California State Polytechnic University, Pomona

Cal Poly Pomona

Academic Program Review - Self-Study
College of Science
Department of Chemistry and Biochemistry
BS Chemistry and MS Chemistry

AY 2024-2025

February 7, 2025

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INTRODUCTION

Cal Poly Pomona (CPP) is one of 23 campuses of the California State University (CSU) system. It is the largest university system in the US, and was created in 1960 under the California Master Plan for Higher Education to focus on instruction and granting of baccalaureate and master's degrees. The CSU system now serves approximately 450,000 students annually, providing more than half of all undergraduate degrees conferred to the state's Hispanic/Latinx, African American, and Native American students combined.

CPP opened in 1938 as an all-male branch campus of Cal Poly San Luis Obispo. It enrolled its first female cohort of 329 students in 1961, formally separated from San Luis Obispo in 1966, gained WSCUC accreditation in 1970, was granted university-status in 1972, and converted from quarters to semesters in 2018. CPP is a regional comprehensive state university serving 26,415 students (Fall 2023; 93% undergraduate). CPP's student population is diverse with 53% self-identifying as Hispanic/Latino, and only 13% identifying as White. Fifty-five percent of our students are first generation, and 42% are Pell grant recipients.

Across 9 colleges, CPP offers undergraduate and graduate-level degrees. The department of Chemistry and Biochemistry is housed within the College of Science which offers 15 undergraduate degree programs and 6 Master's degrees across seven academic departments The College of Science has approximately 150 full-time faculty, 45 staff, and 4,600 active majors.

1.1 Program Overview

This program review encompasses the Bachelor of Science Degree in Chemistry and the Master of Science Degree in Chemistry. Both programs are housed within the Department of Chemistry and Biochemistry, within the College of Science at California State Polytechnic University, Pomona (Cal Poly Pomona or CPP).

The B.S. in Chemistry includes three options:

- American Chemical Society (ACS) Subplan/Option (120 units)
    - The ACS option is approved by the American Chemical Society as providing students with a "broad-based and rigorous chemistry education" that prepares students for continuing their education after graduation or entering the workforce as an effective scientist.
- Biochemistry Subplan/Option (120 units)
    - The Biochemistry option emphasizes the molecular and chemical bases underlying living systems. Students take additional courses from Biological Sciences and upper division Biochemistry electives.
- General Chemistry Subplan/Option (120 units)
    - The General Chemistry option provides students with maximum flexibility in tailoring a curriculum that matches their academic and career interests.

The M.S. in Chemistry has a single option:

- Chemistry (30 units)

Finally, the Department also offers a Minor in Chemistry (25 – 26 units) that provides students with a broad cross-section of the subdisciplines within Chemistry.

1.2 Mission, Vision & Values

UNIVERSITY[1]	**Mission** - We cultivate success through a diverse culture of experiential learning, discovery, and innovation.
	Vision - Cal Poly Pomona will be the model for an inclusive polytechnic university that inspires creativity and innovation, embraces local and global challenges, and transforms lives.
	Values • **Academic Excellence** – We demonstrate academic quality, relevance, and excellence through our teaching, learning, scholarship, and creative activities with student centered faculty in an evidence-based culture. • **Experiential Learning** – Our polytechnic identity fosters an integrative approach to education through collaboration, discovery, learn-by-doing, and innovation. Our approach encourages reflection, informed risk-taking, and continuous learning. • **Student Learning and Success** – We are deeply committed to educational experiences and supportive services that engage our students, enhance personal well-being and growth, provide career opportunities, and foster ethical citizenship. • **Inclusive** – Our diversity across multiple dimensions reflects and enhances our community. We are welcoming and respectful, and we value diversity. • **Community Engagement** – We nurture mutually beneficial and meaningful relationships with community partners and stakeholders. • **Social and Environmental Responsibility** – As global citizens, our individual and collective actions reflect our commitment to one another, society, and the environment.
COLLEGE OF SCIENCE[2]	**Mission** – Educate, mentor, and inspire students through scientific inquiry and hands-on learning
	Vision – Fostering curiosity and culture of scientific discovery
	Values – Curiosity, Integrity, Collaboration, Inclusivity, Innovation
DEPARTMENT OF CHEMISTRY & BIOCHEMISTRY	**Mission and Vision** – Our faculty educate by linking theory and practice. Through these innovative chemistry experiences, our students are transformed into science and industry leaders. **Vision** To catalyze intellectual growth through innovative, hands-on chemistry experiences that transform our students into science and industry leaders. **Mission** To educate by linking theory and practice and inspire Cal Poly Pomona students and the wider community through: • Excellence in teaching • A cohesive, rigorous, lab-intensive curriculum • One-on-one advising and mentoring • Participation in research and scholarly activities • Collaboration with and outreach to local industries and educational institutions • Support of extracurricular student activities

[1] Source: https://www.cpp.edu/~aboutcpp/calpolypomona-overview/mission-and-values.shtml

[2] Source: https://www.cpp.edu/sci/about/index.shtml

1.3 History

The last program review was finalized in Spring of 2018, the term immediately prior to semester conversion. As outlined in this report, there were significant changes made to our curriculum to prepare for the shift from quarters to semesters. Because of the preparation by the department and chair leading up to Fall 2018, the transition was as smooth as it could be. Several bridge courses were offered to students who were caught in the transition between the courses so that they would not be adversely impacted. Advising also heavily emphasized planning schedules to limit students caught in the transition.

During the period of review, the pandemic also had a large impact on our program. For the last 5 weeks of Spring 2020 and the 2020-2021 AY, we were exclusively online. Our program is lab heavy, and as such, a significant amount of innovation by our department faculty (adjunct and tenure-track) was carried out to provide the best laboratory experience possible without actually being in a lab. These innovations included making online videos, providing data, some had simulated data, while others adjusted the experience to focus on data processing and analysis (a key component of any science education). Once we returned to in-person labs Fall 2021, we went back to mostly in-person labs with one or two exceptions. As with almost all our curriculum changes due to the pandemic, we reverted to pre-pandemic modality but used our knowledge and developed resources to provide a better experience for our students.

<u>Previous program review suggestions and actions</u>
The previous program review provided several recommendations and suggested actions. Most notably, there were two categories that needed improvement. The first was facilities, for which our self assessment and reviewer assessment determined that our facilities are inadequate, limiting our course offerings and increasing hazards for our students. The second was course offerings for bottleneck courses, primarily our organic chemistry series.

Facilities: The self assessment and external reviewers agreed that our facilities are woefully inadequate to carry out our university's mission safely. They noted our deteriorating fume hoods and lab spaces in our organic chemistry laboratories, which are pivotal to not only to the safety of our students but the long-term safety of our instructors. They also noted that our limited lab spaces has a deleterious impact on our ability to offer additional sections of organic chemistry lab. Paired with limited evening ours for our onsite health clinic, the reviewers recommended lab renovations complemented with expanding on-campus healthcare access to include evening hours so that we can safely run additional lab sections.

Course Offerings: The self assessment and comments by the external reviewers agree that we had a significant bottleneck in our organic chemistry courses and recommended hiring additional organic chemistry instructors. However, we are limited by the availability of on campus healthcare and the safety of the facilities for our students and faculty.

Actions: Since the review, we completed renovation of one laboratory to update and expand our fume hood capacity. These renovations allowed us to increase each lab section capacity for our Organic Chemistry I and II (CHM 3140L and CHM 3150L). Although we still operate within the same hours (8 am – 7 pm), we are able to accommodate more students in the courses. Additionally, we have hired four additional organic chemists since the last review. Paired with retirements and other attrition, the net gain is 2 additional organic chemists to our department, providing us with the capacity to increase course offerings in organic chemistry.

Major Program Changes and Achievements:
Despite the pandemic, our department has continued to grow and adapt to the changing demographics of our students and community. Our faculty hiring has outpaced attrition and we have grown in organic chemistry and analytical chemistry, two bottleneck areas in our department. Additionally, in Fall of 2023, we piloted an Organic Chemistry 1 and Lab for Chemistry Majors followed by Organic Chemistry 2 in Spring 2024. In addition to the Chemistry Majors only section, we embedded two learning assistants in lecture and one each in the coupled labs. The student learning experience (anecdotally) was significantly improved and the success rate for the course significantly better than the course average (determined by DFW rate).

Fall 2024 we are expanding our student intervention in Organic Chemistry to include embedded tutors in additional course sections, facilitated through the Learning Resource center. We are also piloting an optional activity section for CHM 1210/L and CHM 1220/L as a way of building a better chemistry foundation for those continuing in Chemistry and increase success in our General Chemistry courses. If these pilots are successful, we will expand the offerings and pilot a similar program for organic chemistry.

1.4 Credit Hour

As of July 1, 2011 federal law (Title 34, Code of Federal Regulations, sections 600.2 and 600.4) requires all accredited institutions to comply with the federal definition of the credit hour. For all CSU degree programs and courses bearing academic credit, the "credit hour" is defined as "the amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally established equivalency that reasonably approximates not less than:

- *One hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work each week for approximately fifteen weeks for one semester or trimester hour of credit, or ten to twelve weeks for one quarter hour of credit, or the equivalent amount of work over a different amount of time; or*
- *At least an equivalent amount of work as required in paragraph (1) of this definition for other academic activities as established by the institution, including laboratory work, internships, practica, studio work, and other academic work leading to the award of credit hours."*

A credit hour is assumed to be a 50-minute period. In courses in which "seat time" does not apply, a credit hour may be measured by an equivalent amount of work, as demonstrated by student achievement.

Most courses offered by the Chemistry & Biochemistry Department meet in a face-to-face format, and all courses required for Chemistry majors use this modality. A 3-unit lecture course will meet for 150 minutes per week, and students are expected to spend a minimum of 2 hours outside of class per unit. The Department regularly reviews the material for courses taught by lecturer faculty and assistant/associate professor faculty to ensure the course content meets both the credit hour policy and the course learning outcomes. The review process is conducted by the RTP committee and the Temporary Faulty Evaluation Committee through the evaluation process.

Chemistry & Biochemistry offers laboratory and activity courses, as well as supervisory courses:

- Laboratory course: a 1-unit laboratory course meets for 170 minutes each week. Students are expected to spend 1 – 3 hours per week outside of class preparing for lab. This may take the form of writing lab reports, preparing laboratory notebooks before lab, and studying for in-class quizzes.
- Activity course: a 1-unit activity course meets for 110 minutes each week. Students are expected to spend 2 – 3 hours per week outside of class preparing for the activity course. This may take the form of completing assignments, studying, or working on projects.
- Supervisory course: 1 – 3-unit supervisory courses allow students to earn academic credit for independent research under the guidance of a faculty member. It is expected that students spend 3 – 4 hours per week in the research lab for each unit of a supervisory course. Students can enroll in more than 1 unit with the expectation that the time in research will increase proportionally. At the faculty member's discretion, the student may prepare regular reports detailing progress.

2 PROGRAM EVALUATION – UNDERGRADUATE

2.1 Curriculum and Pedagogy – Undergraduate

For a list of the curriculum, please see the curriculum sheets in the appendix. We have 48 units of Major Required Core that is required for all our majors (CHM 1210/L, CHM 1220/L, CHM 2210/L, CHM 2910A, CHM 3140/L, CHM 3150/L, CHM 3270/L, CHM 3520L, MAT 1140, MAT 1150, PHY 1510/L, and PHY 1520/L. Currently, each option also requires 2 out of the 3 of our analytical series (CHM 3420/L, CHM 3430/L, CHM 3440/L). Additionally, each option requires students to choose from either physical chemistry series CHM 3040/3050 or CHM 3110/3120 (the latter is required for the ACS option). Although Chemistry curriculum is generally universal with some minor changes, the CPP curriculum predominately excels in the laboratory offerings and requirements for our majors. The laboratory training is exemplified by the analytical course requirements for our students, where at least 4 units are required (2 units of lecture and 2 units of lab). Since 2018, we have adopted a required Chemical Communications course (CHM 2910A) which introduces students to industry careers, journal articles, searching scientific literature, communicating with faculty, research, and fundamental "library" skills. Standards over the last 7 years have largely remained unchanged, with new pedagogical approaches being adopted in ways that are still conducive to the rigorous nature of chemical education.

Our department has been focused on post-baccalaureate career preparation. Our students have opportunities for hands-on experience with all of our instrumentation and we provide a research experience for any of our majors that desire one. Because of this flexibility in our curriculum, our faculty have innovated and added project-based inquiry to analytical labs physical chemistry lab. Students are taught and expected to provide oral and written communication in several classes.

Table 1: Comparison of required math, physics, and lab (chemistry) requirements for the Chemistry B.S. degree (ACS option)

	ACS Certification	Math (ACS Option)	Physics (ACS Option)	Research and Seminar (ACS Option)	Total Chem Lab Units
CPP	Yes	12	8	Both	14
CSU Fullerton	Yes	8	8	Both	12
Long Beach	Yes	12	8	Both	13
SLO (qu)	Yes	12	8	Both	12
UCR (qu)	Yes	13	15	Both	6
UCLA (qu)	No	20	17	Research	6

qu = quarter units; all other units are semester

Table 2: Comparison of Chemistry units (including both lecture and lab) for the Chemistry B.S. degree (ACS option)

	General	Analytical	Biochemistry	Inorganic	Organic	Physical
CPP	8	8	4	4	13	8
CSU Fullerton	10	8	3	3	10	9
Long Beach	10	4	3	5	8	9
SLO (qu)	8	5	5	5	15	12
UCR (qu)	15	5	8	4	12	16
UCLA (qu)	15	6	8	8	19	12

qu = quarter units; all other units are semester

American Chemical Society (ACS) Certified Program Comparison

For comparison, only the ACS option of our program is being compared to other institutions. Generally, there is good agreement between our program and those at other CSU's. All but one program (UCLA) is ACS certified, driving a significant amount of uniformity between the programs. The B.S. in Chemistry (ACS Certified) and CPP offers the greatest number of required units of lab when compared to the institutions listed in Table 1, providing students with the "learn by doing" that has become paramount to career readiness. Although expensive to run, dedication to our students through the continued offering of these labs makes our graduates highly desired by companies, graduate schools, and professional schools. Our ACS option provides rigorous curriculum that is certified by the American Chemical Society and must include items such as inorganic chemistry, mass spectrometry, access to a 400 MHz NMR, and biological chemistry/biochemistry. Additionally, our ACS certified degree requires students to carry out research under the supervision of our faculty (curriculum sheet in the appendix).

Biochemistry Option (B.S. Chemistry)

The Biochemistry option provides students with a more in-depth exploration of biochemistry and biological chemistry. Although still a Chemistry B.S. degree, students who elect for the Biochemistry option are required to take a full year of Biochemistry, additional biology courses (such as genetics and molecular biology), upper division biology electives, and specified chemistry electives focused on biochemical systems. Additionally, students in the Biochemistry option are also provided with an opportunity to carry out research for credit by completing our senior project series, which will count toward elective units (curriculum sheet in the appendix).

General Option (B.S. Chemistry)

The General Option provides our majors with the same core requirements as the other two options, but is designed to provide students curricular flexibility by allowing students to take over 23 units of electives, 12 of which can be outside the major (but related to career objectives). Students can then design a curriculum that empowers their exploration of chemistry and related areas in a non-prescribed way, but still facilitating a high quality experience. As with the Biochemistry option, students are encouraged to complete their senior project as part of the elective option so that they can take advantage of research opportunities within our department and earn degree credit (curriculum sheet in the appendix).

Table 3 provides a list of GE courses taught by the department and Table 4 provides a list of honors courses taught by the department. If your department offers Service-learning courses, please provide them in a separate table.

Table 3: General Education Courses[3]

Course	Course Title
CHM 1010	Chemistry in Our World
CHM 1010L	Chem in Our World Lab
CHM 1210	General Chemistry I
CHM 1210L	General Chemistry I Lab
CHM 1220	General Chemistry II
CHM 1220L	General Chemistry II Lab
CHM 2120	Chem for Elementary Educators
CHM 2120L	Chem for Elementary Educators Lab
CHM 3010	Modeling Fund of Physical Chem

Table 4: Honors Courses[4]

Course	Course Title
CHM 4000H	Spec Study for UD Students
CHM 4610H	Senior Project 1
CHM 4620H	Senior Project 2

[3] Source: Tableau https://analytics.cpp.edu/#/site/production/views/ClassSchedule/CourseAttribute?:iid=1
[4] Source: Tableau https://analytics.cpp.edu/#/site/production/views/ClassSchedule/CourseAttribute?:iid=1

Table 5 provides data associated with high non-passing rates for Chemistry and Table 6 provides data for Biochemistry. The data are presented in two separate tables because CSU Dashboard has them as separate options. It is important to note that the numbers reported below are based on filtering the data by major, so only students enrolled as a Chemistry major or Biochemistry major respectively are included in the counts. "Impact" is determined by multiplying the enrollment by the non-passing rate and is the number of students who did not pass the course.

Table 5: High-DFW's by Non-Pass Rates for 2018-2023 for the Chemistry (ACS) and General Chemistry options[5]

Non-Passing					
Year Term	**Course Code**	**Course Title**	**Enrollment**	**Non-passing Rate**	**Impact**
All Academic Yrs-Semester	CHM3110	Classical Physical Chemistry	109	37%	40
All Academic Yrs-Semester	CHM3140	Organic Chemistry I	211	30%	64
All Academic Yrs-Semester	CHM3150	Organic Chemistry II	152	29%	44
All Academic Yrs-Semester	CHM3120	Quantum Physical Chemistry	71	25%	18
All Academic Yrs-Semester	CHM4230L	Physical Organic Chemistry Lab	12	25%	3
All Academic Yrs-Semester	CHM3010	Modeling Fund of Physical Chem	45	22%	10
All Academic Yrs-Semester	CHM4010	Inorganic Chemistry	105	20%	21
All Academic Yrs-Semester	CHM4090	Polymer Chemistry	55	20%	11
All Academic Yrs-Semester	CHM4190	Quantum Chemistry	25	20%	5
All Academic Yrs-Semester	CHM1220*	General Chemistry II	123	18%	22
All Academic Yrs-Semester	CHM2210L	Quantitative Analysis Lab	197	16%	31
All Academic Yrs-Semester	CHM2210	Quantitative Analysis	196	15%	29
All Academic Yrs-Semester	CHM3270	Biochemistry I	165	15%	24
All Academic Yrs-Semester	CHM1210*	General Chemistry I	135	15%	20
All Academic Yrs-Semester	CHM3040	Elements of Physical Chem I	127	15%	19
All Academic Yrs-Semester	CHM3280	Biochemistry II	41	15%	6
All Academic Yrs-Semester	CHM2910A	Chemical Communication Act	233	12%	28
All Academic Yrs-Semester	CHM1220L*	General Chem Laboratory II	115	12%	14
All Academic Yrs-Semester	CHM3050	Elements of Physical Chem II	107	12%	13
All Academic Yrs-Semester	CHM3210	Elements of Biochemistry	31	10%	3

*GE Courses

[5] CSU Dashboard "In Which Courses Do They Struggle" Report https://csusuccess.dashboards.calstate.edu/public/faculty-dashboard/where-do-they-struggle

Table 6: High-DFW's by Non-Pass Rates for 2018-2023 for the Biochemistry Option[6]

Non-Passing					
Year Term	**Course Code**	**Course Title**	**Enrollment**	**Non-passing Rate**	**Impact**
All Academic Yrs-Semester	CHM3140	Organic Chemistry I	324	28%	90
All Academic Yrs-Semester	CHM3010	Modeling Fund of Physical Chem	18	28%	5
All Academic Yrs-Semester	CHM1220*	General Chemistry II	214	27%	57
All Academic Yrs-Semester	CHM4010	Inorganic Chemistry	20	25%	5
All Academic Yrs-Semester	CHM4510	Enzymology	12	25%	3
All Academic Yrs-Semester	CHM3150	Organic Chemistry II	250	23%	57
All Academic Yrs-Semester	CHM1210*	General Chemistry I	268	21%	56
All Academic Yrs-Semester	CHM1210L*	General Chemistry Laboratory I	264	20%	53
All Academic Yrs-Semester	CHM1220L*	General Chem Laboratory II	207	18%	37
All Academic Yrs-Semester	CHM3040	Elements of Physical Chem I	251	15%	37
All Academic Yrs-Semester	CHM2210	Quantitative Analysis	236	14%	34
All Academic Yrs-Semester	CHM4510L	Enzymology Laboratory	14	14%	2
All Academic Yrs-Semester	CHM2210L	Quantitative Analysis Lab	235	13%	31
All Academic Yrs-Semester	CHM2910A	Chemical Communication Act	297	12%	35
All Academic Yrs-Semester	CHM3310L	Clinical Chemistry Laboratory	54	11%	6
All Academic Yrs-Semester	CHM3310	Clinical Chemistry	54	11%	6
All Academic Yrs-Semester	CHM3270	Biochemistry I	261	10%	27
All Academic Yrs-Semester	CHM3050	Elements of Physical Chem II	224	9%	20
All Academic Yrs-Semester	CHM3280	Biochemistry II	186	9%	17
All Academic Yrs-Semester	CHM4530	Infor Biomlcls Recombinant Dna	161	9%	14

*GE Courses

[6] CSU Dashboard "In Which Courses Do They Struggle" Report https://csusuccess.dashboards.calstate.edu/public/faculty-dashboard/where-do-they-struggle

Figure 1 depicts the Chemistry courses with the largest equity gaps for URM and non-URM students for all terms from 2018-2023. Figure 2 depicts the Chemistry courses with the largest equity gaps for Pell and non-Pell recipients. The scale uses grades (*1 = D; 2 = C; 3 = B; 4 = A*).

