Department of Microbiology, Weber State University Program Review

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Review Team:
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Overview:
The Review Team met with select faculty for dinner on 3/26 to discuss the program and review schedule. On 3/27, the Review Team met for breakfast with Dean Easter-Pilcher, Associate Dean Trask, Chair Domek, and Drs. Culumber and Clark and discussed the intent and goals of the review. A general overview of the College of Science and Department of Microbiology was provided. The Review Team was provided tours of teaching and research facilities, and met with Microbiology faculty in two sessions, Microbiology students over lunch, the College of Science Advisor, the Microbiology lab manager and administrative assistant, and a representative from the Advisory Board. Finally, the Review Team met with Dr. Domek to discuss their feedback for the review, followed by dinner with Drs. Domek, Culumber, Nakaoka, and Crook. The Review Team feedback regarding Strengths, Areas for Improvement, and Recommendations for Standards A-H follows.

Standard A-- Mission Statement:

A. Are outcomes of program well defined?
B. Are student accomplishments assessed by stakeholders?
C. Is educational program clearly defined so graduates can meet goals?
D. Does mission statement support college mission statement?

Strengths: The list of desired skills in the mission statement is well defined. There are a plethora of lab courses and a central focus of the curriculum is on developing laboratory and analytical skills. There are curriculum goals that address content in the curriculum. These are understandably very broad, but they support the college mission statement. These learning goals became formalized in their first strategic plan (5 years) and were informed by AAAS Vision and Change and the American Society for Microbiology UG Curriculum.

Areas for Improvement: The Review Team was impressed that the Chair had developed a matrix of these broad goals and each course. However, we had the impression that this was done a while ago, and most faculty were unaware of it. We saw little evidence that all faculty were using learning outcomes in their courses that were actually linked to the learning goals. We also saw little evidence that faculty were using assessment of student learning to "close the loop," that

is, to revise course material based on evidence of learning. Some faculty were doing it informally; others said they didn't know how to do it.

Recommendations: The department needs more faculty sharing of what does and doesn't work in the class or lab. Faculty need opportunities to talk about how they approach each course. The department could pick a particular outcome (e.g., laboratory or data analysis skills) and focus on assessing that for a year across the curriculum. As a department, brainstorm new measures of assessment, try something out, see what works and what doesn't over two semesters. This process would help show everyone how to do it, and sends the message to faculty that the process is important and can be used to improve what is being done in the classroom or lab. Also encourage training and professional development; create a culture where it is expected, particularly as new faculty come in.

Standard B Curriculum:

A. Is there evidence of thoughtful curriculum planning and review?
B. Is the curriculum consistent with mission?
C. Are there resources to support the program?
D. Are courses offered in a timely manner?

Strengths: Gen Ed courses went through a formal renewal and review and there is improved collaboration with these courses and among instructors. Also, faculty are compliant with Gen Ed Revitalization efforts on campus inasmuch as Microbiology Gen Ed courses are designed around a Big Question and include a Signature Assignment to assess general education and program-level learning outcomes. A common text has been adopted by most faculty in MICR 1153, Elementary Public Health, and that has facilitated coherence across faculty in course content. The new Associates degree in Biology (BIO AS) is a definite strength for the department that may answer the weakness below of curriculum bottlenecks due to current Associates degrees. We hope it helps to increase efficiency to help students get through in 2 + 2 years as designed.

The Micro curriculum has a very strong set of core courses. The curriculum is filled with a variety of excellent elective course options across all areas of microbiology and a major strength is the presence of numerous laboratory experiences. They department offers multiple sections of same class each semester, instead of fewer large classes, which also aids student scheduling. In the case of Immunology, the lecture class was separated from the lab to give students more scheduling flexibility. The 3 MICR concentrations (public environmental health; medical microbiology; biotech & industry) should help students choose electives tailored to their interests in the field. Students appreciate the flexibility of the program and feel cared for by the faculty, most of whom seem to have open door policies. The thoughtful and purposeful curriculum planning make the program distinctive in the University and the nation.

Areas for Improvement: Despite use of the same text, it is unclear how much coordination occurs among faculty teaching Elementary Public (Micro 1153) and also the Introductory Microbiology (Micro 1113).

