015. Late blowing of Cheddar cheese induced by accelerated ripening and ribose and galactose supplementation in the presence of by a novel obligatory heterofermentative nonstarter lactobacilli species. American Dairy Science Association Meeting. July 12-16, 2015. Orlando, FL.

Oberg, C., J. Hendricks, J., M. Culumber, T. Oberg, J. Broadbent, and D. McMahon. 2015. Sequencing and annotation of novel plasmids from *Lactobacillus curvatus*. American Dairy Science Association Meeting. July 12-16, 2015. Orlando, FL.

Oberg, C. L. Monerieth, M. Culumber, F Ortakci, J. Broadbent, and D. McMahon. 2015. *Lactobacillus wasatchensis* WDC04 associated with late gas production in aged Cheddar cheese. American Dairy Science Association Meeting. July 12-16, 2015. Orlando, FL.

Oberg, C. 2015. Cheese Microbiology – Nonstarter Bacteria and Unwanted Gas Production. Global Cheese Technology Forum. October 26-28, 2015. Reno, NV.

Oberg, C. 2015. Cheese Texture and Flavor Development in Hard Cheeses. Inlactis National Dairy Conference. November 17-18, 2015. Montevideo, Uruguay.

Oberg, C. 2015. Cheesemaking Parameters and their Relationship to Starter and Nonstarter Activity. Inlactis National Dairy Conference. November 17-88, 2015. Montevideo, Uruguay

Barbara Wachocki and **Mohammad Sondossi.** 2015. Extent of Fungal Symbiosis in *Halogeton glomeratus*. Presentation was made at Botanical Society of America Conference, Edmonton, Alberta, CA, July 2015.

2014

C. J. Oberg, E. Bentley*, K. G. Nakaoka, M. J. Domek, M. D. Culumber. 2014. Microbial Screening of Potable Water Sources in Guatemala: A Potential Source of Disease Transmission. Department of Microbiology, Weber State Univ., Ogden, UT Poster Presentation: American Society for Microbiology General Meeting in Boston, MA on May 20th, 2014

2013

Oberg, C.J., Culumber, M., Oberg, T., Broadbent, J.R., and McMahon. 2013. A New *Lactobacillus* species associated with late gas production in cheese. American Society for Microbiology General Meeting. Denver, CO. 10-23 May.

Culumber, M. D., Domek, M.J., Benson*, C.M., and Oberg, C.J. 2013. Genomic analysis of two novel *Idiomarina* bacteriophage isolated from the Great Salt Lake, UT. Halophiles Conference. Storrs, CT. 23-27 June.

Jennifer Jorgenson, Ashley Badley, Amanda Zaugg, Alessia Banning, Mo Sondossi, William Lorowitz and Karen Nakaoka. 2013. Antibiotic resistance of enterococci isolated from the Great Salt Lake and freshwater sources. General Meeting of the American Society for Microbiology, Denver, Colorado. May 17-20, 2013

Hilary Vachon, Seth Peterson, Jason Fritzler and Karen Nakaoka. 2013. *Vibrio metschnikovii* associated with brine shrimp eggs isolated from the Great Salt Lake. Poster presentation at the Annual Meeting of the American Society of Microbiology, Denver, Colorado. May 2013.

Jason Bass, David Hintze, **Craig Oberg, Karen Nakaoka** and Joel Bass. 2013. Accepted for a poster presentation in. Determination of Microbial Populations in a Synthetic Turf System. Poster presentation at the Annual Meeting of the American Society of Microbiology, Denver, Colorado. May 2013

Presentations at Regional Conferences by year (faculty in bold, student co-authors in bold, italics)

2018

Madison Ballif. 2018. Effect of Triclosan on *C. elegans*. (Mentors: Brian Chung and **Mohammad Sondossi**) WSU Symposium on Undergraduate Research in March 2018

Dariann Gallegos and **Joshua Jorgensen.** 2018. Bacteriophage as an Alternative Treatment for Antibiotic Resistant Bacteria. (Mentor: **Matthew Domek**) WSU Symposium on Undergraduate Research in March 2018

Ireland Green. 2018. Suppression of *Lactobacillus wasatchensis* Growth by Organic Acids. (Mentors: **Craig Oberg** and **Matthew Domek**) WSU Symposium on Undergraduate Research in March 2018

Samuel Kalis. 2018. The degradative Effects of Horseradish Peroxidase on Microbial Biofilms. (Mentor: **William Lorowitz**) WSU Symposium on Undergraduate Research in March 2018

Issac Martineau. 2018. Isolation of a *Lactobacillus wasatchensis*-like isolate from aged European cheddar cheese. (Mentors: **Craig Oberg** and **Michele Culumber**) WSU Symposium on Undergraduate Research in March 2018

Sophie Overbeck. 2018. Bacteriocin Production by Bio-Productive Lab Cultures that Inhibit *Lactobacillus wasatchensis*. (Mentors: **Craig Oberg** and **Michele Culumber**) WSU Symposium on Undergraduate Research in March 2018

Sherie Thorton, Ammon Smart and **Amber Smith.** 2018. Isolation of Pathogens by Probiotic Strains of Lactobacilli. (Mentors: **Karen Nakaoka** and **Michele Culumber**) WSU Symposium on Undergraduate Research in March 2018

