UCC Program Review Committee summary of review

Program – Department of Chemistry and Biochemistry

This program includes the following degrees, minors, and certificates:

- B.A. Chemistry
- B.S. Chemistry
- B.S. Chemistry – Predentistry
- B.S. Chemistry – Premedicine
- B.S. Chemistry – Prepharmacy
- B.S. Chemistry – Honors Tutorial College
- B.S. Chemistry – Biochemistry
- B.S. Forensic Chemistry
- B.S. Environmental Chemistry
- Chemistry minor
- M.S. Chemistry
- Ph.D. Chemistry

Recommendation

This program is found to be viable, see report for commendations, concerns, and recommendations.

Date of last review – AY 2009

Date of this review – AY 2016

This review has been sent to school director and the dean, their joint response is attached.

This review has been sent to the Graduate Council, they have no comments to add.
Executive Summary

This report summarizes the Seven-Year Review of all of Ohio University’s Chemistry and Biochemistry programs (undergraduate, minors, and graduate). The review was conducted on December 10th and 11th, 2015 on the Athens campus. The review team consisted of three internal reviewers (Dr. Trevor Roycroft, Dr. Anirudh Ruhil, and Dr. Warren Galbreath) and two external reviewers (Dr. Bill Malachowski, Bryn Mawr College, and Dr. Fredrick Luzzio, University of Louisville).

The committee is of the opinion that all programs are conditionally viable. However, while the committee believes that the department can continue to service its academic mission for now, the committee is concerned that the programs could face mission-critical difficulties if improvements are not made in three key areas: (1) deficient laboratory and classroom facilities, (2) insufficient graduate stipends, and (3) an insufficient number of Group I faculty lines.

- The most significant problems observed during the review committee’s visit, and thus a recurring theme in this review, are the obstacles associated with the department’s main facility in Clippinger Laboratories. The review committee cannot emphasize enough the problems that this space is causing for the department.

- The review committee is also very concerned about the resources that are available for teaching assistants. The current level of stipend, combined with the salary payback through the general fee, and costly health insurance, presents a level of support that can only be described as bare-bones, and which has not changed since 2008.

- The level of financial resources for faculty does not appear to be sufficient. The level of Group I faculty should be increased. The review committee recommends that a reasonable level of staffing would be 23 Group I faculty members; currently there are 16 with two searches being conducted.

In spite of these limitations, the review committee finds that the program is achieving success in fulfilling its mission:

- The review committee finds that the RSCA is appropriate for the program, and finds examples of excellence that demonstrate the commitment of the faculty. The review committee found strong evidence that Group I faculty are active researchers.
- Service contributions from the department appear appropriate with members of the faculty having served on or currently serving on various department, college and university committees.

- The department is shouldering a substantial role in teaching service to the university in the form of introductory courses to a wide array of programs. Given the limited resources of the program, and the obstacles introduced by the substandard space, the department is serving its undergraduate academic missions as well as it can.

- The review committee finds that the department is attracting majors who are able to succeed. Mean-time-to-graduation rates indicate that students in the program graduate in a timely fashion.

- The department seems to provide adequate curriculum, but only through exceptional efforts and sacrifices being made by the Group I faculty.

The committee wishes to applaud the department faculty (both Group I and II) and the graduate and undergraduate students for their resilience in the face of infrastructure challenges, insufficient graduate compensation, and manpower shortages that they encounter regularly while fulfilling the department’s academic mission. Faculty are securing research grants, students are excited about their academic experience, and the faculty appear to be genuinely collegial. The TAs appear to be very committed to their instructional role and shoulder their responsibilities with purpose. Group II faculty are similarly going above and beyond the typical nature of their duties to also contribute with student advising while also being innovative with their educational activities.
1. Observations on the program as a whole:

   a. Is the current number and distribution of faculty sufficient to carry out the broad overall mission of the Department (Teaching; Research, Scholarship and Creative Activity; Service)?

