Program Review: Department of Chemistry and Biochemistry
Dean's Response
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I would like to thank the program evaluation team members, Dr. Lou Cannizzo (Northrop Grumman), Dr. Angelica Stacy (University of California Berkeley), Dr. Matt Horn (Utah Valley University) and Dr. Matt Nicholaou (Weber State University) for their critical assessment of the College of Science (COS) chemistry and biochemistry programs at Weber State University. I would also like to acknowledge Dr. Laine Berghout (Department Chair) and the faculty members in the Department of Chemistry and Biochemistry for their excellent self-study and their thoughtful and proactive response to the review team's report.

I have thoroughly reviewed the departmental self-study, the program review team's report and the Department of Chemistry and Biochemistry's response to the review team's report. The review team highlighted the many outstanding attributes of the chemistry and biochemistry programs and also delineated a few areas of concern. The dean's response provides commentary on observations made by the program evaluation team as well as the chemistry and biochemistry faculty response. The dean's response follows the organizational structure used by the program evaluation team in the body of their program review report.

Standard A. Mission Statement
The review team commends the Department of Chemistry and Biochemistry on an "excellent job capturing the overall mission of the department." The team went on to say that the "mission statement clearly defines the educational program in terms of degrees offered, education focus, research opportunities, and the objectives of the educational program for different groups at the university who participate in the program." The dean concurs with the review team's assessment and commends the department for their comprehensive mission statement.

Standard B. Curriculum:
The review team recognizes that the chemistry and biochemistry curriculum has undergone significant change over the last five years including the addition of a biochemistry bachelor's degree and curriculum alterations to meet the new ACS program standards. The Chemistry (BS) and the Biochemistry (BS) programs are ACS certified. The dean appreciates the diligence of the department chair and the faculty in making the ACS program changes a curriculum reality in such an efficient and timely manner. The review team noted that their interviews with faculty and students clearly indicated that the department offers an "excellent and comprehensive curriculum." The interviews also indicated that the faculty are deeply invested in the success of their students and in the excellence of their teaching. I agree with this positive review of departmental efforts in this area and highly commend the department for their work. In agreement with the review team, I also commend the department for implementing thoughtful changes to the course schedule and expanding course offerings to ensure that students are making good progress towards graduation.

The team noted that interviews of faculty and staff "identified that the servicing of the lower division and introductory courses are a clear challenge to the department." Indeed, the review team commented several times throughout their report about the heavy faculty and staff workloads. They recommend the

hiring of additional personnel to support the labs and the teaching laboratories and/or an additional faculty member to share the teaching load. The College of Science leadership team (dean, associate deans and all department chairs) had previously identified this issue and prioritized a new faculty line for this department. A strategic college-wide request was supported by Provost Krovi and we expect to have a new faculty member in this department by July 1, 2021. This new chemistry faculty line meets one of the review team's major recommendations and we expect this hire to alleviate some of the challenges described in the review team's report.

Standard C. Student Learning Outcomes and Assessments:
The review team recognizes that the department has put significant effort into their assessment strategies and that adequate assessment data is being collected. The review team also agreed that student learning outcomes were well thought out and clearly defined in the curriculum maps. To retain ACS certification, the department must adhere to the learning outcomes (delineated by the ACS) which includes a broad array of skills and knowledge including lab safety, chemistry literature review and information management, problem solving skills, team skills, communication skills, and ethics. The dean commends the chair and the department faculty for their timely response to the recent changes in ACS guidelines and program evaluation procedures. The review team did note that, while the student learning outcomes were well described and delineated, communication of the assessment results are not well distributed across the faculty. The team recommends that the department compile and assess the learning outcomes data annually and share the results with faculty. The review team also recommends that the department establish and begin "using clear and defined thresholds for assessing student success, such as a minimum score on the ACS exams or other measured competency that relates to the learning outcomes." The dean not only concurs with these suggestions, but recognizes that the department intends that the "course leaders" model (see below) will "facilitate implementation and articulation of uniform assessment thresholds across sections of their courses as recommended by the review team."