Jason Workman and **Jesse Kupfer.** 2018. Characterization of Hemolytic Activity of Probiotic Lactobacilli. (Mentor: **Karen Nakaoka**) WSU Symposium on Undergraduate Research in March 2018

Serena Young, Courtney Thomas and **Connor Kendrick.** 2018. Mutational Analysis of Enterovirus. (Mentor: **Daniel Clark**) WSU Symposium on Undergraduate Research in March 2018

Serena Young, Connor Kendrick, Courtney Thomas, and **Daniel Clark.** “Analysis of Enterovirus Structural Mutations Reveals Changes Responsible for Neuroinvasive Disease in Enterovirus 71” Tri-branch meeting of the American Society for Microbiology in Durango, Colorado; April 6, 2018

P. Estrada-de los Santos, M. Palmer, B. Chávez-Ramírez, C. Beukes, E. T. Steenkamp, L. Briscoe, N. Khan, M. Maluk, M. Lafos, E. Humm, M. Arabit, **M. B. Crook**, E. Gross, M. F. Simon, F. Bueno dos Reis Jr., W. B. Whitman, N. Shapiro, P. S. Poole, A. M. Hirsch, S. N. Venter, E. K. James. 2018. Cleaning up the taxonomy of *Burkholderia sensu lato* using comparative genomics. Tri-branch meeting of the American Society for Microbiology in Durango, Colorado; April 6, 2018

A. J. Watts, M. Guyader, **M. B. Crook.** (2018) “The role of auxin in growth promotion of rice by *Rhizobium* sp. IRBG74.” Tri-branch meeting of the American Society for Microbiology in Durango, Colorado; April 6, 2018

Jess D Gann, Carson N Davis, Michele D. Culumber and **Matthew J. Domek.** 2018. An Investigation of the Lysogenic Phage that infects *Halomonas* Isolated from the Great Salt Lake. Tri-branch meeting of the American Society for Microbiology in Durango, Colorado; April 6, 2018

Dariann Gallegos, Joshua Jorgensen, Emily States, Michele D. Culumber, and **Matthew J. Domek.** 2018. Bacteriophage as an Alternative Treatment for antibiotic Resistant Bacteria. Tri-branch meeting of the American Society for Microbiology in Durango, Colorado; April 6, 2018

Version Date: April, 2018

Amber Smith, Sherie Thornton, Ammon Smart, Michele Culumber and Karen Nakaoka. 2018. Inhibition of pathogens by probiotic strains of Lactobacilli. April 2018. Accepted for poster presentation at the Tri-Branch Meeting of the American Society of Microbiology, Durango, CO.

Ammon Smart, Amber Smith, Sherie Thornton, Michele Culumber and Karen Nakaoka. 2018. Inhibition of pathogens by probiotic strains of Lactobacilli. April 2018. Accepted for oral presentation at the Utah Academy of Sciences, Art and Letters, SUU, Cedar City, UT.

Jesse Kupfer, Frank Sechi, Jayson Workman, and Karen Nakaoka. 2018. Characterization of Hemolytic-like Activity of Probiotic Lactobacilli. April 2018. Tri-Branch Meeting of the American Society of Microbiology, Durango, CO.

Jayson Workman, Frank Sechi, Jesse Kupfer and Karen Nakaoka. 2018. Characterization of Hemolytic-like Activity of Probiotic Lactobacilli. April 2018. Utah Academy of Sciences, Art and Letters, SUU, Cedar City, UT.

2017

Wyatt Powelson, Rusty Crofts, Eric Lancaster and Karen Nakaoka. 2017. Characterization of lactic acid bacteria isolated from over the counter probiotic products. April 2017. Oral presentation at the Utah Academy of Science, Arts and Letters at Utah Valley University, Orem, UT.

Eric Lancaster, Rusty Crofts, Wyatt Powelson, Connor Christensen, George Kayser and Karen Nakaoka. 2017. Characterization of lactic acid bacteria isolated from over the counter probiotic products. April 2017. Poster presentation at the Intermountain Branch of the American Society for Microbiology at Weber State University, Ogden, UT.

Christian Corneal, Cynthia Rudh, Brody Gibson and Karen Nakaoka. 2017. Development of assays to study inhibition of pathogens by lactic acid bacteria and their hemolytic ability. April 2017. Poster presentation at the Intermountain Branch of the American Society for Microbiology at Weber State University, Ogden, UT.

Brody Gibson, Christian Corneal, Cynthia Rudh, and Karen Nakaoka. 2017. Development of assays to study inhibition of pathogens by lactic acid bacteria and their hemolytic ability. April 2017. Oral presentation at the Utah Academy of Sciences, Arts, & Letters conference at Utah Valley University, Orem, UT.

A. Lavigne, and S. Smith. 2017. Effect of bio-protective lactic acid bacteria cultures on *Lactobacillus wasatchensis*. WSU Symposium on Undergraduate Research in March 2017.

G. McKay. 2017. (Mentors: **Craig Oberg**) Microbial analysis of art byproduct waste streams. WSU Symposium on Undergraduate Research in March 2017.

G. McKay. 2017. Microbial analysis of art byproduct waste streams. Utah Academy of Sciences, Arts, and Letters Annual Meeting. April 7, 2017, Orem, UT.

