

## **UCC Program Review Committee Summary of Review**

**Program:** Chemical and Biomolecular Engineering

**Date of last review:** AY 2012-2013

**Date of this review:** AY 2020-2021

The program offers the following degrees, minors, and certificates:

- Ph.D. in Chemical Engineering
- Master of Science in Biomedical Engineering
- Master of Science in Chemical Engineering
- Bachelor of Science in Chemical Engineering

**Recommendation:** This program is found to be viable.

See report for commendations, concerns, and recommendations.

The report was forwarded to the chair of the department and the college dean. Their joint response is attached.

The report was also sent to the Graduate Council. Their comments are attached.

## **Academic Program Review**

### **Department of Chemical and Biomolecular Engineering**

#### Review Committee Members:

Geoff Dabelko, Professor and Associate Dean, Voinovich School of Leadership and Public Affairs, Ohio University

Andre Palmer, Professor, Department of Chemical and Biomolecular Engineering, Ohio State University, External Reviewer

Andrew Ross, Associate Professor, Department of Political Science, Ohio University

Miriam Shadis, Associate Professor, Department of History, Ohio University

The committee visited the Department on February 18th and 19th, 2021 via Teams video conference meetings. We met with departmental leadership, faculty, staff, undergraduate students, graduate students, and the Russ College of Engineering Associate Dean for Research and Graduate Programs. The committee also viewed slide shows depicting research and instructional facilities.

This report is divided into seven sections, following the Ohio University Program Review Committee's questions for reviewers.

#### 1. 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 department is composed of 12 tenure track faculty, with 1 faculty member on unpaid professional leave. The department breakdown by rank consists of 3 assistant professors (2 currently in the tenure and promotion process), 5 associate professors, and 4 full professors. The 11 faculty not currently on leave are capable of delivering the chemical engineering curriculum at the undergraduate and graduate levels. All core courses in the undergraduate curriculum are offered once per year. Therefore, the department is able to accomplish its teaching mission.

Individual faculty teaching load varies by level of research activity and release time buyout. Pre-tenure faculty and senior faculty with significant research teach 2+1 courses and are responsible for teaching an experiment in the unit operations lab (0.25 course). However, it is possible for research active faculty to buy out of teaching 2 courses with 30% release time to teach a minimum of 1 course. If post-tenure faculty are not research active, the teaching load is 2+2. As chair, Dr. Young teaches 2+1 courses. Teaching assignments are fair, and mechanisms are in place to reduce teaching loads for junior faculty and faculty involved in research. Without new hires, it is anticipated that teaching loads will increase.

Average research expenditures for the last 2 academic years ranged from \$300,000 \$400,000/faculty, with the majority of funding coming from research associated with the ICMT center. Currently, nine faculty have funding. This level of funding is excellent.

Currently, the department has 145 undergraduate majors yielding a student to faculty ratio of 13:1. The graduate program is smaller in comparison and has 55 students yielding a graduate student to faculty ratio of 5:1. These ratios are excellent and facilitate better teaching.

Assistant professors feel supported by the chair and faculty. All faculty receive annual reviews. For junior faculty, these are helpful to gauge their progress with respect to teaching, research and service goals towards promotion and tenure. Junior faculty teaching loads are lower than associate and full professors. In addition, junior faculty are assigned to teach the same courses every year until attainment of promotion and tenure, in order to reduce course preparation time and make time for their research activities. Senior faculty also team teach with new faculty to help them acclimatize to teaching at OU. This overall approach to teaching facilitates junior faculty to establish their independent research programs. Junior faculty are also assigned a mentor in their research area to help them establish their research programs.

The service load is appropriate for junior faculty, with most of their effort devoted to teaching and research. In addition, the department helps connect new faculty with resources at OU to promote their research programs e.g., ICMT. Faculty are in the process of clarifying a workload policy that takes into account service to the profession, which is required for promotion, but does not count toward the normal 10% service load.

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?

