

External Review Report
Monmouth College, Chemistry Department
April 26, 2019

External Reviewer

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Introduction

The reviewer conducted a one-day on-site visit on April 26, 2019. Prior to the site visit, the department provided several documents to offer background and the department. These documents included a departmental self-study, faculty CVs, course syllabi, information regarding summer research projects, results of a recent alumni survey, recent American Chemical Society annual reports to support ACS accreditation, and a listing of the courses taught (with enrollment values) for the previous six academic years. Other important documentation, such as information from the academic catalog, college's Mission Statement, and the most recent Strategic Plan, was found on the college's website by the reviewer. Additionally, the reviewer asked the department to complete a SWOT analysis.

The on-site visit included an evening dinner with the department and a full day of meetings with various stakeholders across campus. The reviewer met with each member of the chemistry department including the chemical technician who provided a tour of the facilities. Additionally, the reviewer met with Dean Willhardt, Associate Dean Gersich, and Eric Engstrom (Biology) who chairs the faculty's Assessment Committee. The reviewer also attended a lunch discussion with current students, and, finally, a brief hallway conversation occurred with Chris Fasano (Chair, Physics).

Background and Goals for Departmental Review

Monmouth College has recently been reaccredited by the Higher Learning Commission with the requirement of an embedded report during its Year 4 Assurance Review. As part of this process the college is undergoing a comprehensive external evaluation of each of its academic departments. It is the understanding of the reviewer that this review of the Chemistry Department is the first of those department reviews, and possibly, the first departmental review at Monmouth in a very long time.

The college's President, Clarence Wyatt, arrived in 2014 and spearheaded the development of a strategic plan which, in part, asks the college to create a culture of planning. Regular departmental reflection and review is a necessary part of the planning process. Additionally, at least three other aspects of the Strategic Plan have direct impact on the Chemistry Department – enrollment management, new academic programs in emerging fields of

inquiry, and the “Doing the Discipline” portion of Strategic Direction One. Each of these will be discussed in the review of the department.

The chemistry department is accredited by the American Chemical Society which indicates that its curriculum, facilities and resources meet the national standards for chemical education. As such, this report is structured based on the ACS accreditation criteria as this provides an accepted set of external standards that the institution has committed to meeting (or exceeding).

1. General Program Support and Organizational Structure

The Monmouth Chemistry Department consists of 4 tenured/tenure-track faculty, a laboratory coordinator and a part-time secretary which is shared among eight departments. The department is responsible for supporting the Chemistry and Biochemistry majors (both BA and BS degrees) and teaches courses in support of the investigative forensics minor, the general education Integrated Studies program, and numerous pre-professional tracks for students preparing for careers in medicine, pharmacy, dentistry, and other professions.

The department is well regarded among the administration and their peers. In fact, it was selected as one of the first departments to undergo review due to their reputation as providing a well-organized, engaging, and quality education for their students. Both administrators and faculty members spoke highly of the department and praised their teaching, their commitment to the college, and their ability to create a cohesive cohort of students within their department.

The department is housed in the Center for Science and Business, an academic building which also houses Biology, Physics, Mathematics and Computer Science, Psychology, Accounting, Political Economy and Commerce, Political Science, and Kinesiology. Students in the science departments meet each Friday afternoon for “Science Seminar” where they are required to give presentations on topics in the discipline to their peers. This has proven to be a valuable experience for all students and provides a way for both faculty and students in the sciences to network. Chemistry faculty have curricular collaborations with faculty in the Art, Biology, and History Departments and the newly created neuroscience and engineering majors provide another avenue for partnerships. Despite being in the same building there are a lack of sustained collaborations with faculty members in business.

2. Budget

The department has sufficient funds in the yearly operating budget to maintain their day-to-day activities. Additionally, there are several department-designated endowments which support student academic scholarships, student travel to meetings, instrumentation purchase, and student/faculty summer research. Quite frankly, the amount of monetary departmental support is outstanding!

The college supports salary for both student teaching assistants and student course peer tutors. Teaching assistants are an integral part of chemistry departments across the country and

the concept of peer tutors is innovative and is a great way to enhance and support student learning.

The faculty have been active in pursuing monetary support from external funding sources. These grants have been used to support instrumentation for both teaching and research, student development, and innovation in teaching. Several of these are collaborative grants with others, including with regional colleges and universities. This is a great way to leverage funding opportunities and to help build networks.

3. Curriculum

The Chemistry Department offers an appropriate and rigorous curriculum for its majors and minors. The chemistry major is certified by the American Chemical Society and that recurring review process ensures that curricular content and professional training standards are met. The frequency of course offerings for the foundation and in-depth courses are sufficient to meet the needs of their students.

