



# The Revival of Chemistry: Addressing Common Misperceptions & Understanding How to Use a Chemistry Degree Effectively



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## Statistical Insights into the Chemistry Workforce

### Statistics:

- Chemistry graduates have decreased from 2008-2016 by 60%
- High school students choosing career pathways in STEM decreased between 1992-2017
- Students choosing non-STEM related fields has increased by 8%
- College students choosing chemistry is around an average of 2%

### Reasons:

- Fewer opportunities for minority groups
- Gender inequality in the workforce
- Limited access to professional chemists who could provide guidance and exposure to the opportunities that chemistry grants an individual
- Elementary and high schools are not discussing the full scope of how chemistry is integrated into everyday lives
- The misperception that the field is too narrow and limiting

### Impacts on Economy:

- Shortage of professional workers who are highly qualified to conduct research and work in the scientific field
- Agriculture, pharmaceuticals, environmental effects on human health, optics, transportation, water quality, space exploration, forensics, materials, etc.

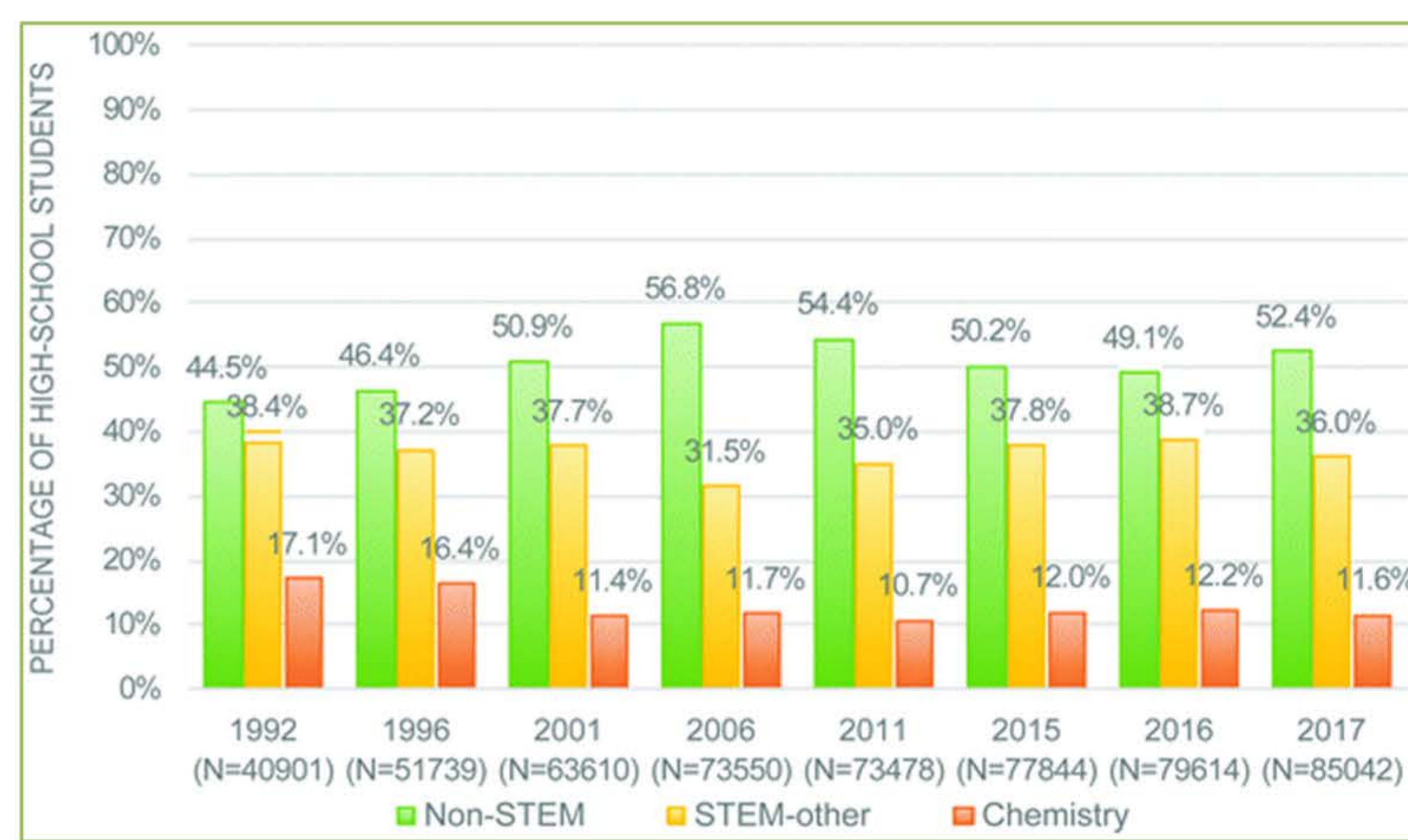
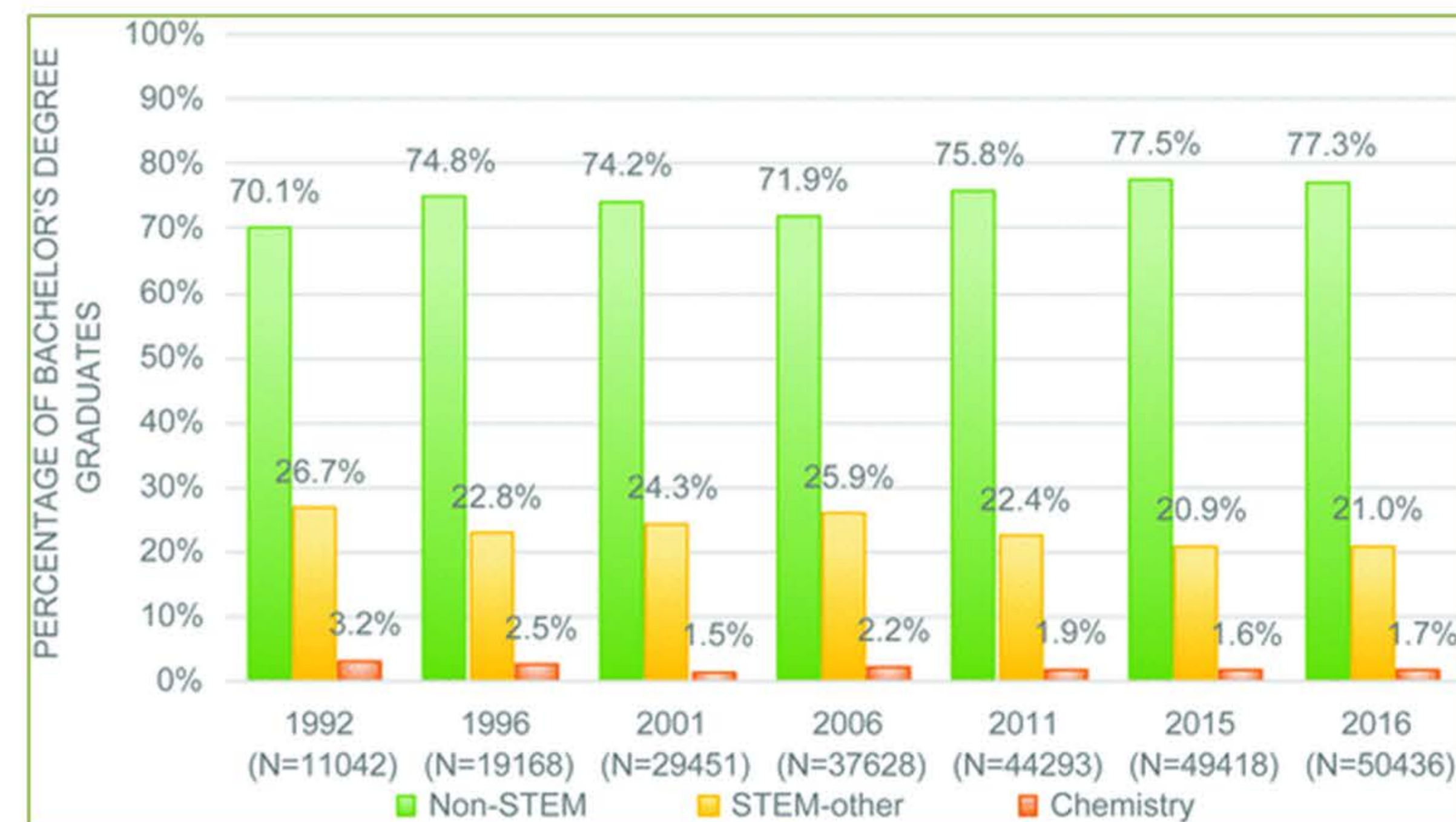