OU is a Carnegie R2 institution. Therefore, the RSCA for the program is appropriate, although the faculty overperform with respect to their research output. The top 20 chemical engineering programs in the US have average annual research expenditures/faculty on the order of ~\$500,000/faculty. Therefore, the chemical engineering department's research expenditures compare quite well with these top departments. The Corrosion Center accounts for a very large percentage of the department's funding, which if increased further creates an unbalanced funding portfolio.

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?

The service load of the department is appropriate, and fulfills its service mission. Departmental leadership ensures that pre-tenure faculty are not called upon to do significant service that would potentially impede their ability to conduct funded research and publish at desired levels.

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

The department has two full time staff that help run the department office and the undergraduate unit operations lab. However, it could use one additional staff member to support the graduate program. Students and faculty reported concerns that the hands-on services formerly offered by its part-time graduate program coordinator are not being delivered at the college level. The loss of this position has also displaced some support services and advising work onto faculty, and affected departmental morale. The current procurement processes often result in significant delays, sometimes months, to receive research supplies and software. These delays are especially problematic for externally funded efforts that often operate on specific timelines. These delays have the potential to adversely affect student learning outcomes and time to completion of graduate degrees. The physical infrastructure in the department is old and in need of renovation. While the university's current fiscal situation may not permit tenure track hiring in the near term, the department is lean in terms of faculty needed to deliver the curriculum and additional departures (such as expected retirements within five years) may significantly erode curricular and research capabilities. Given recent departures and the potential for at least one more, the department could also use additional faculty to improve its research output.

## 2. Undergraduate Program:

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

The department does not offer service courses to the university community.

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 4 year degree completion rate for ChE students ranged from 42-71% during the reporting period, which is the highest in the College of Engineering. After entering their third-year courses, the retention rate is almost 100%. The student to faculty ratio (13:1) is excellent. The undergraduate population during the reporting period ranged from 28-44% for female and 9-17% for underrepresented groups.

Undergraduate enrollment in the program has declined in 2020, but the reduced numbers are commensurate with the campus-wide decline in enrollment during this period.

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

Chemical engineering majors take 52 credits of chemical engineering courses. These courses provide them with a solid background to pursue discipline-related careers or graduate studies.

However, students are concerned about doing coops during the semester, which delays their graduation by 1 year, since core courses are only offered once per year. Students also reported

some reluctance to pursue study abroad and other co-curricular activities that could incur a full-year delay in time to graduation. One student expressed the general observation that they were receiving an education in engineering but did not have access to “the rest of the undergraduate experience.” Students indicated that co-curricular programming was strongly related to engineering topics, but they wished there were more information sessions and advising about campus-wide opportunities such as study abroad during summer semester where programs may not delay time to graduation. Students need very attentive advising in order to take their general education requirements, pass every class, and graduate in a timely way. There is very little room for electives or minors without careful planning from the first semester.

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

The current number of faculty are sufficient to deliver the curriculum. However, additional faculty would help provide more technical electives and research opportunities to students, and the loss of any single other faculty member will jeopardize the department’s ability to offer many electives.

e. Are pedagogical practices appropriate? Are program learning outcomes adequately assessed?

Learning outcomes for B.S. students in Engineering conform to those outlined by ABET (Accreditation Board for Engineering and Technology), and are assessed primarily through project-based learning and examinations. ABET most recently accredited the program in 2016-17, and that accreditation is valid through 9/2023. The Chemical Engineering faculty review the assessment process twice a year.

Students appear to appreciate the more problem-oriented and active learning models used in ChE classes.

Newly hired faculty in the review period attended the National Effective Teaching Institute (NETI) sponsored by the American Society of Engineering Education (ASEE) at the department’s expense. This teaching workshop introduces faculty to best practices in teaching techniques.

Program educational objectives are developed by the faculty in consultation with the Departmental Board of Advisors and the student body. These objectives are then assessed by ABET. ABET defined Student Learning Outcomes for all engineering departments and ChE adopted them.