A. Lavigne, and S. Smith. 2017. Inhibition of *Lactobacillus wasatchensis* by non-starter and bio-protective lactic acid bacteria. ASM Intermountain Branch Meeting. April 15, 2017, Ogden, UT.

G. McKay. 2017. Microbial analysis of art byproduct waste streams. ASM Intermountain Branch Meeting. April 15, 2017, Ogden, UT.

C. Oberg, A. Lavigne, S. Smith, I. Bowen, and D. McMahon. 2017. Inhibition of *Lactobacillus wasatchensis* by bio-protective lactic acid bacteria cultures. Utah Academy of Sciences, Arts, and Letters Annual Meeting. April 7, 2017, Orem, UT.

2016

Shelly Barker, Michele Culumber, Jason Fritzler, Matt Domek, and Karen Nakaoka. 2016. Vibrio Isolated from Hypersaline Waters of the Great Salt Lake. April 2016. Poster presentation at the Intermountain Branch of the American Society for Microbiology at UVU, Salt Lake City, UT.

Marissa Walker, Craig Oberg, Joel Bass, **Shelly Barker** and **Karen Nakaoka.** 2016. Outbreak of Skin Infection among University Football Players. March 2016. Presented at the Utah Academy of Science Arts & Letters, Westminster University, Salt Lake City, UT.

Rebecca Horton 2016. Investigating adaptive niche construction of *Pseudomonas aeruginosa* under nutrient limitation. Mentor: **Mo Sondossi.** WSU Symposium on Undergraduate Research in March 2016.

2015

C. Oberg, A. Lavigne, S. Smith, I. Bowen, and D. McMahon. 2017. Inhibition of *Lactobacillus wasatchensis* by bio-protective lactic acid bacteria cultures. Utah Academy of Sciences, Arts, and Letters Annual Meeting. April 7, 2017, Orem, UT.

Oberg, C. 2015. Unwanted gas production in cheese from *Lactobacillus wasatchensis*. BUILD Dairy Annual Meeting, June 18, 2015, Twin Falls, ID.

Oberg, C. J., J. Hendricks, M. D. Culumber, T. S. Oberg, J. R. Broadbent, and D. J. McMahon. 2015. Sequencing and annotation of novel plasmids in *Lactobacillus curvatus*. Utah Academy of Sciences, Arts and Letters Meeting. March 27, 2015. Ephraim, UT.

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Jakob Oberg*, Heather Thomas, Kayla Blackford, Tyler Allen, Craig Oberg, Matt Domek. 2015. Method to Survey Seasonality of the Great Salt Lake Virosphere. Weber State University, Ogden, UT. Utah Academy of Science, Arts and Letters. Snow College, Ephraim, UT March 27, 2015

Garrett Ward*, Matthew Domek and **Michele Culumber.** 2015. Detection of Halophilic Bacteriophage in Soils Near the Great Salt Lake. Weber State University, Ogden, UT. Utah Academy of Science, Arts and Letters. Snow College, Ephraim, UT March 27, 2015.

Tyler Allen* (Mentor: **Matthew Domek**) 2015. Salt Conditions Affect Bacteriophage Infectivity of *Salinivibrio costicola*. 11th Annual Undergraduate Research Symposium, Weber State University, Ogden, UT. March 30, 2015.

Brody Arave, Jake Haslam and Trevor Annis. 2015. (Mentors: **Matthew Domek** and **Karen Nakaoka**) Isolation of *Enterococcus* Bacteriophage from Northern Utah Water Systems. Poster Presentation: 11th Annual Undergraduate Research Symposium, Weber State University, Ogden, UT. March 30, 2015.

Jakob Oberg, Heather Thomas, Kayla Blackford and Tyler Allen (Mentors: **Craig Oberg** and **Matthew Domek**). 2015. Method to Survey Seasonality of the Great Salt Lake Virosphere. Poster Presentation: 11th Annual Undergraduate Research Symposium, Weber State University, Ogden, UT. March 30, 2015.

Garrett Ward (Mentors: **Matthew Domek** and **Michele Culumber**). 2015. Detection of Halophilic Bacteriophage in Soils Near the Great Salt Lake. Poster Presentation: 11th Annual Undergraduate Research Symposium, Weber State University, Ogden, UT. March 30, 2015.

Cody Zesiger, and **Autumn Brubaker** (Mentors: **Karen Nakaoka** and **Matthew Domek**). 2015. Genotype Analysis of *Enterococcus* Isolates from the GSL. Poster Presentation: 11th Annual Undergraduate Research Symposium, Weber State University, Ogden, UT. March 30, 2015.

