

SCIENCE DEPARTMENT/CHEMISTRY PROGRAM DEPARTMENT & PROGRAM REVIEW 2024

Section 1: Report on Previous Goals & Requests

In the prior Academic Program Review, the Chemistry program stated the following goals:

We would like to **provide a comprehensive lower division program** in chemistry that includes General Chemistry, Organic Chemistry, GOB Chemistry and Physical Science Chemistry. Would like to **work towards an improved FT/PT ratio** with adequate compensation and a bigger commitment to PT faculty. If we are to **expand to northern campuses, we need infrastructure** to support that. We would like to **develop a community of learners** to provide our chemistry students with a clearer view of what their future looks like. We want to **keep a watch on our curricular decisions**—what we are teaching and how we are teaching it.

What requests did you make?

We just need **time** to pursue these interests, **permission to direct our efforts where they make the most sense**. The program is doing well.

Briefly explain the status and/or outcome of these goals and requests.

Re: **provide a comprehensive lower division program**

The Chemistry program has offered General Chemistry (221, 222, 223), Organic Chemistry (241, 242, 243) on a regular schedule in the years since our last Program Review. Introductory Chemistry 1 (CH104) remains a highly-enrolled class. Introductory Chemistry 2 and 3 (CH105 and CH106) ran with low enrollments except for AY22-23, when a staffing shortage forced a cancellation. CH106 will be cancelled again in Spring of 2024. Students were referred to PCC. General Science: Chemistry (GS105) has not been taught for a few years due to a lack of staff, and it's removal from the requirements for Fire Science, which made the course less essential.

A lack of staffing, coupled with limited facilities has driven scheduling decisions at the outer campuses as well. We are trying to maintain some service in those locations but it has been difficult, and placements in Redmond reduce our presence in Bend.

Re: **work towards an improved FT/PT ratio**

Compensation is, of course, mostly tied to the Collective Bargaining Agreement, although it is noted that funding Part-time faculty with rates matched to Adjuncts results in more slowly-growing pay scales for

Part-time faculty than for Full-time faculty. The Chemistry program has attempted to hire Adjuncts and Part-time faculty on multiple occasions without much success.

As for the “commitment” we would like to provide to Part-time faculty, this has also been difficult with Full-time faculty working overload assignments and at outer campuses, just to maintain the most essential level of service.

Re: expand to northern campuses, we need infrastructure

We are pleased to see the Madras campus expansion occurring, with professional architects and laboratory space planners to guide design and construction at that location. No changes have occurred in Prineville. In Redmond, Organic Chemistry (CH241, CH242, CH243) has been taught for 5 terms at that location. The laboratory spaces in RDM are basically workable for this course, with some minor inconveniences and inconsistencies compared to the resources available in MSC in Bend.

Re: develop a community of learners

Certainly the pandemic presented challenges to this goal! However we have managed to serve students, offering not only courses but also quality advising, and support throughout the intervening years. Students work collaboratively with one another and with multiple faculty in the department, as they move through the course sequences we teach, developing valuable connections along the way. These include connections with faculty (who can then make meaningful recommendations to receiving institutions), with peers (who help with academic success in other courses), and with outside entities (such as internships, University programs such as OPRIC, etc.).

Re: keep a watch on our curricular decisions

During the time I (Higginbotham) acted as Science Department Chair, this was supported by clear vertical integration of decision-making from faculty through the Department and into the course schedule. Recent changes in our scheduling systems have shifted considerably, which has caused some confusion and resulted in a loss of control at the program-level. At the course level we are well informed and connected to curricular decisions: via OPIRC, which links us to the University of Oregon programs, and through Common-course numbering efforts at HECC.

Section 2: Fulfilling Your Mission

What is your program or discipline mission statement, and how have you fulfilled this mission since your last APR/DPR?

Chemistry's mission is to provide students with the best possible education in the fundamental areas of modern chemistry while relating it to other disciplines and society.

In the broader context of these past years, "best possible" is worth noting here. With the reduction in chemistry FT faculty from retirement and assigned Chair duties, and with shocks to enrollment, and accompanying forced major shifts in instructional modalities (moving courses online, then partially online) our small group working in Chemistry has needed to demonstrate incredible creativity and flexibility while attempting to maintain this mission.