Faculty expressed concern that many students are delayed in graduation due to coursework for Associates degrees that will not help them efficiently attain a Bachelor's degree in Microbiology. The fact that Microbial Physiology (MICR 4054) and Microbial Genetics (MICR 4154) are each offered once a year presents a scheduling challenge for students. The Review Team was not clear how Microbial Procedures (MICR 3053) fits in the curriculum, and students and faculty expressed concerns that some of the course material may be redundant with other required labs. Students also expressed the desire for more course support (e.g., tutors, supplementary instructors or SI, teaching assistants or TA), especially in MICR 2054. Such course support would benefit the students, the tutors/SI/TAs, and the faculty. Students were not generally enthusiastic about online courses, but indicated that night courses might reduce scheduling challenges.

While the many lab courses are a strength of the program, the Review Team was concerned that faculty do not receive sufficient workload credit for teaching/designing lab courses (0.25 for faculty). The Review Team understands that lab courses are difficult to design and implement and should be equivalent to lecture courses. In addition, whereas students are encouraged to do independent directed research with a faculty mentor (and the Review Team agree that this is an important experience for Microbiology undergraduates), this part of the curriculum seems not well supported: students can only take 3 credits of independent research and faculty do not get full credit workload for these time consuming efforts.

Recommendations: The Review Team encourages the faculty to review the overall curriculum and course offerings to ensure they are offering the most important courses with the most impact, and looking for ways to reduce their offerings to make the scheduling and teaching loads more flexible for faculty and students. For example, are there elective courses that are under-enrolled that could be dropped so Genetics and Physiology be offered every semester? The Immunology lab was separated from the lecture-- does every core course need a lab? Or could labs be combined in some cases? How could MICR 3053 be revised to eliminate unnecessary redundancies and to better fit the needs of the students and the curriculum?

We think the new emphases/concentrations strengthen the curriculum and we encourage the consideration of adding a Food Science emphasis/concentration. As faculty retire, the new hires will need to support the department emphases.

We agree that course titles are important in branding courses and the department to advisors and students. Updating the Public Health Microbiology course to make it stand out in the Microbiology and General Education programs may help to attract more students to Microbiology and the College of Science. This could include updating the course description and improved outreach to college and department advisors to make it clear that this is the LS course for non-majors. The faculty should ensure that both 1153 and 1113 are fairly similar in content

and assessment. The WSU courses are an excellent opportunity to expose more students to the field of microbiology and we appreciate department support of these innovative general education courses.

We recommend that students be allowed to take more than 3 credits of independent research such that students can get their research going in their junior year and have adequate time to get a product for a conference presentation. This will benefit both the student and the faculty mentor to have trained students working in the lab for at least two years. As more research-intensive hires in the department occur, the department may need to consider replacing upper-division laboratories with more directed undergraduate research experiences. We also recommend that current workload policies be revisited in the department and College of Science to provide faculty more support for lab and research efforts. Students should be given the opportunity to tutor and mentor other students as teaching assistants and SIs for credit. This would help support the labs, many of which have 32 students per room.

Standard C. Student Learning Outcomes & Assessments

a. Learning outcomes should reflect expected skills and behaviors achieved by graduation
b. Learning outcomes support goals of program
c. Learning outcomes linked to curriculum (with matrix)

Assessment

a. Programs has clearly defined assessment plan
b. Each learning outcome has a direct measure that is public
c. Evidence of learning is collected and reported regularly
d. Program faculty meet regularly to discuss results
e. Assessment results are being used to improve teaching & learning (i.e., close the loop)

Strengths: The curriculum learning outcomes for the program are based on national recommendations, and reflect core concepts in microbiology. These have been mapped to all courses in the curriculum, ensuring that all learning outcomes are addressed. There is good assessment at the curricular level, and the Chair is commended for much of this work.

Areas for Improvement: While much thought has gone into mapping the program learning outcomes to courses, the Review Team believes that many faculty members are not aware of the learning outcome matrix. While we did not see any course-based learning outcomes, most faculty members said they had them. With the exception of a few faculty, it was not evident from our conversations that faculty were using the learning outcomes to direct or improve teaching. Faculty also do not seem to be sharing learning outcomes when they are teaching the same courses within the same or different semesters (e.g. MICR 1153 and MICR 1113).

For many faculty members, assessment meant the forms they fill out for reporting, and they are unclear on how that data is used. Faculty are concerned that they work hard to generate useless data. There seems to be disconnect among some faculty regarding how to use learning outcomes and assessments to improve teaching and learning. We suspect many faculty members

are doing this informally, revising courses each year based on student feedback or "how a given activity went," but they may not be using evidence-based and standardized methods of assessment.