Garrett Ward (Mentors **Michele Culumber** and **Matthew Domek**) 2015. Detection of Halophilic Bacteriophage in Soils Near the Great Salt Lake. Oral Presentation: American Society for Microbiology Tri-Branch Annual Conference. Fort Lewis College, Durango, CO, April 24, 2015

Brent D. Nelson (Mentors: **Matthew Domek** and David M. Belnap) 2015. Electron micrographs of Morphological Differences in Halophage Capsid Structure from the Great Salt Lake. Poster Presentation: American Society for Microbiology Tri-Branch Annual Conference. Fort Lewis College, Durango, CO, April 24, 2015

Sadie Yearsley. 2015. Assessing Microbial Diversity of Great Salt Lake Using DNA Sequence Comparisons. WSU Symposium on Undergraduate Research in March 2015.
(Mentors: **Mo Sondossi** and Jonathon Clark)

2014

Tyler Allen* and **Matthew J. Domek.** 2014. Salt Conditions affect Bacteriophages Infectivity of *Salinivibrio costicola* Oral Presentation: Utah Academy of Science, Arts and Letters. Dixie State University, St. George, UT April 11, 2014

Randy Olson* and **Matthew J. Domek.** 2014. Infectivity of Bacteriophage Isolated from the Great Salt Lake is altered by pH. Oral Presentation: Utah Academy of Science, Arts and Letters. Dixie State University, St. George, UT April 11, 2014

Kayla Blackford, Matthew J. Domek* and **Craig J. Oberg**. 2014. Survey of Great Salt Lake Virosphere. Oral Presentation: Utah Academy of Science, Arts and Letters. Dixie State University, St. George, UT April 11, 2014

Emma Bentley*, **Craig Oberg**, **Karen Nakaoka**, **Matthew Domek** and **Michele Culumber** 2014. Microbial Screening of Potable Water Sources in Guatemala. Oral Presentation: Utah Academy of Science, Arts and Letters. Dixie State University, St. George, UT April 11, 2014

Tyler Allen* and **Matthew Domek**. 2014. Environmental parameters affect the ability of bacteriophages NS01 and DB01 to infect *Salinivibrio costicola* isolated from the Great Salt Lake. Poster Presentation: American Society for Microbiology Intermountain Branch Annual Conference. Brigham Young University, Provo, UT. March 8, 2014

Emma Bentley*, **Craig Oberg**, **Karen Nakaoka**, **Michele Culumber**, **Matthew Domek**. 2014. Microbial Screening of Potable Water Sources in Guatemala: A potential Source of Disease Transmission. 84408. Oral Presentation: American Society for Microbiology Intermountain Branch Annual Conference. Brigham Young University, Provo, UT. March 8, 2014

Madison Landreth, Autumn Brubaker, Jessica Brooke, Colton Stokes, Jhonny Yovera, Cody Zesiger, Zandy Pashley, April Foley, Michael Harris (Mentors: **Karen Nakaoka, William Lorowitz** and **Mo Sondossi**). 2014. Antibiotic Resistance of Enterococci Isolated from the Great Salt Lake and Fresh Water Sources. Oral presentation at the Annual Meeting of the Utah Conference for Undergraduate at BYU in Provo, UT February 2014.

Madison Landreth, Autumn Brubaker, Jessica Brooke, Colton Stokes, Jhonny Yovera, Cody Zesiger, Zandy Pashley, April Foley, Michael Harris (Mentors: **Karen Nakaoka,, William Lorowitz** and **Mo Sondossi**). 2014. Antibiotics Resistance of Enterococci Isolated from the Great Salt Lake and Fresh Water Sources. Poster presentation at the Annual Meeting of the Utah Academy of Sciences, Arts and Letters, St. George, Utah. April 2014.

Autumn Brubaker, Jessica Brooke, Madison Landreth, Cody Zesiger, Colton Stokes, Zandy Pashley, April Foley, Michael Harris, Jhonny Yovera (Mentors: **Karen Nakaoka,, William Lorowitz** and **Mo Sondossi**). 2014. Antibiotic Resistance of Enterococci Isolated from the Great Salt Lake and Fresh Water Sources. Oral presentation at the Annual Meeting of the Weber State University Symposium on Undergraduate Research. WSU, Ogden, UT. March 31, 2014.

Hill, C., M. Sondossi and J. Clark. 2014. Metagenomics of Great Salt Lake Microbes. Annual Undergraduate Research Symposium, Weber State University. March 31, 2014.

2013

Erik Bruun, Kristi Russell, Matt McKee, Chelsey King, and Karen Nakaoka. 2013. Internalization of *Salmonella* in Tomatoes. Poster presentation at the Annual Meeting of the Intermountain Branch of the American Society for Microbiology, Idaho State University, Pocatello, Idaho. March 2013

Kristi Russell, Erik Bruun, Matt McKee, Chelsey King, and Karen Nakaoka. 2013. Internalization of Salmonella in Tomatoes. Poster presentation at the Annual Meeting of the Utah Academy of Sciences, Arts and Letters, Utah Valley University, Orem, Utah. April 2013

Seth Peterson, Hilary Vachon, Jason Fritzler and Karen Nakaoka. 2013. *Vibrio metschnikovii* associated with brine shrimp eggs isolated from the Great Salt Lake. . Poster presentation at the Annual Meeting of the Utah Academy of Sciences, Arts and Letters, Utah Valley University, Orem, Utah. April 2013.