The chemistry faculty are dedicated to innovative instruction with many examples of new concepts and ideas implemented throughout their courses. This is due to the dynamic nature of the faculty and is supported by generous endowed funds available to the department.

Undergraduate research is a key component of the department's curriculum. All chemistry and biochemistry majors are required to participate in research with a faculty member which culminates in a written report. Along with the Science Seminar and, for most students, presentation of results at regional or national conferences this experience is a capstone to a strong curriculum and is unique among the department's peers.

4. Faculty and Supporting Staff

The Monmouth College Chemistry Department has the minimal number of faculty required to be able to provide the appropriate coverage of topics in a chemistry and biochemistry program. The department acknowledges that there is weaker coverage in the area of inorganic chemistry. It is expected that a fifth member of the department will be hired within the next year in order to support the college's new neuroscience major. While this will help in terms of providing support for a fledgling neuroscience program and likely support the biochemistry major, this will not help fill gaps in the chemistry coverage. The current faculty have been doing all they can in order to ensure a well-balanced chemistry curriculum, but there is a point where this can not continue to be the case. This is compounded by the fact that most members of the department, while trained within specific sub-disciplines within chemistry, have significant interests and overlap with biochemical applications. The faculty members agreed that this enhances collaboration and support within the department, for instance such as in shared research projects; however, this leaves little room for students to experience diverse applications of chemistry. This observation is supported by the alumni survey provided in the review documents.

As mentioned above, the faculty are dynamic, engaging, dedicated to their students, and active educators and scientists. It is a collegial group which appears to work well together, communicate their needs and concerns with each other, and collectively work to make the education of their students the priority. Three of the faculty have been at Monmouth for over 12 years while the fourth has been on campus for over four years and all of them have made a clear commitment to Monmouth College. This stability within the department was mentioned several times as a key component in helping the department function at such a high level.

The department is supported by a talented full-time laboratory coordinator. He is responsible for setting up the teaching laboratories, inventory, purchasing, chemical waste management, and a portion of the instrumentation maintenance. The laboratory coordinator is an integral part of the department and is respected and appreciated by both students and faculty.

5. Students

The department graduates approximately 12-16 total majors each year (chemistry and biochemistry). This number has remained consistent even with lower overall college enrollments which is an indication of the strength of the program. During conversations with students over lunch the reviewer learned that the students appreciate the faculty's office "hours". As it turns out, when students talk about chemistry faculty office hours they are actually referring to the open door policy that is adopted by the faculty. Office doors are always open and faculty readily answer student questions. Students feel comfortable to not only ask questions about course content, but to also talk about classes, research, and careers. This is a great mentoring relationship that sustains the culture within the department. Overall, the students speak highly of the chemistry/biochemistry program and of the department's faculty.

A concern of those outside of the department is that the students seem to be compartmentalized within the chemistry department. The reviewer observed little evidence that this was the case. Of the students that attended the lunch (approximately 12) all were involved in curricular or extracurricular activities across campus. Several were involved in sports or music ensembles which tend to consume a good amount of the student's time. Yet, all were also involved in their departmental activities, including research and/or working as teaching assistants or peer tutors. This level of activity both within and outside of the department is to be expected of strong chemistry departments in liberal arts colleges and is a healthy sign of active, experiential learning.

6. Facilities and infrastructure

Having moved into the new Center for Science and Business in 2013, the department has access to updated and modern classrooms and laboratories that are properly maintained, well-equipped, and safe. The department has sufficient laboratory space for courses; however, there seems to be a minimal amount space for departmental research activities, especially given the number of students involved in undergraduate research. When asked about this concern, the

faculty did not indicate that this was a problem and said that they work carefully with each other to ensure adequate space for each of their research students.

The new building also has the unique and interesting concept of a food chemistry lab. This space provides opportunity for nutrition classes, food chemistry research, and the Monmouth Coffee Project. It appears that the department is the only user of this space which should and could be utilized more broadly.

The department maintains a nice array of modern instrumentation including a 60 MHz NMR and an EPR spectrometer. The department also maintains a computer server which supports modern software capable of performing molecular computational chemistry. Additionally, the department has a full complement of makerspace tools which include several 3D printers and a laser cutter.

The department is rightfully proud of their current facilities, instrumentation, and equipment. Endowed funds help to support the purchase of new instruments and to support instrument repair. The faculty and the laboratory coordinator, in addition to all of their normal activities, are expected to perform routine maintenance.

