

- How did you begin your research? Explain how you came up with your research query/topic.
- How did you discover your sources? Which library or other information sources did you use? Explain particular techniques or strategies that you used while searching and discovering information.
- Did you seek assistance from a librarian, a professor, or someone else? If so, how this interaction impacted your research process? Was there anyone in particular who gave you the inspiration to turn your research in a different direction?
- How did you select and evaluate the sources you found? Explain which criteria you used for selecting sources.
- What did you learn during the research process that will help further your academic or professional career?

A great interest of the Sriram group is to determine the relative rates of reaction in different pathways in a plant species. To obtain this, it is necessary to understand how metabolites and biomolecules are distributed in these pathways. Glucose was particularly an interest since it is the starting point for many metabolic pathways. My project started last semester with an aim to use isotopically-labeled glucose and gas chromatography-mass spectroscopy (GC-MS) to confirm the fragmentation patterns of glucose suggested by DeJongh et al. four decades ago. The distribution of masses produced by glucose fragmentation can be used to calculate metabolic flux.

After reading the publication by DeJongh et al., I performed an initial testing to understand more about glucose fragmentation. I quickly realized a discrepancy between the initial result and the literature, and it made me question the validity of the literature. I consulted with Dr. Ganesh Sriram, and he suggested that I perform a literature search to update myself with any current glucose fragmentation studies. I used several sources including PubMed, ACS SciFinder, and the Web of Science. I have known that these databases are highly credible from my classes and other professors. As an initial approach, I used Google Scholar and Google Book to find publications on fragmentation of glucose. I would scan the title and the abstract of the article to see the relevance of the article. However, that approach was fruitless since viewable articles were limited. Google Book presented many publications about the theory of GC-MS and other mass spectrometry, but none about how glucose fragmentizes. I then looked into a well-known database, PubMed, but I was only able to find studies that have used GC-MS as a method to detect and quantify glucose in blood and food. Feeling discouraged, I decided use the Web of Science hoping to find sources that were either cited by DeJongh et al. or had use that study as a reference. Despite my efforts, I failed find any new studies relevant to the fragmentation of glucose. I know that the National Institute of Standards and Technology and the American Chemical Society have databases that store spectral data from many studies. As I began my experiment reanalyzing the fragmentation pattern found by DeJongh et al., I searched the NIST and the ACS database to find any published mass spectra of glucose using GC-MS, more specifically with an electron impact ionizing source. However, the mass spectra published were generated by other types of mass spectrometers with different methods. With no recent studies on the fragmentation of glucose found, it means that my work would be novel and challenging.

With the guidance of Dr Sriram and Shilpa, a graduate student, I used different isotopically labeled glucose to investigate the fragments proposed by DeJongh et al. As my experiment continued, I ran into problems with interpreting the data and was unsure of the next step. The data did not give a clear indication as to which carbons are in some fragments. Shilpa suggested using label mixtures of varying concentrations to distinguish which carbon is in each fragments. This method would not only allow us to clearly identify the carbons in those fragments, but also test how quantifiable this method is. These mixture experiments produced desirable data and we were able to see trends as the concentration varied. However, the magnitude of these trends were not as predicted, making it difficult for us to understand and explain our experimental results.

Through this experience, I learned that the research process can be exciting and rewarding. I enjoy finding articles that have applied GC-MS for purposes unfamiliar to me because it made me more aware of the other fields of research. The anticipation of obtaining data and interpreting the result was challenging and stimulating, but it also be frustrating when the method doesn't work or the expected result wasn't observed. Solving problems and unveiling puzzles are especially appealing to me, and they were demonstrated through this project. It exposed me to many laboratory techniques that are important for research. Having hands-on experiences with GC-MS increases my understanding and skills required for a career in research, and allowed me to be more competitive for future opportunities.