University of Arkansas Department of Chemistry and Biochemistry Undergraduate Program Assessment (CHEM BA, CHEM BS)

Report: Academic Year 2024

Prepared by Colin D. Heyes, Chair CHBC, cheyes@uark.edu

Program Goals and Learning Outcomes

The overall goals of the degree programs of the Department of Chemistry and Biochemistry can be described in the following broad terms.

1. Foster the scientific curiosity of students about chemistry and biochemistry.

2. Communicate the current state of knowledge and technology to students.

3. Nurture critical thinking, reasoning, and problem-solving abilities.

4. Enhance students' written and oral communication skills for communicating scientific ideas.

5. Prepare students to achieve academic and professional success.

In particular, the Learning Outcomes for students completing a bachelor's degree in chemistry and biochemistry are:

1. Recognize how chemistry is an essential tool for understanding the natural world.

2. Understand how the scientific method is applied in chemistry and biochemistry.

3. Communicate chemical knowledge to both chemistry peers and a general audience.

4. Understand that matter consists of basic building blocks of atoms that differ by their composition of protons, neutrons and electrons. When atoms are combined, molecules are formed. The properties of these molecules depend on how these atoms are arranged.

5. Understand that matter can undergo transformations, either physically or chemically through changes in energy.

6. Know that data is obtained to measure various chemical and physical changes and that this data must be analyzed quantitively to obtain conclusions about these changes. Data can be presented in many ways, including tables, graphs, numerically and descriptively.

7. To understand that all measurements contain error that must be understood to determine whether the measurements indicate real chemical/physical change and to which level of confidence.

8. To design appropriate chemical experiments to test a chemistry hypothesis.

9. To use modern instrumentation to analyze chemical compounds and reactions.

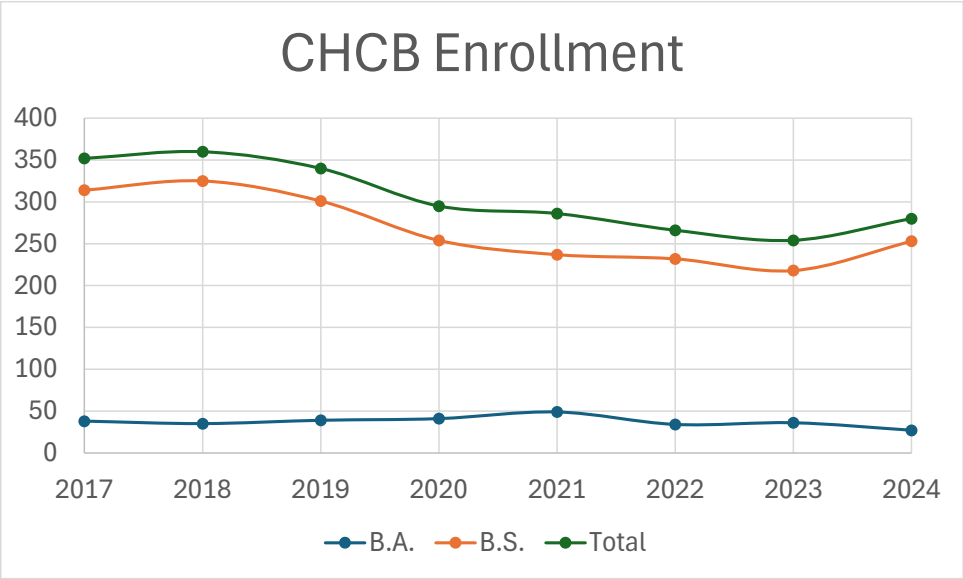
10. To use computer programs to search chemical literature.

