

2023 Annual Review

Introduction

Department Name: **Department of Chemistry & Biochemistry**
College Name: **College of Science, Engineering and Technology**
Department Chair: **Gabriela Chilom**

Department Mission Statement (required for NWCCU).

The Chemistry & Biochemistry Department will provide students with knowledge and skills necessary to understand, assess, and utilize elements of the chemistry and biochemistry they will encounter in the 21st century. The Chemistry & Biochemistry Department will teach students, in a clear and understandable manner, the scientific process and fundamental scientific concepts upon which further, life-long scientific understanding can be built. Courses in the department will provide students with the skills and opportunities necessary to make independent, empirical inquiries about the natural world, apply scientific principles, develop critical decision-making abilities, and understand the roles chemistry and biochemistry play in technological advancement. The skills acquired in chemistry courses allow students to make informed personal and societal decisions about ever increasing amounts of scientific information and their relevance to society.

Department Vision Statement

The Chemistry & Biochemistry Department strives to be a recognized leader in innovative, holistic undergraduate chemistry education. Our mission is to create an inclusive, curiosity-driven learning environment that encourages hands-on learning, intellectual exploration, and critical thinking. We enable all students to participate in high-quality undergraduate research, engaging in comprehensive lab exercises, fieldwork, and real-world applications to solidify their understanding of chemical sciences. This educational experience fosters scientific intuition, technical proficiency, collaboration, and ethical conduct. Our graduates will be ready for professional work in chemistry, capable of applying their knowledge across various fields, and committed to using science responsibly for service, sustainability, and humanity's advancement.

Department or Unit Goals and Accomplishments

1. Report progress on goals identified in last year's report.

Goal 1: ACS accreditation

- Was this goal accomplished? **In progress**
- The preapplication for ACS accreditation was submitted in October 2022 and has been accepted in January 2023. As a result, our Department has been invited to submit a full application before January 2024.

Goal 2: Chemistry and biochemistry early research experiences

- Was this goal accomplished? **Yes**
- Early research experience in the form of CHEM 2700R course was offered for the first time in the FALL of 2022. It included a cohort of nine students (one high school student, two chemistry majors) under the guidance of Dr. Meyer. At the end of this experience, three out of the seven undecided students declared chemistry/biochemistry as their major. Implementation of other early research experiences is a work in progress.

Goal 3: Review curriculum for Biochemistry & Molecular Biology Program

- Was this goal accomplished? **Yes**
- The curriculum for the Biochemistry & Molecular Biology degree was adjusted and it is published in the Fall 2023 catalog. The changes are intended to provide students with more flexibility and enough time to select this program as their major. Some of these changes were providing with an alternative physics path (non-calculus vs calculus-based physics), reducing the requirements in biology courses, and increasing the number of biology electives courses.

Goal 4: New Certificates/ Emphases

- Was this goal accomplished? **Yes**
- Chemical Laboratory Technology – Advanced certificate was developed and it will start Fall 2023. This certificate (a stackable credential) will provide students with a sound understanding of analytical chemistry and biochemistry and provide them with hands-on applications of theoretical knowledge by using state-of-the-art instrumentation. Material Science was identified as the best path for our program focus and the design of this emphasis is a work in progress.

Goal 5: Develop a recruitment strategy

- Was this goal accomplished? **In progress**
- Important recruitment steps were taken last year such as increasing our online presence and strengthening our connection with local k-12 educators; a Professional Day for high-school teachers from Washington County was offered for the first time in February 2023 and over 15 teachers participated. Expanding our reach outside of the local area and better coordination with the Admission Office is envisioned for the coming year.

2. Summarize department highlights. (Provide a brief account of this year's significant happenings and department accomplishments. Include recognitions, honors, publications, presentations, etc.)

Department as a whole:

- Undergraduate Research – Our faculty and students have remained highly engaged in research activities. Our faculty members have spearheaded over ten primary research projects, which have culminated in a total of 13 presentations: seven posters at local conferences (e.g., UT Trailblazer Symposium, Utah Conference for Undergraduate Research), three at regional conferences (American Chemical Society Western Regional Meeting), and three at national conferences (American Chemical Society, American Society for Biochemistry and Molecular Biology).
- Active Learning – Every advanced chemistry course mandates a project. Our students are undertaking a broad spectrum of projects, encompassing experimental work, literature reviews, and scientific proposal developments.
- Academic Performance - Our students consistently surpass national norms and medians on standardized national exams administered by the American Chemical Society. They have scored above the 70th percentile in Analytical Chemistry, Organic Chemistry, and Biochemistry, and above the 80th percentile in the DUCK (Diagnostic of Undergraduate Chemistry Knowledge) exam.
- Recruitment Efforts – Our department has amplified its digital visibility through content creation for our updated website and social media. We've also fostered professional development events for local high school science teachers and expanded the Chemistry & Biochemistry Club's activities within local K-12 organizations.

Faculty:

- Faculty Research/Scholarship
The majority of our faculty members continued to develop research projects in their area of expertise and were successful in mentoring 21 students in undergraduate research:

Faculty / Area	Students	Current Projects
Gabriela Chilom Environmental Chemistry	3	<ul style="list-style-type: none"> · Development of practical strategies for enhancing the health of desert soils. · Identify the relationships between organic carbon storage potential and properties of local soils.
Rico Del Sesto Materials Chemistry	5	<ul style="list-style-type: none"> · Hemp research: Formulation of cannabinoids for medical applications and novel materials science applications, including maintenance of state approved Hemp Processor license for UT. - Magnetic materials: Synthesis of new materials with unique structures and properties in addition to understanding the magnetic interactions within materials

		- Ionic liquid antimicrobials: Development of ionic liquid materials with either broad spectrum efficacy or targeted to specific bacteria, in collaboration with Johns Hopkins.
Jennifer Meyer Biochemistry	7	<ul style="list-style-type: none"> · Synthesis of Pterostilbene derivatives to improve antioxidant capacity and/or reduce cell proliferation. · The potential synergistic effects of dabrafenib and pterostilbene on melanoma cell proliferation. · The effect of pterostilbene and its derivatives endothelial function under hyperglycemic conditions
Diana Reese Computational Chemistry	3	<ul style="list-style-type: none"> · Structure and dynamics of cyclic amino-borane complexes.
Wendy Schatzberg Chemical Education	3	<ul style="list-style-type: none"> · Use of emerging technologies for teaching and learning. · Imaging of nanomaterials.