The review committee finds that the current number of faculty limits the success of the department in meeting its overall mission. This is especially true for inorganic chemistry, where there is only one faculty member in this specialty, and only three in analytical chemistry, which supports the forensic program. Demand for courses offered by the department has grown. The faculty has been hindered by faculty departures, which have disrupted the continuity of program offerings. Group II faculty and Graduate Teaching Assistants bear a substantial load in the teaching mission of the department, and take on a substantial load in advising and other service to the department.

A recurring theme in the review committee’s visit, and thus a recurring theme in this review, are the obstacles that arise from the dilapidated state of the department’s primary facility in Clippinger Laboratories. The review committee cannot emphasize enough the problems that this space is causing for the department. Ultimately, the problems presented by this space filter into all aspects of the department, including teaching, research, and attracting high quality faculty and students. The committee observed first-hand the status of the laboratory space, and heard from faculty, teaching assistants, and students regarding the negative impact of the space on their experience. The committee completely agrees with the assessment offered by these groups, and finds that if anything, the inferior nature of the space is understated in these reports. With regard to teaching, the overcrowded labs interfere with the school’s mission, and present real dangers to students, teaching assistants, and faculty. The ability of the department to attract and retain high quality faculty and students is also negatively affected. This interferes with the teaching mission of the department, and faculty resources are spread even more thinly due to the problems with the physical space in Clippinger.

This is not to say that should Clippinger be renovated, faculty resources would no longer be under undue pressure. Rather, even under an “optimal” space environment, the faculty resources appear to be spread too thin. Specialty areas are understaffed. Group I faculty are consistently engaging in uncompensated overload teaching activities, which crimps time for their research productivity. Increased demands for introductory chemistry courses by other departments has led to increased class sizes, without a commensurate increase in resources.

The faculty of the department that we met demonstrated a commitment to overcoming the limitations presented by the space and other factors, and it is through their substantial efforts that the faculty have been able to partially offset the handicap presented by the inferior and at times dangerous conditions in which they operate. They are to be commended for their efforts.
b. Is the level of the Department’s RSCA appropriate for the program given the size of the faculty and the resources available to the Department? Is the Department’s level of external funding at an appropriate level?

The review committee finds that the RSCA is appropriate for the program, and finds examples of excellence that demonstrate the commitment of the faculty. The review committee found strong evidence that Group I faculty are active researchers. Some Group II faculty also have active research agendas. Service to both internal and external constituencies is also appropriate. Recent grant-funded equipment acquisitions point to the potential for expanded research productivity in the future.

c. Is the level of service, outside of teaching; appropriate for the program given its size and the role that it plays in the University and broader communities it interacts with? Is the Department able to fulfill its service mission?

Service contributions from the department appear appropriate with members of the faculty having served on or currently serving on the UCC, the Graduate Council, College Tenure and Promotion Committees, the College Curriculum Committee, the Research Advisory Committee, various administrator search committees, as Associate Dean, and a variety of other activities. Given the substantial teaching responsibilities of the department, the level of the service to the University and the community seems appropriate.

d. Does the Department have an appropriate level of financial resources, staff, physical facilities, library resources, and technology to fulfill its mission?

The level of financial resources does not appear to be sufficient. As discussed in the teaching area above, the level of staffing should be increased. The review committee recommends that a reasonable level of staffing would be 23 Group I faculty members; currently there are 16 with two searches being conducted. The physical facilities are the most glaring problem with regard to resources available to the department. Given that substantial portions of the building, including much lab space, are approaching their 50th anniversary (with little renovation during the intervening years), it is not surprising to find that facilities are inadequate. Problems with plumbing, electric, climate control, ventilation, and fully depreciated lab benches, hoods, and equipment generate problems for teaching, research, the attraction of high-quality students, and the attraction and retention of high-quality faculty. The review committee believes that the faculty of the department, perhaps because they are forced to live with the situation on a day-to-day basis, underestimate the negative impact of the space on the department. The review committee is concerned that the state of the facilities presents a physical danger to the faculty and students, and the potential for serious harm is very real.