Recommendations

Mission. In none of the review documents or in any conversations with members of the department was there a reference to a departmental mission. The reviewer suggests that the department carefully consider writing a Mission Statement and/or Vision for the department. The mission should follow from the College's Mission Statement (which, by the way, was difficult to find on the college's website) and is separate from the Learning Objectives put forward in the departmental self-study. The Mission Statement is a formal statement of the goals and values of the department which helps to guide all decisions made by the faculty for the department's future direction. It will allow the faculty to think forward and to help focus their decision making processes. It is apparent that the faculty have clear ideas on what the mission and goals of the department are; therefore, it is expected that formalizing and agreeing upon the Mission should be straight-forward.

Assessment. Monmouth College is just beginning to restructure the campus-wide assessment process and departmental external reviews are one component of that re-envisioning. The chemistry department has begun to consider what it means to have a culture of assessment and have already discussed ways that they can implement assessment within their curriculum. As an example, for many years standardized ACS exams have been given in several courses and have been used to evaluate student learning. The long-term trends observed from the results of these standardized exams, when keyed to specific learning goals or topics, can be used to inform departmental curricular and teaching emphases in the future.

Assessment is necessarily a multi-faceted process and not only content knowledge should be assessment. Learning Objectives, in general, are more difficult to assess, yet this process is necessary in order to show the effectiveness of a program. The faculty are encouraged to continue to think about ways to measure the progress of their students with regards to the

learning objectives. They have suggested embedded questions throughout a course or even throughout the curriculum as a way to do this. Another suggestion would be to look at the framework put forward by the Association of American Colleges & Universities VALUE rubrics. These rubrics work to assess broader student learning goals and the examples provided may give the faculty ideas on other ways to implement assessment to complement those already discussed.

Support Personnel. Multiple times during the on-site visit it was mentioned, by both administrators and chemistry faculty, that administrative assistance to the department (and other departments in the Center for Science and Business) is limited to two staff, each part-time and not available during the summer months, shared among all departments in the building. This limited access to secretarial and other assistance impacts the amount of time department members can spend on activities related to being a faculty member. For example, faculty members have stated that the already collected assessment data provided through ACS exams is available but there has not been time to compile that data meaningfully in order to be able to use it effectively. Support for activities such as this, among other items mentioned by the department faculty members, can help the faculty be more efficient and effective in completing the college's mission.

Research. The department has made a clear commitment to providing and supporting undergraduate research opportunities for its students. This is recognized by most chemistry departments at liberal arts colleges as the best way to promote student learning in the discipline. However, undergraduate research in and of itself is not currently emphasized at Monmouth College as a whole. This is evidenced in a number of ways. First, the College's mission statement does not specifically state that some form of active learning or scholarly or creative activity is encouraged by students. While there are some aspects of "Doing the Discipline" around campus (as highlighted in the Strategic Plan), a culture of undergraduate research does not appear to be imbedded on campus. Second, the criteria for faculty tenure does not encourage Monmouth faculty to create sustained research programs with the goal of publication in peer-reviewed journals nor does it encourage the involvement of students in faculty development activities. Finally, there is no clear financial support from the college for including students in research programs (funding for most, if not all, chemistry/biochemistry student research is supported by departmental endowments). This is not a criticism of the college's stance on undergraduate research - it is only a statement of the fact that the Chemistry Department emphasizes undergraduate research differently than other constituencies on campus.

As stated earlier, undergraduate research has been recognized as an important aspect of the chemistry curriculum at liberal arts colleges across the nation; therefore, the reviewer encourages the chemistry department to continue on the path that they have chosen with regards to undergraduate research. The foundation is in place to strengthen and grow this program, both from the perspective of departmental culture and the perspective of funding. It is an important aspect of student learning and both current and prospective students recognize this.

In order to make the program sustainable, the department is encouraged to continue to find ways to promote a culture of undergraduate research campus-wide. Champion the benefits of this practice. Promote the effective student outcomes by highlighting the results of alumni surveys. Continue to look for ways to encourage and collaborate with students and colleagues across campus. Most importantly, faculty should work with the administration, advancement, and admissions to look for ways to encourage and support student scholarly activities in all disciplines. The Kieft Endowment generously and effectively supports student research in the Chemistry Department. It (or portions of it) can be used as a model for other programs across campus to stimulate student research activities. The Chemistry faculty have the passion, experience, and respect of their colleagues in order to be able to act as advocates and shepherds for the cause of undergraduate research at Monmouth.

The lack of summer research programs outside of the chemistry department is an acknowledged concern. As the department knows, building student research opportunities is a long-term project. It takes commitment, financial backing, and a belief that the outcomes are significant. The chemistry department can help by continuing to forge collaborative projects with other faculty members across campus – art, environmental studies, biology, and the new neuroscience and data science programs – and perhaps support those projects financially.