Figure 1– Courses with the Largest Equity Gaps by URM Status for Chemistry[7]

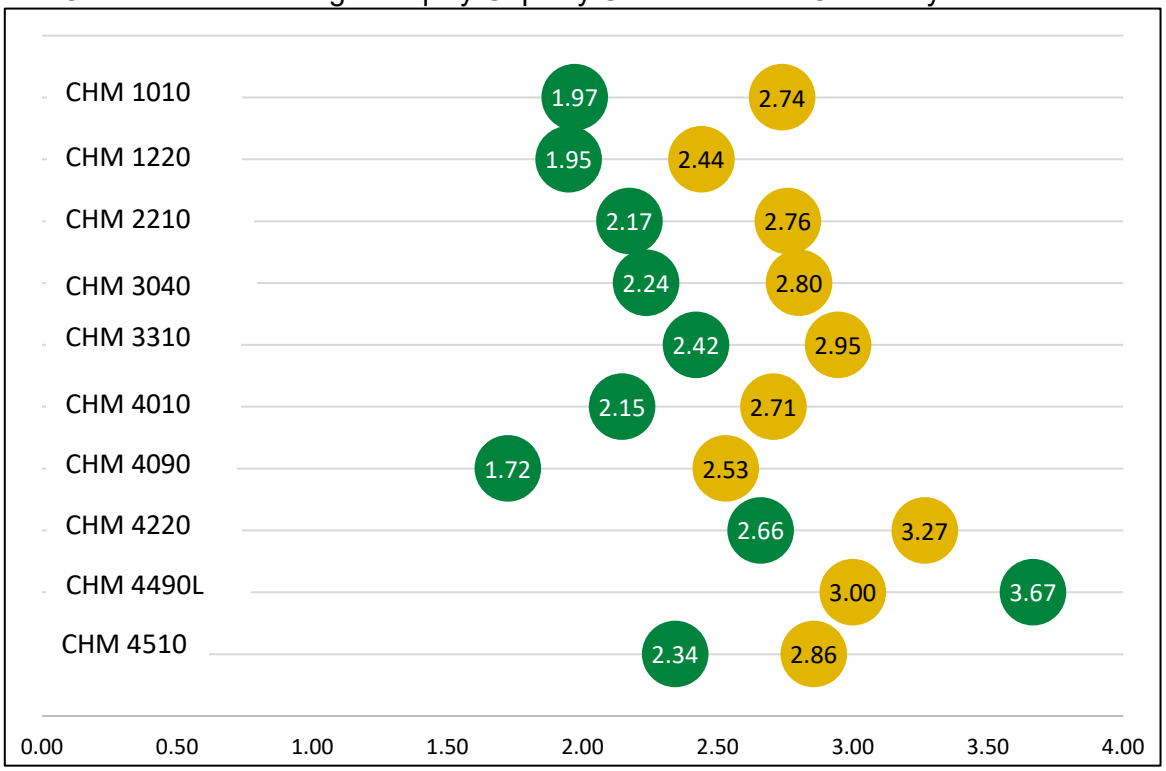
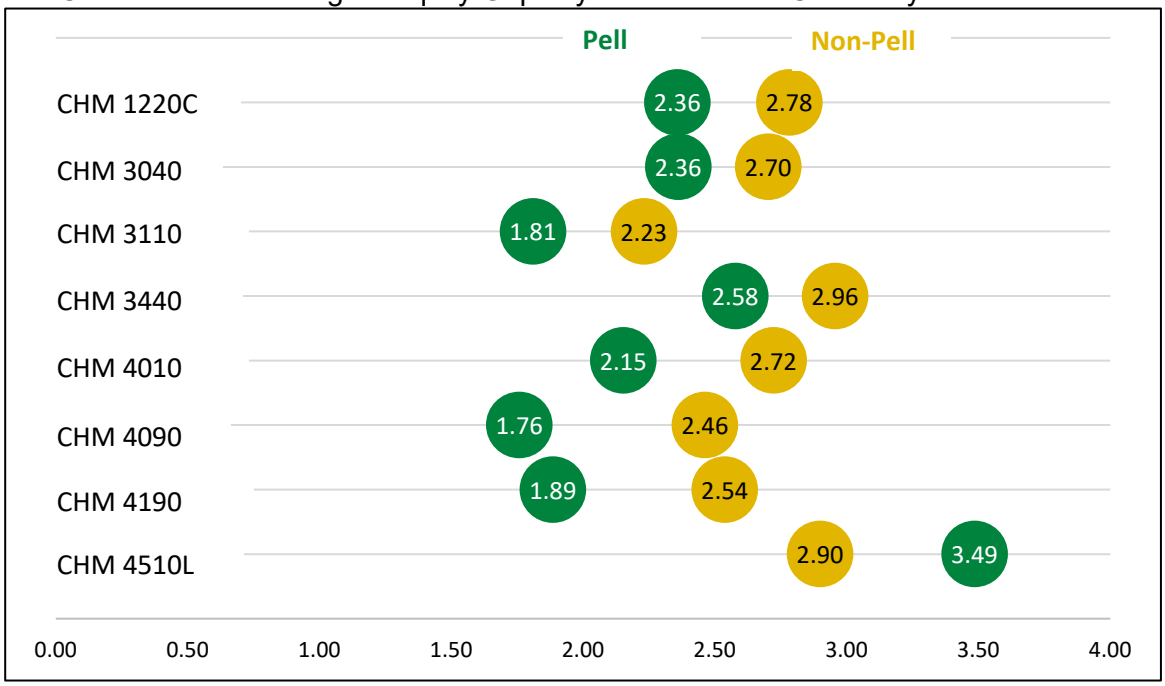


Figure 2– Courses with the Largest Equity Gaps by Pell Status for Chemistry[8]



[7] Source: Tableau https://analytics.cpp.edu/#/site/production/views/CourseEquityGaps/EquityGaps?:iid=1
[8] Source: Tableau https://analytics.cpp.edu/#/site/production/views/CourseEquityGaps/EquityGaps?:iid=1

As outlined in section 1.3, we have instituted major program changes aimed to reduce DFW and repetition rates for our majors. To make sure our majors can enroll in some of our impacted courses, we have created “majors-only” sections to facilitate enrollment (such as CHM 3140/L and CHM 3150/L). Additionally, the majors-only courses are structured to provide foundational knowledge important in all their degree coursework.

We are piloting activity sections for General Chemistry to support student learning and increase access to resources and help. If successful, we will expand the pilot to Organic Chemistry in AY 2025.

Courses in related areas are essential to supporting our department. Some of these related areas include Math and Statistics, for which calculus two is required for many of our majors and Linear Algebra with Differential Equations is required for our ACS option. Additionally, PHY 1510 and 1520 is also a requirement to support our physical chemistry series. These support courses have introduced elements to enhance the success of our students, including PHY 1510A, which is an optional activity to enhance student learning and there are common calculus finals to better calibrate the student experience.

2.2 Assessment of Student Learning – Undergraduate

Table 7: Curriculum Matrix

Student Learning Outcome	Course Number																				
	CHM 1210	CHM 1210L	CHM 1220	CHM 1220L	CHM 2210	CHM 2210L	CHM 2910A	CHM 3140	CHM 3140L	CHM 3150	CHM 3150L	CHM 3270	CHM 3270L	CHM 3420/L	CHM 3430/L	CHM 3520L	CHM 4010	CHM 4220/L	CHM 4230/L	CHM 4240/L	CHM 4630
SLO 1. Students will compare, contrast and predict physical and chemical properties based on atomic and molecular structure. Students will apply these principles to the chemistry of living systems and demonstrate the ability to solve quantitative, interdisciplinary, and real-world problems.	**I**	**I**	**I**	**I**	**D**	**D**		**D**	**D**	**MA**	**M**	**D**	**D**	**MA**	**MA**	**MA**	M	M	M	M	M
SLO 2. Students will be able to design and execute an experimental procedure, work independently, interpret experimental results, and draw a reasonable, accurate conclusion. Students will synthesize, isolate, purify and characterize compounds using modern methods and instrumental techniques.		**I**		**I**		**D**			**D**		**M**		**D**	**M**	**M**	**MA**		M	M	M	
SLO 3. Students will observe safe practices in the laboratory and will know how to respond in an emergency. Students will learn to gather hazardous materials information and will recognize and respond properly to potential hazards of handling chemicals and chemical waste.		**I**		**I**		**D**			**D**		**MA**		**MA**	**M**	**M**	**M**		M	M	M	
SLO 4. Students will use computer technology to gather, process, analyze, and present chemical data, and communicate critical analysis of scientific information through written reports, laboratory notebooks, and oral presentations.		**I**		**I**	**D**	**D**	**IA**		**D**		**M**		**D**	**MA**	**MA**	**MA**	M	M	M	M	M
SLO 5. Students will use chemical literature and computer resources to gather research information.					**I**	**I**	**IA**				**D**		**D**	**D**	**D**	**M**	M	M	M	M	M
SLO 6. Students will demonstrate the ability to function as practicing chemists, through activities such as undergraduate research, Senior Project and Co-op. Through coursework and laboratory experiences, students will work successfully both independently and as part of a team.		**I**		**I**		**D**			**D**	**D**	**M**	**D**	**M**	**MA**	**MA**	**M**	M	M	M	M	M
SLO 7. Students will benefit from faculty mentoring and academic advising. Through organizations and activities such as the SMACS Chemistry Club, alumni panels, seminars, and Professor for a Day, students will explore career opportunities and participate in career and graduate school planning.							**IA**														M

Table 8: Alignment Matrix

Program Learning Outcome	Student Learning Outcome	Core Competencies					Strategic Vision		
		Critical Thinking	Information Literacy	Oral Communication	Written Communication	Quantitative Reasoning	Innovation and Creativity	Civic Engagement	Problem Solving
Theory and Practice (PLO 1): Students will apply fundamental chemical principles to solve problems, interpret data and explain outcomes.	**SLO 1.** Students will compare, contrast and predict physical and chemical properties based on atomic and molecular structure. Students will apply these principles to the chemistry of living systems and demonstrate the ability to solve quantitative, interdisciplinary, and real-world problems.	X				X			X
Laboratory Skills and Safety (PLO 2): Students will use a variety of laboratory techniques to safely conduct chemical experiments and procedures.	**SLO 2.** Students will be able to design and execute an experimental procedure, work independently, interpret experimental results, and draw a reasonable, accurate conclusion. Students will synthesize, isolate, purify and characterize compounds using modern methods and instrumental techniques.				X	X	X		
	SLO 3. Students will observe safe practices in the laboratory and will know how to respond in an emergency. Students will learn to gather hazardous materials information and will recognize and respond properly to potential hazards of handling chemicals and chemical waste.		X						
Communication and Information Literacy (PLO 3): Students will develop and utilize effective computer, written and oral communication skills in a scientific setting.	**SLO 4.** Students will use computer technology to gather, process, analyze, and present chemical data, and communicate critical analysis of scientific information through written reports, laboratory notebooks, and oral presentations.			X	X				
	SLO 5. Students will use chemical literature and computer resources to gather research information.		X						

Program Learning Outcome	Student Learning Outcome	Core Competencies					Strategic Vision		
		Critical Thinking	Information Literacy	Oral Communication	Written Communication	Quantitative Reasoning	Innovation and Creativity	Civic Engagement	Problem Solving
Readiness for Career or Advanced Degree (PLO 4): Chemistry major graduates will be prepared to pursue a career or an advanced degree in chemistry or a chemistry-related field.	**SLO 6.** Students will demonstrate the ability to function as practicing chemists, through activities such as undergraduate research, Senior Project and Co-op. Through coursework and laboratory experiences, students will work successfully both independently and as part of a team.	X			X		X		
	SLO 7. Students will benefit from faculty mentoring and academic advising. Through organizations and activities such as the SMACS Chemistry Club, alumni panels, seminars, and Professor for a Day, students will explore career opportunities and participate in career and graduate school planning.							X	

Table 9: Overall assessment plan

PLO/SLO Alignment	SLOs	Courses where each SLO is addressed.	Assessment activity (signature assignment) used to measure each SLO.	Assessment tool used to measure outcome success	How assessment data will be reported as evidence SLO performance criteria have been met	Designated personnel to collect, analyze, and interpret student learning outcome data for the program	Student learning outcome data dissemination schedule	Closing the loop strategies
Theory and Practice (PLO 1): Students will apply fundamental chemical principles to solve problems, interpret data and explain outcomes.	**SLO 1.** Students will compare, contrast and predict physical and chemical properties based on atomic and molecular structure. Students will apply these principles to the chemistry of living systems and demonstrate the ability to solve quantitative, interdisciplinary, and real-world problems.	CHM 1210/L, 1220/L, CHM 2210/L, CHM 3140, 3150 CHM 3270/L, CHM 3420/L, CHM 3430/L, CHM 3520L, CHM 3270	embedded exam questions, ACS standardized final, periodic MFT test	grading rubric	% of students met or exceeded competent performance	collected by course instructor(s); analyzed by Curriculum Committee	Department assessment meeting Spring semester	developing active-learning strategies focused on LO
Laboratory Skills and Safety (PLO 2): Students will use a variety of laboratory techniques to safely conduct chemical experiments and procedures.	**SLO 2.** Students will be able to design and execute an experimental procedure, work independently, interpret experimental results, and draw a reasonable, accurate conclusion. Students will synthesize, isolate, purify and characterize compounds using modern methods and instrumental techniques.	CHM 1210L, 1220L, CHM 2210L, CHM 3420L, CHM 3430L, CHM 3520L	sample laboratory reports	grading rubric	% of students met or exceeded competent performance	collected by course instructor(s); analyzed by Curriculum Committee	Department assessment meeting Spring semester	modifying lab exercises and experiments
	SLO 3. Students will observe safe practices in the laboratory and will know how to respond in an emergency. Students will learn to gather hazardous materials information and will recognize and respond properly to potential hazards of handling chemicals and chemical waste.	CHM 1210L, 1220L, CHM 2210L, CHM 3140L, 3150L CHM 3270L, CHM 3420L, CHM 3430L, CHM 3520L	sample laboratory report, embedded quiz questions	grading rubric	% of students met or exceeded competent performance	collected by course instructor(s); analyzed by Curriculum Committee	Department assessment meeting Spring semester	modifying lab exercises and experiment; improving training and resources
Communication and Information Literacy (PLO 3): Students will develop and utilize effective computer,	**SLO 4.** Students will use computer technology to gather, process, analyze, and present chemical data, and communicate critical analysis of scientific information through	CHM 2210/2210L, CHM 2910A, CHM 3140L, 3150L CHM 3270L, CHM	sample laboratory report/notebooks	grading rubric	% of students met or exceeded competent performance	collected by course instructor(s); analyzed by Curriculum Committee	Department assessment meeting Spring semester	modifying lab exercises, training and resources

PLO/SLO Alignment	SLOs	Courses where each SLO is addressed.	Assessment activity (signature assignment) used to measure each SLO.	Assessment tool used to measure outcome success	How assessment data will be reported as evidence SLO performance criteria have been met	Designated personnel to collect, analyze, and interpret student learning outcome data for the program	Student learning outcome data dissemination schedule	Closing the loop strategies
written and oral communication skills in a scientific setting.	written reports, laboratory notebooks, and oral presentations.	3420/L, CHM 3430/L, CHM 3520L						
	SLO 5. Students will use chemical literature and computer resources to gather research information.	CHM 2210/L, CHM 2910A, CHM 3270L, CHM 3420/L, CHM 3430/L, CHM 3520L	oral presentation	presentation rubric	% of students met or exceeded competent performance	collected by course instructor(s); analyzed by Curr.Committee	Department assessment meeting Spring semester	modifying lab exercises, training and resources
Readiness for Career or Advanced Degree (PLO 4): Chemistry major graduates will be prepared to pursue a career or an advanced degree in chemistry or a chemistry-related field.	**SLO 6.** Students will demonstrate the ability to function as practicing chemists, through activities such as undergraduate research, Senior Project and Co-op. Through coursework and laboratory experiences, students will work successfully both independently and as part of a team.	CHM 3420L, CHM 3430L, CHM 3520L, CHM 4410, CHM 4610, 4620, 4630	Exit survey for graduating seniors, laboratory reports	survey analysis, grading rubric	% of students participating in UG research, team projects	collected by course instructor(s); analyzed by Curriculum Committee	Department assessment meeting Spring semester	implement suggestions from survey
	SLO 7. Students will benefit from faculty mentoring and academic advising. Through organizations and activities such as the SMACS Chemistry Club, alumni panels, seminars, and Professor for a Day, students will explore career opportunities and participate in career and graduate school planning.	CHM 2910A	Exit survey for graduating seniors	survey analysis,	% of students reporting benefit	collected by course instructor(s); analyzed by Curriculum Committee	Department assessment meeting Spring semester	implement suggestions from survey

Table 10: Assessment Data Collection Timeline

Student Learning Outcome	Academic Year					
	AY 20-21	**AY 21-22**	**AY 22-23**	**AY 23-24**	**AY 24-25**	**AY 25-26**
SLO 1. Students will compare, contrast and predict physical and chemical properties based on atomic and molecular structure. Students will apply these principles to the chemistry of living systems and demonstrate the ability to solve quantitative, interdisciplinary, and real-world problems.	CHM 3280 exam	CHM 3150 ACS standardized final exam	CHM 3520L embedded exam questions, MFT test		SLO 1. Students will compare, contrast and predict physical and chemical properties based on atomic and molecular structure. Students will apply these principles to the chemistry of living systems and demonstrate the ability to solve quantitative, interdisciplinary, and real-world problems.	CHM 3280 exam
SLO 2. Students will be able to design and execute an experimental procedure, work independently, interpret experimental results, and draw a reasonable, accurate conclusion. Students will synthesize, isolate, purify and characterize compounds using modern methods and instrumental techniques.	CHM 3270L sample lab report		CHM 3040/3050 exam or CHM 3110/3120 exam		SLO 2. Students will be able to design and execute an experimental procedure, work independently, interpret experimental results, and draw a reasonable, accurate conclusion. Students will synthesize, isolate, purify and characterize compounds using modern methods and instrumental techniques.	CHM 3270L sample lab report
SLO 3. Students will observe safe practices in the laboratory and will know how to respond in an emergency. Students will learn to gather hazardous materials information and will recognize and respond properly to potential hazards of handling chemicals and chemical waste.		CHM 3150L sample laboratory reports			SLO 3. Students will observe safe practices in the laboratory and will know how to respond in an emergency. Students will learn to gather hazardous materials information and will recognize and respond properly to potential hazards of handling chemicals and chemical waste.	
SLO 4. Students will use computer technology to gather, process, analyze, and present chemical data, and communicate critical analysis of scientific information through written reports, laboratory notebooks, and oral presentations.			CHM 3520L research report	CHM 3420L and CHM 3430L lab reports	SLO 4. Students will use computer technology to gather, process, analyze, and present chemical data, and communicate critical analysis of scientific information through written reports, laboratory notebooks, and oral presentations.	