- Faculty Publications

- **Rico del Sesto**, "Injectable, drug-eluting nanocrystals prevent fibrosis and stricture formation in vivo", *Journal of Gastroenterology*, 2023, 937-952.
- **Diana Reese**, "Nuclear Motion in the Interconverting σ -H₂ and Di-/Tri-Hydride Regime: Mo(PH₃)₅H₂/ Mo(PH₃)₄(PH₂)H₃", *Journal of Physical Chemistry A*, September 2022.

- Faculty Presentations

- **Gabriela Chilom**, "Enrichment of organic carbon: the effect on soil water repellency", UCUR February 2023.
- **Gabriela Chilom**, "Enrichment of carbon soil by sequential sorption of dissolved organic carbon", Trailblazer Symposium April 2023.
- **Rico Del Sesto**, "Reversible synthesis of pyridinium ionic liquids.", ACS Western Regional Meeting, October 2022.
- **Rico Del Sesto**, "Surface interactions of antimicrobial ionic liquids.", ACS Western Regional Meeting, October 2022.
- **Rico Del Sesto**, "Formulation of amphiphilic cannabinoids.", ACS Western Regional Meeting, October 2022.
- **Jennifer Meyer**, "Synthesis and Characterization of Novel Pterostilbene Derivatives for Potential use as Therapeutics", Trailblazer Symposium April 2023.
- **Jennifer Meyer**, "Investigation of the synergistic effects of dabrafenib and pterostilbene on melanoma cells", Trailblazer Symposium April 2023.
- **Jennifer Meyer**, "The Effects of Pterostilbene, a Novel Antioxidant, on NADH oxidase activity in Human Endothelial Cells exposed to Hyperglycemic Conditions", Trailblazer Symposium April 2023.
- **Jennifer Meyer**, "Synthesis and evaluation of pterostilbene amino alcohol derivatives as antioxidants and reversible acetylcholinesterase inhibitors", ACS Fall 2022.
- **Jennifer Meyer**, "Synergistic effects of Pterostilbene and Dabrafenib in Melanoma Cells", ASBMB November 2022.
- **Diana Reese**, "Computational Investigation of Hydrogen Storage in (CH₂)₃BH_{NH}₃ & (CH₂)₃NHBH₃", Trailblazer Symposium April 2023.

- **Diana Reese**, “A computational investigation of the hydrogen storage potential of two cyclic amino-borane complexes.”, Trailblazer Symposium April 2023.
- **Wendy Schatzberg**, “Hollow hair and how its structure helps big game animals thermoregulate”, Trailblazer Symposium April 2023.
- Faculty Grants
 - **Gabriela Chilom (PI)**, “Soil stability as a function of increasing organic carbon content “, Utah Tech University Faculty Research Grant, \$5,000 – **funded**.
 - **Rico Del Sesto (co-PI)**, “Utah STEM Minority Explorations (STEM ME) Program”, NSF Louis Stokes Alliances for Minority Participation (LSAMP) STEM Pathways (SPIO), **pending**.
 - **Rico Del Sesto (co-PI)**, “Colorado Plateau Regional Engine for Earth and Space Science and Technology (CREST)”, NSF Innovation Engines: Type 2 program, **pending**.
 - **Rico Del Sesto (co-PI)**, SBIR-NIH proposal, **to be submitted**.
 - **Jennifer Meyer (PI)**, “Investigation of the potential synergistic effects of pterostilbene with dabrafenib in melanoma cells”, Utah Tech University Faculty Research Grant, \$7,000 – **funded**.
 - **Jennifer Meyer (PI)**, National Kidney Foundation of Idaho and Utah, \$15,000 – **funded**.
 - **Jennifer Meyer (PI)**, NIH R15 AREA (Academic Research Enhancement Award) for undergraduate institutions, \$272,712, **pending**.
 - **Wendy Schatzberg (co-PI)**, “Using Eye Tracking Technology to Improve Physics Exam Questions”, Utah Tech University CTL grant, **funded**.
- Faculty Awards/Honors
 - **Rico Del Sesto**, winner of Distinguished Faculty Award.
 - **Jennifer Meyer**, winner of Excellence in Undergraduate Research Mentoring Award.
 - **Jennifer Meyer**, finalist Teacher of the Year Award.
 - **Diana Reese**, Faculty Spotlight, Center for Teaching & Learning.
 - **Teisha Richan**, two nominations for Distinguished Teaching Award.
 - **Sarah Black**, Faculty Spotlight, Center for Teaching & Learning.
- Faculty Outreach
 - **Gabriela Chilom** – mentored student for Success Academy Science Fair.
 - **Rico Del Sesto** – coordinated several community events of Southern Utah Science Café with scientist panels to discuss topics related to the natural and physical science of our local region. He served as campus liaison for several climate groups, including Citizens’ Climate Lobby, HEAL Utah, ICLEI.
 - **Teisha Richan** – under her leadership the membership of the Chemistry & Biochemistry Club has grown to include over 50 students. The club has been very active in supporting science demos at St. George Public Library, visit local schools, participate at all the events organized by our department and CSET. The club also received ACS and ASBMS status.
 - **Jared Hancock** – coordinated the event for local science high school teachers. This newly designed event provided training for new labs and POGIL assignments on a variety of topics and helped teachers to receive credit towards their continuing education requirements for each year as well as build report with those secondary science teachers.

- Faculty Service
Chemistry faculty members served in over 20 committees at department, college and university level, and chaired over 5 of them.
They were also active in introducing new campus-wide initiatives and serve their professional organizations:
 - **Rico Del Sesto** – coordinated and implemented the new Center for Climate Resilience and Sustainability, an interdisciplinary and community-collaborative center, approved by Board of Trustees 03/2023.
 - **Jennifer Meyer** – member of University of Utah Board of Admissions for their medical school.
- Staff Contributions
Stacey Haendiges (stockroom manager) and **Christina Quinn** (Lab coordinator) work in establishing and maintaining a safety culture in our chemistry facilities played a major role in how well the department performed at the Safety Audit.

Students:

- Our department graduated four students, three of them with BS in Chemistry and one with BS in Biochemistry & Molecular Biology. All four of them were able to secure positions in professional programs and industry.
- Two students applied and were accepted to prestigious Graduate Programs
 - Emily Flory – University of North Carolina
 - Jaxon George – University of Michigan
- Five chemistry major students applied and were offered internships for summer of 2023:
 - Eli Bliss – University of Utah
 - David Jackson – Johns Hopkins University
 - Cheyenne Rose - Oncology Genetic Counseling Team at IHC
 - Nya Black – Brigham Young University
 - Tyler Reed – Idaho National Laboratory
- Two students mentored by Dr. Meyer received a travel grant from the American Society for Biochemistry and Molecular Biology and one of them received a small research grant from this society. This group of students also won in the category “Greatest Impact – Health” at the Trailblazer Symposium.