An important aspect of undergraduate research is not only presentation of results at national meetings, but also publishing those results in peer-reviewed journals. The faculty have indicated that this has not been a priority because of time constraints. The reviewer noted that several faculty are due, or past due, for sabbatical leaves. Sabbaticals are the perfect time to spend focused on preparing papers for journal submission and the faculty are encouraged to take advantage of this benefit.

Time. Finding time to do the things we want or need to do is the battle faculty members continually face. The Monmouth College chemistry department faculty are dedicated to both their college, their students, and their department. The list of activities engaged in by each of the faculty members, both on campus and off, is too long to include here. It is quite remarkable that they are able to do it all. It is a testament to their commitment, energy, and intellect. However, there are always more things to do and several suggestions to help this time crunch, such as secretarial support and sabbatical leaves, are mentioned above.

Another way to help is to minimize these time commitments. The reviewer notes that the chemistry faculty spend a great deal of time in service to the college. They serve on (multiple) major committees on campus, multiple faculty search committees, and many *ad hoc* committees. The fear is that since the chemistry faculty are so engaged and committed to the college they are automatically asked to be on a committee or to provide a service to the college because people know they will say ‘yes’. Both the faculty and the administration should be careful not to exploit the faculty’s time. Also, the reviewer noticed that the college does not give release time for department Chairs to perform all of the necessary administrative duties nor does there seem to be a way for faculty to receive compensation for teaching overload sections of classes. Both of these concerns should be addressed by the administration.

Finally, the faculty are encouraged to think carefully about all of their time commitments and decide which are the most important – both personally and professionally. This is where a departmental mission statement plays a key role. What activities will help move the department forward? What activities are required for the college or department? Be mindful of the time that is spent on activities which may not have a direct impact on your teaching or research. Decide if all of the current activities that you are involved in are appropriate or important enough to continue to pursue. Choose the most appropriate ones and follow them to completion and beyond. These are all difficult choices and decisions for us to make, especially since the Monmouth chemistry faculty have so many excellent ideas, but periodically a self-evaluation is necessary and appropriate.

Relationship with Biology. Both faculty and students regularly interact with faculty members in the Biology Department as part of the Biochemistry curriculum and pre-professional programs. However, it is noted that after conversations with both faculty and students in chemistry it appears that the relationship between the departments is strained. There could be several reasons for this, but no matter the cause, it is important that they are able to work together to ensure a stable biochemistry program and new neuroscience program. Since the reviewer did not have the chance to explore this issue more completely, there are no specific suggestions for moving forward. Perhaps the best course of action is to gather together all members of both departments, over a dinner hosted by the Dean, and openly discuss their departmental relationship. How can it be improved? What are the principal concerns?

One other observation which may play a role in the relationship is the emphasis on student research. The Biology, Chemistry, and Physics departments all require their students to participate in Science Seminar and take capstone Research courses. However, it seems that criteria for these courses are different for each department and student expectations vary depending on your major. This can be confusing to both students and faculty and is certainly confusing to an outside reviewer. Discussions on standardizing these requirements could help to encourage inter-departmental dialogue.

Other Areas of Concern. In the department self-study, it is suggested that areas of needed improvement within the chemistry curriculum are scientific writing, safety training, and ethics training. The department has already thought about each of these topics to varying degrees and with varying success. It is the opinion of the reviewer that each of these concerns can be solved with ideas stated in the department self-study. Scientific writing is best taught in a step-wise fashion beginning with small assignments (i.e., figure captions) in the lower level courses and increasing in complexity in upper level courses. Repetition, or spiraling, is also effective in this area – similar assignments both in the same course and in other courses at a similar level. Beyond the basic safety protocols at the beginning of each lab course, safety training is expected for those students who are participating in undergraduate research. Much of that training can occur in a short afternoon. Designate a time at the beginning of the school year (or semester) and gather together the students enrolled in the research course to review or introduce them to safe lab practices. Scientific ethics is best taught at the upper level and most

effective using case-based scenarios. This is a topic of concern to all scientists, so perhaps embedding ethics discussions in the Science Seminar might be appropriate.

Conclusion

The Chemistry Department at Monmouth College shows a very real commitment to student learning and exploration. The faculty are hardworking, highly skilled, and engaged thereby creating a cohesive environment which serves to foster the growth of their students. As the department moves forward they must build on the strength of their undergraduate research program and leverage the benefits of the departmental endowed funds to help promote student engaged activities across campus. A shared, strategic vision for the program will help the department as it continues to move forward.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Craig R. Bieler". The signature is written in a cursive style with a large initial "C".

Craig Bieler, Ph.D.
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