Jennifer Jorgenson, Ashley Badley, William Lorowitz and Karen Nakaoka. 2013. Antibiotic resistance of enterococci isolated from the Great Salt Lake and freshwater sources. Oral presentation at the Utah Conference for Undergraduate Research, Utah State University, Logan, Utah. February 2013

Jennifer Jorgenson, Ashley Badley, Amanda Zaugg, Alessia Banning, Mo Sondossi, William Lorowitz and Karen Nakaoka. 2013. Antibiotic resistance of enterococci isolated from the Great Salt Lake and freshwater sources. Poster Presentation at the Annual Meeting of the Intermountain Branch of the American Society for Microbiology, Idaho State University, Pocatello, Idaho. March 2013

Amanda Zaugg, Alessia Banning, Jennifer Jorgenson, Ashley Badley, Mo Sondossi, William Lorowitz and Karen Nakaoka. 2013. Antibiotic resistance of enterococci isolated from the Great Salt Lake and freshwater sources. Poster presentation at the Annual Meeting of the Utah Academy of Sciences, Arts and Letters, Utah Valley University, Orem, Utah. April 2013

Jason Bass, David Hintze, Craig Oberg, Karen Nakaoka and Joel Bass. 2013. Determination of Microbial Populations in a Synthetic Turf System. Poster presentation at the Utah Conference for Undergraduate Research, Utah State University, Logan, Utah. February 2013.

Jason Bass, David Hintze, Craig Oberg, Karen Nakaoka and Joel Bass. 2013. Determination of Microbial Populations in a Synthetic Turf System. Poster presentation at the Annual Meeting of the Intermountain Branch of the American Society for Microbiology, Idaho State University, Pocatello, Idaho. March 2013.

Jason Bass, David Hintze, Craig Oberg, Karen Nakaoka and Joel Bass. 2013. Determination of Microbial Populations in a Synthetic Turf System. Poster presentation at the Annual Meeting of the Utah Academy of Sciences, Arts and Letters, Utah Valley University. April 2013.

Mentoring Activities

New faculty are primarily mentored by the chair. This includes making sure faculty are aware of service opportunities on College and University level committees. In the Department we have supported attendance at discipline specific conferences such as the American Society for Microbiology Conference for Undergraduate Educators. The pre-tenured faculty undergo a required review process outlined in the Policies and Procedures Manual. For example, Currently, Matthew Crook is undergoing a second year review by the Chair and the report will be shared with the Dean. The third year review is a more formal review where the documentation is submitted as professional file to the Deans Office.

Diversity of Faculty

Among eight faculty we have two women. In our future hires we are making a commitment to hiring faculty that reflect the racial and gender diversity of our students.

Ongoing Review and Professional Development

All faculty submit an annual report that summarizes their accomplishments in teaching, scholarship and service. In addition, there is a formal post-tenure review process outline in the Policies and Procedures manual. Many of our faculty including our new faculty are participating in the ongoing "Student Success" series (lecture and workshops) initiated by the provost office. Listed below are some of the recent examples of Professional Development and Professional Service by Faculty in Microbiology. Additional information can be found in faculty C.V.'s (Appendix E)

Matthew B. Crook

- Peer-reviewer for *Microbiology Open*, *Journal of Bacteriology*, *MPMI*, *BMC Genomics*, *Scientific Reports*, *Bioscience Horizons*, *FEMS Microbiology Letters*, *American Journal of Botany*

Michele D. Culumber

- 24th Annual American Society for Microbiology Conference for Undergraduate Educators, Denver, Co. June 2017
- American Society for Microbiology, Biology Scholars Assessment Residency, 2015-2016.
- ASM Curriculum Guidelines for Undergraduate Microbiology: Aligning Concepts, Learning Outcomes and Assessments, Sue Merkel, Cornell University, Ithaca, NY; Ann Stevens, Virginia Tech, Blacksburg, VA, Duration: 46:17, ASM M(icro)OOCs, 13 August 2014.
- WSU Innovative Teaching Workshop, 18-19 October 2013. The Canyons, Park City, UT
- National Conference for Undergraduate Research, April 2013, La Crosse WI

Matthew J. Domek

- 24th Annual American Society for Microbiology Conference for Undergraduate Educators, Denver, Co. June 2017
- University Curriculum Committee 2014-2018
- Pre-Dental Advisor 2006-2015
- Department Chair 2016-present
- New Building Committee 2014-2016
- Dean Search Committee 2017-2018

Karen Nakoka

- Pre-PA adviser for Microbiology Students (2017-2018)
- WSU Pre-PA advisor and Pre-PA club advisor (1997-2017)

Craig J. Oberg

- Chair, Faculty Senate 2014-16
- Athletic Board 2009-present
- Athletic Equity Committee 2009-present
- Athletic Compliance Committee 2009-present
- Faculty Governance Award, Weber State University, 2016
- Undergraduate Research Mentor Award, College of Science, WSU, 2016

Mohammad Sondossi

- Editorial Board: International Biodeterioration and Biodegradation,
- Hearing Committee/ Student Grievance/Complaint, Hearing officer
- Safety Committee
- Sigma Xi Committee

Evidence of Effective Instruction

- Regular Faculty
 - The annual reports submitted by each faculty year have a section (B) where the faculty report on Teaching and Learning. They are required to submit student evaluations for two courses per year (although many faculty do more). Faculty list improvements to courses made each year which range from adding content or new laboratory experiments to adding elements of active learning (formative assessment with clickers). Faculty also report on goals for the upcoming year and list accomplishments regarding past goals.
 - All department faculty are routinely rated as Excellent or Good on annual report evaluations.
- Adjunct Faculty
 - Adjunct faculty are reviewed annually by the Department chair and dean, and through student course evaluations. General education courses taught by adjunct faculty are, and will continue to be, evaluated with the same metrics used for all general education courses as described above. Adjunct faculty vita and evaluations are kept in the chair's office.