3. Department Part-Time Instructor Information

- Number of part-time instructors that taught in
fall 2021 _____ 7 PT
spring 2022 _____ 7PT
- Total number of credit hours taught by part-time instructors
fall 2021 _____ 37 hours
spring 2022 _____ 28 hours

Program Effectiveness and Performance Data

Complete items #4- & #7 for each degree program in your department. (Duplicate this section as needed for the number of associate's, bachelor's or master's degrees in your department.)

Name of degree program: **Chemistry**

4. CLO to PLO Mapping--now required for every course syllabus as stated in Policy 609. In the space below, cut and paste an example from a course syllabus that illustrates how this program maps course learning outcomes to PLOs. Do not include the whole syllabus--just the map showing CLOs to PLOs. (CLO to PLO map examples from syllabi are found on the web site.)

Program Learning Outcomes (PLOs)

At the successful conclusion of this program, students will be able to:

1. Assess and critique local and global issues based on acquired knowledge in chemistry to formulate solutions to problems.
2. Integrate knowledge of basic, fundamental laws, concepts, and theories, apply them to everyday life.
3. Consider the process of science — how scientific knowledge is generated and validated — to make independent, empirical inquiries about the chemical world.
4. Evaluate, interpret, and communicate data in the form of tables, graphs, and charts in oral and or written form.
5. Analyze original data through research or internship and present findings in a professional setting.

Assessment Map CHEM 2310

Course Learning Outcome	Chem PLO	Biochem PLO	Pharmacy PLO	Assessment
1. <u>Explain</u> structures and <u>compare</u> physical properties of organic compounds	2, 4	4	1, 2	Quiz α EXAM 1
2. <u>Name</u> organic molecules, <u>draw</u> correct structures, <u>identify</u> and label stereoisomers, <u>recognize</u> the possible stereochemical implications of a chemical reaction, and <u>characterize</u> and identify organic compounds	2, 3	2, 3	1	Quiz β EXAM 2
3. <u>Formulate</u> , <u>identify</u> , and/or <u>draw</u> starting materials, reagents, and products for reactions of alkanes, alkenes, and alkynes	2, 4	2, 4	1	Quiz δ EXAM 4
4. <u>Apply</u> mechanistic principles to recognize nucleophiles, electrophiles, acids, and bases, and correctly <u>draw</u> the mechanisms of selected reactions	2, 3	3	1	Quiz γ EXAM 3
5. <u>Apply</u> fundamental concepts to complex and advanced problems beyond the immediate context, including in making informed decisions in everyday life.	1, 2, 3	1, 2, 3	1, 2, 5	ALL

5. University-wide assessment was not collected this year. However, if this program did conduct assessment and you would like to report it, you may do so below. Otherwise you may skip this item.

The assessment was not carried out this year.

6. Describe any major curriculum updates that occurred in this program this academic year (course changes, program changes, new stacked certificates, etc.)

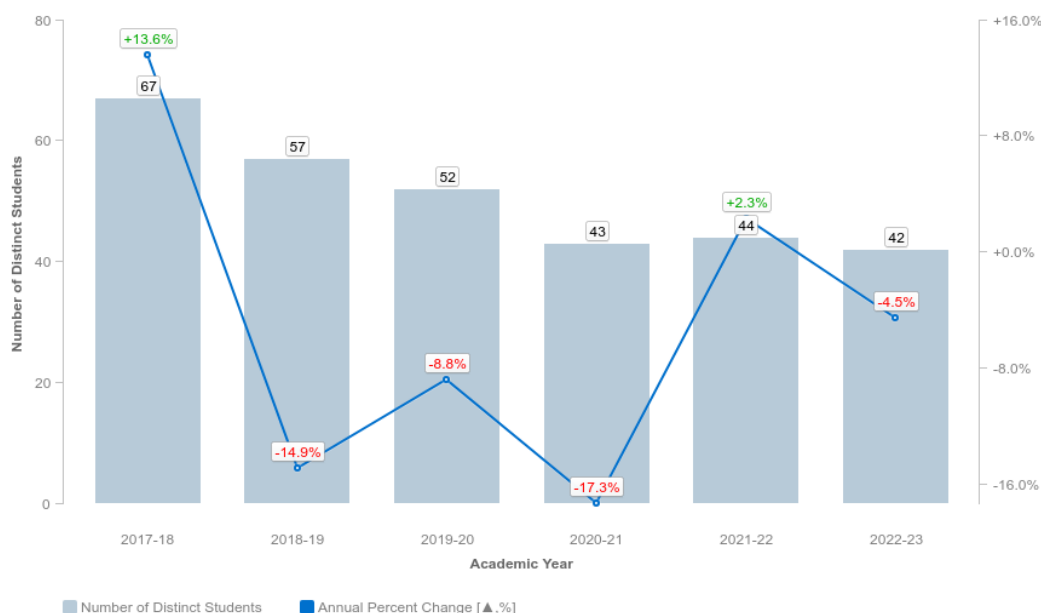
- Chemical Laboratory Technology – Advanced Certificate was developed and it will start Fall 2023. This certificate (a stackable credential) will provide students with a sound understanding of analytical chemistry and biochemistry and provide them with hands-on applications of theoretical knowledge by using state-of-the-art instrumentation.
- Courses:
 - CHEM 2600 Laboratory Safety & Practices – new course that covers chemical safety, governmental regulations and standards as applied to laboratory practice.
 - CHEM 2990R Chemistry Seminar and Professional Development - repeatable – includes different guest speakers each semester.
- Program
 - removed BIOL1620/1625 (to align with the other chemistry programs in Utah)
 - added CHEM 2600, 2990R (for improving career readiness)
 - added one more math Courses (2210 or 2250 or 2270 or 3060) (to align with the other ACS approved chemistry programs in Utah)

7. Show Program performance data (Use information from EAB Academic Performance Solutions--APS.)

A. Enrollment--3 years of trending data (APS Analytics, select Programs tab, filter for the following: Academic Year = 2021-22; Term = All; your college and department. Under Program Attributes, select the Degree Name—click all options of the degree name. For instance, if it has an AA AND an AS AND an AAS option, then click all three boxes. If the degree program has both a BA and a BS option, then click both boxes. Select the Major Name from the dropdown menu. Select ALL for both Student Attributes boxes. Click Apply.