The review committee also observed first-hand the increase in costs of operating the department that results from the disrepair of the facility. Costly specialized equipment (for example, the new NSF-funded 500Mhz NMR) has been damaged due to problems with water systems. Faculty have had to fabricate insulation for the laser laboratory because the room would not otherwise hold at needed temperature and humidity levels. Computer equipment has been damaged due to a corrosive atmosphere in labs. All the fume hoods are old and inadequate, and in fact the committee was surprised that they met safety standards (as indicated by a sticker dated June 2015). The elephant-trunk vents used in some labs also appear to be sub-par. In addition,
activities that should be conducted with hoods are instead being conducted on the bench because of inadequate facilities. Replacement of these outdated and dangerous facilities should be the first priority of the College and the University.

The review committee is also concerned about the resources that are available for teaching assistants. The current level of stipend, combined with the salary payback through the general fee, and costly health insurance, presents a level of support that can only be described as bare-bones, and has not changed since 2008. Despite the low level of compensation, teaching assistants are, nonetheless, expected to shoulder a substantial burden in fulfilling the department’s teaching mission. The committee found that teaching assistant resources were being fully utilized, and that compensation was subpar as compared to peer institutions. It is important to note, however, that the growth in the number of students served by the department is outside the control of the department, as service to numerous university programs, especially in the health sciences, is driving demand for course seats. Given the key role in providing service to these growing fields, it is important to note that the chemistry department takes on the role of a “binding constraint” on the ability of the university to grow in the health-sciences-related fields. Here again, the university needs to take a larger view, and recognize the university-wide benefits that would arise from the devotion of expanded resources to this department.

2. Undergraduate Program:

a. Is the Department fulfilling its service role, adequately preparing non-majors for future coursework and/or satisfying the needs for general education?

As discussed above, the department is shouldering a substantial role in service to the university. Given the limited resources of the program, and the obstacles introduced by the substandard space, the department is serving its undergraduate academic missions as well as it can given existing staffing and infrastructural resources. However, the department is concerned about and considering ways to address the various challenges that have emerged from increased enrollment and Q2S. For example, one-third of the freshmen taking chemistry classes are first-generation students, often needing special assistance to ensure their success. Similarly, with Q2S, students are coming in with less mathematics preparation, and hence requiring some remedial work in the courses. With students likely to DFW, more resources need to be devoted and the department is doing what it can with recitations, PLTL, flipped classrooms, and the like. However, this is being done with space and manpower constraints (for e.g., PLTL groups meet in the hallways; class and lab scheduling is a challenge; students are sharing lab lockers).

b. Is the program attracting majors likely to succeed in the program? Is the number of majors appropriate for the program? Is the program attracting a diverse group of students?

The review committee finds that the department is attracting majors who are able to succeed. Mean-time-to-graduation rates indicate that students in the program graduate in a timely fashion. The number of majors in the program (approximately 255 over the past four years) appears to be an upper limit given the size of the faculty, however, the growing service to outside departments
may further ultimately hinder the department’s ability to serve its majors if outside course headcount continues to grow.

Here again, the Clippinger facility presents a barrier to success. Faculty are reluctant to take prospective undergraduate students on tours of the facilities, and the review committee can understand why this strategy makes sense. Prospective students have mentioned that the labs were better in their high school. The College and University should recognize that the department’s ability to continue to attract high-quality majors is placed at risk by the decrepit facilities.

The student body seems to be fairly well representative in terms of gender. However, there are few minorities, something the department recognizes, and actively works to address. For example, the department participates in every opportunity to showcase the major/minor and recruit students, be it at an event organized by multicultural affairs at OU or some other unit. Further, the pool of minority students is very small and unless one can offer competitive financial aid, excellent lab facilities, and ample instructional support one often loses them to better-equipped programs.

c. Does the undergraduate curriculum provide majors with an adequate background to pursue discipline-related careers or graduate work following graduation?