SLO 5. Students will use chemical literature and computer resources to gather research information.			CHM 3520L research report	CHM 4630, CHM 2910A	SLO 5. Students will use chemical literature and computer resources to gather research information.	
SLO 6. Students will demonstrate the ability to function as practicing chemists, through activities such as undergraduate research, Senior Project and Co-op. Through coursework and laboratory experiences, students will work successfully both independently and as part of a team.		CHM 42x0L lab reports	CHM 3420L and CHM 3430L lab reports		SLO 6. Students will demonstrate the ability to function as practicing chemists, through activities such as undergraduate research, Senior Project and Co-op. Through coursework and laboratory experiences, students will work successfully both independently and as part of a team.	
SLO 7. Students will benefit from faculty mentoring and academic advising. Through organizations and activities such as the SMACS Chemistry Club, alumni panels, seminars, and Professor for a Day, students will explore career opportunities and participate in career and graduate school planning.		Exit survey for graduating seniors	Exit survey for graduating seniors	Exit survey for graduating seniors	SLO 7. Students will benefit from faculty mentoring and academic advising. Through organizations and activities such as the SMACS Chemistry Club, alumni panels, seminars, and Professor for a Day, students will explore career opportunities and participate in career and graduate school planning.	

Program Student Learning Outcomes	Assessment Findings and Closing-the-Loop Actions
(SLO 1) Students will compare, contrast and predict chemical properties based on atomic and molecular structure. Students will apply these principles to the chemistry of living systems and demonstrate the ability to solve quantitative, interdisciplinary, and real-world problems.	This SLO requires critical thinking and encapsulates much of what a successful chemistry student should be able to do by graduation. As such, this SLO was assessed five times during the period under review: AY 17-18, 18-19, 20-21, 21-22, and 23-24. • In AY 17-18, students in the last quarter of the organic chemistry sequence (CHM 316; CHM 3150 under semesters) completed the national American Chemical Society Organic Exam; their performance relative to the national average was used to assess whether the SLO was being met. The findings showed that in 16 questions on the national exam, our students scored above average, demonstrating that this SLO is being met. o One question revealed students struggled with reactions at the alpha-carbon. This was addressed by giving students additional practice problems to engage with the material and using time during lecture to cover this topic. • In AY 18 – 19, the University's core competency *quantitative reasoning*, was assessed in two upper division analytical chemistry lab courses; this competency aligns with SLO 1. The findings revealed that 56% of students were at the developing level (on a 3-level scale of introductory, developing, and mastery) and 35% of students were at the mastery level. One key insight from this assessment: o Both courses providing artifacts used an active learning approach, where students begin the term learning individual techniques and then transition to inquiry-based learning, allowing students to apply their knowledge to solve a problem using any of the skills learned earlier in the course. This approach led to more than 90% of students being scored as developing or mastery. The practice of ending upper division laboratory exercises with inquiry-based projects has been continued and is also used in other courses. • In AY 20 – 21, SLO 3 was scheduled to be assessed but remote instruction made that unfeasible. Instead, SLO 1 was assessed and measured the ability of students to compare and contrast changes in molecular structure. o The majority of students were at the developing (15%) or mastery (81%) level and showed proficiency using molecular visualization software to analyze

Program Student Learning Outcomes	Assessment Findings and Closing-the-Loop Actions
	protein structure. These practices are being continued. • In AY 21 – 22, the same instrument was used to assess SLO 1 in both semesters of Organic Chemistry Laboratory (CHM 3140L and CHM 3150L). Student lab reports were collected and used as artifacts; critical thinking, calculations, and data interpretation from modern instrumentation were scored. o A significant shift in students at the proficient and mastery levels is seen in students at the end of the second semester of organic chemistry lab. Nearly a fifth of students in CHM 3140L were at the introductory level, while only 5% of CHM 3150L students were at that level. This finding highlights that regular and repeated exposure to techniques, calculations, and analyses produce more sustained learning. • In AY 23 – 24, we returned to assessment of quantitative reasoning. This assessment used an embedded final exam question that required students to visually represent their data, perform calculations, analyze their results, and communicate their findings. o When compared to AY 18 – 19, students at first seem to be performing not as well. However, many students scored poorly on an added communication component on the rubric. When only the first three areas are considered, nearly more than 75% of students scored at developing or mastery level. This revealed that we should continue using our educational approaches but that our students may benefit from additional practice in scientific communication.
(SLO 2) Students will be able to design and execute an experimental procedure, work independently, interpret experimental results, and draw a reasonable, accurate conclusion. Students will synthesize, isolate, purify and characterize compounds using modern methods	We assessed SLO 2 twice during the period of review. This SLO requires both the critical thinking and laboratory skills necessary for chemistry majors. In AY 20 – 21, SLO 2 was assessed in CHM 3270L, Biochemistry I Laboratory and used four separate student exercises that required molecular visualization software to analyze and characterize protein structure. • For each exercise, at least 80% of students were at proficient or mastery. • This assessment used artifacts collected during remote

Program Student Learning Outcomes	Assessment Findings and Closing-the-Loop Actions
and instrumental techniques.	instruction. These findings suggest using molecular visualization programs that do not require the student to install software on their computers may be a good complement to in-person exercises. In AY 22 – 23, SLO 2 was assessed using formal written lab reports from CHM 3520L, Physical Chemistry Laboratory. The lab exercise chosen was a computational exercise that required students to download and execute various commands to carry out vibrational and charge analyses of molecules. • Students very near graduation were mostly (more than 75%) at proficiency or mastery levels for designing and executing an experiment. o These results support continuing to use inquiry-based and project-based learning where students are first introduced to lab exercises to learn a technique or skill and then later asked to use their knowledge to solve a problem. • The program goal of two-thirds or more meeting proficiency or advanced were not achieved for interpretation and reaching conclusions or for deploying modern methods, with half and just over one third at proficient or higher. o These lower percentages may reflect student discomfort with installing software and efficiently using the programs. These results indicate that more incorporation of computational aspects into courses would benefit our students.
(SLO 3) Students will observe safe practices in the laboratory and will know how to respond in an emergency. Students will learn to gather hazardous materials information and will recognize and respond properly to potential hazards of handling chemicals and chemical waste.	This SLO was not assessed during the period of review. Our assessment plan called for using student lab reports from 3000-level courses as artifacts to assess this SLO during AY 2020-21 and AY 2021-22. However, the pandemic led to an emergency transition to virtual laboratory classes and socially distanced lab classes during those academic years and artifacts were not collected. The updated assessment plan and assessment timeline call for using the department's safety training quiz required for research students as artifacts (scores collected every semester). Lab reports will also be used to supplement the safety quiz results and will be collected every three years.
(SLO 4) Students will use computer technology to gather, process, analyze, and present chemical	We assessed SLO 4 four times during the period of review. This SLO aligns with the core competencies of written and oral communication.

Program Student Learning Outcomes	Assessment Findings and Closing-the-Loop Actions
data, and communicate critical analysis of scientific information through written reports, laboratory notebooks and oral presentations.	In AY 18 – 19, the same artifacts used to assess SLO 1 was used and the communication component of the rubric reflects student competency. 57% of students were at the developing level, and 33% of students achieved the mastery level. In AY 19 – 20, SLO 4 was assessed again, this time in CHM 2910A, the Chemical Communication activity course. Artifacts for this assessment were oral presentations and were scored using a rubric. The data were disaggregated by student standing (juniors vs seniors) to explore proficiency near graduation. • For each of the five elements in the rubric, students with senior standing outperformed students with junior standing. This difference was most pronounced in *organization*, where roughly 6% of juniors were at mastery level and 70% of seniors were at mastery. This result suggests that senior-level students who have had more experience in giving oral presentations are better able to organize their presentations. In AY 22 – 23, SLO 4 was assessed in CHM 3520L, the physical chemistry laboratory course. This class is primarily senior undergraduate students and students write formal lab reports, which were used as artifacts. • Results showed more than 70% of students were proficient or better in terms of providing context and purpose for writing, as well as using chemistry-specific conventions for writing. • Just under two-thirds of students were proficient in clarity and grammar, showing room for growth. Over half of students were proficient or better in organization and development, revealing this as an area that students need additional exposure and practice executing. • These scores are similar to those seen in AY 18 – 19, before the pandemic. In AY 23 – 24, SLO 4 was assessed using embedded questions on the final exams of two upper division analytical courses where students were asked to interpret figures to draw conclusions. • Nearly three quarters of all students were at either advanced or proficient levels in their ability to draw conclusions and interpret figures from the literature.
(SLO 5) Students will use chemical literature and computer resources to gather research information.	We assessed SLO 5 during AY 2022-23 using formal lab reports from Physical Chemistry Laboratory (CHM 3520L) as artifacts. The SLO was broken into two components – identification and inclusion of relevant primary sources (1) and citations (2). The program met our goal by having 80% of students at proficient or higher for proper

Program Student Learning Outcomes	Assessment Findings and Closing-the-Loop Actions
	citation use. However, only 50% of students were at proficient or higher for identification and use of primary sources. These results have revealed the following points: • Students are introduced to chemical communication conventions and how to search the chemical literature in CHM 2910A (Chemical Communications Activity), a course intended for majors after completing General Chemistry. Students use the American Chemical Society citation style regularly in formal lab reports and other written activities throughout the upper division curriculum, so it is not surprising that a large majority of students are proficient in using proper citations. • Students show room for growth in identification and use of primary sources, as reflected in only half of students being proficient or higher in this area. The program has not yet assessed this SLO a second time – it is scheduled for AY25-26. In the meantime, the faculty are considering ways to provide additional opportunities to engage with the literature and reinforce the use of primary sources.
(SLO 6) Students will demonstrate the ability to function as practicing chemists, through activities such as undergraduate research, Senior Project and Co-op. Through coursework and laboratory experiences, students will work successfully both independently and as part of a team.	This SLO was not assessed during the period under review. Our assessment plan called for using an exit survey for graduating seniors to gather indirect evidence in support of this SLO. The assessment plan also called for using student lab reports as artifacts for assessment. The assessment timeline and assessment plan were updated in Spring 2024 and Fall 2024, respectively. Under the updated plan, this SLO will use the University's graduating senior survey to collect student input, collecting survey data annually. The department's assessment committee will then use multiple years' data and analyze the findings every other year.
(SLO 7) Students will benefit from faculty mentoring and academic advising. Through organizations and activities such as the SMACS Chemistry Club, alumni panels, seminars, and Professor for a Day, students will explore career opportunities and participate in career and graduate school planning.	This SLO was not assessed during the period under review. Our assessment plan called for using an exit survey for graduating seniors to gather indirect evidence in support of this SLO. The assessment timeline and assessment plan were updated in Spring 2024 and Fall 2024, respectively. Under the updated plan, this SLO will use the University's graduating senior survey to collect student input, collecting survey data annually. The department's assessment committee will then use multiple years' data and analyze the findings every other year.

Assessment of SLOs has been uneven over the period under review – three of the program SLOs were assessed at least three times over the last 7 years, while another three were not assessed at all. The timeline for assessment was disrupted by the pandemic, and we are working on reestablishing a regular timeline for assessing each SLO. We are also implementing best practices, such as using the same/similar assignment/course/rubric so that trends can be reliably identified and meaningfully discussed.

3 STUDENTS - UNDERGRADUATE

3.1 Student Profile at Admission and Enrollment Undergraduate

The following data in Tables 9 and 10 were compiled using the Applicant Profile dashboard on Tableau.

Table 11: Admission trends for first-time freshmen[9]

	Fall 2023	Fall 2022	Fall 2021	Fall 2020	Fall 2019
Applied	**903**	**1025**	**938**	**877**	**1000**
Gender					
Female	597	623	578	522	596
Male	302	399	359	355	403
Nonbinary	4	3	1	0	1
URM Status					
URM	409	466	405	383	430
Non-URM	494	559	533	494	570
1st Generation Status					
1st Generation	469	527	480	482	556
Not 1st Generation	434	498	458	395	444
Admitted	**868**	**806**	**848**	**804**	**703**
Gender					
Female	578	508	530	488	429
Male	286	295	317	316	274
Nonbinary	4	3	1	0	0
URM Status					
URM	394	318	348	336	244
Non-URM	474	488	500	468	459
1st Generation Status					
1st Generation	452	389	418	436	359
Not 1st Generation	416	417	430	368	344
Enrolled	**70**	**60**	**77**	**91**	**60**
Gender					
Female	40	34	44	51	32
Male	29	26	32	40	28
Nonbinary	1	0	1	0	0
URM Status					
URM	48	28	41	56	28
Non-URM	22	32	36	35	32
1st Generation Status					
1st Generation	41	25	45	57	27
Not 1st Generation	29	35	32	34	33

[9] Source: Tableau https://analytics.cpp.edu/#/site/production/views/ApplicantProfile/AdmissionsCustomTable?:iid=3

Table 12: Admission trends for transfer students[10]

	Fall 2023	Fall 2022	Fall 2021	Fall 2020	Fall 2019
Applied	**118**	**171**	**213**	**230**	**262**
Gender					
Female	59	104	131	127	145
Male	59	67	82	102	117
Nonbinary	0	0	0	1	0
URM Status					
URM	44	74	96	95	123
Non-URM	74	97	117	135	139
1st Generation Status					
1st Generation	67	100	127	151	165
Not 1st Generation	51	71	86	79	97
Admitted	**98**	**101**	**118**	**174**	**175**
Gender					
Female	54	62	75	94	102
Male	44	39	43	80	73
Nonbinary	0	0	0	0	0
URM Status					
URM	37	43	49	73	73
Non-URM	61	58	69	101	102
1st Generation Status					
1st Generation	58	57	77	117	114
Not 1st Generation	40	44	41	57	61
Enrolled	**15**	**18**	**25**	**37**	**28**
Gender					
Female	7	11	11	16	19
Male	8	7	14	21	9
Nonbinary	0	0	0	0	0
URM Status					
URM	8	6	7	20	12
Non-URM	7	12	18	17	16
1st Generation Status					
1st Generation	8	6	14	27	17
Not 1st Generation	7	12	11	10	11

*Note: A demographic breakdown is not provided for cohorts with less than 15 students.

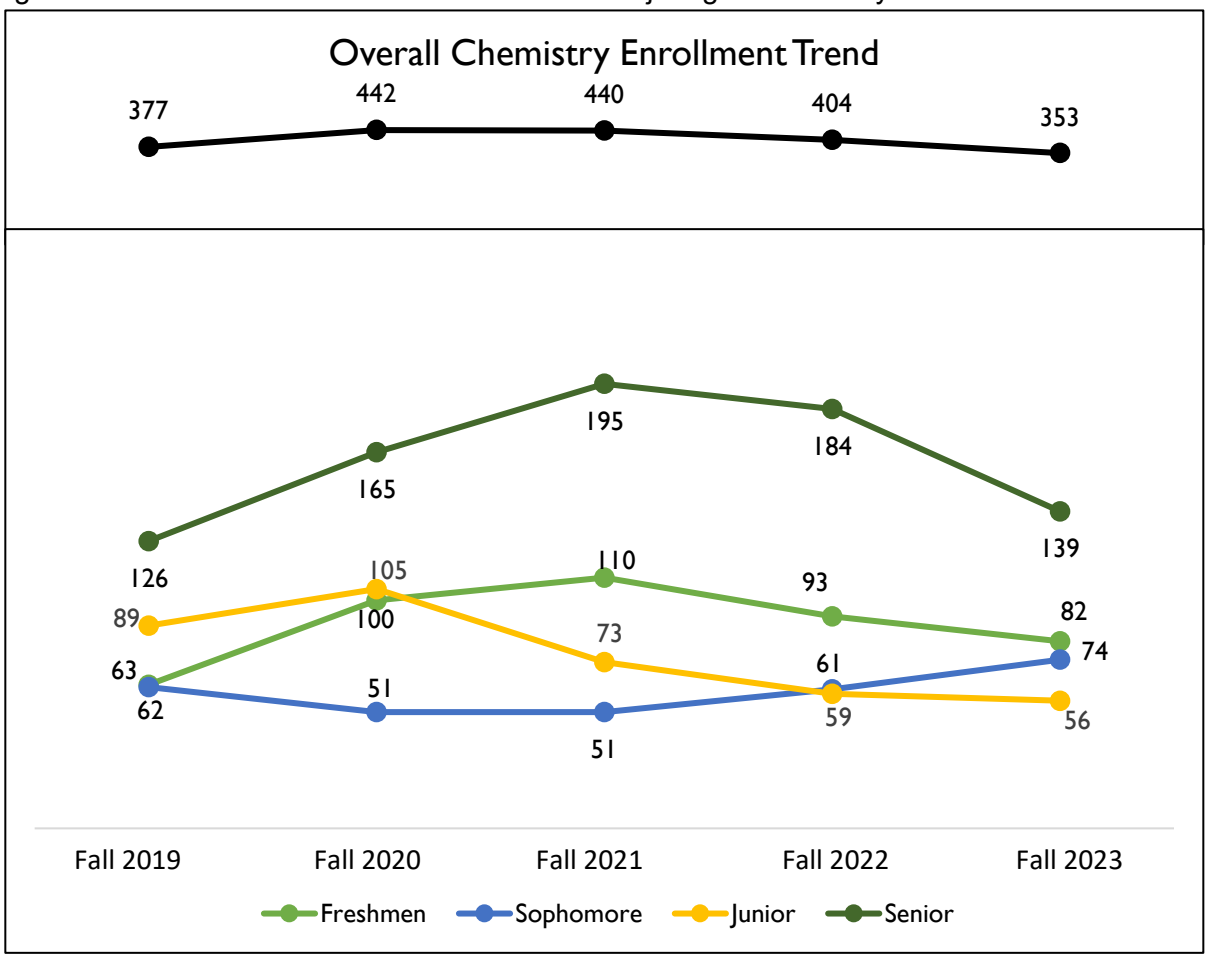
[10] Source: Tableau https://analytics.cpp.edu/#/site/production/views/ApplicantProfile/AdmissionsCustomTable?:iid=3

Table 13 and Figure 3 provide enrollment trends for the program.

Table 13: Enrollment trends for all students[11]

Enrollment Trends					
Term	**Overall Program**	**Freshmen**	**Sophomore**	**Junior**	**Senior**
Fall 2019	377	63	62	89	126
Fall 2020	442	100	51	105	165
Fall 2022	440	110	51	73	195
Fall 2022	404	93	61	59	184
Fall 2023	353	82	74	56	139

Figure 3: Enrollment headcount for all students majoring in Chemistry



[11] Source: Tableau https://analytics.cpp.edu/#/site/production/views/EnrollmentTrend/EnrollmentTrend?:iid=1

Table 14 provides a snapshot of starting degree vs graduation degree. Approximately 45% of students graduating in Chemistry began as Chemistry students.