11. To use proper chemical hygiene.

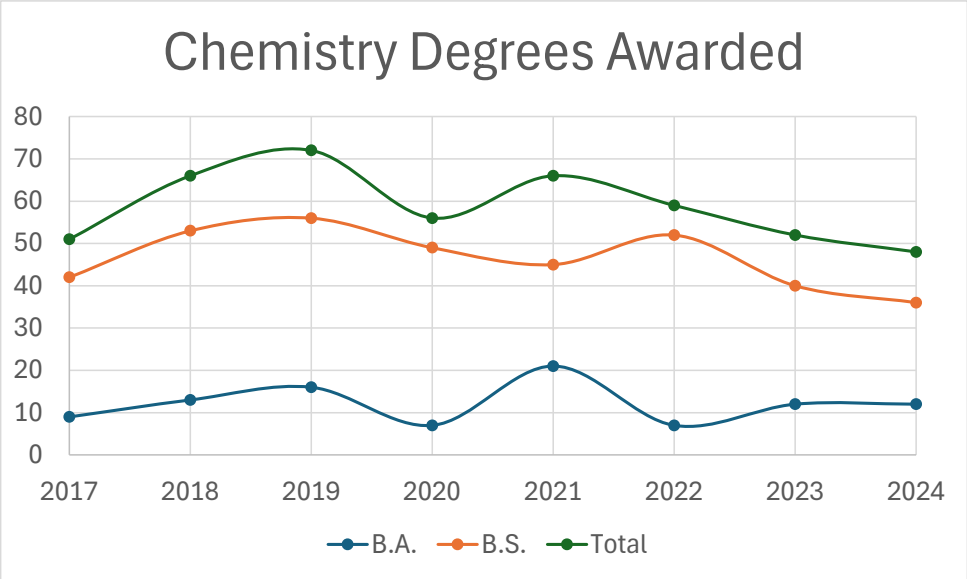
12. Use this knowledge to enroll in graduate and professional schools or accept chemistry and biochemistry related jobs in the public or private sector.

2024 Data and Assessment

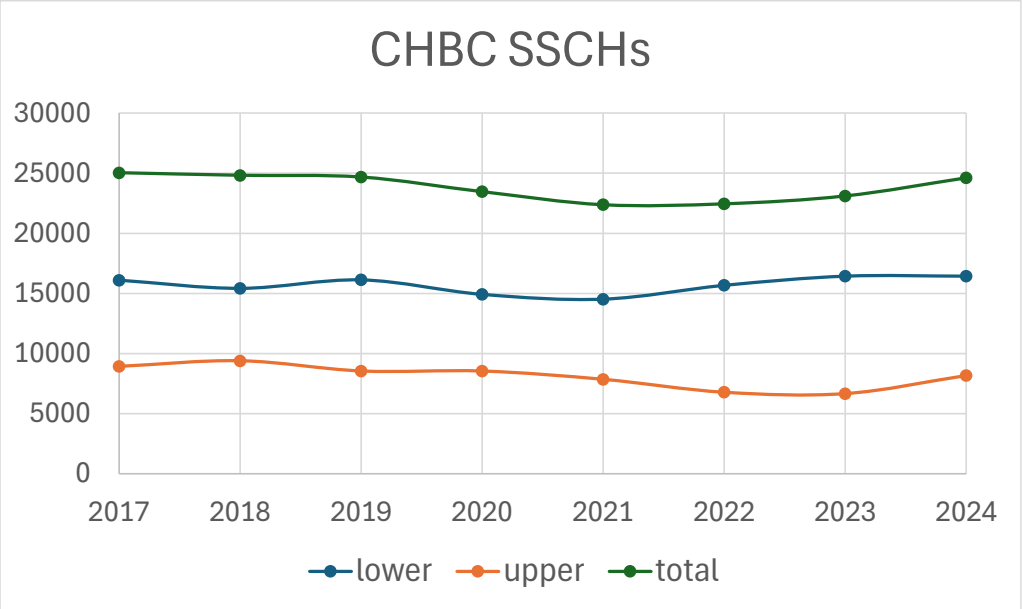
Based on data from the Office of Institutional Research and Assessment, the total enrollment in undergraduate chemistry programs (B.S. and B.A.) in 2024 was 280. This enrollment is about 10% higher than it was in 2023 (254) and is split into 27 B.A. and 253 B.S. majors, but is still lower than the pre-COVID years.