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

Senior students expressed concern about the limited number of chemical engineering companies that attend the OU career fairs. Some students expressed interest in greater geographic diversity among industry representatives in job fairs (beyond Ohio). There is general consensus that Handshake is not a good tool for looking for jobs, and the Career Leadership Development Center is inadequate to the particular needs of engineers. However, students appreciated the career advice given by faculty when students solicited it.

### 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?

The graduate program attracts many international students, especially top-notch students interested in corrosion research. There are on-going challenges associated with recruiting international students that extend far beyond Ohio University and potentially make Ohio University (and most engineering colleges) vulnerable to external factors. The department and college are actively managing these challenges as much as possible and faculty leaders cited new geographic diversification of graduate students based on networks from new junior faculty.

During the reporting period, the composition of the graduate program ranged from 36–43% for female students and 0–7% for underrepresented students.

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

The graduate curriculum provides a solid foundation in applied mathematics, thermodynamics, transport phenomena and kinetics and reactor design, which allows the majority of graduate students to find careers in industry.

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

The placement record for graduate programs is very strong, with high numbers heading to industry positions and a select number to academic positions.

Students indicated they would welcome more systematic and more robust contacts with alumni playing mentoring and job preparation roles. Such a program may also reduce the advising burden on current faculty.

The high number of international students creates special needs for both initial orientation and on-going support. Students would benefit from periodic reminders or briefings relating to department procedures and resources, as well as college- and university-level support services.

For example, students were unsure about to whom to take their concerns, when faculty were leaving and labs were closing.

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

The number of faculty are currently sufficient to support the graduate program. However, if Amir Farnoud does not return to Ohio University from his current leave to work in industry, this departure of a well-regarded and highly productive colleague will impact course offerings and research training in the biomedical engineering MS program.

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

The graduate student stipend ranges from \$25,000-\$30,000. This is competitive nationally given the low cost of living in Athens.

f. Are program learning outcomes adequately assessed?

Program learning outcomes are comprehensively assessed via passing required core courses, electives, thesis or dissertation proposal, comprehensive and qualifying exams, and the final thesis defense.

Doctoral students expressed some concern about the structure and timing of the comprehensive exam and qualifying exam. There appears to be a credible rationale for the department's approach to this assessment process, and so there may be room for clearer communication regarding its rationale.

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

In general, students were able to secure industrial and postdoctoral positions. Students in the ICMT center placed well in industry.

However, graduate students need more support in securing jobs. The Ohio University Career Center can provide basic professional development and advice in securing employment, but it is not able to provide the more discipline and sector-specific assistance associated with engineering careers. Coordinating support between university-wide resources and college and department specific resources would likely improve job seeking support.

4. Areas of concern.

Ohio University has Carnegie R2 teaching expectations of its faculty, but the university and departments including Chemical and Biomolecular Engineering often has R1 research expectations of its faculty. Recent communications from the OU senior administration have not been consistent on this question suggesting greater emphasis on curriculum than research. Some faculty in the department expressed confusion and frustration regarding these potential changes in expectations for tenure and promotion. Moreover, faculty at the associate professor level were unclear about what precisely would be required of them or count toward promotion to full professor.

Delivering the MS biomedical engineering program will be difficult if Amir Farnoud leaves OU.

Two senior faculty will retire within 5 years. It is critical that OU replace them to continue to effectively deliver the undergraduate program. One of these faculty bears a significant amount of administrative duties and is responsible for preparing the ABET accreditation self-study, course scheduling, serves as college curriculum committee chair, advises students, performs graduation checks, approves transfer credits, and visits with high school students and parents.

The size of the faculty is at a critical stage, where losing one faculty member will have a significant effect on delivering the undergraduate curriculum.

It seems like there are serious issues with space for faculty research. A new building will yield ~15,000 sq ft for the department, but specific faculty are in need of additional space in the interim, a period that is expected to last years rather than months.