Table 14: Snapshot of Starting Degree for Student Population for the Chemistry (ACS) and General Chemistry Options[12]

Major at Entry	Major at Graduation	# Students
Chemistry	Chemistry	29
Chemical Engineering	Chemistry	12
Biochemistry	Chemistry	11
Undeclared	Chemistry	4
Liberal Studies	Chemistry	1
Computer Engineering	Chemistry	1
Botany	Chemistry	1
Applied Mathematics	Chemistry	1
Physics	Chemistry	1
Economics	Chemistry	1
Architecture	Chemistry	1
Science, Technology and Society	Chemistry	1
Food Science	Chemistry	1

Note: The information above is for first-time full-time freshmen who graduated in 2021, 2022, or 2023

Table 15 provides a snapshot of starting degree vs graduation degree for students earning a B.S. in Chemistry (biochemistry option).

Table 14:Snapshot of Starting Degree for Student Population for the Biochemistry Option

Major at Entry	Major at Graduation	# Students
Biochemistry	Biochemistry	42
Chemistry	Biochemistry	10
Undeclared	Biochemistry	4
Accountancy	Biochemistry	2
Chemical Engineering	Biochemistry	2
Apparel Merchandising, Mgmt	Biochemistry	1
Dietetics, Food Admin, Nutrition	Biochemistry	1
Pre-Veterinary Science	Biochemistry	1
Aerospace Engineering	Biochemistry	1
Electrical Engineering	Biochemistry	1
Psychology	Biochemistry	1
Biology	Biochemistry	1
Computer Science	Biochemistry	1

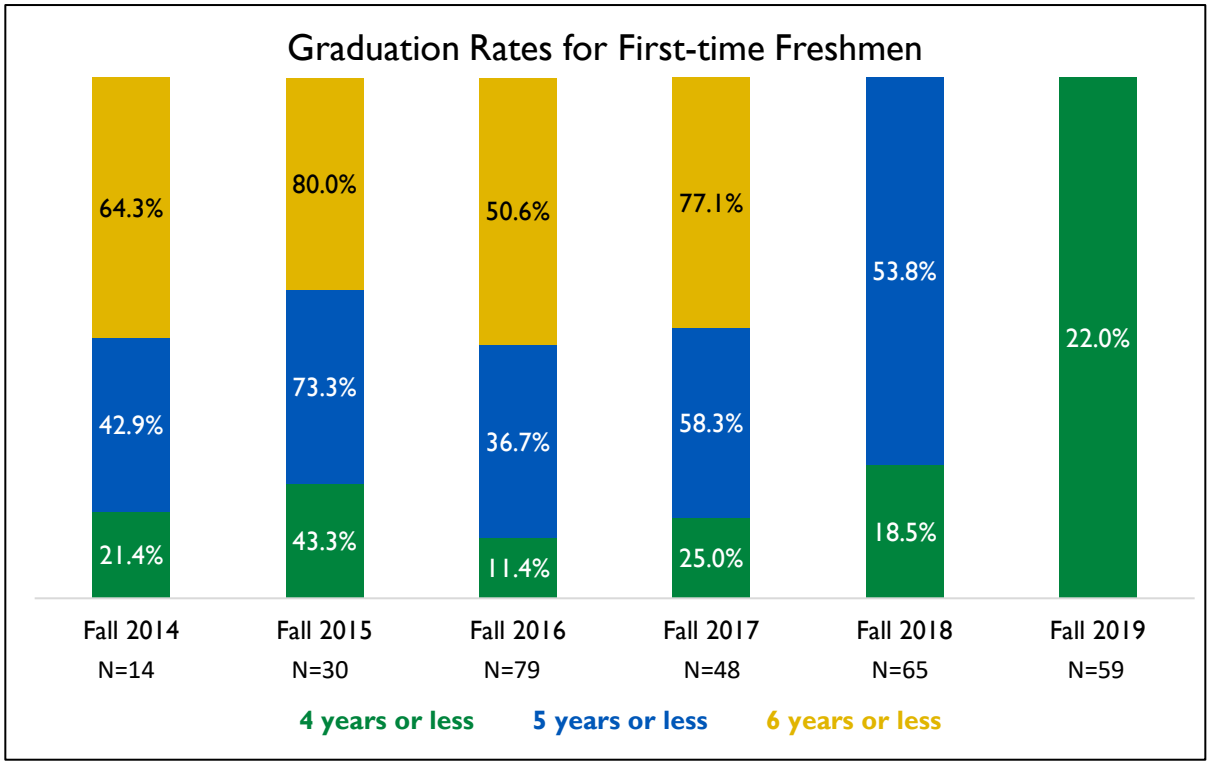
[12] CSU Dashboard "What Paths Do They Follow" Report https://csusuccess.dashboards.calstate.edu/public/db-what-paths-do-they-follow

To support enrollment in the chemistry department, during AY 2023-2024 our department piloted a “cohort model” for CHM1210/L, CHM1220L, CHM3140/L, and CHM3150/L. This model reserves specific sections of each of the above courses and laboratories exclusively for Chemistry majors, providing them with additional resources and continuity of instructor. The cohort sections of chemistry majors are assigned a faculty instructor for two semesters (e.g. one faculty assigned to the cohort for both CHM1210/L and 1220/L; then one faculty assigned to the cohort for both CHM3140/L and CHM3150/L) to provide for continuity of instructor. This ensures students have sufficient time to adjust to the instructor style and allows the instructor to adjust the organization and pace since they will have the same students going into the second semester of each of these yearlong sequences and have the same group of students in laboratory sections as well. As an additional support element, the cohort sections are allotted Student Learning Assistants, who are available outside of class as well as embedded with students during lectures and labs to provide additional guidance and support. Anecdotally, after one year, student response has been positive, with the cohort model helping Chemistry majors to form closer contacts with each other and begin their collaborative work earlier in their careers. Prior to this model, Chemistry students did not take their General Chemistry or Organic Chemistry with fellow majors, so began to form collaborative relationships later in their education, primarily in upper-division Chemistry courses.

3.2 Student Retention and Graduation Rates – Graduation Initiative 2025

Figure 4 provides graduation data for students entering the Chemistry major as First-Time Freshmen only. Any on-campus transfers who started in another major as a freshman are not accounted for in the First-Time Freshmen Graduation Rates for Chemistry. The figure below shows that 50.6% of student who started in 2016 graduated in six years or less, 36.7% of students who started in 2016 graduated in five years or less, and 11.4% of students who started in 2016 graduated in four years or less.

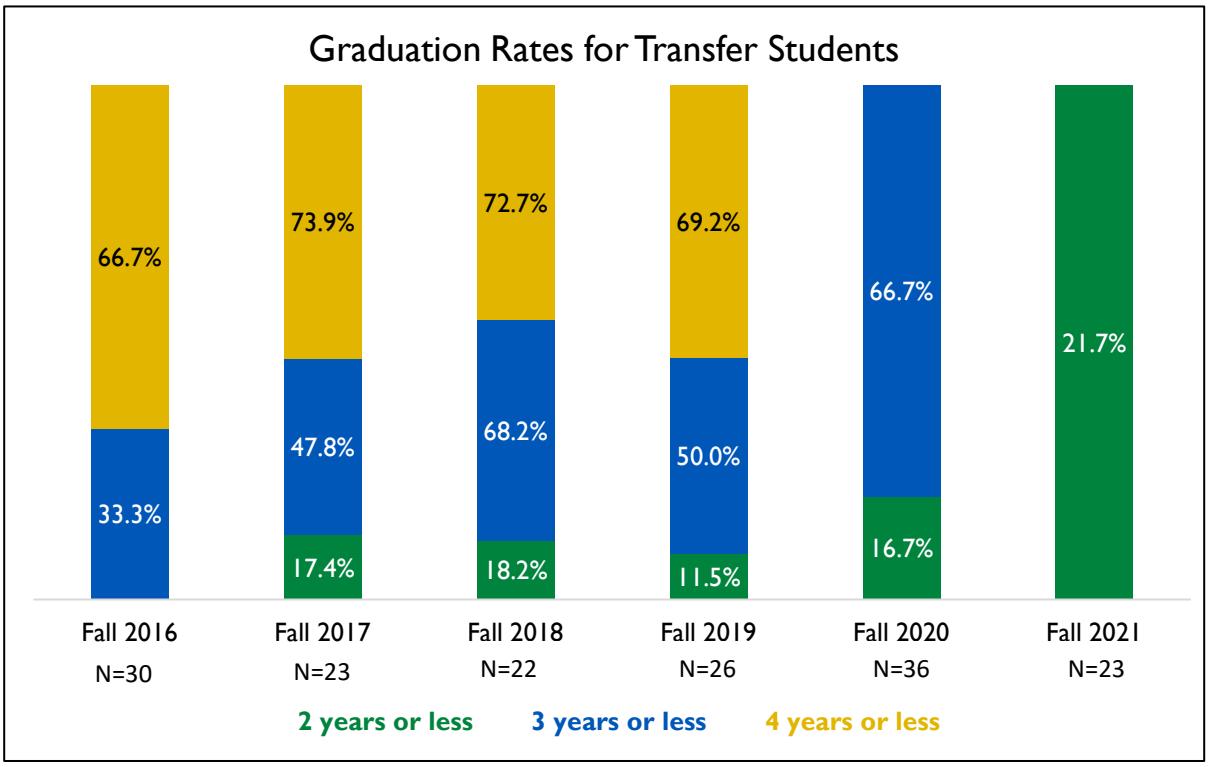
Figure 4 – First-time Freshmen Graduation Rates for Chemistry [13]



[13] Source: Tableau https://analytics.cpp.edu/#/site/production/views/GraduationRatesDashboard/FTFGradRates?:iid=2

Figure 5 provides graduation data for students entering as a Chemistry major as off-campus fall term Transfers. Any transfers entering in a term other than fall or are on-campus transfers are not accounted for in the Fall Entering Transfer Graduation Rates for the Chemistry program. The figure below shows that 18.2% of transfer students who started in 2018 graduated in two years or less and 72.7% of those who started in 2018 graduated in four years or less.

Figure 5 – Transfer Student Graduation Rates for Chemistry [14]



[14] Source: Tableau https://analytics.cpp.edu/#/site/production/views/GraduationRatesDashboard/FTFGradRates?:iid=2

The figures below depict six-year graduation rates for underrepresented minorities (URM) and Pell-eligible First-time freshmen majoring in Chemistry. Figure 6 indicates that 45.9% of URM students and 54.8% of non-URM students who started in 2016 graduated in six years or less. Figure 7 below indicates that 52.8% of students who receive the Pell Grant and 48.8% of students who do not and started in 2016 graduated in six years or less.

Figure 6 – First-time Freshmen URM Gap for Chemistry[15]

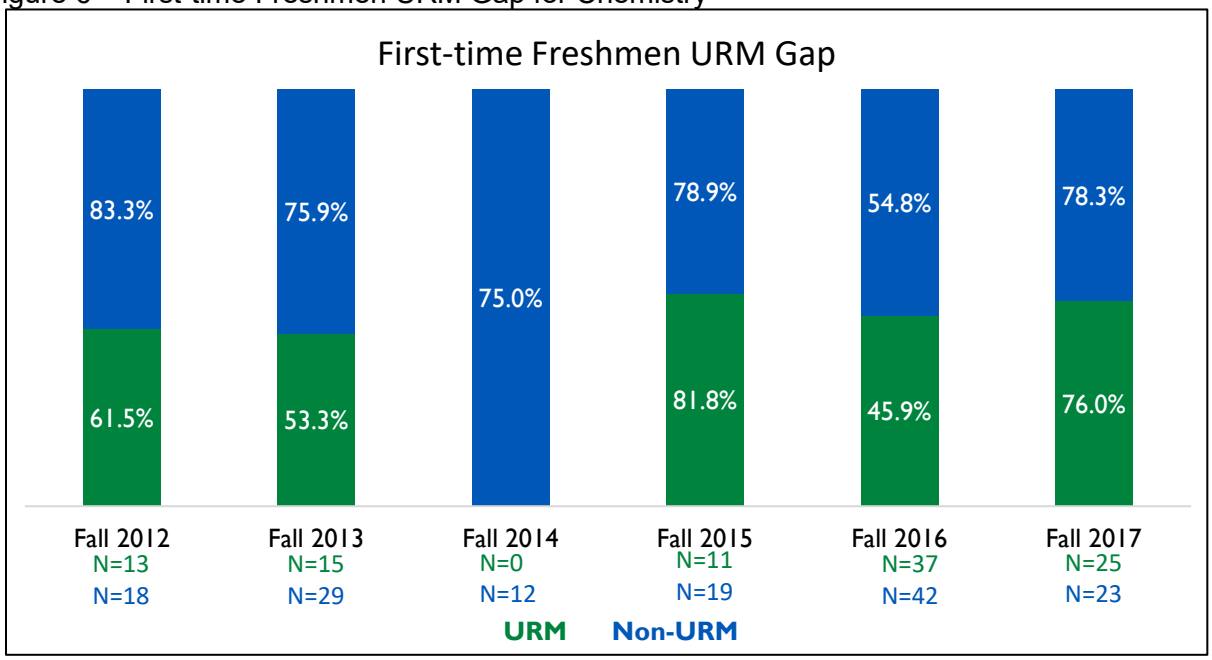
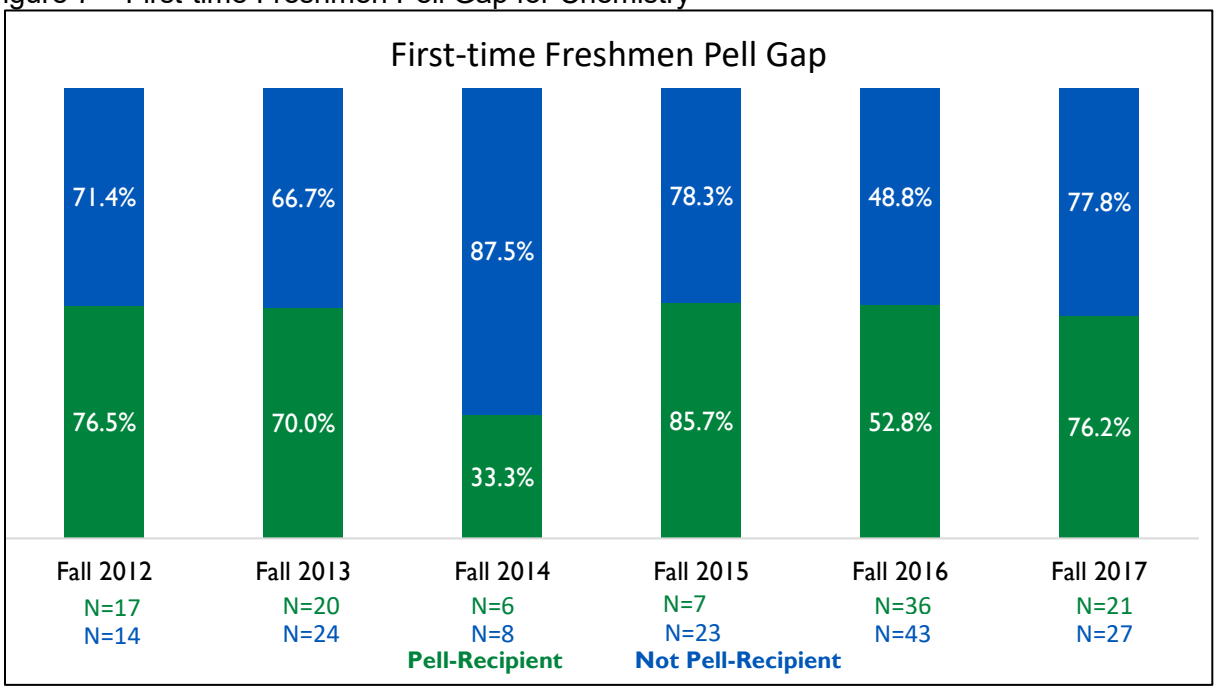


Figure 7 – First-time Freshmen Pell Gap for Chemistry[16]



[15] Source: Tableau https://analytics.cpp.edu/#/site/production/views/GraduationRatesDashboard/FTFGradRates?:iid=2
[16] Source: Tableau https://analytics.cpp.edu/#/site/production/views/GraduationRates_0/FTFPellGap?:iid=2

The department is working with instructors on several areas to enhance outcomes for our students. First, we are expanding ways we engage our students so that they have more access to learning resources. We are working with the Learning Resource Center to add more chemistry tutors (especially for our high DFW classes and high repetition courses). Although broadly available to all our students, we expect that expanding tutor access will have a positive outcome on our DFW rates. Second, we are working with external vendors and instructors to set up online resources to support in-class instruction. Reliable and informative homework that guides students through their course. Virtual lab spaces that are used for pre-lab instruction so students are more familiar with new equipment and techniques before the hands-on training. Worksheets and problem sets that are coupled with pedagogy and curriculum so that students have extra, standardized help. Finally, we are going to start working to standardize the laboratory experience so that there is more uniform grading.

Success is not only associated with in-class and pedagogical supports, but by building a community. Last year, members of our department started a Chemunity meant to emphasize and embrace the diversity that is our department. With support from the student success funds, they have engaged in several different activities that are open broadly to members of our department (including faculty, staff, and students) and has been widely popular. Providing a place and safe space for our under-represented students has created a community and a way for our students to feel like they belong. Such sense of community and achievement will help with student persistence and graduation rates.

3.3 Student Support, Satisfaction and Services Undergraduate

3.3.1 Co-Curricular

The department houses two student organizations, Student Members of the American Chemical Society (SMACS) and ChemUnity (see above, section 3.2). SMACS is a student-run organization that meets biweekly and supports the department's mission and values through its events and activities in the following ways: creating avenues for student-faculty interaction outside of the classroom including invited faculty presentations, flash talks, and student-faculty game days; acting as a forum for student research recruitment, promoting research and scholarly activities; fostering collaboration with local industries through invited talks of local industry and alumni (e.g. presentations from Abstrax employees including several CPP alumni); undertaking outreach to local educational institutions (e.g. Science at the Zoo day, open houses); and supporting student extracurricular activities like attending ACS national meetings.

The department currently has robust engagement with student research, with numerous faculty members running multimember research teams including undergraduate and graduate students. Faculty work with students to research literature, design, and execute experiments using computational, chemical, and biochemical techniques to investigate problems across medicine, agriculture, biochemistry, pollution and climate change, materials, and outer space. Students conduct research and regularly present their findings at local, regional, and national conferences. For example, between 2018-2023 students presented over 120 poster and oral presentations at on-campus symposia, along with dozens of presentations at regional (e.g. Southern California Conference on Undergraduate Research) and national meetings (e.g. American Chemical Society National Meeting, SACNAS Annual Meeting, ASBMB, PittCon, and others). Faculty also work with students to formally publish their findings in peer-reviewed journals. From 2018-2024, faculty from our department have published over 70 peer-reviewed publications, many including undergraduate and graduate co-authors.

Students engaged in undergraduate research in the chemistry department apply their theoretical and practical knowledge gained from their curriculum to contemporary problems in the field. Students deepen their understanding by reading current literature, pushing their knowledge beyond the textbook, learning the most modern topics. Research students gain independence in their ability to critically evaluate the literature, which grows their skills for lifelong learning, well after their time at CPP has ended. In turn, the skills gained through undergraduate research help students in the classroom. Most upper-division chemistry courses incorporate literature reading exercises and/or independent projects into their structure. The skills students gain in their research work directly strengthens students' ability to complete these more open-ended assignments.

3.3.2 Academic Advising

Historically, the Chemistry & Biochemistry department has offered faculty advising appointments each semester prior to registration – prior to Spring 2020, these faculty advising sessions were mandatory, and an advising hold was placed on student accounts to ensure that every undergraduate Chemistry major met regularly with a faculty member. During these advising appointments, student progress toward the degree was tracked, students could get advice if struggling in their courses, and faculty could engage students in career and post-graduation planning. In Spring 2020, the University moved to a more centralized model for academic advising (the College of Science (CoS) Advising Center has two advisors responsible for advising Chemistry majors). There has been some turnover within the CoS Advising Center and there was a period where some Chemistry majors did not have an assigned CoS advisor.