Figure 1A (top). Analysis of subject interests within high-school students

Figure 1B (bottom). Analyzing the percentage of college students choosing chemistry as a major



Avargil, S. et al; Chem. Educ. Res. Pract. 2020 21(2) 668-684

## Analytical Chemistry – Barding Research Lab

### Objective:

- Utilize fluorescence as a highly sensitive method to determine if species is present in trace amounts within a sample
- Attach fluorophore, 9-chloromethyl anthracene (9-CMA) to organic acids

### Experimental Methods:

- Performed HP-LC to find separation patterns of anthracene in organic acids
- Developed in-depth test procedure for synthesizing the derivative 9-CMA for malic and citric acid

### Results:

- Validated identity of product using methods of CNMR, IR spectra, and GC-MS of recrystallized product

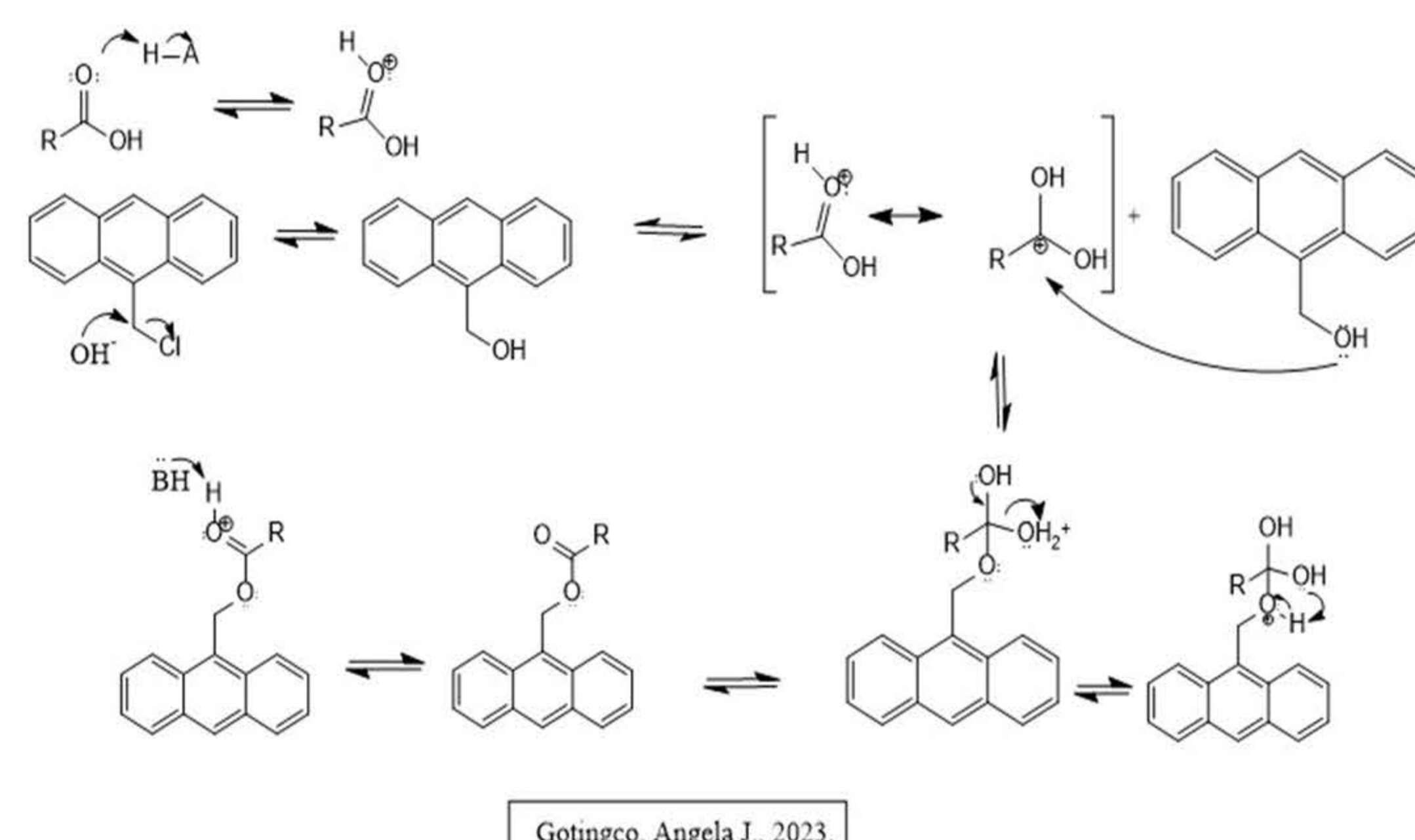


Figure 2. Proposed mechanism of carboxylic acid interaction with 9-chloromethylanthracene

## Rocketry – CPP Liquid Rocket Laboratory

### Test Engineer Responsibilities:

- Developed test procedures for component and system-level testing
- Researched solid propellant grains as candidates for B1LV engine
- Performed post-test evaluation for Recovery System Flight Test (RSFT) on the Patriot rocket
- Learned terminology for various piping and instrumentation of the rocket
- Brought new perspective of understanding the chemical reaction of rocket ignition and propulsion



Figure 3 (left). Patriot rocket airframe experienced zippering potentially due to shock cord cutting through cardboard airframe.