In the midst of all that we did manage to adjust and grow in ways that increased access to our courses and nurtured relationships with outside entities:

- We reinstated Organic Chemistry, a key course for students who wish to pursue bachelor's degrees in the sciences or pre-health professions. (aligning with the American Chemical Society's expectation for 2-year programs)
- We shifted courses into a hybrid mode involving reduced seat time for classes, with in-person classroom and lab sessions weekly, all scheduled on a single day. (improving access)
- We joined the University of Oregon's Oregon Pathways to Industry Research Careers (OPIRC) program. OPIRC is a National Science Foundation program supporting students at Community Colleges who are pursuing a MS degree, through the Knight Campus Graduate Internship Program (KCGIP). This year (AY23-24) we have had 2 OPIRC students, and are working on recruitment strategies to increase visibility of the program.
- Faculty have continued to work with Bend-LaPine and Jefferson County Schools, providing professional support to teachers at Middle and High School levels through the American Chemical Society/American Association of Chemistry Teachers (ACS/AACT) Science Coaches program. We have been involved now for 5 years, building professional relationships with 5 teachers in the program and others (teachers and district staff) through ancillary activities.
- Relating chemistry to other disciplines and society includes the development of SUS103, a Climate Change course taught by a chemist. In its inaugural offering, the class had a wait list.

With a staffing shortage it is difficult to grow or expand. However we remain aware of College priorities and have worked hard to maintain efforts that align with broader College goals:

- Programming to the Redmond campus continued, with continued sections of CH104 Introductory Chemistry scheduled at that location, and with Organic Chemistry also taught there. Service at the outlying campuses did not decline even with loss of staff in late Summer 2023.
- Students needing General Chemistry continued to be served well even when in-person instruction was impossible. Instructors identified and used the best-quality online lab and homework systems to give students experiences that were as authentic as possible (Aktiv Chemistry, PIVOT interactives). Consequently students had homework systems that allowed for chemical structure drawing, proper formula and reaction syntax, etc.. Also, online labs included

real experiments with student hypothesis generation and testing, student measurements, and data generated by students used as evidence supporting those hypotheses (or not! As happens in science).

Section 3: College Goals and Initiatives

How has your program or discipline participated in fulfilling the College's plans and priorities, attaining campus-wide goals, or participating in broad initiatives (e.g., strategic plan state or grant initiatives) since your last APR/DPR?

COCC Strategic Plan Values	Chemistry Program alignment with Value, example activities
Empowering Students	With students the center of concern, we have modified course offerings to provide multiple modalities (e.g. hybrid courses, online, etc.). Faculty use student-centered instructional approaches.
Engaging our Communities	Program involvement with OPIRC. Program connection to local businesses, Bend-LaPine Schools, University of Oregon.
Championing DEIB	Faculty searches in Chemistry advanced multiple candidates from historically-marginalized groups, including job offers to 4). Faculty involvement in OPIRC, which targets students from low SES and marginalized groups. Faculty involvement in C-JUSTICE project, the Climate Justice grant proposal (currently under review). Faculty work, supported by the College and OpenOregon, on OER Accessibility project to make Chemistry OER texts accessible to blind and visually impaired readers.
Supporting our Colleagues	Program flexibility with scheduling for faculty. Committee work on Tenure. Providing Department Chair.
Achieving Excellence	
Embracing Environmental Sustainability	Development of SUS103 Climate Change course. Continuing concern for materials acquisition, handling and proper disposal of hazardous materials within the Department and across campus (work with other programs).
Fostering Communication	State efforts at Common Course Numbering have come to Chemistry in order to align high-enrollment courses in the discipline (the General Chemistry course series and Introductory

	Chemistry). The HECC subcommittee for Chemistry includes membership from our Department.
Embracing Fiscal and Operational Sustainability	Careful handling of budget, including concern related to materials acquisition, handling and proper disposal. Attention to scheduling in order to offer courses which are adequately enrolled.

Section 4: Diversity and Inclusion Insights

The discipline of chemistry (internationally) has a complicated and sometimes embarrassing¹ history with respect to diversity, equity and inclusion efforts. For a snapshot of the current situation nationally, one can visit the American Chemical Society's organizational membership demographics report². ACS is the singular professional society for chemists in the United States, with a total membership of around 160,000, so the data on membership can reasonably be assumed to reflect the profession in general.

A review of those statistics reveals that chemistry as a discipline has demographics that do not fully represent the diversity in our communities. How does this occur?