Faculty continue to offer advising sessions in the weeks leading up to each registration term. These advising appointments are optional and scheduled by the student. During these advising appointments, students receive advising as described above. Additionally, the Department Chair and Department Associate Chair maintain regular appointment schedules throughout the academic year to meet with students interested in discussing curricula, post-graduate plans, and other issues. Anecdotally, fewer students are meeting with a faculty advisor, and this has resulted in some students enrolling in the wrong course or taking courses in a sequence that is not optimal – both of which can and do delay time to graduation.

Research-active faculty maintain close relationships with their mentees and often include professional development activities (poster preparation, writing, graduate school, etc.) in their group activities.

The Department works closely with the CoS Advising Center to ensure that information regarding course sequences, course scheduling, and degree progress is current and shared with students. This has been especially important for students in the General Chemistry option, as they often have questions about what courses can be used to satisfy their upper division elective requirement. For Biochemistry students, the schedule of offered courses is often of concern. The Department works less closely with the University Bronco Advising Center (BAC). Students with questions regarding General Education courses, financial aid, and enrollment/registration are referred to the BAC for assistance.

With the change in the campus advising model that does not allow for academic holds, student use of faculty advising has dropped. An advising challenge that arises relatively often is in getting students to engage with faculty advisors when the students are falsely confident in their academic plan or when they are mistaken or misinformed (by peers) about course substitutions

or course offerings. Enrolling in courses that do not advance students toward graduation discourages the student and adds time to graduation.

3.3.3 Student Satisfaction

Current Students
A focus group of current senior level students was facilitated by the Center for the Advancement of Faculty Excellence on 12/5, and the results indicated the program's strengths include the faculty, many of whom are willing to invest in close mentorship relationships with students, and undergraduate research opportunities. The weaknesses are the uncertain availability of classes needed to progress to their degree, and lack or good equipment or facilities in some situations. Most students recognized the need to take initiative in their own learning, but some expressed an inability or unwillingness to do so.

3.4 Stakeholders

Based on the available evidence, our program offers good preparation for meaningful lives, further education, and successful careers. A few areas in need of improvement were also illuminated.

Recently we have increased our promotion of graduate school opportunities and observed an increase in the number of students pursuing PhD programs, especially among undergraduates who participated in research. For example, over the last four years at least 3 students each year from our department have been invited to the "ChemNext" graduate recruiting weekend at the University of Minnesota. Students are now more aware of graduate opportunities, and 7 CPP graduates from the last three years are currently enrolled in the PhD program there.

Alumni Survey
A survey was distributed to BS alumni from the department with 13 responses from graduates between 2018-2024. The survey only received one response from MS alumni, so those results are not discussed herein. Among the respondents, 92% graduated in 5 years or less, with 67% in 4 years or less. 83% of respondents were employed full time. Based on the results of this survey, areas of satisfaction and areas of improvement were identified. The table below details some highlights.

Table 16: Alumni Survey – Highlights

Please rate how effective your CPP program/education was in the following areas		
1 = not effective, 2 = somewhat effective, 3 = effective, 4 = very effective		
Area	**Mean Effectiveness**	**Place Rank**
Prepare you to be a lifelong learner	3.57	1
Promote analytical approach to complicated problems	3.43	2
Encourage personal leadership development	3.29	3
Support collaborative learning with peers in discipline	3.14	4
Educated on available technologies applicable to success	2.86	5
Cultivate communication skills	2.57	6
Appreciate cultural/ethnic differences	2.57	6
Importance of community engagement/outreach	2.57	6
Collaboration outside of discipline	2.14	9

Which factors were most relevant to your success?		
1 = least relevant, 7 = most relevant		
Response	**Mean relevance**	**Place Rank**
Major Curriculum	5.14	1
Participating in research	4.71	2
GE curriculum	4.71	2
Co-Curricular	4.3	4
Faculty advisors	3.86	5
Staff Advisors	3.14	6
Clubs related to major	2.86	7

Respondents reported satisfaction with the **curriculum**, with Major Curriculum ranking as the most relevant factor to their success. Additionally, among nine possible options, the most highly rated areas of effectiveness were “Prepare you to be a lifelong learner in your area of study” and “Promote an analytical approach to complicated problems concerning your overall growth and professional success,” both of which were rated Effective (43%) or Very Effective (57%) by all respondents, indicating good preparation for meaningful lives, further education, and success in their careers (Place rank of 1 indicates highest relevance).

Another area of satisfaction concerned interactions with **faculty**. All respondents agreed (67%) or strongly agreed (33%) with the statement “Personal interactions between you and your professors/advisors were encouraged.” This and the highlighted importance of undergraduate research demonstrates faculty-student interaction and mentorship as a strength in our program.

Development of **Leadership** and **collaboration** skills were identified by our alumni as other effective areas, who ranked “Encourage personal leadership development” and “Support

collaborative learning efforts among your peers in your field" as among the most effective areas of their education.

Alumni ranked "Cultivate communication skills" as a lesser relevant factor in their success, suggesting our program needs improve emphasis on this aspect. Currently, nearly all of our upper division offerings incorporate papers and/or presentation assignments. Our department is in the process of incorporating the CSU writing (what our campus refers to as GWAR, the Graduate Writing Assessment)requirement into Chemistry courses, which will further increase our promotion of strong communication skills.

One component of our program that needs to be better emphasized is **co-curricular learning**. A majority of respondents (63%) disagreed with the statement "My program effectively promoted co-curricular activities that occurred outside of the classroom (i.e. campus clubs, competition teams, research, etc.)." Additionally, the factor "Co-curricular" was ranked as 4th most relevant to success, and "Clubs related to major" was ranked 7th most relevant among respondents. However, the co-curricular activity "Participating in Research" was rated as the second most relevant factor to student success, tied with "GE curriculum." This highlights the distinctive importance of undergraduate research in the Chemistry department, despite co-curriculars being a clear area of necessary improvement.

The structure of **student advising** is another area of potential improvement, based on alumni responses. For example, Faculty Advising and Staff Advising were rated among the least relevant factors to success (5th and 6th, respectively).

We are in the process of improving in the co-curricular area. This year and in the future our faculty will increase emphasis and support of co-curricular activities like clubs. For example, this year multiple faculty have made an improved effort to be present at all SMACS meetings and have increased our participation in SMACS with events like "Pie a Professor" and "Mole Day Bowl Day. Strong student leadership has been essential in good partnership with the club. In addition, ChemUnity continues to host community events, speakers, and gatherings that bring students, staff, and faculty into a single space for enriching activities. Finally, CPP is starting a SACNAS chapter with a Chemistry faculty as advisor, and we anticipate this will be highly relevant and fruitful for our students. These efforts should strengthen our emphasis on co-curricular activities and fortify our already strong culture of frequent personal interactions between students and faculty.

In the area of advising, much of the shifts discussed above were essentially imposed by the administration. The consensus among the faculty is that direct, mandatory faculty-student advising is the approach with the best outcomes, and that optional advising with staff advisors who may not be as familiar with our upper-division offerings leads to more uncertainty in student course selection, leading to more students falling through the cracks.

4 PROGRAM EVALUATION –GRADUATE

4.1 Curriculum and Pedagogy –Graduate

Our M.S. program is a 30-unit program designed to provide both flexibility and a "cohort" style experience for our students through our core requirements. All students are required to take CHM 5510L (Advanced Instrumental Analysis Laboratory), CHM 5520 (Advanced Chemical Equilibria and Kinetics), and CHM 5500 (Advance Chemical Communications). Unlike other M.S. programs, we require a laboratory experience for our graduate students so that our students have hands-on exposure to state-of-the-art instrumentation even if the students did not graduate from our program or another program with similar hands-on training. With the exception of SLO, CPP's Chemistry M.S. is the only program with a required laboratory component, however, SLO's M.S. is specifically in Polymers and Coatings Science and follows a well-defined curriculum.

The core requirement was developed to provide our students with a cohort model, emphasizing networking and collaboration. Since our M.S. students come from a variety of backgrounds, we wanted to ensure that they also benefit from our extensive collection of instrumentation and leave with a similar experience as our undergraduates. Regardless of where they end up, our M.S. students will be ready for the workforce.

Table 17: Comparison of graduate programs (Chemistry M.S.)

	Core requirement	Core Units	Instructional Lab Units	Seminar Units	Total Instructional/Research Units
CPP	Yes	7	2	2	24/6
CSU Fullerton	Yes	5	0	1	18/12
Long Beach	No	-	0	1-3	21/9
SLO (qu)	Yes	15	6	3	36/9
UCR (qu)	No	-	0	6	27/9
*UCLA (qu)	-	-	-	-	-

qu = quarter units.
*UCLA does not regularly admit to M.S. program – only under "exceptional circumstances"

Our graduate courses do not have high DFW/DUF or Bottleneck courses for our graduate program. For our core classes (CHM 5500, CHM 5510L, and CHM 5520), we are able to offer in regular intervals and accommodate all our graduate students. For the remaining units, we offer several graduate courses per year and students can also take senior level (undergrad) courses to fulfill their degree requirements.

Prior to semester conversion, we struggled to offer enough graduate level courses. However, in the last two years, we've been able to offer enough 5000 level courses that students have the opportunity to take all 5000 level classes to complete their degree requirements. Many students still take 4000 level courses as it may pertain to their area of interest.

4.2 Assessment of Student Learning – Graduate

Table 18: Curriculum Matrix

Student Learning Outcome	Course Number																					
	CHM 5510L	CHM 5500	CHM 5520	CHM 5230	CHM 5310	CHM 5410	CHM 5420	CHM 5430	CHM 5460	CHM 5530	CHM 5540	CHM 5550	CHM 5610	CHM 5650	CHM 5670	CHM 5710	CHM 5720	CHM 5810	CHM 5820	CHM 6910	CHM 6940	CHM 6960	CHM 6990
SLO 1: Question and probe scientific issues through critical analysis of the chemical literature	I-A			D		D	I	D			I	D	I					D	I	D-A		M-A	
SLO 2: Demonstrate proficiency in scientific writing	D-A				I	D	I	D	D	I	D			I	D	D	I	I	D	M-A		M-A	
SLO 3: Demonstrate proficiency in oral communication of science		M-A	D	I	D				D	I				D	D	D	M	I	D	D-A		M-A	
SLO 4: Develop and pursue hypothesis through appropriate experimental design			D									D								D-A	M-A	M-A	
SLO 5: Demonstrate successful application of the scientific method	D												I							D-A	M-A	M-A	

Key: I=Introduce; D=Develop; M=Master; A=Asses

Table 19: Alignment Matrix

Program Learning Outcome	PLO/SLO Alignment	Student Learning Outcome	Graduate Institutional Learning Outcomes				Strategic Vision		
			GILO1	GILO2	GILO3	GILO4	Innovation and Creativity	Civic Engagement	Problem Solving
PLO1: Graduates will independently implement skills, techniques, and practices applicable to the broader chemical industry or in preparation for graduate/professional school	PLO3	Question and probe scientific issues through critical analysis of the chemical literature		X					X
PLO2: Graduates will demonstrate effective communication skills applicable to the broader scientific community	PLO2	Demonstrate proficiency in scientific writing	X		X	X			
PLO3: Graduates will independently pursue hypothesis-based research	PLO2	Demonstrate proficiency in oral communication of science	X			X			
	PLO1, PLO3	Develop and pursue hypothesis through appropriate experimental design			X		X		
	PLO1, PLO2, PLO3	Demonstrate successful application of the scientific method.		X		X			X

Table 20: Overall Assessment Plan

SLOs	Courses where each SLO is addressed.	Assessment activity (signature assignment) used to measure each SLO.	Assessment tool used to measure outcome success	How assessment data will be reported as evidence SLO performance criteria have been met	Designated personnel to collect, analyze, and interpret student learning outcome data for the program	Student learning outcome data dissemination schedule	Closing the loop strategies
Question and probe scientific issues through critical analysis of the chemical literature	CHM 6910 or CHM 5510L	Students will complete literature projects in classes and in development of thesis proposal.	Rubric designed around criteria for each SLO	Percentage of students exceeding minimum level	Thesis chair will collect the graded rubric from the thesis committee and summarize the results Graduate Coordinator will analyze and report the results	At the end of each term, the graduate coordinator will submit an annual assessment to the department chair	Revising syllabi OR Teaching methods OR Curriculum
Demonstrate proficiency in scientific writing	CHM 6960	Students will write reports and papers and write thesis.					Revising syllabi OR Teaching methods OR Curriculum
Demonstrate proficiency in oral communication of science	CHM 5500; CHM 5510L (CORE CLASSES)	Students will give oral presentations in classes and do oral defense of thesis.			Instructor will grade the presentations and provide a written assessment Graduate Coordinator will analyze and report the results		Revising syllabi OR Teaching methods OR Curriculum
Develop and pursue hypothesis through appropriate experimental design	CHM 6940; CHM 6910; CHM 6960	Students will develop original thesis proposal and conduct research.			Thesis chair will collect the graded rubric from the thesis committee and summarize the results Graduate Coordinator will analyze and report the results		Revising syllabi OR Teaching methods OR Curriculum
Demonstrate successful application of the scientific method.	CHM 6960	Students will complete a research thesis.					Revising syllabi OR Teaching methods OR Curriculum

Table 21: Assessment Data Collection Timeline

Student Learning Outcome				
	AY 20-21	**AY 21-22**	**AY 22-23**	**AY 23-24**
Question and probe scientific issues through critical analysis of the chemical literature	X			
Demonstrate proficiency in scientific writing		X		X
Demonstrate proficiency in oral communication of science			X	
Develop and pursue hypothesis through appropriate experimental design	X	X		

Program Student Learning Outcomes	Assessment Findings and Closing-the-Loop Actions
(SLO 1) Question and probe scientific issues through critical analysis of the chemical literature.	Based on thesis and defense rubrics completed by faculty serving on M.Sc. defense committees, students are graduating at either the mastery or developing level, based on an average score above 2 (on a 3 point scale). Due to the small number of artifacts collected annually (between 4 and 8), the data are not disaggregated. • The program has continued to use the core curriculum that requires two semesters of Advanced Chemical Communication to prepare students for the 6 units of thesis research and thesis writing that culminate in their defense. • We will continue to mentor students closely and require them to complete the communications course to develop and hone skills related to critical analysis of the chemical literature.
(SLO 2) Demonstrate proficiency in scientific writing.	Based on thesis rubrics completed by faculty serving on M.Sc. defense committees, students are graduating at either the mastery or developing level, based on an average score above 2 (on a 3 point scale). Due to the small number of artifacts collected annually (between 4 and 8), the data are not disaggregated. • The program has continued to use the core curriculum that requires two semesters of Advanced Chemical Communication to prepare students for the 6 units of thesis research and thesis writing that culminate in their defense. • We will continue to mentor students closely and require them to complete the communications course to develop and hone skills related to scientific writing.
(SLO 3) Demonstrate proficiency in oral communication of science.	Based on defense rubrics completed by faculty serving on M.Sc. defense committees, students are graduating at either the mastery or developing level, based on an average score above 2 (on a 3 point scale). Due to the small number of artifacts collected annually (between 4 and 8), the data are not disaggregated. • The program has continued to use the core curriculum that requires two semesters of Advanced Chemical Communication to prepare students for the 6 units of thesis research and thesis writing that culminate in their defense. • We will continue to mentor students closely and require them to complete the communications course to develop and hone skills related to oral communication of science.
(SLO 4) Develop and pursue hypothesis through appropriate experimental design (thesis proposal).	Based on thesis and defense rubrics completed by faculty serving on M.Sc. defense committees, students are graduating at either the mastery or developing level, based on an average score above 2 (on a 3-point scale). Due to the small number of artifacts collected annually (between 4 and 8), the data are not disaggregated. • Students will continue to be required to complete the

Program Student Learning Outcomes	Assessment Findings and Closing-the-Loop Actions
	Advanced Instrumental Analysis course (CHM 5510L) to gain hands-on experience using modern instrumentation that can be further developed during thesis research. • We will continue to mentor students closely during formal coursework and in independent research to ensure this SLO continues to meet our goals for student development of hypotheses and experimental design.
(SLO 5) Demonstrate successful application of the scientific method (thesis completion).	Based on thesis and defense rubrics completed by faculty serving on M.Sc. defense committees, students are graduating at either the mastery or developing level, based on an average score above 2 (on a 3-point scale). Due to the small number of artifacts collected annually (between 4 and 8), the data are not disaggregated. • Students will continue to be required to complete the Advanced Instrumental Analysis course (CHM 5510L) to gain hands-on experience using modern instrumentation that can be further developed during thesis research. • We will continue to mentor students closely during formal coursework and in independent research to ensure this SLO continues to meet our goals for applying the scientific method.

The graduate Program Learning Outcomes are assessed through two rubrics completed by the thesis committee (committee chair and two other members): a defense rubric to evaluate the student's proficiency in SLOs 1, 3, 4, and 5 and a thesis rubric to evaluate SLOs 1, 2, 4, and 5. For SLOs 1, 2, and 3 graduate students develop their skills in CHM 5500 (Advanced Chemical Communication), which they are required to take twice. SLOs 4 and 5 are met by close mentorship between the graduate student and their faculty mentor(s). Mentorship and guidance through the thesis process also supports students in achieving SLOs 1, 2, and 3.

Over the period under review, the chemistry graduate students nearly all performed at the mastery and developing level, as expected for graduate students. Beginning in Fall 2018, a graduate program committee of faculty members representing the various subdisciplines within chemistry developed the rubrics referenced above to evaluate student SLO proficiency levels, which were used beginning in Fall 2019. The use of these rubrics has increased the assessment data collected for analysis and they will continue to be used for evaluating student proficiency. As needed, the graduate program committee meets to review and discuss both the rubrics and student performance.

5 STUDENTS - GRADUATE

5.1 Student Profile at Admission and Enrollment Graduate

The following data in Table 22 was compiled using the Applicant Profile dashboard on Tableau. Table 22 provides admission trends.

Table 22: Admission trends for graduate students[17]

	Fall 2023	Fall 2022	Fall 2021	Fall 2020	Fall 2019
Applied	**18**	**17**	**30**	**32**	**19**
Gender					
Female	9	8	16	10	11
Male	9	9	14	22	8
Nonbinary	0	0	0	0	0
URM Status					
URM	6	7	11	19	9
Non-URM	12	10	19	13	10
1st Generation Status					
1st Generation	8	8	17	20	10
Not 1st Generation	10	9	13	12	9
Admitted	**14**	**13**	**23**	**17**	**15**
Gender					
Female	6	6	14	4	9
Male	8	7	9	13	6
Nonbinary	0	0	0	0	0
URM Status					
URM	3	6	9	10	7
Non-URM	11	7	14	7	8
1st Generation Status					
1st Generation	5	7	16	10	8
Not 1st Generation	9	6	7	7	7
Enrolled	**8**	**7**	**8**	**11**	**11**
Gender					
Female					
Male					
Nonbinary					
URM Status					
URM					
Non-URM					
1st Generation Status					
1st Generation					
Not 1st Generation					

*Note: A demographic breakdown is not provided for cohorts with less than 15 students.