It was not clear that the faculty meet to discuss course learning outcomes and how they relate to overall program learning outcomes and goals, and they do not share assessment methods to determine how these learning outcomes are being assessed.

Recommendations: We highly recommend that the faculty as a whole take time, either at an annual retreat or on a quarterly/monthly basis, to share course learning outcomes and how faculty strive to assess them. Faculty teaching the same courses should be using most of the same learning outcomes. Assessment of these learning outcomes does not have to be identical, but it should address all the learning outcomes.

Faculty should divorce the assessment process in their classroom from the reporting that they do for the College and University. The kind of assessment information that is useful in the classroom is often not what is required for reporting.

Faculty should receive training and professional development on how to connect learning outcomes and assessment to ensure that the assessment is being done and that the "loop" is being closed to improve student learning. There is clearly some deep knowledge of this process within the department, but it is not universal. One recommended approach is to pick a priority assessment outcome (e.g. Are students achieving our learning outcomes for quantitative skills? Or data analysis? Or certain lab skills?), and then collect data on that one outcome for a year, and then have a collective discussion about the learning outcome, the assessment data, and how to "close the loop". A standard rubric or series of questions within core classes can provide assessment. Also a possible senior-outcomes assessment (exit-survey) prior to graduation may help to assess learning outcomes. The Review Team recognizes that collecting and analyzing assessment data requires resources and support. This may come in the form of help from Office of Institutional Effectiveness or the College of Education, student internships, or additional support in the form of course-release for interested faculty and financial support for staff.

Standard D. Academic Advising

a. Clearly defined strategy of advising
b. Students receive appropriate assistance in planning course of study
c. Students receive appropriate assistance in planning career

Strengths: Currently, new students first go to advisors at the Student Success Center or in the College of Science for assistance with general education and AS-level requirements. Weber is now implementing new procedures for campus-wide new student orientation. If students show an interest in science, they are directed to a College of Science Advisor. The new Biology AS degree is fantastic because it should help to ensure that students take the appropriate general education courses for the College of Science in their first 2 years.

If students are interested in Microbiology, they are directed to Chair Domek or Dr. Culumber for advising. Such centralized advising is a strength since it ensures that students are receiving consistent information about the department and curriculum. The 3 concentrations should help students choose electives by giving them even more structure within the major.

Students are encouraged to meet once a year with an advisor. The centralized advising within the department seems to be working. Students appreciate the flexibility of the program and feel cared for by the faculty, most of who seem to have open door policies. The faculty are overwhelmingly available to students, which takes a fair amount of their time. Informally, students said they hear about which courses to take from other students, including the students in the Microbiology Club.

Build Dairy is the closest thing to a formalized pipeline that works for internship and career placements. [BUILD Dairy is a network of colleges and dairy food companies and organizations in the western region. Its goal is to build university and industry linkages and they provide funding of stipends to increase the number of students conducting dairy food research.] The departmental advisory board and Dr. Keswick are also deemed significant strengths for career advising and placement.

Areas for Improvement: Students who are interested in science need to know which courses count and do not count toward bachelor's degrees in the College of Science. This is especially problematic with high school students who are taking college-level courses via concurrent enrollment or early college. Students may make mistakes in course selection that delay their graduation.

When asked about career decisions, students said their conversations with faculty advisers are valuable. Interactions with faculty are likely best for upper division students who are performing directed research. But for students who are less engaged with the department, it's not clear how they are getting information about career planning and placements. Students may need more centralized information about internships, directed research, study abroad and fieldwork.

Recommendations: The Biology AS degree should help with scheduling and advising issues currently facing the department. Centralized advising seems to work in the department, but <u>all</u> advising faculty must be compensated with release time for the time and effort that goes into meeting with students. In addition, the department could alleviate some of the pressure on faculty by providing advising support through other means. One suggestion is to develop an Advising Handbook to provide more information about the program and major for students (see Psychology for an example). Such a Handbook should be made available in the department and online on the department webpage for easy student access. We also suggest exploring whether or not the Microbiology Club could play a role in some sort of informal peer advising. For example, have Club members host periodic get-togethers to talk about courses and how they found internship or career opportunities.

The committee supports the efforts of the Advisory Board to develop alumni contacts for information, mentoring, job, and internships. Dr. Culumber's use of the Micro Seminar also facilitates out-of-classroom experiences by providing the opportunity for co-op work experience (students write a paper and get employer feedback).