There are multiple factors, but one contributor is the entrenched educational system in Chemistry, which has occasionally impeded efforts at inclusion. While we chemists excel at providing consistent curriculum and content standards across the nation, at holding high expectations, and making sure students have deep backgrounds in math and science, we also unfortunately tend to make achievement in chemistry difficult for those who have less traditional backgrounds. Introductory courses in Chemistry have relatively high attrition rates compared with other disciplines, with minoritized groups more affected.³

Community Colleges, which educate over 40% of students enrolling in General Chemistry, have an important role to play in solving this problem, with proportionally higher enrollment of minoritized groups and strong cultures of care and belonging. By building paths to progress via DEI efforts, providing supports for all students and pathways to successful completion of lower-division coursework and transfer, all students from all backgrounds can develop confidence they are able to reach their STEM education goals.

At COCC we participate in these efforts by:

- Utilizing pedagogies of inclusion, such as POGIL and other highly interactive, non-competitive approaches
- Monitoring attrition and student success to head off any problems with attrition or poor rates of success (Drop/Withdraw/Fail rates)
- Working to make student expectations clear and achievable, with strong supports (tutoring, for instance) for students who might benefit from them

¹ See <https://www.chemistryworld.com/news/angewandte-essay-calling-diversity-in-chemistry-harmful-decried-as-abhorrent-and-egregious/4011926.article>

² <https://www.acs.org/about/diversity.html>

³ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7286681/>

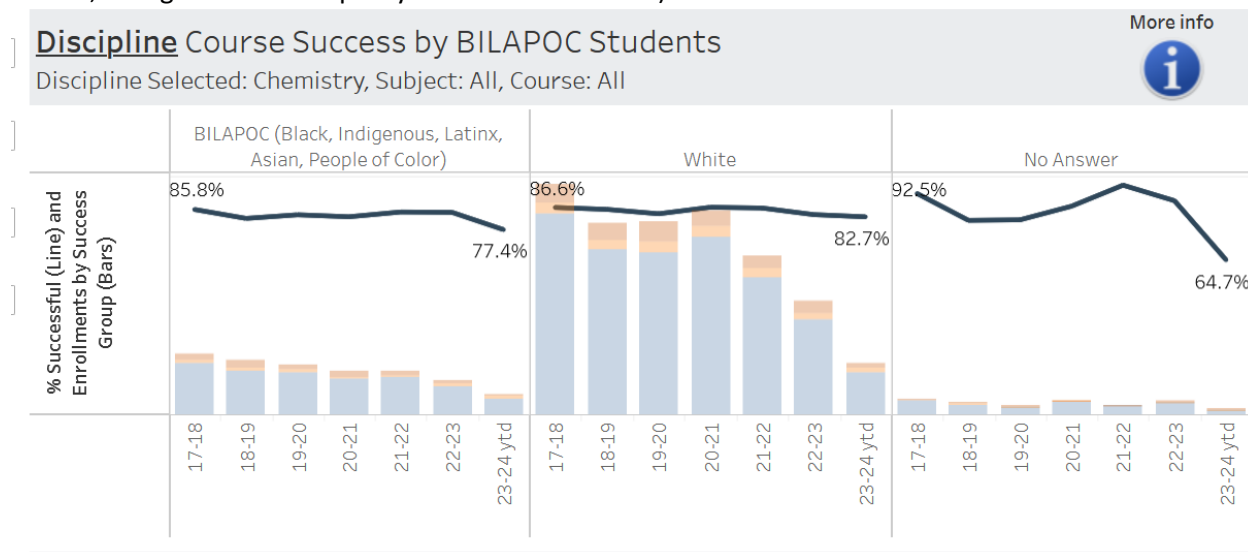
- Maintaining open enrollment in our courses to the extent possible (minimize prerequisites)
- Adhering to the COCC Principles of Community
- Employing approaches to hiring, staff and student support that benefit historically minoritized people, as described for instance by Dr. Beronda Montgomery and Dr. Ebony McGee

Special projects by faculty showing concern for DEIJ also include:

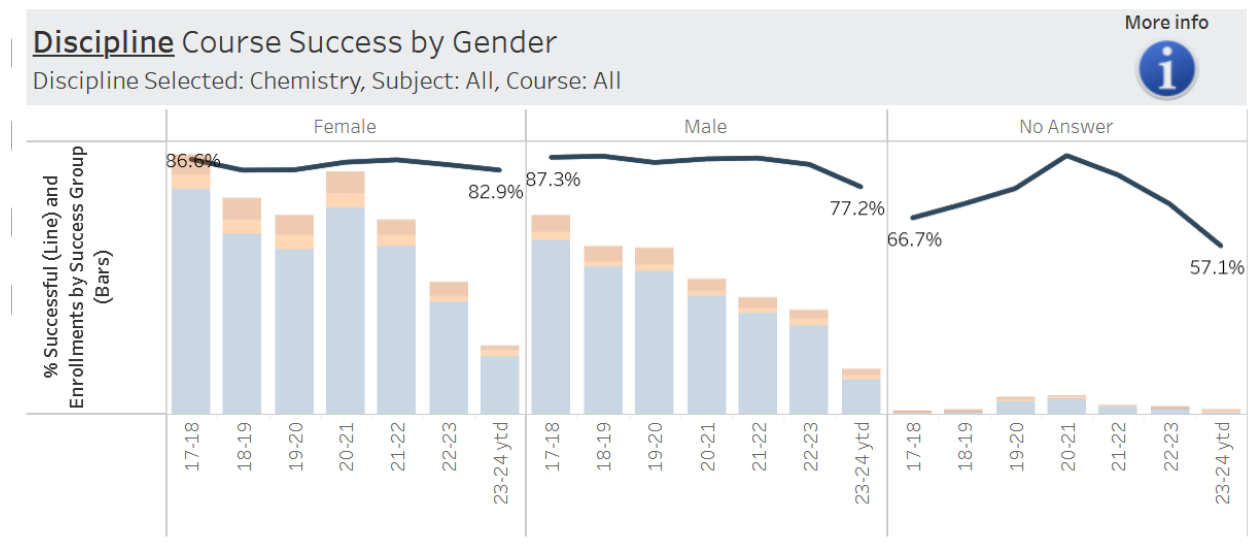
- Involvement in OPIRC, which is highly interested in extending scientific opportunities to underrepresented communities
- Grant-supported OER development for an Introductory Organic text which is fully accessible to blind/low vision individuals
- Partnerships with BLP Schools to provide Science Coaches to areas of the district with higher proportions of students from demographic groups which have been historically marginalized
- Participation in the Science Department Diversity group, and associated on-campus experiences for K12 students
- Participation in School of Ice workshop, which has as one component of its mission improved representation, and service to minoritized populations, and also use of materials from SOI in classes (improving representation)
- Climate Justice work (both as a participant in the Faculty Cohort for the WA C-JUSTICE program, and as a contributor to the grant proposal authored by Doucette and Price for an upcoming extension of this program beyond the state of Washington.

A review of data collected by the College on student demographics in Chemistry shows no notable differences between Chemistry and whole-College performance in success metrics by any of these categories: Gender, BILAPOC, Age, Veterans, Pell Grant receipt.

BILAPOC student success in Chemistry (compares favorably to College averages as +0.6-+7.2% over dates shown, though there is not parity with White students)



WOMEN students in Chemistry (compares favorably to College averages by (0.2-3.7% over dates shown))



Section 5: Strengths and Accomplishments

The Chemistry group at COCC continues to provide excellent education in chemistry in a welcoming environment, to all students. We continue to develop partnerships that benefit all students, supporting other programs (such as Nursing and Allied Health programs and Engineering, as well as general transfer), while also asserting our place as a discipline with its own pipeline to family-supporting employment opportunities.

To that end, we see as highlights:

- OPIRC participation, which has reinvigorated some parts of our curriculum and helped us re-grow a sense of connection to University programs,
- Science Coaches participation has nurtured relationships with K12 schools,
- Maintenance of core functions during upheaval of the pandemic, and challenges associated with reduced available staff has allowed us to continue serving students adequately,
- Reestablishment of the Organic class has now provided more complete lower-division coursework to our Chemistry instruction for students who intend to transfer for Bachelor or Masters Degrees, which is smoothing their transfer process (and keeping STEM students at COCC for longer, benefitting the whole college)

Section 6: Challenges

In order to grow successfully, the Chemistry program is first and foremost in need of qualified instructional staff to support excellence in the classroom, with advising, and other supports to students.

We have been working with a reduced instructional staff for several years as a consequence of (a) Chair assignment out of the program, (b) retirement of a key full-time faculty member, (c) loss of an Adjust faculty member, and (d) difficulty successfully recruiting to respond to a-c.

Recruitment is stymied by salary and benefit packages which are not competitive with other opportunities for employment, for chemists with similar education and experience.