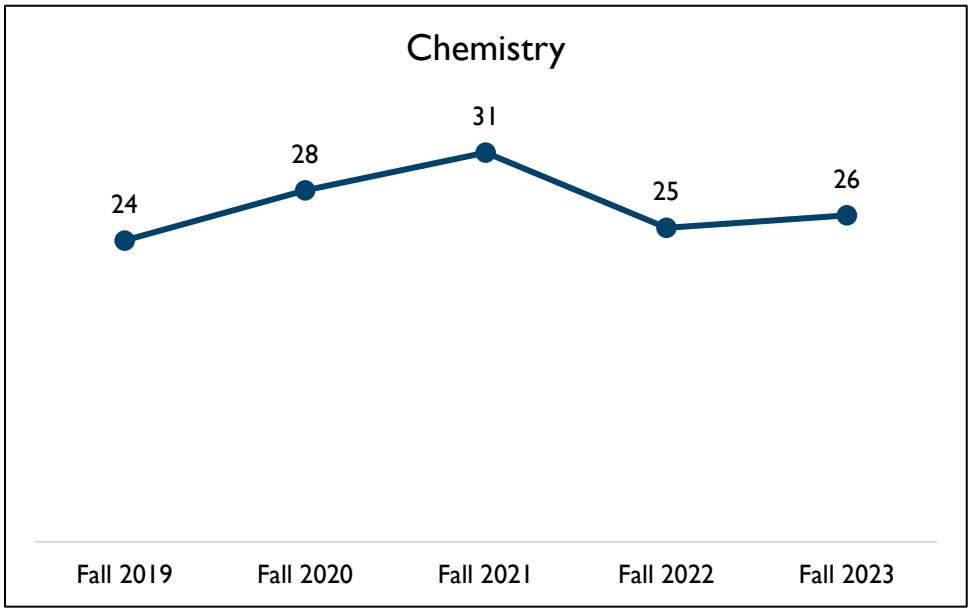
[17] Source: Tableau https://analytics.cpp.edu/#/site/production/views/ApplicantProfile/AdmissionsCustomTable?:iid=3

Table 23 and Figure 8 provide enrollment trends for the graduate program.

Table 23: Enrollment Data by Major[18]

	Fall 2019	Fall 2020	Fall 2021	Fall 2022	Fall 2023
Chemistry	24	28	31	25	26

Figure 8 – Student Enrollment [19]



[18] Source: Tableau https://analytics.cpp.edu/#/site/production/views/EnrollmentTrend/EnrollmentTrend?:iid=1
[19] Source: Tableau https://analytics.cpp.edu/#/site/production/views/EnrollmentTrend/EnrollmentTrend?:iid=1

The Master's program in our department is attracting and enrolling students that are capable of succeeding in the program. Many of our graduates gain employment in the local industry. Some of our MS graduates move on to PhD programs. One marker of graduate student success is the number of MS graduates from the last seven years that have returned to our department as lecturer faculty. Lecturers Zaw Naing, Erica Hummel, Nathan Wagner, Christa Larino, and Bronwyn Horton all graduated between 2017-2024 and now make essential contributions to the program in the General Chemistry series, Analytical, and Organic divisions.

5.2 Student Retention and Graduation Rates

Tables 24 and 25 show cumulative continuation and graduation rates by fall cohorts and were obtained by IRPA.

Table 24: Cumulative Graduation & Continuation Rates by Headcount[20]

Year	Cohort Headcount	Cumulative Graduation & Continuation Rates							
		Within 1 Year		Within 2 Years		Within 3 Years		Within 4 Years	
		Cont.	Graduate	Cont.	Graduate	Cont.	Graduate	Cont.	Graduate
Fall 2018	5	4	0	3	1	2	2	0	2
Fall 2019	10	10	0	6	4	0	8	0	8
Fall 2020	11	11	0	5	4	1	7		
Fall 2021	8	8	0	5	3				
Fall 2022	7	7	0						
Fall 2023	8								

Table 25: Cumulative Graduation & Continuation Rates by Percentage[21]

Year	Cohort Headcount	Cumulative Graduation & Continuation Rates							
		Within 1 Year		Within 2 Years		Within 3 Years		Within 4 Years	
		Cont.	Graduate	Cont.	Graduate	Cont.	Graduate	Cont.	Graduate
Fall 2018	5	80.0%	0.0%	60.0%	20.0%	40.0%	40.0%	0.0%	40.0%
Fall 2019	10	100.0%	0.0%	60.0%	40.0%	0.0%	80.0%	0.0%	80.0%
Fall 2020	11	100.0%	0.0%	45.5%	36.4%	9.1%	63.6%		
Fall 2021	8	100.0%	0.0%	62.5%	37.5%				
Fall 2022	7	100.0%	0.0%						
Fall 2023	8								

Since Fall of 2018, our department has seen an increase in Fall admits to our program. The small data size magnifies small fluctuations in our program, however, the trends from 2018 to Fall 2021 do show consistency in our program, if not improvement in our persistence and graduation rates. Additionally, our program caters to students who are employed, full-time chemists and as such, 2- and 3-year graduation rates are typically lower. To reduce attrition, the department's graduate advisors are actively engaged with the department graduate student population, hold regular advising sessions, and also communicate with students who are or are thought to be struggling.

[20] Source: IRPA data request for Continuation and Graduation Rates
[21] Source: IRPA data request for Continuation and Graduation Rates

To improve student retention and increase the size of our graduate program, we have been discussing the addition of a “Chemical Education” option that would appeal to both Chemistry Majors that are interested in jobs specifically in secondary education as well as closely related majors from outside our discipline. We have also been discussing adding a “non-thesis” option for students who are all but degree – although not ideal, it would provide us a mechanism to support our students who are finished with their courses but are struggling to find the time to complete their lab work.

5.3 Student Support, Satisfaction and Services - Graduate

5.3.1 Co-Curricular

The department houses two student organizations, Student Members of the American Chemical Society (SMACS) and ChemUnity (see above, section 3.2). SMACS is a student-run organization that meets biweekly and supports the department’s mission and values through its events and activities in the following ways: creating avenues for student-faculty interaction outside of the classroom including invited faculty presentations, flash talks, and student-faculty game days; acting as a forum for student research recruitment, promoting research and scholarly activities; fostering collaboration with local industries through invited talks of local industry and alumni (e.g. presentations from Abstrax employees including several CPP alumni); undertaking outreach to local educational institutions (e.g. Science at the Zoo day, open houses); and supporting student extracurricular activities like attending ACS national meetings.

5.3.2 Academic Advising

All our faculty who mentor graduate students engage the students in career advice. Unlike other degree programs, a M.S. in Chemistry is unusual in that students can go directly from a B.S. to a Ph.D. program. M.S. programs are usually for three categories of students. First, are those who are unsure of their career objective. Second, are those who may not make the GPA cutoff for Ph.D. programs or who want to strengthen their chances of a more competitive program. Third, are those who returned to school after time in industry and are using a M.S. to move up in a company. As such, we work hard to ensure our students post-graduation professional goals are supported while pursuing their M.S. with our program.

For academic advising, we have two faculty who are designated graduate advisors that are responsible for guiding our M.S. students through their education, including petitions, course offerings advice, and communicating with the Office of Graduate Studies on behalf of the students. Although our department does not officially partner with many programs on campus, our students regularly use the resources made available by the university, including the Graduate Writing Center and the learning center. Our graduate advisors maintain a Canvas page that all our graduate students are enrolled in. Through that portal, our students receive important updates, deadlines reminders, and can communicate with the graduate advisors (if they choose to not directly email). The graduate advisors also hold advising every semester with the students and provide career advice along with academic guidance.

5.3.3 Student Satisfaction

Alumni
A survey of BS and MS alumni was completed but we received results from only 1 MS alumni, so these results are not discussed due to poor sample size. The poor sample size is something we will improve on as a department in the future. We plan to have departing MS students complete the survey in order to obtain more data for the future.

5.4 Stakeholders

A survey was conducted among recent MS graduates, but unfortunately we only received one response, thus a too-small sample size to draw conclusions from. Moving forward our department will discuss implementation of an exit survey and other methods of tracking student outcomes.

6 INCLUSIVE POLYTECHNIC EDUCATION

Each element below represents a vital component of the university as an inclusive polytechnic university. When applied together and in a synergistic fashion, these elements give powerful expression to the educational experience of our students.

Table 26- Alignment of Department Activities to the Inclusive Polytechnic Education

Department Activity (Curricular and Co-Curricular)	Elements of Inclusive Polytechnic Education							
	Application of Knowledge	Critical Thinking & Problem Solving	Creativity, Discovery, & Innovation	Diverse & Multi-Disciplinary Perspectives	Integration of Technology	Collaborative Learning	Community & Global Engagement	Professional & Career Readiness
Senior Project	X	X	X		X			X
SMACS				X			X	X
Conference Attendance							X	X
CHM 3520L	X	X	X		X	X		X
Chemunity				X			X	X
Independent Research	X	X	X		X	X		X
Upper Division Analytical Projects	X	X	X	X	X	X		X
CHM 2910A/CHM 5500				X	X	X	X	X
Grad Welcome Poster Session							X	X
PolyX Research Experience	X	X	X	X	X	X	X	X

Every student in our department has access to intense mentorship through our senior project/supervised research courses. Although all do not take advantage of this opportunity, our program is proud of the opportunities it provides students to ensure preparedness for their post-baccalaureate careers. Many of these projects are interdisciplinary, requiring students to learn how to communicate not just with other chemists but also with professionals outside of our discipline as well as the greater community. In table 6.1, we highlight 10 different activities that provide a PolyX experience for our students, and these activities include courses, clubs, community events, and research experiences.

As part of our effort to provide students with an “Inclusive Polytechnic Education”, several of our research programs have been certified as “PolyX”. Additionally, CHM 5500 (Advanced Chemical Communications), one of our core graduate level courses, has also been recognized as a “PolyX” signature experience. All students, at every level of education, are exposed to an “Inclusive Polytechnic Education.”

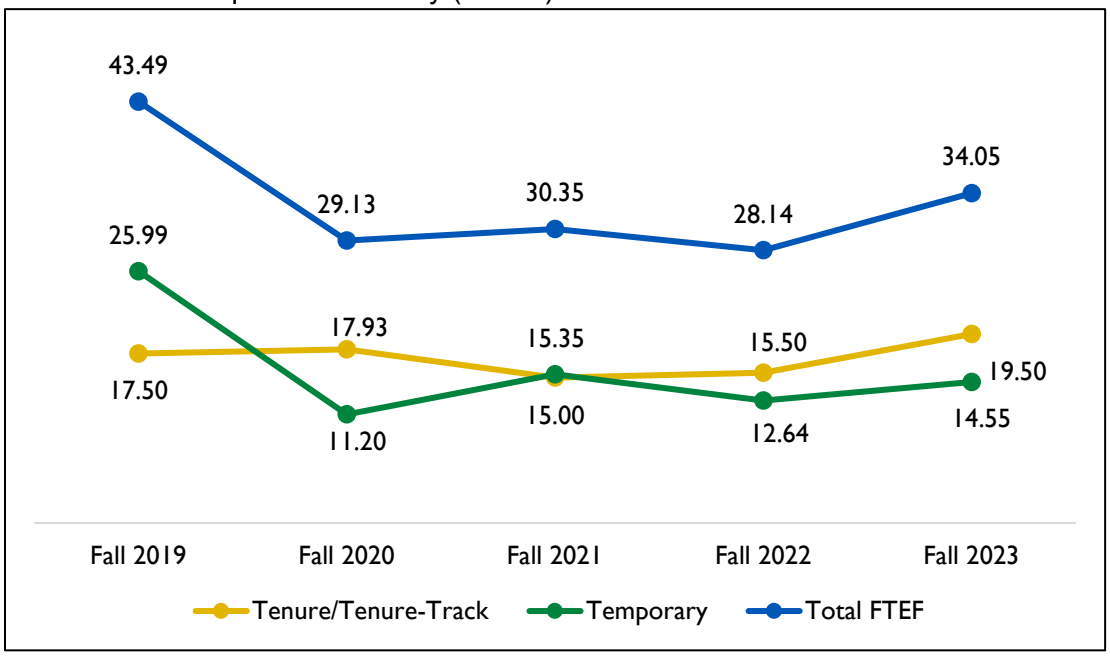
7 FACULTY

7.1 Overview of Faculty

Figure 9 to Figure 12 provide data over 5 years on the historical Full Time Equivalent-Faculty (FTE-F), Full Time Equivalent-Student (FTE-S), Student to Faculty Ratio (SFR), and Major to Faculty Ratio (MFR). The following definitions are from the Office of Academic Resources. Full Time Equivalent-Faculty is an aggregate measure of faculty workload based on payroll appointment fractions. Student to Faculty Ratio is an aggregate measure of students served based on units in course sections and student level. For FTE-S reporting, graduate student (master or doctoral) is considered full-time with 12 units; all others are considered full-time with 15 units. Student Faculty Ratio is FTE-S divided by FTE-F. Lastly, Major Faculty Ration is the number of stateside degree-seeking students enrolled at census by the FTE-F for tenure-line faculty in the department.

Please note that the data for the following contains information for both undergraduate and graduate programs.

Figure 9 – Full Time Equivalent-Faculty (FTE-F)[22]



[22] AR "FTE-Faculty with Status Detail Tenure-Track and Temporary Faculty" https://www.cpp.edu/academic-resources/budget-and-finance/faculty-reports.shtml

The Office of Academic Resources no longer provides a break down the FTE-S data for Tenure/Tenure-track and Temporary faculty at the time our office conducted the data pull.

Figure 10 – Full Time Equivalent-Student (FTE-S)[23]

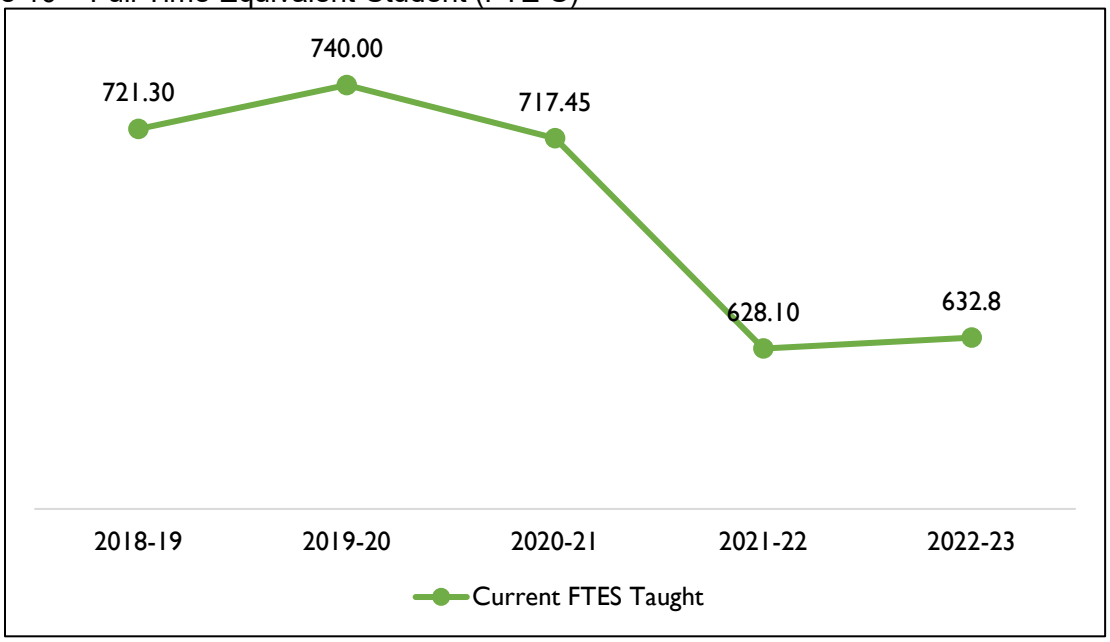
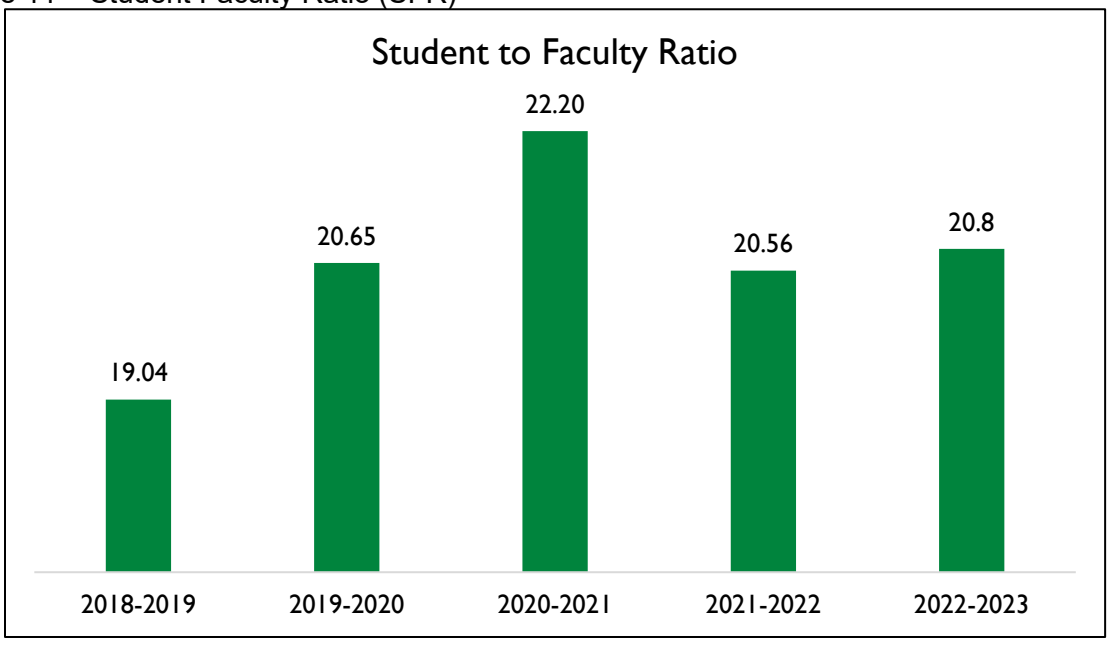
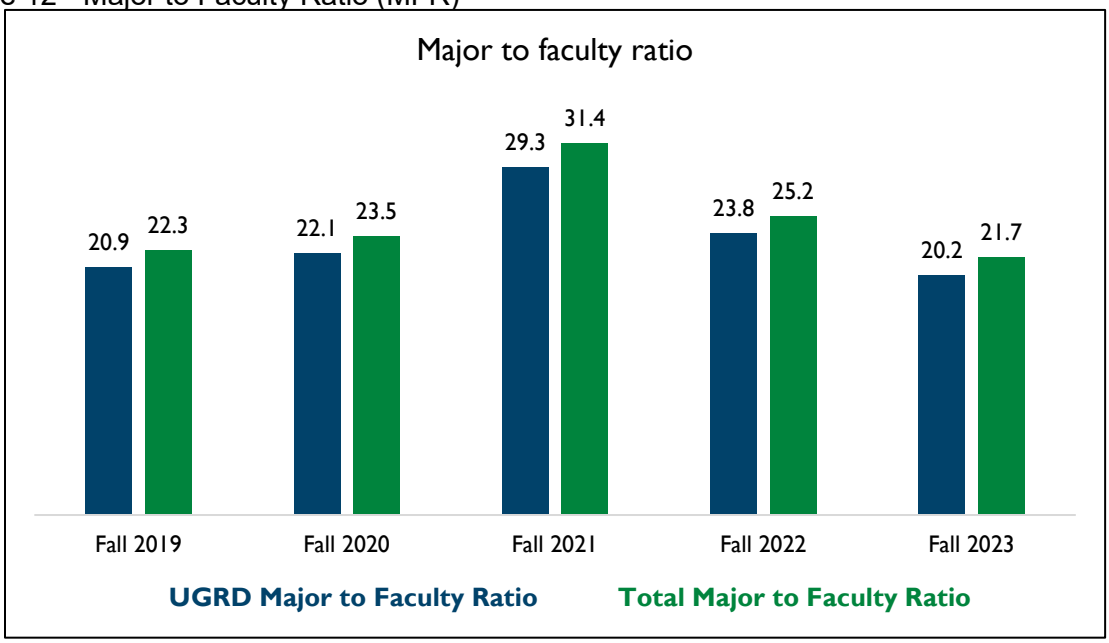


Figure 11 – Student Faculty Ratio (SFR)[24]



[23] AR "Student to Faculty Ratio Reports" https://www.cpp.edu/academic-resources/budget-and-finance/faculty-reports.shtml
[24] AR "Student to Faculty Ratio Reports" https://www.cpp.edu/academic-resources/budget-and-finance/faculty-reports.shtml

Figure 12 - Major to Faculty Ratio (MFR)[25]



The following professional development information is a list of workshops provided by the Center for the Advancement of Faculty Experience (CAFE). The image depicts the number of faculty, department chairs, and teaching assistants who attended events. Unfortunately, there is no way to separate undergraduate from graduate faculty, so the following table represents both.