The review committee finds that the undergraduate curriculum is appropriate. The department’s commitment to its students is demonstrated by the range of course offerings, and the ability of students to engage in research as undergraduates. The review committee was told that approximately one-third of students appear to go on to work or intern with such companies as Proctor and Gamble, Sherwin Williams, and Battelle Memorial Institute. Another one-third of department majors go on to graduate school and the remaining students go to professional schools.

The committee recognizes that it is impossible to track each and every undergraduate student past matriculation. However, the committee encourages the department to consider ways of using social media or other means to track its graduates. This might allow for an evaluation of career outcomes, as but one indicator of program success. The committee also reiterates that staffing levels do not allow for an excellent student-centered learning experience in every field; an upper-level inorganic chemistry course had to be taught by a Group II faculty member because there is ONE Group I faculty member in inorganic chemistry.

d. Are the resources and the number of and distribution of faculty sufficient to support the undergraduate program?

The earlier discussion of faculty resources applies here. Faculty levels should be increased to promote the mission of the department. Both teaching and advising loads are excessive. As emphasized earlier in this report, Group I and Group II staffing levels need to be raised. Additional TAs would improve undergraduate student learning outcomes, and especially with
respect to DFWs. There are critical shortages in inorganic chemistry and analytical chemistry. Analytical chemistry supports the forensic chemistry major so with an insufficient number of analytical chemists the forensic chemistry track cannot perform optimally.

**e. Are pedagogical practices appropriate? Is teaching adequately assessed?**

Teaching practices described point to appropriate practices and innovation. The review committee found that faculty were highly motivated regarding teaching practices, and that excellence in teaching was appropriately valued for both Group I and Group II faculty. Here too, the review committee found that the physical space was a hindrance to the teaching mission of the department. Both lab space limitations and classroom space limitations interfere with teaching success. However, in spite of these limitations, examples of teaching innovation include: flipped classroom strategies, use of student personal response systems in large lecture courses, peer-led team learning, publisher’s supplemental resources, and undergraduate research experiences.

**f. Are students able to move into discipline-related careers and/or pursue further academic work?**

The committee understands that about one-third of their graduates go on to graduate school, one-third to industry, and the final third to professional programs. However, the committee encourages the department to better track their graduates. The committee also wanted to encourage the department to be attentive to recent changes in medical school preparation requirements and corresponding MCAT adjustments.

3. **Graduate Program:**

   **a. Is the program attracting students likely to succeed in the program? Is the number of students appropriate for the program? Is the program attracting a diverse group of students?**

Comments by the faculty indicate a sense that the quality of incoming graduate students has changed over the past decade. An increasing number of the students now tend to be international, and a fair number of these students come with language barriers that impact both their instructional work as TAs but also their own learning experience in the graduate program. The department does what it can to ensure their successful progress through the Ph.D. program, but is hampered by the teaching needs (which may mean that some less-qualified graduate students serve as TAs when in fact they should be taking either English language classes or brushing up on their basic chemistry knowledge). To a large extent this shift in quality can be addressed by increasing graduate stipends to make them competitive. Asking a high-quality graduate student to enroll in a Ph.D. program with $20,000 (pre-tax) for a 12-month period, a substantial clawback through the university general fee, no health coverage, no guaranteed conference travel and inadequate lab facilities is not a recipe for success.
The graduate student body reflects little diversity; there are no African-American, Asian-American, or Hispanic students, something the department recognizes, and actively works to address. The department seems to recognize this issue but the committee isn’t clear on how this issue is being tackled by the graduate recruitment process in use. The committee does, however, recognize that the pool of minority students is very small and unless one can offer competitive financial aid, excellent lab facilities, and ample instructional support one often loses minority students to better-equipped programs with higher graduate stipends.