The program enrollment has been negatively affected by the pandemic and subsequent challenges across higher education. However we also recognize significant opportunities may exist for enrollment growth in our program area in the future, and other programs we support (e.g. Engineering, Health Care careers and Biology). We ask that the College invest in 'rediscovering' Chemistry and providing marketing and internal supports (such as prioritization for new catalog program pages), to improve our visibility.

We remain a program which relies on substantial physical resources, as well. While our position with respect to these supports is currently great, it is very possible that in coming years there will be needs for financial support in order to repair or replace aging equipment and facilities.

Section 7: New Goals

While the work described above deserves classification as "accomplishments," work in the areas highlighted is not complete. Continuing progress in all the areas described will benefit the Program, Department, College and Community. That includes:

- Continued development of diversity among our Chemistry students: opportunities for outreach and supports for students who represent groups less-commonly supported in Science, including women, BIPOC students, disabled students, and LGBTQ+ students.
- Continued work to stabilize staffing, so we have highly-qualified and professional faculty to move our program forward and serve as models for our students.
- Improved visibility to the Community, aiding recruitment and access to people and resources from across the College district.
- Support systems that allow for continued excellence in physical-resource availability to assist in student learning.

These goals can be reviewed and assessed at the next DPR, with success looking like:

- A more diverse student body
- An invigorated, active professional faculty with high credibility to outside institutions,
- Increased enrollments with improved representation from minoritized groups and students from across the district,
- Gains in physical resource management and enriched lab experiences for students

Section 8: Resource Needs

Resources, strategies and support to accomplish the goals described above include:



Continued development of diversity among our Chemistry students: opportunities for outreach and supports for students who represent groups less-commonly supported in Science, including women, BIPOC students, disabled students, and LGBTQ+ students.

This goal could be supported with **robust support and training** for department faculty and staff, to identify and learn how to adopt pedagogical strategies that align with the goal. It could also be supported with **supported opportunities for faculty to make connections to the community** that invite and encourage students of all kinds to come and learn from us. Additionally, **investigation of and possible implementation of online coursework** in support of online degree programs might affect access to our courses, and thus demographics.

Continued work to stabilize staffing, so we have highly-qualified and professional faculty to interact with and serve as models for our students, and to mentor incoming Department faculty and staff.

This goal could be supported with **better pay and benefits for faculty, and/or with improvements to working conditions** and support that makes the work experience more pleasant and meaningful. The first step in achieving that is to get out of a staffing-shortage-low-morale loop, where a dearth of competent faculty leads to overloads which further deteriorates the work experience.

Steps that could be taken to assist in this process include (a) getting a handle on Advising expectations, (b) adopting a generous attitude for faculty who wish to develop new creative projects that align with the College goals, but which are only allowed as 'added work', and (c) reducing the administrative workload put onto faculty (without additional compensation) from existing systems (e.g. ARAs), change out of their control (e.g. schedule process changes) and increased interactions with complex new systems (e.g. Course Leaf).

One key to making a number of these changes is prioritizing support for Chairs, providing more time for them to have real influence and control 'on the ground' in the Departments, and less work that serves Administration without immediate Departmental benefit.

Improved visibility to the Community, aiding recruitment and access to people from across the College district.

Support for this goal could come from **investments of time and resources put toward any activity that connects program personnel to the Community**: K12 schools, projects with nonprofits, visits to/from local businesses, and marketing.

Support systems that allow for continued excellence in physical-resource availability to assist in student learning.

The Program has excellent support from a Lab Specialist and Lab Specialist Supervisor who assist with procurement, safe handling, storage and disposal of consumable materials as well as a large inventory of laboratory equipment and apparatus. We are deeply grateful for this, and any improvement in this area should involve lab staff design. **Improvements could target sustainability (in the fiscal sense) of this key support area.** This might come from developing plans for lifecycle processes for some equipment, including more expensive items (such as our infrared spectrometer, rotavaps) as well as lower-priced items that we use often (e.g. hot plate/stirrers, LabQuest data loggers). Making such changes might

require adjustments to budgeting systems, however, relying on systems for Capital purchases that require the program to write detailed requests on an annual timeline is somewhat of a mismatched process for the needs we might have.

Additionally, some physical resource improvements could improve instruction in the lab area of Redmond Building 1, where Chemistry is taught. These might include, for instance, improving the benchtop surfaces with chemical-resistant materials, along with redesign of cup sinks so spilled water can be directed into drains in the benches. Also, air handling and filtration could be improved to avoid the intake of sawdust from the outdoors, and storage for chemicals could be made both more secure and more appropriate for the materials being stored.