Table 27: CAFE Professional Development Count, 2023-2025

Year	Event	Count
2023 - 2024	AI Symposium in Higher Education	1
2023 - 2024	Course design for Cal Poly Pomona	1
2023 - 2024	Final Grades with the Registrar	1
2023 - 2024	New faculty orientation	1
2023 - 2024	Technology Tuesday : GradeScope	1
2023 - 2024	Technology Tuesday: Introducing the QLT Template	1
2023 - 2024	Technology Tuesday: Course Evaluations	1
2023 - 2024	Academic Integrity	1
2023 - 2024	AI Series	1
2023 - 2024	Equity in Practice Symposium 2024	2
2023 - 2024	Faculty Day Luncheon	7
2023 - 2024	Parenting Group	2
2024 - 2025	AI Summer Series: Assignment Design REGISTRATION ONLY as of June 7	1
2024 - 2025	AI Summer Series: Course Design REGISTRATION ONLY as of June 7	1
2024 - 2025	AI Summer Series: Prompt engineering REGISTRATION ONLY as of June 7	1

[25] ARAR “Major to Faculty Ratio” https://www.cpp.edu/academic-resources/budget-and-finance/faculty-reports.shtml

We have faculty expertise representing almost all areas of chemistry, including Physical Chemistry, Inorganic Chemistry, Organic Chemistry, Analytical Chemistry, Computational Chemistry, Biochemistry, and Chemical Education. However, as our department continues to grow, we need additional growth in Chemical Education so we can intentionally enhance our chemistry curriculum in a way that is supported pedagogically.

Currently, we have 19 adjunct faculty that are responsible for teaching a majority of our introductory courses, including General Chemistry 1 and General Chemistry 2, Chemistry for Engineers, and some of our other upper division coursework including Organic Chemistry 1 and 2 lecture and labs. As an example, in Fall of 2023 adjunct faculty taught 4 of our 8 CHM 1210 (General Chemistry 1 Lecture) sections (369 seats, compared to 315 seats for TT faculty). When considering labs, the number shifts dramatically for non-tenured faculty (including TA's) who taught 25 of the 28 offered sections (588 seats, compared to just 71 seats for TT faculty).

In addition to adjunct lecturers, we use TA's, learning assistants, instructional student assistants, and graders in our curriculum. TA's and lecturer/adjunct faculty teach a large portion of our freshman level courses while the other categories are spread throughout our curriculum in ways to support faculty workload while also enhancing student success.

Currently, our program is stable with some moderate growth. Although based on our SFR (majors only), we have the capacity to increase significantly, what is not factored is our heavy service load to other departments. In Fall of 2023, we filled over 1900 seats in General Chemistry 1 and 2, lecture and lab combined, for a total of 54 sections (12 lecture, 42 laboratory). The "Learn by Doing" model is stressed by limited laboratory enrollment cap in order to safely offer a high-quality experience for the students. Similarly, for Organic Chemistry 1 and 2, lab and lecture combined, we had over 600 seats filled between 8 sections of lecture and 14 sections of lab. The current model for growth only factors in SFR and FTES, at the consequence of the program, as we have no control over the growth of other "in demand" majors but are required to provide courses essential to their curriculum. While we have the capacity in our upper division courses, we are concerned about capacity in our "introductory" courses and that could have a deleterious impact on the success of continuing to increase our majors.

7.2 Faculty Support

A survey of faculty experience was conducted, receiving 12 responses from TT and 7 responses from non-TT faculty.

Among non-TT faculty, areas of highest satisfaction related to collegiality and support by colleagues related to assessment, mentorship by senior faculty, and support for professional development. Non-TT faculty also reported making frequent contributions to many components of student learning, including developing student's ability to apply knowledge, think critically, solve problems, while supporting student innovation and discovery. The areas of lowest satisfaction were workload, job security, and campus climate. Professional development was identified as something in need of significant promotion and enhancement, as respondents reported infrequent participation in most forms of professional development within the last five years.

Within the TT faculty, the areas of greatest satisfaction indicate strong mentorship by senior faculty and support for the RTP process and pedagogical development. The lowest areas of

satisfaction in work environment were workload, resources on campus, and campus climate. TT faculty reported overall lower satisfaction compared to non-TT with the resources available on campus, and by far the area of lowest satisfaction was with the physical instructional facilities, with which 2/3 of respondents were Dissatisfied or Very Dissatisfied.

Tenure track faculty are encouraged through the RTP process to pursue professional development opportunities. Tenure track faculty take advantage of the offerings to enhance the student learning experience, simplify their time management while not sacrifice quality, and also to engage with other faculty. These experiences are essential to the overall success of both our faculty and our students. CAFÉ, which is overseen by Faculty Affairs, is the primary provider of professional development opportunities. The opportunities they offer are excellent resources for the faculty and range from workshops on grading, AI in the classroom, active learning, and technology.

Although open to all faculty (tenure-track and adjunct alike), these opportunities are difficult to encourage our adjunct faculty to attend. Unlike our TT faculty, our adjunct faculty are not evaluated on professional development opportunities. The department will explore how best to encourage our adjunct faculty to attend these opportunities so that both they and our students can benefit from these resources.

8 UNIVERSITY SUPPORT AND RESOURCES

8.1 Personnel

Our department has a total of 5 technicians (four that maintain our stockrooms and 1 for maintains our instrumentation) and 1.5 coordinators (one full-time ASCII and an ASCI that we share with Physics). Each of these are essential for our student success. Our laboratory technicians ensure that our labs are running smoothly and our instructors have the resources and chemicals prepared needed to instruct in a safe laboratory environment. Without our technicians, we would not be able to provide instruction to our more than 60 combined laboratory sections of General Chemistry I, General Chemistry II, Organic Chemistry 1 and Organic Chemistry 2 labs. The instrument technician ensures that our state-of-the-art equipment runs smoothly and is maintained. Our ASCI and II are essential for assisting students in course enrollment, finding adequate class space for instruction, ordering office supplies for faculty, and many other functions.

As with every other academic unit in the CSU, we were recently downsized from two ASC positions to 1.5. The increased workload required to maintain a large number of classes, labs, and faculty is increasing turnover and decreasing office morale. Our department (students and faculty) would benefit from have two full time coordinators in our office as it we cannot maintain the “do more with less” pace for the provided resources. Our technicians are also underfunded. We have three stockrooms in three different buildings that serve our instructional and research laboratories, with only one extra technician. Currently, we meet demand hiring student assistants. This is a great opportunity for students to gain valuable work experience while also mitigating the costs associated with hiring additional personnel, however, that model only works in stable budget years. As we are looking at a turbulent funding model over the next few years, an increase in permanent staff would provide more stability and better workload distribution so that we can continue to meet the growing demand that is part of our department mission.

8.2 Facilities and Space

We use both laboratory spaces (for instruction and scholarship), a computer lab managed by the department, as well as large lecture spaces. The computer lab needs some upkeep, including new chairs and the hardware will need upgrading within the next 5 to 7 years. For the large lecture space, we are working hard with Academic Planning to ensure we can meet demand for our General Chemistry series. The large lecture spaces are in demand as departments try to meet and improve their FTES, however, our general chemistry series is often used as a gateway course for several other majors in other departments. Being able to meet demand includes increasing access to the large lecture spaces, which is paramount for our students to graduate in a timely manner. For many majors, general chemistry is first in a series of 4 classes (that can only be taken in sequence) and so a one semester delay can have detrimental impact to their academic progress.

Laboratory spaces are also part of the quintessential science education. We have several lab spaces that are classified based on courses (for example, general chemistry labs are separate from biochemistry labs). As demand increases, we have the ability to increase offered sections, however, many of these time slots would conflict with the availability of the health center. As with any science lab, there is the danger of accidents occurring and having access to the health center is paramount to ensuring our students are treated quickly upon reporting an accident. For our organic chemistry 1 laboratory, we are at capacity. We do not have the laboratory

space to increase offerings while demand is high. Paired with the limited availability of stockroom staff, we are unable to run many labs outside of normal business hours (for example, we try to avoid scheduling organic chemistry labs to end after 5pm wherever possible). To meet demand, we need to increase our full-time staff and should also have a health center that is open during scheduled laboratory courses.

8.3 Library

The first set of data below pertains to **BS in Chemistry**.

The University Library assigns specific librarians to support specific disciplinary areas. For the BS Chemistry program, there is no assigned library faculty member. However, the University Library is currently recruiting for a full-time, tenure-track, Science librarian and the anticipated hiring date is August.

Subject librarians provide the following services:

- Design and deliver library-related course-integration instruction at the request of teaching faculty;
- Develop online tutorials and guides for specific courses or projects as well as more general online research guides for the disciplinary area;
- Available on a by-appointment basis to meet with individual students or with small groups of students for personalized research consultations in-person, via Zoom or chat, or by phone or email. https://www.cpp.edu/library/reference-instruction/contact-subject-librarian.shtml

Outreach Efforts

As the statistics that follow illustrate, outreach toward the BS program in Chemistry has been minimal over the past 5 years as the position of Science Librarian has been mostly vacant. During part of this time, the Data Management Librarian functioned as the assigned liaison librarian for the College of Science; however she conducted minimal outreach to the College of Science or specific departments such as Chemistry.

Research Assistance

Research assistance is available in a variety of ways– in-person, via online, chat, by telephone, or via email. Library faculty provide research services and offer one-on-one research consultations. The chart below outlines the number of research questions and consultations conducted in the specific disciplinary area over the last five fiscal years.

	FY 2023-24	FY 2022-23	FY 2021-22	FY 2020-21	FY 2019-20
Research Questions	4	3	15	18	12
Research Consultations	2	3	9	15	10
Total	6	6	24	33	22

Course-Related Instructional Statistics

The chart below outlines the number of course-integrated instructional sessions offered by library faculty at the request of teaching faculty teaching specific credit courses in the academic program. Total number of attendees and contact hours are also provided. These statistics cover sessions offered for specific credit courses over the last five fiscal years.

	FY 2023-24	FY 2022-23	FY 2021-22	FY 2020-21	FY 2019-20
Number of Course-Integrated Instructional Sessions	0	0	0	0	0
Total Number of Attendees	0	0	0	0	0
Total Number of Instructional Contact Hours	0	0	0	0	0

Library Workshop Instructional Statistics

The chart below outlines the number of library-sponsored workshops designed and delivered by library faculty. Total number of attendees and contact hours are also provided. These statistics cover the following workshops offered over the last five fiscal years:

	FY 2023-24	FY 2022-23	FY 2021-22	FY 2020-21	FY 2019-20
Number of Course-Integrated Instructional Sessions	0	0	0	0	0
Total Number of Attendees	0	0	0	0	0
Total Number of Instructional Contact Hours	0	0	0	0	0

Online Research Guides

Library faculty created online research guides for specific courses and disciplines. The full list is available on the library website here: https://libguides.library.cpp.edu/

For this subject area, the subject librarian has developed and maintained the following research guides listed below. The chart also includes the number of views by fiscal year which indicates usage.

Online Research Guide Titles + Link	FY 2023-24 As of 6/5/2024	FY 2022-23	FY 2021-22	FY 2020-21	FY 2019-20
1210 BIO	2,923	3,837	6,003	8,286	2,978
Biological Science	235	1,759	3,565	5,572	3,322
Science	57	87	122	306	315
Master's Thesis/Project Formatting Guidelines	3,613	5,237	4,459	3,428	2,083
Chemistry & Biochemistry	189	201	N/A	N/A	N/A
Math & Statistics	47	86	47	N/A	N/A
Physics & Astronomy	29	53	57	142	N/A

Online Tutorials & Modules

Library faculty create online tutorials and modules for specific courses and disciplines. Listed below are the relevant tutorials and modules for this academic program and the number of views which indicate usage.

Online Tutorial & Module Titles + Link	FY 2023-24 As of 6/5/2024	FY 2022-23	FY 2021-22	FY 2020-21	FY 2019-20
Citation Tutorial Guide	12	9	4	10	N/A
Research 101 Tutorials	65	94	48	58	22
Library Skills Tutorials	0	1	12	14	12

Library Resources

For this program area, there are 378 electronic resources that support the discipline. These resources include both journals and databases. These resources and the number of searches are indicated below – not all data was available.

Thirteen (13) librarian-recommended databases and the top 10 most used journals are indicated below. The data for database usage FYs 2019-20 and 2020-2021 can only be accessed by vendor request.

Electronic Resource Titles	FY 2023-24 # Searches As of 6/5/2024	FY 2022-23 # Searches	FY 2021-22 # Searches	FY 2020-21 # Searches	FY 2019-20 # Searches
Academic Search Premier	30,883	45,865	66,719	N/A	N/A
ACS Web	13,798	16,970	12,642		
Annual Review of Biochemistry	22	17	41		
Biological Abstracts	123	969	303		
Global Newsstream	422,725	478,269	597,755		
O'Reilly Online Learning E-books	356,320	214,234	200,523		
PubMed			Open Access		
SAGE Journals Online	20,458	30,999	30,129	N/A	N/A
ScienceDirect	123,941	142,741	124,562		
SciFinder Web Edition	12,618	14,188	14,066		
SPIE Digital Library	259	332	204		
SpringerLink	26,338	37,173	27,647		
Wiley Online Library	N/A *	21,041	42,930		

Note: * Due to limited budget, the University Library cancelled the Wiley Online Library in January 2023; no complaints have been received over the last 18 months.

Based on usage, the top 10 journals in Chemistry are:

1. Organometallics
2. Journal of the American Chemical Society
3. Inorganic Chemistry
4. Journal of Chemical Education
5. Environmental Science & Technology
6. Journal of Agricultural & Food Chemistry
7. The Journal of Organic Chemistry
8. Industrial & Engineering Chemistry Research
9. Analytical Chemistry
10. Chemical Reviews

The data below pertains to **MS Chemistry**.

The University Library assigns specific librarians to support specific disciplinary areas. For the MS Chemistry program, there is no assigned library faculty member. However, the University Library is currently recruiting for a full-time, tenure-track, Science librarian and the anticipated hiring date is August.

Subject librarians provide the following services:

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Outreach Efforts

As the statistics that follow illustrate, outreach toward the MS program in Chemistry has been minimal over the past 5 years as the position of Science Librarian has been mostly vacant. During part of this time, the Data Management Librarian functioned as the assigned liaison librarian for the College of Science; however, she conducted minimal outreach to the College of Science or specific departments such as Chemistry.

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	FY 2023-24	FY 2022-23	FY 2021-22	FY 2020-21	FY 2019-20
Research Questions	0	0	15	18	12
Research Consultations	0	1	9	15	10
Total	0	1	24	33	22

Course-Related Instructional Statistics

The chart below outlines the number of course-integrated instructional sessions offered by library faculty at the request of teaching faculty teaching specific credit courses in the academic program. Total number of attendees and contact hours are also provided. These statistics cover sessions offered for specific credit courses over the last five fiscal years.

	FY 2023-24	FY 2022-23	FY 2021-22	FY 2020-21	FY 2019-20
Number of Course-Integrated Instructional Sessions	0	0	0	0	0
Total Number of Attendees	0	0	0	0	0
Total Number of Instructional Contact Hours	0	0	0	0	0

Library Workshop Instructional Statistics

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	FY 2023-24	FY 2022-23	FY 2021-22	FY 2020-21	FY 2019-20
Number of Course-Integrated Instructional Sessions	0	0	0	0	0
Total Number of Attendees	0	0	0	0	0
Total Number of Instructional Contact Hours	0	0	0	0	0

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Library Skills Tutorials	0	1	12	14	12

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Thirteen (13) librarian-recommended databases and the top 10 most used journals are indicated below. The data for database usage FYs 2019-20 and 2020-2021 can only be accessed by vendor request.

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Annual Review of Biochemistry	22	17	41		
Biological Abstracts	123	969	303		
Global Newsstream	422,725	478,269	597,755		
O'Reilly Online Learning E-books	356,320	214,234	200,523		
PubMed	Open Access				
SAGE Journals Online	20,458	30,999	30,129	N/A	N/A
ScienceDirect	123,941	142,741	124,562		
SciFinder Web Edition	12,618	14,188	14,066		
SPIE Digital Library	259	332	204		
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3. Inorganic Chemistry
4. Journal of Chemical Education
5. Environmental Science & Technology
6. Journal of Agricultural & Food Chemistry
7. The Journal of Organic Chemistry
8. Industrial & Engineering Chemistry Research
9. Analytical Chemistry
10. Chemical Reviews

To date, the current library resources are sufficient and allows us to meet our need and we do not feel that current resources are unnecessary. Currently, there is limited engagement with the library, however, we look forward to more interaction as we enter a new era with AI and how that can impact our students.

8.4 Other Campus Resources

Our students use the Learning Resource Center (LRC) and Graduate Resource Center to increase student success. Recently, we have engaged with the Director of the LRC to increase the student learning assistants available for our Organic Chemistry 1 and 2 courses/labs. We are working with our faculty to find students who would make exceptional tutors for organic chemistry and the LRC has agreed to prioritize those who are referred by our faculty. We are also exploring other opportunities with the partnership, such as in-class tutors and other ways we can increase student success in an otherwise difficult course.

8.5 Budget

The department is not provided with an operating or lecturer budget, but tracks our expenses carefully to ensure that we are meeting the basic needs of our students while simultaneously practicing an austere spending posture. The benefit of not having a lecturer budget is that the centralized nature of the budget provides savings across departments, ensuring that if one department has an over enrollment in our introductory courses, there is flexibility to open additional sections. Additionally, our College is only provided a meager $400,000 (pre-2024) operating budget with 7 departments – three of which run many sections of laboratories (i.e., General Chemistry Lab, Physics Lab, Biology Lab), and the operating expenses do not cover the actual cost of running the college. As such, our operating budget is non-existent.

The department is provided with a “student engagement” fund, provided through part of the student success fees collected as part of student tuition. These fees are the only resource our department is provided by the University to engage without majors and is approximately $4000 per year (based on head count). We use these funds to support our DEI initiatives, such as Chemunity, through which we invite external speakers, hold events to celebrate heritage, and engage in thoughtful discussions with our majors. We also use the student engagement funds to support tour Chemistry Club events that are open to the entire department.

The department has access to two different foundation accounts to help support various activities. These funds are either provided via donations (the Chemistry Excellence Account) or by indirect cost recovery from grant expenditures. The ICR account is primarily meant to support research costs that the University is not able to, including our “foundation fee” of 4.5% for any procured grant, even if there is no overhead allowed. Large instrument purchases through grants such as the NSF-MRI and DOD-HIS grant opportunities are supported through this fund since we have no other adequate university support for research and instrumentation upgrade. The Chemistry Excellence Account is used to support initiatives within our department that are student focused and underfunded (such as our chemistry club and the Chemunity forum).

9 CONCLUSION

Program Strengths

All our degree programs have a foundational strength in analytical chemistry, supported by our high lab requirement for our students. Because of the diverse course offerings, we have three options which provides our majors with the flexibility to tailor their coursework to suit a variety of post-baccalaureate careers, including professional school, graduate school, industry, or government work. The General Chemistry option was intentionally designed to assist later career majors switching from a science or engineering related degree to Chemistry and has since grown in popularity with all our majors.