b. **Does the graduate curriculum provide an adequate background to pursue discipline-related careers following graduation?**

The department seems to provide adequate curriculum, but only through exceptional efforts and sacrifices being made by the Group I faculty. For example, even though they have a course release faculty often teach extra graduate courses because students need them to complete their program of study.

c. **Does the program provide adequate mentoring and advising to students to prepare them for discipline-related careers?**

With a relatively small graduate program, faculty can provide individualized attention to graduate students to develop their disciplinary-related skills and provide career advice. This includes reviewing lab results as well as writing reports and manuscripts. The department helps support attendance at national/regional meetings and facilitates meeting with visiting speakers from industry and academia. The department has also recently started a new course that complements their scientific education and helps graduate students develop important workplace skills such as teamwork, problem-solving and critical observation.

d. **Are the resources and the number of and distribution of faculty sufficient to support the graduate program?**

As noted earlier, the presence of only one inorganic chemist has hampered some graduate program curriculum. There is also a deficiency of analytical chemistry faculty, noted earlier as they support the undergraduate forensic chemistry program, but this also creates challenges for graduate students in the analytical chemistry field. Otherwise, the Group I faculty do a laudable job in stretching themselves and their resources to help the graduate program survive. The addition of a new 500 MHz NMR and a high resolution mass spectrometer through NSF major instrumentation grants is an example of the Group I faculty efforts and success in providing the necessary resources for the graduate research program.

e. **Does the program offer appropriate financial support to graduate students?**

The graduate student stipend is insufficient and hampers the success of the Chemistry and Biochemistry Department in both their educational and research missions. Increasing the graduate student stipend is the most pressing and most critical need to energize the program. An immediate 10% percent increase ($2,000) in the stipend would bring the salary more in line with
regional competitors and lead to a significant increase in morale. Increasing the stipend could also help address the lack of diversity in the department graduate student ranks.

f. **Is teaching adequately assessed?**

Graduate student instructional activities are reviewed by Group II faculty supervisors in an informal way. There is a training session for teaching assistants at the beginning of the academic year. The committee was unable to ascertain if there is a more formal mechanism for graduate student teaching evaluation.

g. **Are students able to move into discipline-related careers?**

The Ph.D. graduates do appear to be capable of moving into discipline-related careers, although, as is standard in the chemistry field, many entered a postdoctoral position immediately after graduating to further their training. Nevertheless, the second most common placement was in the private sector. Less was known about the placement of M.S. students, where 75% were unknown.

4. **Areas of concern.**

1. Low stipends for graduate students.
2. Inadequate number of Group I faculty in inorganic chemistry and analytical chemistry.
3. Inadequate research lab facilities.
4. Inadequate and unsafe teaching lab facilities.
5. Inadequate classroom space.

5. **Recommendations.**

1. The committee recognizes that while there are some preliminary efforts being made to address the deficiencies in space, space improvements will likely be many years down the road. Thus, graduate stipends present an actionable item that can have an immediate and positive impact on the program.
2. In order to better deliver an excellent undergraduate and graduate student learning experience the inadequate and unsafe laboratory facilities must be modernized.
3. Group I faculty hires must be made, most immediately in the areas identified above (inorganic chemistry and analytical chemistry). Optimal Group I faculty strength appears, to the committee, to be about 23.

6. **Commendations.**

The committee wishes to applaud the department faculty (both Group I and II) and the students for their fortitude despite the infrastructural challenges and manpower shortages they face in delivering the department’s academic mission. Faculty are securing research grants, students are excited about their academic experience, and the faculty appear to be genuinely collegial. The TAs seem to be very committed to their instructional role and shoulder their responsibilities with
purpose. Group II faculty are similarly going above and beyond the typical nature of their duties to also assist with student advising while also remaining research active.