The review team also raised the concern that assessment of learning outcomes may differ across faculty who are teaching sections of the same course. In response to this, the chair and the faculty have decided to pilot "course leaders" for those courses where different faculty teach sections of the same course. The hope is that this approach may "ensure that unified course objectives and assessments are being used across sections." I support this strategy and would only suggest that "course leaders" be skilled communicators and ground their leadership strategies in an understanding of the respect, independence and academic freedom that their peers will expect.

The review team was very positive about student perceptions of the curriculum and the faculty. "The students raved about their professors and the knowledge they received while progressing through the various programs. They were genuinely excited by the new curriculum offerings, like medicinal chemistry, and feel they are well prepared for careers in the chemical sciences." The dean appreciates these comments and the department's commitment to providing cutting edge curriculum to their students. I also commend the department for their ongoing and extensive exit interviews of their students when they graduate. These exit interviews have provided the department with a history of student perceptions of assessment strategies and program outcomes as well as other valuable pieces of information.

Standard D. Academic Advising
The dean applauds the faculty in this department for their commitment to the success of their students. She recognizes that for many students and faculty there are strong advising and mentoring relationships.

Having said this, the review team did feel that advising within the department could be strengthened. The team felt that the primary weakness of the advising system was that it catered only to proactive students who, "…actually go to the effort of aligning their advisor with their interests." The team went on to suggest that the advising system used by the department "demands a great deal of unofficial communication between students about who is and who is not a good advisor. Any students that sit outside the traditional power structures of the student body face the real possibility of worse outcomes based on nothing more than their own bad luck as they enter the program" (students are initially assigned an advisor by their names). I found this idea, of students sitting outside the traditional power structures of the student body and how that can affect their success in higher education in ways we might not be considering, thought provoking. This could be a good topic for university-wide discussions relating to retention.

The review team recommends that the department formalize the "advisor change" procedure so that all students may benefit from a good advisor/student alignment. They also recommend that advising become a formal part of a faculty member's workload. In response to these recommendations, the department has decided to pilot an advising system where three faculty members are assigned formal advising responsibilities and would be given associated reassigned load as appropriate. The department is also considering innovative ways of requiring students to meet with their program advisor. The dean concurs and is supportive of these strategies.

Advising in general, is not just an issue for this department, but is a university–wide issue. In this dean's experience, mandatory advising can have very positive results for students, but that is a university-wide discussion outside the scope of this document.

Standard E. Faculty:
The review team commends the core of faculty in this department as strong, qualified and "clearly committed to the success of their students." The review team and the dean recognize that there are innovative teaching practices occurring in the department and that faculty members in the department are passionate about undergraduate education. The review team contends however, that active teaching and learning strategies are not being implemented across the curriculum. "Students are not thriving in the courses where improvements with active pedagogies are not being made." The dean, department chair, and many of the department faculty are fully aware that "there is clear evidence in the chemical education literature that active learning pedagogies produce superior results to passive learning approaches." The dean notes that active learning strategies are especially critical in gateway chemistry courses. The review team recommends that the department figure out a way to reward faculty that are using active pedagogies and encourage those who do not. In addition, the review team recommends that the department consider "mandating reasonable course improvements by providing support to faculty and setting clear and achievable goals for each time that the course is offered." The dean does not necessarily agree with a "mandatory" course improvement approach, but does support (and has supported in the past) alternative strategies (workshops, conferences, college-wide presentations etc.) targeting faculty who are not currently using active pedagogical methods. Several department faculty members are leaders in the COS in utilizing Process Oriented Guided Inquiry Learning (POGIL) in their courses. Perhaps, more faculty can be incentivized to consider this approach.

The department is hopeful that the course "faculty leader" model will "help encourage implementation of active learning pedagogies by encouraging faculty to work together to design activities and assessments that promote active student engagement in the learning process." The dean will work with the department chair and the COS leadership team to determine whether and how we may be able to incentivize faculty to implement active learning approaches in the classroom.

The review team also recommended that the department "needs to build strength in research to provide opportunities to undergraduate students." The dean recognizes that the department does provide a significant number of research opportunities for their students including through capstone experiences required by all ACS certified majors, through Research Experience for Undergraduates (REU) programs, through required capstone research experiences etc. The dean recently attended Zoom research poster presentations by upper-level chemistry students and was very impressed with their professionalism and their knowledge.