Since GI 2025 demonstrated the inequities of education, our department has actively pursued strategies to enhance the student experience in our courses. We are actively working with our General Chemistry and Organic Chemistry series, amongst our highest DFW courses, to provide additional opportunities for students to succeed. For General Chemistry, we are piloting an activity course to provide extra assistance in both lecture and lab by reinforcing concepts, highlighting difficult to understand topics, and increase facetime with our faculty. For Organic Chemistry, we are working with the university to establish embedded tutors and learning assistants in lectures and labs. The embedded tutors and learning assistants also hold office hours to provide additional points of contact for the students in an otherwise difficult course. Additionally, we are in our second year of piloting a coupled lecture and laboratory designed for Chemistry majors. The course is designed to provide more enriched connections with their subsequent coursework so that our majors are more prepared for their post-baccalaureate careers.

Finally, over the last 7 years our department has continued to grow by recruiting and retaining faculty that provide our students with rich and diverse research experiences and who exemplify CPP's Teacher-Scholar model. Our desire to support our students extends into our university service, where our faculty are deeply involved to ensure that we use every tool possible to represent our students and department. These activities include representation on the academic senate and in senate leadership, University assessment leadership, co-Chairing the University's Chemical Hygiene committee, and co-PIs on grants focused specifically on providing research opportunities to students and research and teaching training for postdoctoral scholars.

Program improvement

Despite our success, our program will continue to grow and evolve to meet student demand and expectation. Some areas our department can continue to work on include curriculum design and development. As student interest evolves, our program should also adapt to the needs and demands of our students. Some areas include incorporation of cosmetics and natural products in directly in our curriculum as well as elements of environmental toxicology. These areas can easily fit in with our existing curriculum and expanded to include elements unique to CPP.

Another improvement that would benefit our faculty would be to find ways to support adjunct faculty to participate in professional development opportunities. Although all on-campus professional development opportunities are open to all faculty (tenure-track and adjunct alike), there is little support and motivation for adjunct faculty to participate. Finding ways to include and encourage all faculty to participate in professional development would benefit the faculty, students, and department as whole.

Facilities is another area that could use improvement. We are now at max capacity for CHM 3140L (Organic Chemistry I lab) and are limited by several factors. First, we only have one laboratory technician available to serve these labs, limiting the stockroom availability. We are able to use student assistants and equipment carts to bridge some of the time but we are unable to run labs that do not overlap with the stockroom availability. Second, we are limited by lab space. Even if we could increase stockroom availability, the physical lab space associated with organic chemistry is limited. Additional lab space is essential to our ability to meet demand. Third, our environmental controls are severely outdated. As noted in our last review, our fume hoods are irresponsibly inadequate and create a safety hazard for our students and instructors. The organic chemistry laboratory spaces need renovated to handle our existing capacity but also to increase our laboratory offerings. Organic Chemistry and Organic Chemistry Lab are essential courses for a variety of majors and post-baccalaureate careers (such as medical school, veterinary school, dental school, and graduate school). Without adequate facilities, these important service courses will be limited in their offerings as we are at maximum capacity.

Appendix

Curriculum Sheets

Cal Poly Pomona College of Science

Name:

Plan: **Chemistry, B.S.**

Subplan/Option: **General Chemistry**

Min. Units Required: **120 units**

2023-2024 University Catalog
Degree Curriculum Sheet

Major Required — 48 units

CHM1210 - General Chemistry I (3) (B1)
CHM1210L - General Chemistry Laboratory I (1) (B3)
CHM1220 - General Chemistry II (3) (B1)
CHM1220L - General Chemistry Laboratory II (1) (B3)
CHM2210 - Quantitative Analysis (2)
CHM2210L - Quantitative Analysis Laboratory (2)
CHM2910A - Chemical Communication Activity (1)
CHM3140 - Organic Chemistry I (4)
CHM3140L - Organic Chemistry Laboratory I (1)
CHM3150 - Organic Chemistry II (3)
CHM3150L - Organic Chemistry Laboratory II (1)
CHM3270 - Biochemistry (3)
CHM3270L - Biochemistry Laboratory I (1)
CHM3420 - Spectroscopic Methods (1)
CHM3420L - Spectroscopic Methods Laboratory (1)
CHM3430 - Separation Methods (1)
CHM3430L - Separation Methods Laboratory (1)
CHM3520L - Physical Chemistry Laboratory (2)
MAT1140 - Calculus I (4) (B4)
MAT1150 - Calculus II (4) (B4)
PHY1510 - Introduction to Newtonian Mechanics (3) (B1)
PHY1510L - Newtonian Mechanics Laboratory (1) (B3)
PHY1520 - Introduction to Electromagnetism and Circuits (3)
PHY1520L - Introductory Laboratory on Electromagnetism and Circuits (1)

Subplan/Option Required — 10 units

BIO1150 – Basic Biology (3) (B2)
BIO1210L – Basic Biology Laboratory (1) (B3)
CHM3110 – Classical Physical Chemistry (3) and
CHM3120 – Quantum Physical Chemistry (3)
OR
CHM3040 – Elements of Physical Chemistry I (3) and
CHM3050 – Elements of Physical Chemistry II (3)
OR
CHM4220 – Organic Analysis (2) and
CHM4220L – Organic Analysis Laboratory (2)

Subplan/Option Electives — 23 units

Students may take any 3000/4000 level chemistry Courses not already counted in the major required to satisfy units excluding CHM 3010, CHM3040, CHM 3050, CHM 3110, CHM 3120, and CHM 3210. Up to 12upper division units may come from outside CHM. See advisor/dept for suggested courses that prepare for specific areas in chemistry or to tailor your curriculum to career goals.
B5 Science and Technology Synthesis (upper division) courses are to be excluded from this list.

General Education Requirements — 48 Units

Students should consult the Academic Programs website.

https://www.cpp.edu/~academic-programs/general-education-course-listings.shtml

for current information regarding this requirement. Unless specific courses are required, please refer to the list of approved courses under General Education Requirements, Areas A through E.

Area A. English Language Communication and Critical Thinking (9 units)

At least 3 units from each sub-area

1. Oral Communication
2. Written Communication
3. Critical Thinking

Area B. Scientific Inquiry and Quantitative Reasoning (12 units)

At least 3 units from each sub-area

1. Physical Sciences
2. Life Sciences
3. Laboratory Activity
4. Mathematics/Quantitative Reasoning
5. Science and Technology Synthesis

Area C. Arts and Humanities (12 units)

At least 3 units from each sub-area and 3 additional units from sub-areas 1 and/or 2

1. Visual and Performing Arts
2. Literature, Modern Languages, Philosophy and Civilization
3. Arts and Humanities Synthesis

Area D. Social Sciences (9 units)

At least 3 units from each sub-area

1. U.S. History and American Ideals
2. U.S. Constitution and California Government
3. Social Science Synthesis

Area E. Lifelong Learning and Self-Development (3 units)

Area F. Ethnic Studies (3 units)

Interdisciplinary General Education — 18 Units

An alternate pattern for partial fulfillment of GE Areas A, C, and D available for students is th

Interdisciplinary General Education (IGE) program. Students should see an advisor for specific GE coursework required by their major. Please refer to the University Catalog General Education Program section for additional information.

How IGE fulfills General Education Requirements:

Year	*Completion of IGE Courses*	*Satisfies GE Requirements*
First	*IGE 1100, IGE 1200*	*A2 and C2*
Second/Third	*IGE 2150, IGE 2250*	*C2 and D1*
	IGE 2350	*C1*
Third	*IGE 3100*	*C3 or D4*

American Institutions — 6 Units

Courses that satisfy this requirement may also satisfy GE Area D1 and D2.

Graduation Writing Test

The Graduation Writing Test (GWT) is suspended until Fall 2025. Students entering Cal Poly Pomona before Fall 2025 are not required to take the Graduation Writing Test

Cal Poly Pomona College of Science

Name:

Plan: **Chemistry, B.S.**

SubPlan/Option: **Biochemistry**

Min. Units Required: **120 units**

2023-2024 University Catalog
Degree Curriculum Sheet

Major Required — 48

CHM1210 - General Chemistry I (3) (B1)
CHM1210L - General Chemistry Laboratory I (1) (B3)
CHM1220 - General Chemistry II (3) (B1)
CHM1220L - General Chemistry Laboratory II (1) (B3)
CHM2210 - Quantitative Analysis (2)
CHM2210L - Quantitative Analysis Laboratory (2)
CHM2910A - Chemical Communication Activity (1)
CHM3140 - Organic Chemistry I (4)
CHM3140L - Organic Chemistry Laboratory I (1)
CHM3150 - Organic Chemistry II (3)
CHM3150L - Organic Chemistry Laboratory II (1)
CHM3270 - Biochemistry I (3)
CHM3270L - Biochemistry Laboratory I (1)
CHM3420 - Spectroscopic Methods (1)
CHM3420L - Spectroscopic Methods Laboratory (1)
CHM3430 - Separation Methods (1)
CHM3430L - Separation Methods Laboratory (1)
CHM3520L - Physical Chemistry Laboratory (2)
MAT1140 - Calculus I (4) (B4)
MAT1150 - Calculus II (4) (B4)
PHY1510 - Introduction to Newtonian Mechanics (3) (B1)
PHY1510L - Newtonian Mechanics Laboratory (1) (B3)
PHY1520 - Introduction to Electromagnetism and Circuits (3)
PHY1520L - Introductory Laboratory on Electromagnetism and Circuits (1)

Subplan/Option Required — 24-25 units

BIO1210 - Foundations of Biology: Energy, Matter, and Information (3) (B2)
BIO1210L - Foundations of Biology: Energy, Matter, and Information Laboratory (1) (B3)
BIO1220 - Foundations of Biology: Evolution, Ecology, and Biodiversity (3)
BIO1220L - Foundations of Biology: Evolution, Ecology, and Biodiversity Laboratory (1)

BIO2060 - Basic Microbiology (3) and
BIO2060L - Basic Microbiology Laboratory (1)
OR
BIO2400 - Genetics (3)

CHM3040 - Elements of Physical Chemistry I (3)
CHM3050 - Elements of Physical Chemistry II (3)
CHM3280 - Biochemistry II (3)
CHM3280L - Biochemistry Laboratory II (1)
CHM4530 - Informational Biomolecules and Recombinant DNA (3)

Subplan/Option Electives — 8-9 units

Select at least one course from Option Electives and one BIO course.

Option Electives

CHM3310 - Clinical Chemistry (2)
CHM3310L - Clinical Chemistry Laboratory (1)
CHM4510 - Enzymology (3)
CHM4510L - Enzymology Laboratory (1)
CHM4520 - Advanced Biomolecular Structure (3)
CHM4540 - Advanced Metabolism (3)
CHM4610 - Senior Project I (2) *

Suggested Chemistry (CHM) Electives

CHM3440 - Electroanalytical Methods (1)
CHM3440L - Electroanalytical Methods Laboratory (1)
CHM4410 - Internship in Chemistry (1-2)
CHM4500 - Bioanalytical Chemistry (3)
CHM4500L - Bioanalytical Chemistry Laboratory (1)
CHM4620 - Senior Project II (2) *
CHM4630 - Research Student Seminar (1) *
CHM 3000/4000 level: Additional course from Option Electives (1-4)

Suggested Biology (BIO) Electives

BIO3620 - Applied Microbiology (2)
BIO3620L - Applied Microbiology Laboratory (1)
BIO3640 - Food Microbiology (2)
BIO3640L - Food Microbiology Laboratory (1)
BIO4020 - Developmental Biology (3)[1]
BIO4020L - Developmental Biology Laboratory (1)
BIO4030 - Human Genetics (3)[1]
BIO4040 - Advanced Genetics (3)
BIO4300 - Concepts of Molecular Biology (3)[1]
BIO4320 - Molecular Biology Techniques (3)
BIO4320L - Molecular Biology Techniques Laboratory (1)
BIO4360 - Recombinant DNA and Protein Technology (3)
BIO4360L - Recombinant DNA and Protein Technology Laboratory (1)
BIO4380 - Bioinformatics (2)
BIO4380L - Bioinformatics Laboratory (2)
BIO4400 - Stem Cell Biology (3)[1]
BIO4400L - Stem Cell Biology Laboratory (1)
BIO4450 - Physiology I: Cells (3)
BIO4450L - Physiology I: Cells Laboratory (1)[1]
BIO4480 - Plant Physiology (3) 2
BIO4480L - Plant Physiology Laboratory (1) 2
BIO4540 - Plant Genetics (3)

BIO4635 - Medical Microbiology (3) BIO4635L – Medical Microbiology Laboratory (1)

BIO4660 - Microbial Physiology (3)

Note(s):

*Students who do senior project should take CHM 4610, CHM 4620, and CHM 4630 to complete requirement. 1 BIO 3220 - Cell and Molecular Biology , is a prerequisite. 2 BIO 2050 - Form and Function in Plants / BIO 2050L - Form and Function in Plants Laboratory , is a prerequisite.

General Education Requirements — 48 Units

Students should consult the Academic Programs website

https://www.cpp.edu/~academic-programs/general-education-course-listings.shtml

for current information regarding this requirement. Unless specific courses are required, please refer to the list of approved courses under General Education Requirements, Areas A through E.

Area A. English Language Communication and Critical Thinking (9 units)
At least 3 units from each sub-area
1. Oral Communication
2. Written Communication
3. Critical Thinking

Area B. Scientific Inquiry and Quantitative Reasoning (12 units)
At least 3 units from each sub-area
1. Physical Sciences
2. Life Sciences
3. Laboratory Activity
4. Mathematics/Quantitative Reasoning
5. Science and Technology Synthesis

Area C. Arts and Humanities (12 units)
At least 3 units from each sub-area and 3 additional units from sub-areas 1 and/or 2
1. Visual and Performing Arts
2. Literature, Modern Languages, Philosophy and Civilization
3. Arts and Humanities Synthesis

Area D. Social Sciences (9 units)
At least 3 units from each sub-area
1. U.S. History and American Ideals
2. U.S. Constitution and California Government
3. Social Science Synthesis

Area E. Lifelong Learning and Self-Development (3 units)

Area F. Ethnic Studies (3 units)

Interdisciplinary General Education — 18 Units

An alternate pattern for partial fulfillment of GE Areas A, C, and D available for students is the Interdisciplinary General Education (IGE) program. Students should see an advisor for specific GE coursework required by their major. Please refer to the University Catalog General Education Program section for additional information.

How IGE fulfills General Education Requirements:

Year	*Completion of IGE Courses*	*Satisfies GE Requirements*
First	*IGE 1100, IGE 1200*	*A2 and C2*
Second/Third	*IGE 2150, IGE 2250*	*C2 and D1*
	IGE 2350	*C1*
Third	*IGE 3100*	*C3 or D4*

American Institutions — 6 Units

Courses that satisfy this requirement may also satisfy GE Area D1 and D2.

Graduation Writing Test

The Graduation Writing Test (GWT) is suspended until Fall 2025. Students entering Cal Poly Pomona before fall 2025 are not required to take the Graduation Writing Test.

Cal Poly Pomona College of Science

Name:

Plan: **Chemistry, B.S.**

SubPlan/Option: **American Chemical Society**

Min. Units Required: **120 units**

2023-2024 University Catalog
Degree Curriculum Sheet

Major Required — 48 units

CHM1210 - General Chemistry I (3) (B1)
CHM1210L - General Chemistry Laboratory I (1) (B3)
CHM1220 - General Chemistry II (3) (B1)
CHM1220L - General Chemistry Laboratory II (1) (B3)
CHM2210 - Quantitative Analysis (2)
CHM2210L - Quantitative Analysis Laboratory (2)
CHM2910A - Chemical Communication Activity (1)
CHM3140 - Organic Chemistry I (4)
CHM3140L - Organic Chemistry Laboratory I (1)
CHM3150 - Organic Chemistry II (3)
CHM3150L - Organic Chemistry Laboratory II (1)
CHM3270 - Biochemistry (3)
CHM3270L - Biochemistry Laboratory I (1)
CHM3420 - Spectroscopic Methods (1)
CHM3420L - Spectroscopic Methods Laboratory (1)
CHM3430 - Separation Methods (1)
CHM3430L - Separation Methods Laboratory (1)
CHM3520L - Physical Chemistry Laboratory (2)
MAT1140 - Calculus I (4) (B4)
MAT1150 - Calculus II (4) (B4)
PHY1510 - Introduction to Newtonian Mechanics (3) (B1)
PHY1510L - Newtonian Mechanics Laboratory (1) (B3)
PHY1520 - Introduction to Electromagnetism and Circuits (3)
PHY1520L - Introductory Laboratory on Electromagnetism and Circuits (1)

Subplan/Option Required — 24-25 units

BIO1150 – Basic Biology (3) (B2)
BIO1210L – Basic Biology Laboratory (1) (B3)
CHM3110 – Classical Physical Chemistry (3)
CHM3120 – Quantum Physical Chemistry (3)
CHM3120L – Quantum Physical Chemistry Laboratory (1)
CHM4010 – Inorganic Chemistry (4)
CHM4220 – Organic Synthesis (2) and
CHM4220L – Organic Synthesis Laboratory (2)
OR
CHM4230 - Physical Organic Chemistry (2) and
CHM4230L - Physical Chemistry Laboratory (2)
OR
CHM4220 – Organic Analysis (2) and
CHM4220L – Organic Analysis Laboratory (2)
MAT2550– Linear Algebra with applications to Differential Equations (4)

Subplan/Option Electives — 8-9 units

CHM300/4000 level (2-4) *
CHM4610 – Senior Project I (2)
CHM4620 – Senior Project II (2)
CHM4630 – Research Student Seminar (1)

Note(s):

Chemistry courses not already counted in Major/Option Required (2-4) excluding CHM3010, CHM3040, CHM3050, and CHM3210

Unrestricted Electives — 0-2 units

Select enough courses so that the total from "major required", "subplan/option required", "subplan/option Electives"," GE"," Unrestrictive Electives" is at least 120 units.

General Education Requirements — 48 Units

Students should consult the Academic Programs website.

https://www.cpp.edu/~academic-programs/general-education-course-listings.shtml

for current information regarding this requirement. Unless specific courses are required, please refer to the list of approved courses under General Education Requirements, Areas A through E.

Area A. English Language Communication and Critical Thinking (9 units)

At least 3 units from each sub-area

1. Oral Communication
2. Written Communication
3. Critical Thinking

Area B. Scientific Inquiry and Quantitative Reasoning (12 units)

At least 3 units from each sub-area

1. Physical Sciences
2. Life Sciences
3. Laboratory Activity
4. Mathematics/Quantitative Reasoning
5. Science and Technology Synthesis

Area C. Arts and Humanities (12 units)

At least 3 units from each sub-area and 3 additional units from sub-areas 1 and/or 2

1. Visual and Performing Arts
2. Literature, Modern Languages, Philosophy and Civilization
3. Arts and Humanities Synthesis

Area D. Social Sciences (9 units)

At least 3 units from each sub-area

1. U.S. History and American Ideals
2. U.S. Constitution and California Government
3. Social Science Synthesis

Area E. Lifelong Learning and Self-Development (3 units)

Area F. Ethnic Studies (3 units)

Interdisciplinary General Education — 18 Units

An alternate pattern for partial fulfillment of GE Areas A, C, and D available for students is the Interdisciplinary General Education (IGE) program. Students should see an advisor for specific GE coursework required by their major. Please refer to the University Catalog General Education Program section for additional information.

How IGE fulfills General Education Requirements:

Year	*Completion of IGE Courses*	*Satisfies GE Requirements*
First	*IGE 1100, IGE 1200*	*A2 and C2*
Second/Third	*IGE 2150, IGE 2250*	*C2 and D1*
	IGE 2350	*C1*
Third	*IGE 3100*	*C3 or D4*

American Institutions — 6 Units

Courses that satisfy this requirement may also satisfy GE Area D1 and D2.

Graduation Writing Test

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