1. What is the 3-year trend rate for student enrollment? **-1.2%**
2. Paste *Trends in Student Enrollment* chart for 2020-2021 here: (To copy and paste charts from APS, move the cursor to the top middle of the chart just below the title and click on the 3 dots that will appear. Select Download as Image. Copy, paste, then resize the image to fit in the desired space in the report.)

Trends in Student Enrollment in Programs by Academic Year



3. Describe the factors that have influenced this enrollment trend.

The Chemistry program's enrollment has remained steady for the past three years, with an average of 43 students per year. While this pattern may suggest that we've arrived at a saturation point, we remain optimistic about potential expansion. Currently, our department is executing a recruitment strategy aimed at maximizing the enrollment of students from our local area, while also broadening our efforts to regions beyond our immediate locality.

Name of degree program: **Biochemistry & Molecular Biology**

Program Learning Outcomes (PLOs)

At the successful conclusion of this program, students will be able to:

1. Assess and critique local and global issues based on acquired knowledge in chemistry to formulate solutions to problems.
2. Integrate knowledge of basic, fundamental laws, concepts, and theories, apply them to everyday life.
3. Consider the process of science — how scientific knowledge is generated and validated — to make independent, empirical inquiries about the chemical world.
4. Evaluate, interpret, and communicate data in the form of tables, graphs, and charts in oral and or written form.
5. Analyze original data through research or internship and present findings in a professional setting.

Assessment Map CHEM 2310

Course Learning Outcome	Chem PLO	Biochem PLO	Pharmacy PLO	Assessment
1. <u>Explain</u> structures and <u>compare</u> physical properties of organic compounds	2, 4	4	1, 2	Quiz α EXAM 1

2. <u>Name</u> organic molecules, <u>draw</u> correct structures, <u>identify</u> and label stereoisomers, <u>recognize</u> the possible stereochemical implications of a chemical reaction, and <u>characterize</u> and identify organic compounds	2, 3	2, 3	1	Quiz β EXAM 2
3. <u>Formulate</u> , <u>identify</u> , and/or <u>draw</u> starting materials, reagents, and products for reactions of alkanes, alkenes, and alkynes	2, 4	2, 4	1	Quiz δ EXAM 4
4. <u>Apply</u> mechanistic principles to recognize nucleophiles, electrophiles, acids, and bases, and correctly <u>draw</u> the mechanisms of selected reactions	2, 3	3	1	Quiz γ EXAM 3
5. <u>Apply</u> fundamental concepts to complex and advanced problems beyond the immediate context, including in making informed decisions in everyday life.	1, 2, 3	1, 2, 3	1, 2, 5	ALL

5. University-wide assessment was not collected this year. However, if this program did conduct assessment and you would like to report it, you may do so below. Otherwise you may skip this item.

The assessment was not carried out this year.

6. Describe any major curriculum updates that occurred in this program this academic year (course changes, program changes, new stacked certificates, etc.)

- Courses:
 - CHEM 2600 Laboratory Safety & Practices – new course that covers chemical safety, governmental regulations and standards as applied to laboratory practice.
 - CHEM 2990R Chemistry Seminar and Professional Development - repeatable - different guest speakers each semester.
- Program
 - removed BIOL 1620/1625 and BIOL3010 from requirements
 - added CHEM 2600, 2990R (for improving career readiness)
 - allow two sequences for Physics: College or Calculus-based sequence
 - require 3 electives as more courses were added to the elective list (one chemistry course and four biology courses)
 - These changes will provide a more flexible program, closer to what other schools are offering and allow students to take a more variety of courses.

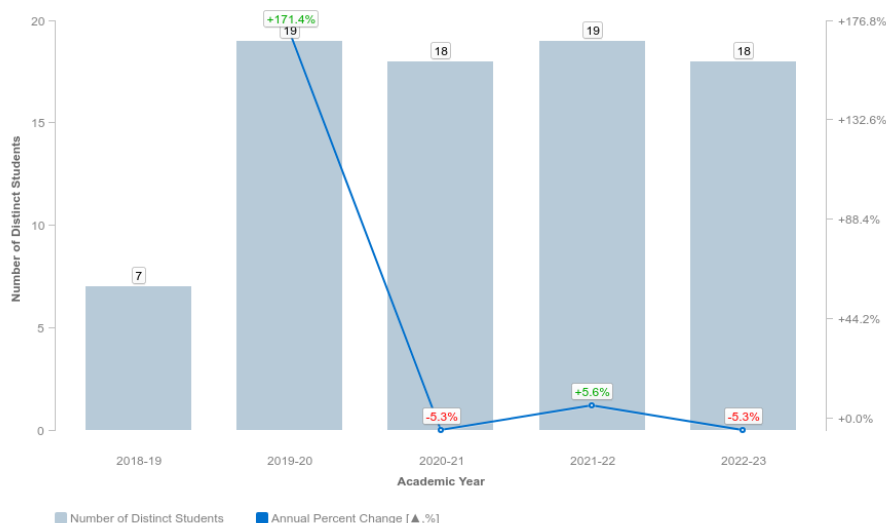
7. Show Program performance data (Use information from EAB Academic Performance Solutions--APS.)

- A. Enrollment--3 years of trending data (APS Analytics, select Programs tab, filter for the following: Academic Year = 2021-22; Term = All; your college and department. Under Program Attributes, select the Degree Name—click all options of the degree name. For instance, if it has an AA AND an AS AND an AAS

option, then click all three boxes. If the degree program has both a BA and a BS option, then click both boxes. Select the Major Name from the dropdown menu. Select ALL for both Student Attributes boxes. Click Apply.

1. What is the 3-year trend rate for student enrollment? **0.0 %**
2. Paste *Trends in Student Enrollment* chart for 2020-2021 here: (To copy and paste charts from APS, move the cursor to the top middle of the chart just below the title and click on the 3 dots that will appear. Select Download as Image. Copy, paste, then resize the image to fit in the desired space in the report.)

Trends in Student Enrollment in Programs by Academic Year



3. Describe the factors that have influenced this enrollment trend.

The number of students enrolling in our Biochemistry program has consistently averaged around 18 per year for the past three years. This stability suggests we've hit a steady state, but we believe there's ample opportunity for expansion. Given the anticipated growth in the application of chemistry to health-related fields in the coming years, we foresee an increase in interest. The recent modifications to our curriculum have already started to spark curiosity among students, with numerous inquiries about this degree program being received.