The dean commends the department's desire to increase active learning strategies and to expand undergraduate research. I also understand the realities of the current teaching loads and the fact that most faculty simply do not have the bandwidth to undertake substantive reform. Nevertheless, I support the desire of many faculty members within this department and across the COS to increase active and inquiry–based learning pedagogies and to expand undergraduate research. I recognize that workload issues impede this progress. The COS academic leadership team has spent part of the last couple of years addressing workload issues. We know from the data that active learning pedagogies, including undergraduate research enhance student retention and success in the sciences and mathematics. We recognize that many COS faculty members are eager to implement these kinds of strategies, but need support from administration to really move in this direction. The dean is prepared to continue her support (as noted above) and encourage forward progress in this critical area.

The review team commented on the popularity of the newer biochemistry program and the strain that the success of this program is putting on all of the faculty in the department. Again, the new faculty line which has been procured for the department should help to alleviate this strain.

Finally, the review team recognized that "the diversity of the chemistry department is weak." They recommend that the department develop "a plan to systematically improve the representation of underrepresented minorities in the chemistry department." This is not just a departmental issue, but is a college and university–wide issue which has been prioritized in our current WSU strategic plan (in development). This dean, this department, and the entire COS is committed to building an inclusive environment that is welcoming to students from all backgrounds. For the new chemistry faculty line, the search committee has been working with personnel from the WSU diversity office. The search committee has altered the job description to ensure inclusive language throughout and the department and the college have funded additional recruitment ads in publications that serve underrepresented communities. Due to a new university-wide program focused on increasing underrepresented faculty across our campus, the COS will be able to offer additional salary support to candidates from these groups. The COS is hopeful that these strategies will encourage faculty candidates from underrepresented minorities to accept positions in the COS and to build their careers with us.

Standard F. Program Support:

The team comments that the two individuals that serve as support staff know the "workings of the chemistry department inside and out." This is not to be taken lightly. Support staff who know the department, college and university procedures and rules "inside and out", are invaluable. During

interviews with these two staff members, the clerical staff member did not indicate that she was overworked, but the lab support staff member is clearly stretched far too thin. The review team commented that comparable sized schools have three lab managers to handle chemistry classes (general, organic, and upper-level chemistry classes). In this case, our single staff member supports all of the departmental lab needs and she manages the stockroom/store. The review team commented that "it defies believability that the department is as well-served by their staff as they could be if their staff were not so overworked." The dean learned through this review process that a second staff member in this department was previously lost to budget cuts. The review team recommends restoring that staff line. The dean is aware that lab support is a concern across the college. Numerous students have historically been employed as lab or stockroom assistants. In at least two COS departments (including chemistry), student assistant numbers have dwindled significantly (almost to zero with the pandemic) and there is no one to take up the slack except (in both departments) the single lab manager. In partial response to this need, the COS leadership team prioritized the hire of an equipment/instrument lab technician who could also help with some of the equipment setup for labs and for undergraduate research efforts. The COS is in the middle of a search to fill this position. The dean expects that the hire of this COS instrument tech along with the new faculty hire in this department will alleviate some strain. However, I am also aware that this will not be a fix-all, and that we may need to consider hiring a couple of lab assistants on a more permanent basis in the COS.

Standard G. Relationships with External Communities:
The review team and the dean recognize the efforts of this department in terms of community outreach noting several very popular chemistry field trip site visits, internships of students at external laboratories, and community outreach events. The dean also recognizes the questionable sustainability of these activities given the amount of time and effort required from faculty to pull off field trips, internships, and community events. The dean and the COS leadership team recognize the value of departmental and college outreach efforts and we are taking these kinds of "hidden" activities into consideration as we assess and reconsider faculty workload across the college.

Standard H. Results of Previous Program Reviews
I concur with the review team that the department did a fantastic job of responding to all previous program review recommendations. The hire of a new analytical chemistry faculty member which was recommended in that earlier program review is now underway. However, the recommendation to increase funding to support faculty research (decrease teaching loads) has not been accomplished due to budgetary constraints.

In summary, I am excited about the future for this department. I will continue to give them my full support as they move forward to, in their words, "make real and substantial progress toward accomplishing our goals to improve and transform the Chemistry and Biochemistry programs at Weber State University."