In 2024, the total number of B.A. degrees awarded was 12, and the total number of B.S. degrees awarded was 36, for a total number of 48 bachelor degrees in chemistry and biochemistry awarded. This is approximately the same as it was in 2017, although there has been a steady decline since 2021.



With lower-level chemistry courses being a requirement for many majors, the total number of SSCHs for chemistry and biochemistry in 2024 was 16441 in lower-level undergraduate courses and 8172 in upper-level undergraduate courses.

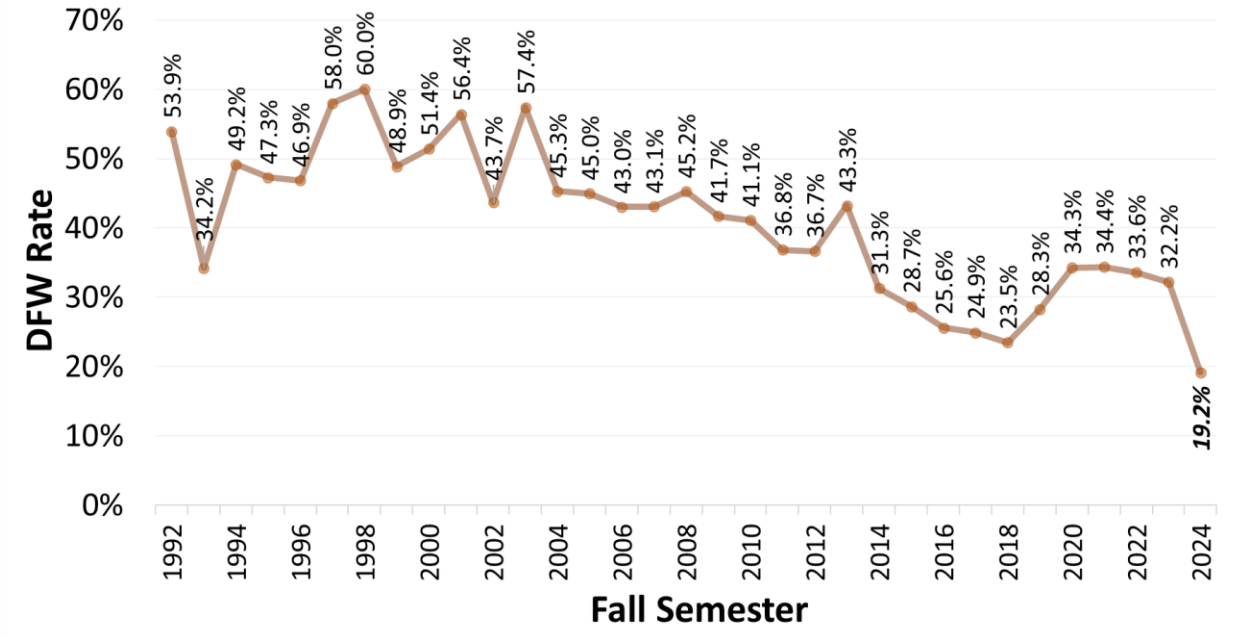


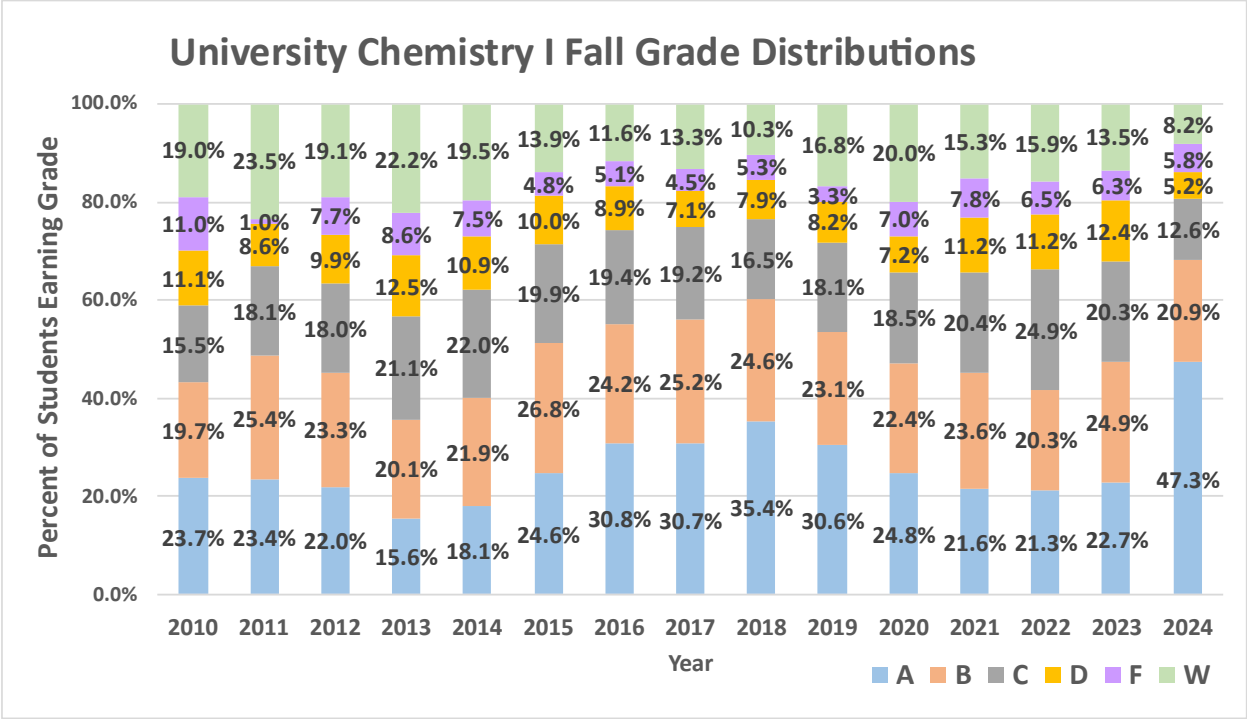
Due to the importance of success in introductory chemistry courses to University of Arkansas students in other programs, we have been particularly proactive at reducing DFW rates in University Chemistry I and University Chemistry II courses. Since 2023, we

have been instigating an exam retake program in an effort to improve student outcomes. This was piloted for 56 students in summer 2023, and has been scaled up steadily since (363 students in fall 2023, 885 students in spring 2024 and over 1500 students in fall 2024.