Name of degree program: **Pharmacy Preparation**

Program Learning Outcomes (PLOs)

At the successful conclusion of this program, students will be able to:

1. Apply principles of chemistry to pharmacy; recognize classes of drugs based on functional groups and predict the impact of structure on drug efficacy.
2. Apply science and mathematics to solve complex problems including the analysis and interpretation of data from lab experiments.
3. Apply biological concepts and principals in the analysis of biological processes.
4. Communicate effectively both orally and in writing.
5. Evaluate evidence and logic in various texts.

CLOs and assessment map for CHEM 2320

Course Learning Outcomes:

At the successful conclusion of this course, students will be able to:

1. Recognize nucleophiles and electrophiles, acids and bases, and correctly draw the mechanisms of elected reactions using mechanistic principles.
2. Utilize mechanistic and kinetic information to predict regio- and stereo-chemistry of reactions with complex functional groups.
3. Design multi-step reaction sequences to synthesize increasingly complex organic molecules.
4. Apply fundamental organic chemistry concepts to biomolecules including proteins, lipids, and carbohydrates.

CLO	Chem PLO	Pharm PLO	Assessment
1	4	4	Quiz 6
2	4	2	Quiz 5
3	2,4	2	Exam 7
4	2,3	1	Exam 8

There is no data for this degree in EAB.

End of Program Effectiveness and Performance Section for Individual Programs

Department Data

8. Show Department performance data (Use information from EAB Academic Performance Solutions--APS.)

- A. Intercurricular Dependencies (APS Analytics, select Department Scorecard from the top menu and filter for Academic Year = 2021-22; Term = All; and then for your college and department, then hit Apply. Scroll to Courses, scroll to Intercurricular Dependencies by Department and record the data in the chart below. Change Academic Year to 2020-21 and hit Apply for the next line, etc.)

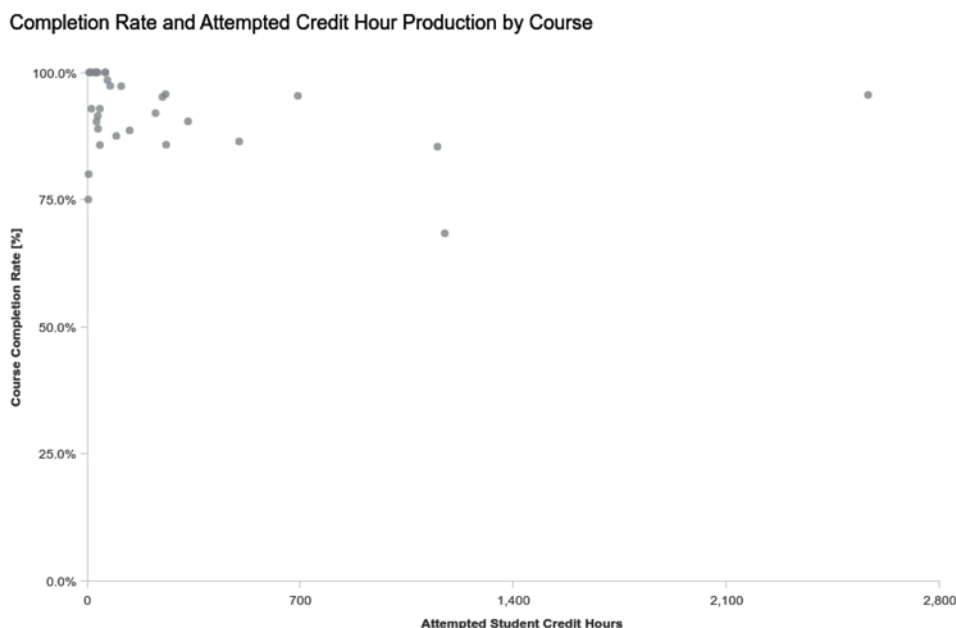
Academic Year	Own Majors	Service Majors	Attempted SCH
2020-21	8.0 %	92.0 %	8,502
2021-22	8.3 %	91.7 %	8,567
2022-23	3.9 %	96.1 %	8,719

- B. Opportunities for Expansion or Consolidation for 2020-2021 (APS Analytics, select the Courses tab from the top menu, scroll to Course Bottlenecks, then Impact of Course Bottlenecks on Course Completion.) Explain any opportunities for expansion (additional sections, or additional seats).

CHEM 3525 (Biochemistry 2 lab) has 96% fill rate. It is a required course for Chemistry & Biochemistry majors and an elective for Biology majors, and it is offered only in Spring semester. At this time the department cannot add more sections without additional faculty/staff. The limit on the number of seats is given by the physical size of the lab and therefore we can not add more seats.

C. Student Progress (APS Analytics, select the Students tab in the top menu. Be sure to unclick summer in the TERM dropdown menu so only the data for Fall and Spring will show. Scroll to the Completion Rates section.)

1. 2021-2022 Completion Rate vs. Attempted Credit Hour Production by Course--paste scatter plot below, then respond to the questions below. (To copy and paste charts from APS, move the cursor above the chart and click on the 3 dots that will appear. Select Download as Image. Copy, paste, then resize the image to fit in the desired space in the report.)



- a. Describe the spread (What are the highs and lows of both completion rate and credit hour production? By clicking on the dots to reveal the courses, can you discover what might be the reason for the spread on each axis? Is there a relationship between the two axes--if one increases or decreases, does the other move in some predictable way?)

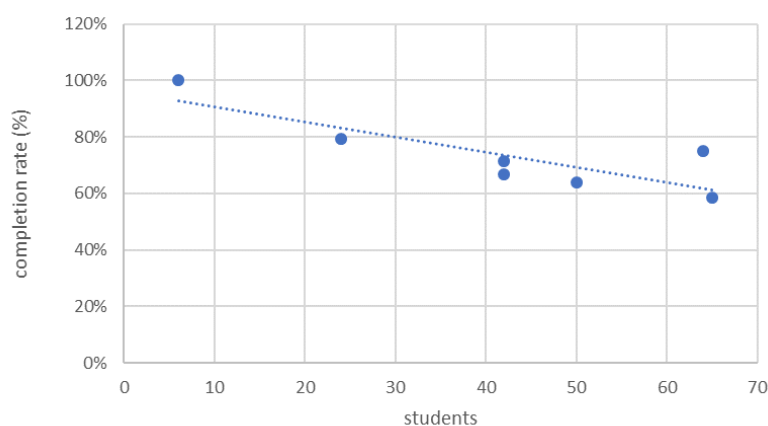
The completion rates of chemistry courses have the following characteristics:

- all courses are having a completion rate greater than 75% with the exception of General Chemistry I (CHEM 1210) (see below).
- the lower level (1000 level GE courses) courses have a completion rate above 85%. These are large sections taught by same instructor.
- the upper level (3000 and above) courses have a completion rate above 85%. These courses have one section, with an enrollment lower than 25 students.
- the 2000 degree level courses, Organic Chemistry I and II, have high rates of completion. They have sections with enrollment between 25 to 30 students and are taught by different instructors. No differences in completion rates have been noticed for these courses.