7. **Overall judgment: Is the program viable as a whole?**

The committee is of the opinion that the program is conditionally viable. That is, the department can continue to service its academic mission for now but could face mission critical difficulties if the situation does not improve – the problems with the building and laboratory and classroom facilities, graduate stipends, and Group I faculty lines need to be addressed.
July 6, 2016

Dear Program Review Committee:

We would like to thank the Review Committee for their report and the obvious seriousness and care in reviewing the department. The overall recommendations of the Review Committee are very positive with respect to departmental efforts to provide a quality educational experience, but the committee also identified legitimate areas of concern. This letter will focus on the areas of greatest concern.

We draw attention to a few points that are not absolutely correct. First the committee noted that the stipend for teaching assistants has not changed since 2008. However, cost of living increases have been made to the teaching assistant stipends for the past two years. We would agree that these have not kept pace with increases in the general fee and health insurance costs. The department will be increasing the teaching assistant stipend with a 5-10% increase in the next fiscal year.

The Review Committee recommended an increase in Group I faculty to a total of 23 from the current 16. It is important to note that the department has been searching for at least one Group I faculty member almost every year for the past several years. What was not clearly stated in the Review Committee’s report is that we have lost multiple Group I faculty members, through retirement, moving to new positions over this same time frame. We have, however, just completed the hiring of 2 new faculty members in inorganic chemistry and are still searching for 1 additional Group I faculty member in analytical chemistry. If this search is successful, this will bring the total of Group I faculty to 19. The department has requested 1 new Group I faculty position for the next year.

At the most recent departmental retreat, the faculty agreed that increasing the Group I faculty to 23 was likely unrealistic. A goal of maintaining the Group I faculty size at approximately 20 seemed attainable and would meet the department’s teaching needs. A combination of group I and II faculty lines provides the best path to achieving this end of optimal faculty staffing.

We share the Review Committee’s concern with the physical facilities (Clippinger Laboratories). Their comments that “the overcrowded labs interfere with the school’s mission, and present real dangers to students, teaching assistants, and faculty” is an overstatement. The department ensures that the labs, both undergraduate teaching labs and research space, are operated with the safety of all
participants in mind.

The Department of Laboratory and Radiation Safety (LRS) supports the staff of the Chemistry Department and the Clippinger building in many ways. LRS conducts lab audits, provides safety trainings, coordinates the certification of fume hoods, and works closely with the staff and Departmental Chemical Hygiene Officer (CHO) to provide guidance on laboratory safety and regulatory matters. The teaching and research laboratories in Clippinger are inspected thoroughly by Laboratory and Radiation Safety at least annually with special attention paid to safety procedures and equipment. **Periodic walk-throughs occur as well to ensure on-going safety and compliance is maintained.** Minor safety issues that are not able to be corrected immediately are made aware to the staff/PI/chemical hygiene officer and department chair and are followed up on at subsequent inspections. More serious infractions requiring immediate attention are brought to the attention of the PI and department chair and the appropriate corrective action taken. OSHA Chemical Hygiene Training is offered on average weekly, and the University CHO gives a joint training session with the Departmental CHO to all new incoming TA’s during summer orientation. Chemical Hygiene training covers the OSHA Laboratory Safety Standard. Additionally, Hazard Communications and OSHA GHS (Global Harmonization System) training is also provided. LRS works directly with the Chemistry staff and the Departmental CHO to solve problems as they arise and provide guidance for proper use of hazardous materials and other laboratory matters.

Planning for a new addition and renovations to Clippinger is well underway. The first phase will result in a significant portion of a new Clippinger annex building dedicated to laboratory space for Chemistry and Biochemistry. This will alleviate the concerns regarding the state of Clippinger Laboratories.

Regards,

\[Signature\]

Stephen C. Bergmeier, Ph.D.
Professor and Department Chair

\[Signature\]

Robert A. Frank, Ph.D.
Professor and Dean