Standard F – Program Support

Support Staff, Administration, Facilities, Equipment, and Library

Adequacy of Staff

Laboratory Manager

The Microbiology Department has 10-month appointment laboratory manager. Karen Mann is a recent hire and has done an exemplary job supporting our entry level and upper-division courses, through media preparation, laboratory set up and clean up, maintaining laboratory equipment, purchasing supplies, and serving as the point person for the College for the autoclave and dishwasher maintenance and repair. She also has a role supporting the teaching laboratory and undergraduate research students when they need reagents, supplies, or training. Ms. Mann also trains, manages, and mentors between one and three undergraduate student employees in the preparatory laboratory each semester.

Staff Development

Ms. Mann participates in training offered by the Office of Work Place learning and recently took a chemistry course (Chem Tech seminar).

Administrative Support

The Department is fortunate to have Katie Nelson as our Department's administrative assistant who is also a recent hire. Ms. Nelson is generally the first Departmental contact for new Microbiology majors and she serves as a valuable resource for students. Some of Ms. Nelson's regular responsibilities include:

- General office support:
 - Photocopies, mail, reception, ordering office supplies
- Faculty support:
 - bookstore orders, class rolls, proofreading and editing
- Chairperson support:
 - Budget reports and budget transfers, P-card reconciling, PAR's, payroll for hourly employees, preparation for Department audits
 - Calculates yearly course statistics and tracks faculty loads for year-end reports, coordinates with continuing education, tracks progress of upcoming graduates and clears majors in CatTracks for graduation
 - Course scheduling
- Student support:
 - Answer's student inquiries when appropriate, processes registration overrides, helps students with course transfer issues, changes program of study when requested

Ms. Nelson continues to receive training as appropriate, including Lynx, CatTracks, Curriculog and Banner training. Because of the amount of work she accomplishes Ms. Nelson's position should be 1.0 FTE instead of 0.75

Adequacy of Facilities and Equipment

In 2016, the College and Department moved into the new Tracy Hall Science Center. The new building is a tremendous upgrade in terms of space, equipment, student and faculty areas, and safety issues.

Adequacy of teaching space

The new teaching spaces are large enough to accommodate 32 students, which is larger than desired for most lab classes, but which leaves us with flexibility in class sizes and scheduling. The equipment upgrades (e.g. microscopes, shakers, water baths, incubators) were all necessary following the move to replace aging equipment and are being used heavily. The multimedia arrangement for the teaching labs is adequate. Teaching spaces are also used for many undergraduate research students, and a bench in one lab has been dedicated to media preparation for research students.

Action plan for teaching labs:

1. Continue to update and add equipment as necessary for efficiency or safety.
 - a. 16-32 ceramic burners for all labs
 - b. Additional microscopes with camera attachments (4-8)
 - c. Three additional shaking incubators for teaching and research
2. Discuss equipment servicing plans with the College administration for College equipment that is housed within the Department (e.g. autoclaves, dishwasher) and how these will be maintained into the future.

Adequacy of research space

During the move and construction of the labs, research space was sacrificed for teaching space. This has created a problem for faculty that are highly engaged in research, *but do not have dedicated research laboratories or space*. While we don't object to sharing facilities, there is simply not enough space to accommodate the level of ongoing research. In addition, we have added a faculty position and *that new faculty member does not have dedicated research lab space*. This could hinder his research and progress toward tenure. Other faculty are required to find space in the teaching labs to mentor undergraduate research.

Currently our **biggest problem** is that the lab that had been dedicated as "Medical Microbiology" *does not meet this need* for several reasons. It is not located in close enough proximity to the autoclaves. The door opens into a general hallway with a lot of traffic, and contaminated materials need to travel through the main hallway to reach the autoclave room. This is not safe for pathogen handling. The biosafety hood was never installed, and the space is now being used for general molecular biology research applications.

Action plan for research space:

1. Turn Room TY466 into a Pathogenic BSL 2 Microbiology Laboratory
 - a. Currently unused
 - b. Close proximity to the autoclaves
 - c. In the hallway behind the blast doors, not on the main hallway
 - d. Close proximity (shared wall) to other biological safety hoods for easy electrical and ventilation installation of the existing hood

(note: this room does not "belong" to us, but we think it would be a good place to put a pathogens lab")

Core Equipment and Facilities

- Teaching Labs: BS2-designated for 32 students
 - equipped with fume hoods
 - Nuair NU-540-600 Class II Type A2 Biological Safety Cabinets (8)
 - 20 Leica DM750 Phase contrast compound microscopes--some with integrated cameras
 - Isotemp water baths
 - Sorvall ST16 centrifuges (2)
 - Microcentrifuges
 - Vortexers
 - MaxQ4450 benchtop incubator/shakers (2)
 - Heratherm microbiological incubators
 - Heracell VIOS 160i CO₂ incubators (2).
- Media prep room with two large-capacity autoclaves, fume hood, chemical cabinet, media refrigerator, hot/stir plates, pH meter, microbalance, and dishwasher.
- Olympus BX43 fluorescence microscope with 130W mercury vapor source, DP22 2.8 Mp CCD camera, and filters for DAPI, FITC, and CY3.
- Olympus FV3000 Confocal Scanning Laser Microscope (College Resource)
- Research Labs
 - Environmental microbiology lab (2 faculty)
 - Coy vinyl anaerobic chamber Heraeus Megafuge 1.0R Centrifuge
 - Cell culture lab (3 faculty)
 - BioSpec Mini-Beadbeater
 - NanoDrop Lite Spectrophotometer
 - Tecan Infinite M200 plate reader (visible, fluorescence and luminescence capable)
 - Barnstead MicroPure water purification system.
 - Inverted microscope
 - “Medical” microbiology lab (currently used as an all purpose molecular biology lab) (4 or 5 faculty)
 - Applied Biosystems QuantStudio 3 RT-PCR system
 - Clean hood
 - Eppendorf Mastercycler Thermocycler
 - Microcentrifuge
 - Gel electrophoresis systems
 - Grow light bank and stands
 - “Student research” lab (not big enough for intended purpose 2 faculty share)
 - Applied Biosystems SimpliAmp Thermal Cycler