Figure 4. At Lucerne Valley after a successful launch of the Patriot Rocket for the Recovery System Flight Test (RSFT). The results from the RSFT was used to verify the functionality of the B1LV Single-Bay Dual-Deployment recovery system by using 1/2 Scale Patriot Missile. Image from CPP LRL.

## Remote Sensing – NASA Jet Propulsion Laboratory

### Question:

- How can we address the “holes” in spectrometer datasets that result from sky obstructions such as clouds and aerosols for future space missions?

### Method:

- Utilized data retrievals from OCO-3 satellite to determine the local time of the descending node for the SBG-VSWIR satellite orbit

### Background:

- Orbiting Carbon Observatory-3 (OCO-3) was a mission is to retrieve information on the global geographic distribution of carbon dioxide sources and sinks within Earth’s atmosphere

### Results:

- 10:30am-12:00pm for the LA Basin, California, USA and Santiago, Chile had fewer gaps of data coverage

### Background cont.:

- OCO-3 is stationed on the International Space Station (ISS) and can diurnal, analytical capabilities

### Impact of Work:

- Validated NASA’s Level 1 Mission Requirements for SBG-VSWIR, presented new ideas for future work in how to address current satellite limitations

Time Range	9:30AM-10AM	10AM-10:30AM	10:30AM-11AM	11AM-11:30AM	11:30AM-12PM
Frac. Yield Avg.	0.38	0.49	0.6	0.53	0.68
# of SAMs	4	3	13	5	2
Weight Factor	2	2	5	3	1
Total Score	0.76	0.98	3.01	1.58	0.68

Table 1. Values used to evaluate the time with the highest fractional yield. A weight factor was applied to the average values dependent on how many datasets were used for each time frame.