Standard E. Faculty

a. Faculty size, expertise, professional development are aligned with mission
b. Programs has core faculty required to maintain quality program
c. Adjunct faculty are qualified
d. Program strives to achieve diversity among faculty
e. Plan in place for mentoring new faculty
f. Plan in place to assignment teaching and service loads
g. Teaching is monitored to assess effectiveness
h. Have formal periodic review process for faculty

Strengths: The faculty are very dedicated to their mission, students, and the field of microbiology. The Chair sets the workload based on areas of expertise and course demand. The Review Team commends the Chair and faculty for their work effort. The Chair noted several times how the faculty rarely decline a request to do more. Each faculty member seems to have found his/her niche in the department. The adjunct faculty member, Daniel Clark, seems particularly dedicated to teaching and learning. Clark was one of the few faculty who mentioned seeking help from other faculty to learn how to better use learning outcomes and assessments to evaluate student progress. The College has a new Dean who appears supportive and especially concerned about mentoring new faculty.

There seem to be opportunities on and off campus for professional development, including a retreat for new faculty and a retreat for adjunct faculty. The Chair has encouraged, and offered to pay, faculty to participate.

Areas for Improvement: There is some concern that the current workload may not be sustainable, especially among some key and newer faculty members who are also trying to maintain research programs. Faculty teaching load expectations seem to leave little room for any flexibility in the teaching schedule or sabbatical leaves. Other departments allow faculty to build up "bonus credit" for mentoring research students. However, course release in this department may be problematic because so many courses, that all have laboratories, are offered with a small number of faculty and no undergraduate/graduate teaching assistants. In addition, while we did not see a shared departmental workload policy or tenure policy, faculty indicated that beyond teaching, research and service were also expectations.

We have particular concerns for the new hires taking on "too much, too soon". There appears to be some mentoring, but no formal mentoring program. A group of early career faculty from a number of College of Science departments sent a memo to college administrators

asking for workload changes and more support. We hope the department and administration support their efforts.

Only a few faculty members have taken advantage of professional development opportunities, and most have only been to one or two events during their careers. One barrier seems to time since many faculty teach labs all afternoon.

Teaching is periodically evaluated by the Chair and senior faculty, but classroom teaching is rarely observed. Student evaluations appear to be one major source of information, as are assessment reports. However, studies have shown that student course evaluations provide little insight into teaching effectiveness.

The message surrounding the goals of faculty research programs is not clear and not well supported. Faculty are provided a start-up package for research with undergraduates but often not provided a laboratory or bench space in which to perform research.

The faculty at this time is not particularly diverse relative to its population.

Recommendations: We encourage the Chair to try to build more of a culture of learning in the department, not just for the students but for the faculty. Conversations among the faculty about teaching could help, as would more encouragement and requests to participate in professional development. The faculty should be encouraged to talk about evidenced-based teaching approaches at faculty meetings. Dr. Culumber has put forth good efforts to do this. Teaching certainly should be part of any strategic planning discussions.

We encourage the Chair to consider having a department faculty retreat to address some of the issues around professional development, curriculum, and mentoring. Perhaps by reducing redundancy in some courses and the number of electives offered, and exchanging course laboratories for more directed research opportunities, the teaching schedule can become more flexible and can also support faculty research efforts.

Student evaluations should not be used for assessment of teaching (i.e., to determine if the course is ‘good’ or a faculty member is doing a ‘good job’). There are a number of teaching practice inventories (e.g., Wieman et al.) that examine whether faculty are using a range of different teaching practices (not just lecture with PowerPoint slides) and allows faculty to monitor their progress over time. In addition, peer-observation of teaching should be utilized.

We recommend that at least one new faculty line be directed to the Microbiology Department. These new hires should be strategic to areas of expertise that will provide more teaching flexibility for all faculty. A new hire may be more research intensive to provide more undergraduate research opportunities, but a new line for faculty with expertise in STEM education and a teaching focus would also greatly benefit the program. We encourage future search committees to put forth extra effort to diversify.

Standard F. Program Support

a. Number and capabilities of staff adequate to support mission and objective
b. Administrative support available to assist staff
c. Facilities, equipment and library capable of supporting program mission

Strengths: The current Administrative Assistant, Katie Nelson, is clearly an asset to the department. Katie is organized and efficient. The monthly staff meetings in the College of Science are providing her with critical information. In addition, the Review Team was impressed with the level of support provided by the Lab Manager, Karen Mann. Karen Mann has a background in GLP/GMP and has put together a set of safety training procedures that are very beneficial to the Department. The department staff is clearly hard-working and dedicated.