## 5. Recommendations.

The loss of Dr. Botte and Dr. Farnoud, the departure of Dr. Lee, impending retirements of Drs. Crist and Ridgeway, and financial problems at OU will present serious challenges in delivering the ChE curriculum while maintaining research activities. The committee recommends that the department be allowed to hire faculty to replace lost faculty and future faculty retirements. As noted in the self-study, the next faculty hires should continue to prioritize diversity.

The Department should take steps to enhance support for graduate students. Areas needing attention include guidance for the comprehensive exams, information relating to department procedures and resources, and orientation to college- and university-level services.

The Department could consider ways to enhance support for undergraduate students. Additional course offerings or a more flexible curricular structure could allow students to pursue study abroad, internships, coop placements, and other co-curricular activities without incurring a delay in progress to graduation. Undergraduates could benefit also from additional career planning resources at departmental and college levels.

## 6. Commendations.

Dr. Young deserves credit for speaking out against racial and social injustice issues when many other leaders across campus did not. Faculty and staff also reported general appreciation for Dr. Young's extended service and her work in maintaining a collegial culture within the department.

Faculty associated with the Corrosion Center are well funded with graduate students going on to successful careers in industry and academia.

The 4+1 Biomedical Engineering option with undergraduate affiliates drawn from across Russ College engineering majors is an example of synergistic recruiting at both the undergraduate and master's levels.

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

The program is fulfilling its goal towards teaching and training students for successful careers in industry. Faculty research is adding to the knowledge base in chemical engineering. And the faculty are contributing to service activities at all levels throughout the university, and the greater scientific community. The program is viable.



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To: Barbel Such, Chair, UCC Curriculum Council  
From: Valerie Young, Chair, Department of Chemical and Biomolecular Engineering  
Mei Wei, Dean, Russ College of Engineering and Technology  
cc: 7 Year Review Committee members  
Geoff Dabelko (Voinovich School of Leadership and Public Affairs),  
Andre Palmer (Department of Chemical & Biomolecular Engineering, the Ohio State  
University),  
Andrew Ross (Department of Political Science),  
Miriam Shadis (Department of History)  
Date: 7 April 2021  
Re: Combined Department and College Response to the Report of the 7 Year Review  
Committee for Chemical and Biomolecular Engineering

We thank the committee for the time devoted to reading the department self-study, to meeting with faculty, staff, and students virtually over two days, and to preparing their report. In a time when all of us are stretched particularly thin, their commitment to service is much appreciated.

This response is prepared by Department Chair Valerie Young, and has been reviewed and approved by Dean Wei.

There are two corrections and two clarifications to the committee's report.

Corrections:

- The correct spelling of the undergraduate program chair's name is "Ridgway".
- Required core courses in the first two years of the BS CHE curriculum are taught twice per year. Required core courses in the second two years of the BS CHE curriculum are taught once per year.

Clarifications:

- Release time (paid from external funds) required to reduce teaching load to 1 course is 45% (i.e., 45% of salary and benefits paid with external funds) as of AY 20-21. The 30% value was in effect for the review reporting period, under our prior workload policy.
- Although the department did not teach service courses during the review period, as a result of recent cuts in non-tenure-track faculty outside of our department, we will add 4 – 8 sections of service courses for programs in the college to our teaching obligations beginning in AY 21-22. (We have sufficient faculty teaching capacity to cover 4 as a result of other curricular changes, assuming no changes in our faculty numbers.)

As department chair, I agree with the concerns raised by the committee regarding the critical state of our faculty numbers and the corresponding fragility of our future ability to meet teaching and service obligations to our undergraduate and graduate programs in engineering. Two senior faculty recently departed (Dr. Botte to be congratulated on her position as Department Chair at