Adequacy of Library Resources

The central Stewart Library provides digital databases, online journal subscriptions, and has enhanced interlibrary loan services. Library holdings are generally adequate providing research is along the lines of the journal's emphasis. Certain additional journals would be helpful, but probably are not worth the expense. Our science librarian, Miranda Kispert, is readily available to help both students and faculty find and access materials.

Standard G - Relationships with External Communities

Description of Role in External Communities

Faculty within the department serve as a resource for microbiology and microbiology education within the community. This primarily involves community and school outreach programs and lectures, as well as mentoring for science fairs. The department is often contacted by members of the local microbiology industries for advice and to promote open positions.

Summary of External Advisory Committee Minutes

The Microbiology Advisory Board consists of 14 members outside of the Department (see list below), most from local microbiological industries. We have held five meetings since 2015. Bruce Kesewick is the chairperson. We have an advisory board charter. The main purposes of the advisory board have been to:

- Promote an active alumni and friends network
- Identify professional development and job opportunities for students and graduates in private companies, public agencies, and educational organizations
- Identify key skills (educational, laboratory, or professional) that graduates need to succeed for local, regional, and national employment
- Support the Departmental mission to recruit and develop graduates by providing professional development workshops, lectures, mentoring, or networking opportunities.
- Promote the Department of Microbiology through outreach and educational activities in collaboration with faculty and students of the Department
- Support fundraising for the Department and College of Science, although this is not among the primary goals of the MAC

In recent meetings the advisory board has discussed the importance of internships and certificate programs as well as how these might be implemented into the Department. Advisory board members have been involved in working with students by providing lectures in courses, career panels, and informing the Department of career opportunities.

Minutes are available upon request

Microbiology Department
Advisory Board Members Info (2018)

Name	Organization	Email
Ken Burgener	Sewage Treatment North Davis County, Lab Director	kenburgener@ndsd.org
Evan Call	Lab Director EC-Services Adjunct at Weber State University	ecall@weber.edu
Cristie Cothran	Fresenius Medical Care	cristie_c@hotmail.com
Steve Curtis	Nellson Nutraceutical	steveelcurtis@hotmail.com
Jessi Done	Quality and Food Safety Systems	jerseybombshell@gmail.com
Karen W. Fairbanks	The Distribution Group (TDG)	karen@tdg.coop
Anne Fortier PhD	NIH/Walter Reed – Microbiology researcher, High School teacher, NUAMES	anne@fortierworld.com
Kevin Jensen	Nelson Labs, director of lab operations	kjensen@nelsonlabs.com
Bruce Keswick, PhD	Procter & Gamble	brucekeswick@gmail.com
Stephen Merrigan	ARUP R&D Scientist II	stephen.d.merrigan@aruplab.com
Dave McKean	Wasatch Squatters Co-op	dave@wasatchbeers.com
Greg Nielsen	Weber State University Career Services	gnielsen@weber.edu
Randall Thunell	Vivolac Culture Company	rthunell@vivolac.com
John Mull, PhD	Professor - Zoology, Weber State University	jmull@weber.edu

Standard H – Program Summary
 Results of Previous Program Reviews

Problem Identified	Action Taken	Progress
Issue 1 Resources are not adequate to support teaching and scholarly activities	Previous 5 Year Program Review:	
	Hired two new faculty	New faculty has external funding support for research
	Outside collaborations developed with the “Build Dairy” program	Supports faculty mentors and 4-5 undergraduate researchers per year
Issue 2 Faculty SCH loads are too high	Previous 5 Year Program Review:	
	Some of the problem is external to the Department	Faculty continue to maintain high standards in teaching
	Scheduling changes made to reduce lab sizes and class size. Adding more lecture sections of Micr 2054 and teaching Micr 2054 in summer.	One instructor per lab room instead of one instructor overseeing multiple rooms. More course offering allows flexibility for students to take required courses fewer conflicts

Issue 3 Faculty load credit for lab contact hours and undergraduate research is below the national standard	Previous 5 Year Program Review:	Progress
	The credits offered are set by the University	Issue needs to be addressed in terms of a workload model for the College
Issue 4 Continue Growing the major	Previous 5 Year Program Review:	Progress
	Enrollments in upper division have remained constant even with decreases in overall SCH's in the Department, College and University (Appendix F)	We graduate the most majors (31% of COS) of any department in COS over the last five years. (Appendix F)
		Focus efforts to raise SCH's on recruitment of NUAMES students, Biology A.S. and update of Microbiology degree emphases.