Semester	Course	Sections: Instructor / Students	Total Students in Course	Exam Delivery / Retake Delivery
Summer 2023	UCI	Gerner / 22	56	Remote / Remote
		Gerner / 10		
		Gerner / 13		
		Gerner / 11		
Fall 2023	UCII	Gerner / 130	363	Remote / Remote
		Gerner / 233		
Spring 2024	UCI	Gerner / 364	885	Remote / Remote
		Gerner / 258		
		Wadumethrige / 190		
		Wadumethrige / 73		
Summer 2024	UCI	Gerner / 34	47	MTC / MTC
		Gerner / 13		
Fall 2024	UCI	Gerner / 255	1298	Remote / In-person TA proctored
		Gerner / 194		
		Isu / 211		
		Isu / 248		
		Omogo / 194		
		Omogo / 196		
	UCII	Hunter / 160	361	In-person TA proctored / MTC
		Hunter / 201		

There has been an extensive analysis performed of the impacts of this exam retake policy each semester it has been offered, and the scope of the analysis is too vast to include it all here. Focusing on University Chemistry I in fall 2024 (the largest implementation), there is a clear and significant decrease in DFW rate to a historical low. Other data show an overall increase of approximately 1 letter grade for students across the board, not just those at risk of DFW grades. Data for University Chemistry II is equally promising.