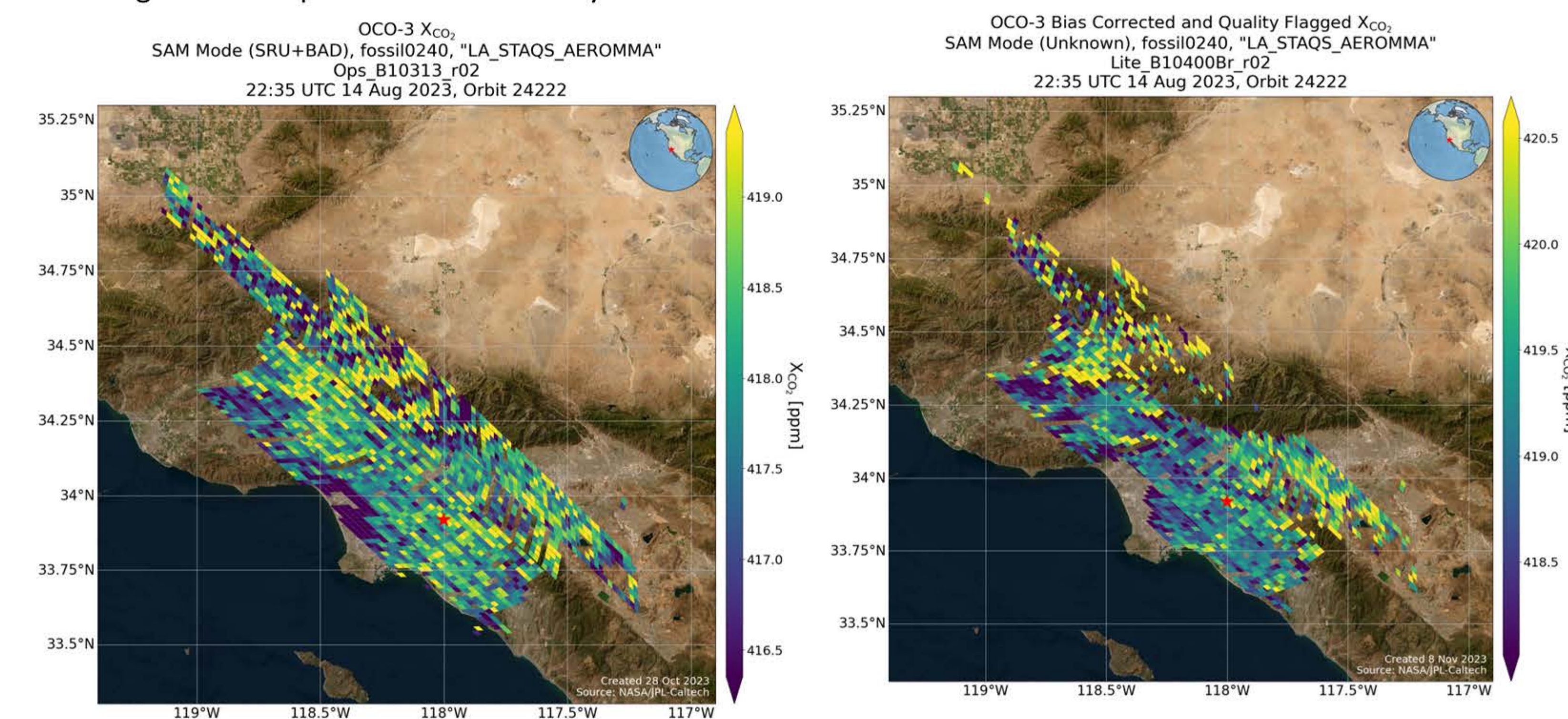


Figure 5 (left). This figure represents the gaps in data coverage that generally result from clouds or optically thick aerosols. Figure 7 (right). Measurements after bias correction and quality flags applied.

## Acknowledgments

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- CPP Liquid Rocket Laboratory B1LV Team

## References

1. Avargil, S., et al. Trends and perceptions of choosing chemistry as a major and a career. Chem. Educ. Res. Pract. 2020, 21(2), 668-684. DOI:https://doi.org/10.1039/C9RP00158A
2. “Plots | OCO-3 SAM.” OCOv3.jpl.nasa.gov, oCOv3.jpl.nasa.gov/sams/plots.php?sid=33936. Accessed 21 Feb. 2024.