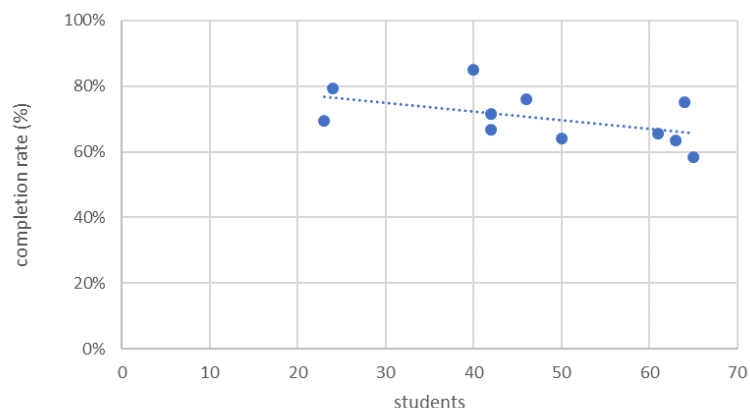
- b. Find your lowest completion rate course and click on the dot. Once the new scatter plot comes up, go to upper right and click on the Table icon. This shows each section on your selected course. What is the spread in the completion rate? What might be the drivers of this spread?

Course Ref No	Course Completion Rate [%]	Attempted Student Credit Hours
20172	75.0%	256
20606	58.5%	260
23547	0.0%	4
40253	65.9%	164
41721	71.4%	168
42170	64.0%	200
42423	79.2%	96
43930	100.0%	4
44083	100.0%	24
Rollup	68.4%	1,176

- General Chemistry I (CHEM 1210) has consistently seen the lowest completion rates for some time. Although it has surpassed the 75% threshold in many past years, this year's rate stands at 69%. This course, designed for freshmen, presents a level of difficulty that surpasses their prior experiences. Instructors noted this year that students had an even harder time adjusting to the course requirements compared to previous years. While the level of chemistry knowledge among the enrolled students varies greatly, it was their preparedness for college expectations that played a decisive role this year. Students particularly struggled with understanding abstract concepts, connecting different ideas, and navigating quantitative processes.
- The distribution of the completion rates among different sections did show a decrease with class size. The data for this year distribution is shown below:



- Establishing a correlation between the completion rate and class size necessitates quantitative data. The completion rate is influenced by numerous factors, including class size, instructor, and the range of student skills. Over the last two years, we've mitigated the impact of instructor variability by standardizing assessments across all non-concurrent enrollment sections. Compilation of the last two years data for CHEM 1210 is shown below:



Based on our present data, it appears that a class size of 30 or fewer students offers the highest probability of achieving a completion rate above the 75% threshold for CHEM 1210. We will persist in gathering and scrutinizing data to gain a more precise understanding of the correlation between the completion rate and class size.

9. Please add any other performance data you might like to include here that will help inform an accurate snapshot of your department or unit.

Academic year 2022-2023	Students
Graduates	4
Graduate School Acceptance Rate	100 %
Job Placement	100 %
Undergraduate Research Mentored by Chemistry Faculty	21
Presentations	13
Summer research internships	5

10. Conduct Department/Unit SWOT Analysis—Strengths, Weaknesses, Opportunities, Threats (*Identify internal strengths and weaknesses, and external opportunities and threats. Analysis of facilities, resources, administration/staff, budgets, outside influences, competition and stakeholder satisfaction.*)

Strengths

- Culture of the Department - Our workspace fosters a balance of professionalism and relaxation; each faculty member and staff are given a voice, offered opportunities to contribute meaningfully, and consistently recognized for their efforts. We further cement our camaraderie through two annual social events, marking the commencement and culmination of the academic year, where all can convene and celebrate our shared progress.
- Academic Excellence - Our rigorous chemistry degree program is exclusively facilitated by our full-time faculty, ensuring continuity and consistency throughout the coursework. Additionally, upper-level labs are instructed by the same full-time faculty members who conduct the lectures, allowing students to garner a cohesive and in-depth understanding of these advanced courses.

- Community Involvement of Students and Faculty - We actively engage in a range of outreach activities, including chemical demonstrations at public libraries, Science Fairs, and Science Olympiads, among others. Our students are streamlined into these engagements via our active Chemistry & Biochemistry Club, boasting over 50 members.
- Modern chemical facilities and spaces – enable us to offer each student hands-on research experience and foster collaborative initiatives within the University and broader community.

Weaknesses

- Program Enrollment - Although our student numbers have been stable over recent years, there remains untapped potential for growth. It is vital that we attract prospective students to consider us as their go-to destination for chemical field studies. By sparking their interest early in their educational journey, we aim to make the Utah Tech their preferred choice for a chemistry degree.

Opportunities

- Specialized Expertise - We are actively establishing our distinct presence in Utah's landscape of chemistry degree programs. Though we are a small department, our faculty is skilled to cover all core teaching areas. However, given our size, the potential for overlapping interest and expertise is limited. We find ourselves competing with larger departments that have a more extensive faculty, where overlap in expertise and interest areas is more likely. Our strategy lies in leveraging the research and project experience of our faculty, with a concentrated effort towards distinguishing our program as a hub for Material Chemistry. This focus is supported by several factors: the opportunity to highlight Material Science requirements in hiring for Inorganic Chemistry TT position, the fact that current projects of three out of five faculty members align with material design and analysis, the expansion of the Engineering program at UT, the scarce presence of Material Chemistry programs in Utah as well as the projected impact of interdisciplinary work like catalysis on the national economy.

Threats

- Faculty and Staff Exhaustion - The heavy teaching workload, outreach and service activities, coupled with research demands, place considerable stress on our faculty and staff. Some have voiced concerns of fatigue and struggle to strike a balance between their personal lives and career obligations without compromising the academic standards at some point.

Faculty members would appreciate a more nuanced approach to teaching loads that considers the specifics of the discipline. For instance, allotting 0.1 credit per student for research is seen as insufficient when faculty members spend an average of three hours in the lab with each student. The time-consuming aspect of our activities made faculty turned down opportunities to mentor international students.