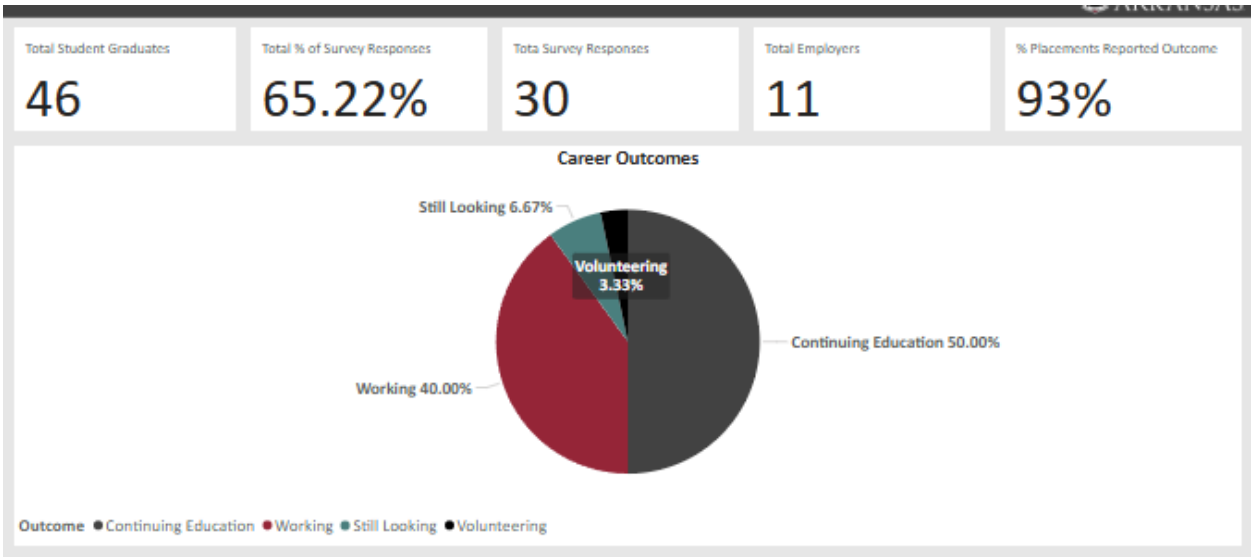




The majority of assessment of undergraduate students are in the form of grade point average of graduating students. The average GPA for students receiving an undergraduate degree in chemistry in 2024 was 3.619, which has been historically steady. Clearly the rigor in the chemistry program remains consistent.

AY 2015	3.650
AY 2016	3.565
AY 2017	3.540
AY 2018	3.545
AY 2019	3.567
AY 2020	3.606
AY 2021	3.721
AY 2022	3.494
AY 2023	3.590
AY 2024	3.619

Other indicators of program success are where graduates are placed. Data from the division of student affairs show that for chemistry graduates, with a 65% survey response rate, half of them continue their education (primarily at medical school), while 40% are employed. Of the remaining 10%, 6.7% are still looking and 3.3% are volunteering.



Future directions

We will continue to focus on improving critical thinking skills for our chemistry majors. Currently, due to our accreditation with the main professional organization in our field – the American Chemical Society (ACS) – we do not believe changing the course offerings for our undergraduate degree is necessary or wise. However, we do need to focus on increasing the number of chemistry and biochemistry majors while at the same time maintaining the rigor in the program. The vast majority of our undergraduate majors are pre-med students, and may opt to take less mathematically rigorous majors that still allow them to pursue medical school. We hope that as students in University Chemistry I and II see improved grades as a result of our exam retake program, they may consider switching their major to

chemistry. Although logistically challenging, we also plan to track if the increase in student success in University Chemistry as a result of the exam retake policy results in better graduation rates for these students as they progress through their undergraduate degree.