Texas Tech, Dr. Lee voluntarily separated after 3+ years of administrative leave); we were fortunate to hire one new assistant professor who started in AY 20-21. We face losing up to four faculty to retirement within 3 years, plus the immediate possibility of losing our faculty member currently on unpaid professional leave to industry. Impending retirements include the CHE undergraduate chair and CHE graduate program chair. The recent contraction of administrative staff and college-level non-tenure-track faculty lines has increased our service and teaching obligations. This department long ago made many “teaching efficiency” decisions: not offering under-enrolled courses, offering elective courses and even some graduate core courses only every other year, so these types of measures will not change our situation. I also note that our teaching load is driven by the number of courses in the discipline that must be taught, and although we lack capacity to teach more courses, we could accommodate more students in those courses. We prefer our undergraduate student : faculty ratio stable at about 17:1, and actively participate in college recruiting efforts. We have a recent undergraduate enrollment drop in line with the university as a whole (report section 2b), which we are working locally to reverse.

The committee expressed concern that it will be difficult to deliver the MS BME program if Amir Farnoud leaves permanently for industry, commenting (report section 3.d) on Dr. Farnoud’s contributions in teaching and research mentoring. Fortunately, the interdisciplinary nature of the program provides resilience for research mentoring. Having added Dr. Andrew Weems of Mechanical Engineering and Dean Wei as active BME advisors, the MS BME program’s research mentoring aspect is stable, and will be markedly stronger if Dr. Farnoud returns as hoped. However, the loss of teaching capacity would not be easily covered in the case of Dr. Farnoud’s permanent departure; Dr. Weems’ home department has no excess teaching capacity. We hope that it will be possible to engage faculty in HCOM in leading the small number of core courses required for this interdisciplinary program, given our recent formalization of the MS BME / DO combined degree program.

I share the committee’s concern regarding inconsistent messaging from the highest university administrative levels about the research mission. This department has responded over more than two decades to calls from the college and university to strive for R1 research performance while valuing teaching and mentoring. This department’s research expenditures compare favorably to the top 20 departments in our discipline in the nation (report section 1.b). The committee also notes our research space deficit, recent senior administration statements that de-emphasize research, and a tendency for Ohio University to impose R2 workload expectations for teaching and service with R1 expectations for research. The best R2 institutions include exceptional research units. I look for support from the college and university for this department to continue in such a role.

I concur with the committee’s recommendation for this department to hire faculty *soon*, given the concerns outlined. I hope for approval to begin a search in Fall 2021 for a new faculty member to start in Fall 2022. Should Dr. Farnoud decide to remain in industry after his leave ends in Summer 2021, approval for a search on that timeline becomes imperative.

Regarding recommendations for graduate and undergraduate support, the department will continue to update professional advising for students and welcomes the feedback that we should better communicate the reasoning behind our curricular decisions to students. I would ask the

Career and Leadership Development Center to examine and enhance support to graduate students across all disciplines. At the college level, support for career development is recovering from restructuring in response to budget cuts and the disruption of the pandemic and is an area of college emphasis. I appreciate the college's recent graduate recruiting initiatives.

I wish to call attention to the committee's comments in section 1d about procurement (which is a university-level problem to address) and about the leanness of staffing.

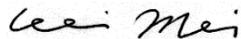
Finally, I appreciate the committee's commendations for the department and for me. In my 15 years as department chair, it has been an overall pleasure to serve the faculty and staff of this department, who demonstrate their commitment to student success daily.

I note that Dean Wei has reviewed and approved this response. Under her leadership, the college is reviewing workload policies and their implementation at the department level, as well as research space quality and utilization.

Regards

A handwritten signature in cursive script that reads "Valerie L. Young".

Valerie L. Young, Chair

A handwritten signature in cursive script that reads "Mei Wei".

Mei Wei, Dean

**From:** [Yang, Lijing](#)  
**To:** [Such, Barbel](#)  
**Subject:** Re: Program Review/ Chemical and Biomolecular Engineering  
**Date:** Wednesday, May 5, 2021 8:28:59 AM

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Hi Barbel,

The Grad Council concurred with the program review team that the Chemical and Biomolecular Engineering program is viable. We also found the Dean and Department Chair's joint responses have addressed the main recommendations raised by the review team. We have no additional comments.

Thank you!

Lijing

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