A scarcity of qualified local part-time instructors/staff also puts a strain on our tenure-track faculty, limiting the time they could otherwise spend on hands-on activities for upper-level courses.

Chair's Response--Planning for the Future

11. Based on the above data, list specific goals your department/unit will target to accomplish during the coming academic year. If any of your programs were evaluated by internal/external reviewers this year, you might include some of their suggestions as goals.
Note: In next year's report, follow up reporting on these goals will be covered in #1 as in this report.

Goal 1: ACS accreditation

- Is this goal being carried over from the previous year?
Yes
- Action Plan
Prepare the full application.
- Desired Outcome
Submit the full application for review to American Chemical Society.
- Timeline
January 2024
- How does this goal align with departmental and instructional goals?
Accreditation is a recognition of our program offering a broad-based and rigorous chemistry education that gives students intellectual, experimental, and communication skills to become effective scientific professionals. There are currently seven Chemistry programs in Utah, five of them are ACS accredited and one fulfills the requirements (it was not approved by ACS for lack of a specific instrument).
- What resources will be needed?
The chair will prepare and submit the application.

Goal 2: Material Chemistry Emphasis

- Is this goal being carried over from the previous year?
No
- Action Plan
 - Design the curriculum requirements of the new emphasis.
 - Discuss the new requirements with local and regional companies.
- Desired Outcome
 - Introduce Materials emphasis for the BS in Chemistry.
- Timeline
The Emphasis will be submitted for approval Spring 2024 and intend to start Fall 2024.
- How does this goal align with departmental and instructional goals?
Introduction of an emphasis like Materials will open interdisciplinary job opportunities for our graduates; it will best utilize the expertise of our faculty and strengthen collaborations with other departments from CSET. This goal will also help distinguish our program from the other chemistry programs in state of Utah; all these programs are well established programs and most of them have a Health Sciences emphases.
- What resources will be needed?
We will need a successful search to fill the TT position for Inorganic Chemistry, ideally with a candidate with experience in Material Chemistry.

Goal 3: Expand on chemical services offered to community

- Is this goal being carried over from the previous year?
No
- Action Plan
 - Create the SOPs for Nutritional analysis – area that we get the most questions from by community.
 - Establish the legal/ethical framework for chemical analysis for community.
- Desired Outcome
 - Add the list of services on the Department's website.
- Timeline
Fall 2023.
- How does this goal align with departmental and instructional goals?
As most of these analyses will be run by students this goal will provide them with authentic experience, and will help them gain experience with advanced instrumentation. This goal will also make the community aware of our chemistry facilities and expertise.
- What resources will be needed?
We will need the support of the legal and safety & risk management team.

Goal 4: Develop collaborative internships with local companies

- Is this goal being carried over from the previous year?
No
- Action Plan
 - Establish the framework for chemistry collaborative internships.
- Desired Outcome
 - Introduce two internships in collaboration with Deseret Lab and Red Mesa Science.
- Timeline
Fall 2023.
- How does this goal align with departmental and instructional goals?
The development of these internships will provide our students with valuable experience in a real-life laboratory, will give them the chance to apply their theoretical knowledge and practice good laboratory skills. The collaborative aspect is important as there is a limited number of local chemical companies and a shared cost (50:50) for the internship is considered a motivation for these companies to get involved in training the next generation of chemists.
- What resources will be needed?
We will need the support of the legal team in designing the framework for these internships as chemistry poses safety risks. We would also appreciate financial support from CSET to help start this internship program.

Goal 5: Recruitment strategy

- Is this goal being carried over from the previous year?
Yes
- Action Plan
 - Develop an annual list of topics of interest to high school students by meeting with the K-12 teachers.
 - Identify the list of schools outside of our local region that are of interest.
 - Coordinate recruitment efforts with the Admission Office.
- Desired Outcome

- Have faculty and students address the topics raised by the high school students.
- Introduce our department to schools in the area as well as outside the area.
- Contact the students admitted to UT that declared Chemistry as major of interest and invite them to attend a day of classes/labs on our campus.
- Timeline
 - Spring 2024
- How does this goal align with departmental and instructional goals?

Increased enrollment of students will help grow the department; it will solidify the academic achievements and create more possibilities for scholarship and career ready activities for our students. This type of growth will make our Department more attractive for recruiting and retaining more diverse faculty.
- What resources will be needed?

Funding to support the travel of our faculty and students to a variety of school events.
Minimizing the overload so faculty have the time and energy to be engaged in the recruiting strategy.

12. Provide any other comments you would like to include.

Our program has successfully facilitated undergraduate research experiences for each of our students, a success underscored by the numerous presentations at local, regional, and national peer-reviewed conferences. Yet, the undergraduate research experience is not the only high-impact practice our faculty implements. Experiential learning forms another critical component of our program; students in our advanced courses are required to develop projects as part of their curriculum. These projects have primarily been confined to classroom presentations. However, we plan to broaden this scope by showcasing these projects at a new event planned for the College of Science, Engineering, and Technology (CSET). This event will host project presentations from all departments and will cater to a large audience of professionals and community members, thereby extending the impact of our students' work beyond the classroom.

13. What are your department's high priority needs for the coming year including any resources for student learning?

- Fill in the TT position in Inorganic Chemistry (replacement for a tenured faculty that resigned) with a candidate with expertise in Material Science.
- Support at College Level in identifying and securing funds for development of an Early Research Experience.

14. What are department's projected needs for the next 3-5 years? *(Include staffing, space, budget, etc.)*

- Hiring
 - 1 x Faculty (Tenure Track) to include teaching and Instrument Manager responsibilities.
 - 1 x Faculty (Tenure Track)
 - 1x Lab Manager (convert existing PT to FT)

- Travel
Funding to travel to larger region to meet with employers, and to recruit from high schools and community colleges.
Funding the CHEM 2990 seminar course to support participation of external speakers that share their experience with diverse graduate programs and/or careers in the chemistry and biochemistry fields. This will also allow our department to expand networking with professionals and organizations regionally and nationally.

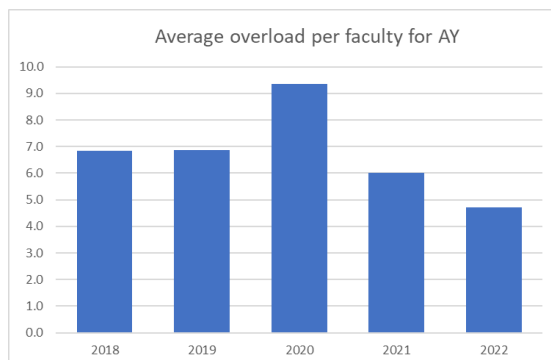
15. Connecting and interacting with regional employers who might hire your graduates and/or inform the content of your programs is now expected of every program at UT. Please report on your connections/interactions with regional employers. To what degree do these employers influence the content or direction of your programs?