The new building, Tracy Hall Science Center, also is a clear asset to Microbiology since the last review cycle. The building has a beautiful open floor plan to promotion collaboration and faculty-student interaction, along with excellent, state-of-the-art teaching lab spaces, including biosafety cabinets and new equipment, worthy of much envy. Students seem to get adequate safety training. The location of the autoclaves and space for media prep is appropriate to reduce biosafety concerns. There were no concerns put forth by faculty/staff about adequate teaching lab space. In addition a confocal microscope is available for teaching and research.

Areas for Improvement: The Review Team was in agreement that the Department has more than enough work to support the Administrative Assistant as a full-time employee. In addition, the Administrative Assistant may need more access to training. More salary support for the Lab Manager may be required to ensure low turnover in this position.

While the teaching space in the new building is excellent, the faculty are in critical need of more research space. Research space is so lacking that some faculty have to move between multiple spaces and others share small spaces among them. Research experience is increasingly necessary for students going on to post-graduate training or into the job market. Because students often find their passion and develop problem-solving skills through research, it is critical the Microbiology have adequate space for both faculty and student research. The Review Team noted that one laboratory centrally located in the department (TY 466) continues to sit vacant while new Microbiology faculty hires do not have enough bench space. There is also a need for servicing plans for current laboratory equipment.

In addition, there continue to be some concerns regarding laboratory safety and faculty compliance of regulations in teaching labs. It is sometimes difficult to monitor thirty-two students in each lab space without additional help.

Recommendations: While the Administrative Assistant seems content with her part-time position, there is clearly much work to do. We encourage the Department to make time for continuing professional development.

In addition, the Review Team strongly recommends that additional space be dedicated to faculty research laboratories. In particular, faculty are in need of a BSL-2 research laboratory

with easy access to autoclaves and media prep space. TY 466 is exactly what they need, and it was not clear to the Review Team why that space was not being developed for Microbiology.

Finally, additional levels of support for biosafety in both teaching and research are recommended through the use of protocols through the Institutional Biosafety Committee. The Microbiology Department should have a faculty representative on this committee. Student teaching assistants in the lab classes could help improve monitoring and lab safety.

Standard G. Relationships with External Communities

a. Formal external relationships exist
b. Role and contribution are clearly defined
c. External advisory board exists and communicates regularly

Strengths: The Advisory Board and Dr. Keswick are clear strengths for Department connections to local industry and career prospects. The Board meets regularly and also interacts with students. The Advisory Board is clearly interested in providing career and skills support. The formal University connection to a local high school (NUAMES) is a strength that works to attract promising students. Students have a mechanism for taking local external internships for credit that can lead to careers. The BUILD program is a great strength for supportive undergraduate research.

Areas for Improvement: While internships exist, there is no centralized organization or easy mechanism by which students can find them. More avenues to fund undergraduate summer research and external internships need to be explored.

Recommendations: Include internships as a potential senior "capstone" experience and have students present their work to the department. We encourage the entire faculty to interact with the Advisory Board, which is interested in providing more support and information to the faculty about the skills that students need in the workforce and job opportunities in the region.

Standard H. Program Summary

a. Program showed it implemented recommendations from previous review

Strengths: The Department has provided evidence that it was very responsive to the previous program review. Most notably, the construction of Tracy Hall Science Center resolved many concerns surrounding the need for additional, and safe, teaching and research space. A Strategic Plan was developed, which includes Program Learning Outcomes and curriculum/concept mapping. General Education courses were assessed and standardized across sections. Student advising was improved and streamlined from the College to the Department. A new Laboratory Manager and Administrative Assistant were hired. Some scheduling adjustments were made to reduce student course bottlenecks. Finally, a new faculty line was added.

Areas for Improvement: While these are impressive changes to almost all goals since the last review, the Review Team did not see much evidence of increased collaboration with other Departments, with the exception of the development of the Biology AS degree and the development of successful WSU courses. In addition, there was not enough change to reduce faculty SCH loads, and credit load for lab contact hours remains below the national standard.

Recommendations: A faculty workload model with lower SCH loads should be developed to support both teaching and research. This model will likely require the hiring of a new faculty line to ease scheduling and research constraints. Changes to credit load policies are needed to support the faculty in laboratory course development and teaching.