Issues identified the External Review Team (not identified in self-study)

Issue 1 Lack of Strategic Plan	Previous 5 Year Program Review:	
	In 2015 we implemented a strategic plan	Many goals were met and it is time re-evaluate assessment goals
Issue 2 Centralized advising and lack of structured/required advising	Addition of COS advisors and formal advising process for pre-professionals has been improved; pre-professionals tracked as a cohort	More students receive advising although it is not mandatory
	Additional faculty have been trained on advising software: Cattracks and starfish	Advisors are more accessible to students
Issue 3 Physical Facilities, Safety concerns	Tracy Hall Science Center opened Fall 2016	Vastly improved teaching facilities and provides a safe working environment
Issue 4 Collaborative efforts with other departments and silos relative to other departments	Three Life Science Departments attended PULSE conference 2015 and professional Development Conferences	Developed interdepartmental Goals: A.S. in Biology, with a shared curriculum
	Collaborative hiring of Geosciences faculty	Geosci faculty teaches Microbiology courses
	Collaborative teaching activities with Physics (even years)	Microscopy lab experience between Micro 4054 - Microbial Physiology and Physics PHYS 4410 - Materials Characterization Laboratory
	New shared equipment (among departments)	See progress in Issue 3 and 5

Issue 5 State of the Art research opportunities Incentives to encourage acquisition of new grants	Equipment upgraded with the opening of Tracy Hall	Continue to acquire new equipment through grants and donors
	Confocal microscope, molecular biology equipment upgrades (RT-PCR)	Collaborative effort to acquire new equipment
Issue 6 Minimal involvement of Industry, alumni, and the community	Advisory board instituted in 2016, comprised of alumni and industry representatives	Addressing issues of job placement, work skills, internships
Issue 7 New Hires	One new Faculty line (2017)	Systems microbiologist adds to diversity of sub-disciplines covered by the Department
	One replacement faculty (2018)	Parasite-Host interactions and Medical Microbiology

Action Plan for Evidence of Learning Related Findings

Problem Identified	Action to Be Taken
Issue 1 General Education assessment	Current 5 Year Program Review:
	Year 2019: <ul style="list-style-type: none"> • Assessment of general education courses will be standardized across instructor. • Identify better ways to administer assessments to students in online and face-to-face sections
	Year 2020: <ul style="list-style-type: none"> • Assess all courses using new tools
	Year 2021: <ul style="list-style-type: none"> • Report on findings make modifications to courses

	<p>Year 2022:</p> <ul style="list-style-type: none"> • Report on findings make modifications to courses
Issue 2 Assessment of Upper Division Courses	<p>Current 5 Year Program Review:</p>
	<p>Year 2019:</p> <ul style="list-style-type: none"> • Department will update assessment plan, focusing on major's courses, and present that in the 2019 assessment report. • A published concept inventory will be used as part of the assessment for <i>Principles of Microbiology</i> (currently only 1 semester of data is available).
	<p>Year 2020:</p> <ul style="list-style-type: none"> • Assessment of the curriculum will be aligned with the AAAS Vision and Change Document. • Develop more standardized assessment techniques for upper division courses
	<p>Year 2021:</p> <p>Report on findings make modifications to courses</p>
	<p>Year 2022:</p> <ul style="list-style-type: none"> • Report on findings make modifications to courses
Issue 2 Laboratory Skills map	<p>Current 5 Year Program Review:</p> <ul style="list-style-type: none"> • Lab Skills Matrix Developed • Presented to the Advisory Board Fall 2018
	<p>Year 2019-2020:</p> <ul style="list-style-type: none"> • Include assessment of lab skills in courses • Reevaluate skills matrix • Identify missing skills
	<p>Year 2021:</p> <ul style="list-style-type: none"> • Incorporate missing skills into labs • Propose new courses if necessary
	<p>Year 2022:</p> <ul style="list-style-type: none"> • Report on findings make modifications to courses

Action Plan for Staff, Administration, or Budgetary Findings

Problem Identified	Action to Be Taken Current 5 Year Program Review:	Progress
Issue 1 The current budget barely covers operating expenses, and does not keep pace with increased SCH's	The budget has not changed	We are monitoring spending on lab supplies per class to assess budget needs Once data is compiled over several semesters, ask for a budget review.
Issue 2 The Laboratory manager position is currently part-time, hourly, position	Current 5 Year Program Review: New lab manager hired in 2015, left for another job in 2016 Current lab manager (Karen Mann) hired in 2017 on a 10-month appointment	
Issue 2 The Department secretary is currently a part-time, hourly position	Current 5 Year Program Review: New Administrative assistant (Katie Nelson) hired in 2017 (0.75 time appointment).	

Department of Microbiology
Program Review Team Members

Sue Merkel, M.S.
Department of Microbiology
smm3@cornell.edu
Cornell University
111 Wing Hall
Ithaca, NY 14850
(607) 254-2767

Dr. Leigh A. Shaw
lshaw@weber.edu
Department of Psychology
Weber State University
Lindquist Hall, Room 379
(801) 626-7429

Dr. Juliette Tinker
juliettetinker@boisestate.edu
Department of Biological Sciences
Boise State University
Science Building, Room 229
Boise, ID 83725-1515
(208) 426-5472