Prioritizing our students' career advancement, the department places significant emphasis on building connections with potential employers. We continue partnerships with organizations like Deseret Lab, Red Mesa Science and Refining, Zion National Park, Berry's Manufacturing, 5N+ Semiconductors, Johns Hopkins School of Medicine, and various departments within the University of Utah (including Chemistry, Materials Science and Engineering).

We have already derived substantial value from the discussions held within the College Industry Board, as well as individual conversations with each company. These collaborative efforts have resulted in ongoing projects and the development of promising internship opportunities within these organizations, fortifying the pathway for our students' professional growth.

16. Please respond to the following questions from the Provost

1. Please report the number of release time credits in your department.
The release time credits for the last year (fall and spring) are 33 credits:
 - Chair – 9 credits
 - Director CTL – 18 credits
 - ACS accreditation – 2 credits
 - Instrumentation Maintenance – 4 credits
2. What is the total amount of overload in your department?
The total amount of overload for the last year is 42 credits, with an average of 4.7 credits/full time faculty.



3. Please provide at least one specific example of how your department has implemented a strategy to improve the quality of instruction or elevate student learning or both.
- Enhanced coordination for introductory degree courses. Two faculty members responsible for General Chemistry I collaborated on a weekly basis to develop uniform resources for the course. These resources included worksheets, quizzes, exams, and review materials.
 - Optimized student laboratory experiences. Faculty teaching advanced lab courses convened to review the existing lab experiments. This was done to ensure minimal overlap between experiments and to guarantee that students are fully utilizing all the available new equipment.
4. Please provide at least one specific example of how your department has implemented a strategy to improve student retention.

Promoting a sense of community and belonging for our students in the field of chemistry by:

- Providing increased support for the Chemistry & Biochemistry Club. This organization serves as an excellent platform for student interaction, with all our majors participating in the club's activities.
- Encouraging and rewarding our students for attending and offering feedback on presentations at the Senior Seminar.
- Converting the Chemistry Seminar and Professional Development course into a repeatable course, as we host a diverse range of professionals presenting each semester.
- Ensuring that all our students are informed about research opportunities both on and off campus, with personal guidance provided by our faculty members throughout the application process.

Note to Chairs: Please attach the Annual Academic Fee Report as the last page of this report. The Academic Budget Director will be sending you this form with your department's list of academic fees. Please review the fees and the index account(s) expenditures for this year and provide justification for any carryover. You may want to refer to Policy 614. The Provost and UTSA will be reviewing these forms annually.

FY22 Annual Academic Fee Report

Department Name: Chemistry & Biochemistry
 Department Chair: Gabriela Chilom
 College Name: College of Science, Engineering, & Technology
 College Dean: Eric Pedersen

Course Subject	Course Number	Course Title	Fee Amount	Index Code
CHEM	1015	Intro to Chemistry Lab	50.00	NAT308
CHEM	1115	Elem General/Organic Chemistry Lab (LAB)	150.00	NAT308
CHEM	1125	Elem Organic/Bio Chemistry Lab	150.00	NAT308
CHEM	1155	Integrated Chemistry for Health Sciences Laboratory (LAB)	150.00	NAT308
CHEM	1215	Principles of Chemistry I Lab	150.00	NAT308
CHEM	1225	Principles of Chemistry II Lab	150.00	NAT308
CHEM	2315	Organic Chemistry I Lab	150.00	NAT308
CHEM	2325	Organic Chemistry II Lab	150.00	NAT308
CHEM	3065	Physical Chemistry I Lab	100.00	NAT308
CHEM	3075	Physical Chemistry II Lab	100.00	NAT308
CHEM	3515	Biochemistry I Lab	100.00	NAT308
CHEM	3525	Biochemistry II Lab	100.00	NAT308

FY	INDEX	FUND TITLE	BEGINNING BALANCE	REVENUE BALANCE	EXPENSE BALANCE	TRANSFER BALANCE	ENDING BALANCE
22	NAT308	Student Fees-Chemistry	131,914.33	151,000.00	(79,128.29)		203,786.04

Justification for carryover balances and transfers:

- Setting aside funds for maintenance, repair and replacement of equipment. These expenses do not occur every year.

Signature: _____

G. Chilom

Dean's Response

17. Provide your general assessment of the accomplishments and needs, including budget allocation needs (*particularly address # 13 & #14*).

- The department continues to make progress toward accreditation through ACS
- Faculty are highly engaged in research experiences for students
- Enrollment numbers are flat and the department is highly engaged in recruitment
- Many examples of student success, and the department is engaging with industry to provide opportunities
- Departmental goals are well defined and of strategic importance to the department
- Faculty burnout is a significant risk, greater workload for research is requested
- Department is seeking to differentiate through emphasis in material science
- Faculty needed to support student experiences, provide new expertise, and alleviate faculty overload

Summary of Meeting with Provost

- Chemistry will seek accreditation with American Chemical Society in January with initial submission. Accreditation requirements for faculty teaching load is an average of 15 credits and no teaching load over 18 credit.
- Currently there are 43 majors; 21 students involved in Undergraduate Research.
- Faculty all participating in scholarship/development activities including grants.
- Academic Report suggestion to highlight students going to PhD programs and participating in qualified internships.**** These students could also participate in the recruitment film day for Science Engineering and Technology to share their stories and experience.
- Part-time Instruction includes long-time instructors that can be trusted with high quality.
- Assessment is progressing with work being identified in CANVAS, but not uploaded into Anthology.
- Advisor in WCSD and Success Academy do not currently identify Utah Tech as an option for students. Department plans to continue recruitment efforts by inviting teachers and students to campus into classrooms.
- Pharmaceutical degree is not in EAB, bran new just last year. May not have data yet.
- Student completion rate in early chemistry coursework represents a concern that students are not as prepared. Tutors and TAs available to assist with preparation.
- Materials Chemistry emphasis is a path for the program to build an overlap and specialty which would be inclusive with Engineering.

- Course fee balance is due to cost of repairman visits. Some balance needs to be available for emergencies.
- Desert Technologies will be a focus of the Innovation District. The department and Dr. Chilom has expertise in this area to increase soil stability.