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As a senior in high school, chemistry was always my favorite science subject to study. Whether learning about Gauss's law or how to work a stoichiometry problem, I took pleasure in learning the wide range of chemistry topics taught at Hoover High School. When it came to working in chemistry lab, however, things couldn't be less enjoyable. Each week, I performed a chemistry lab by following a set of instructions and then wrote up a lab report. This experience led me to believe that labs were all about following instructions, replicating a set of procedures that had been performed previously. If all I was doing in a lab was replicating a set of procedures, though, then what must professional researchers do in their laboratories? As luck would have it, my question was answered when I received the opportunity to work in a research facility at UAB.

Lab experience at UAB

I first considered joining a research lab after talking to a friend who had worked in a research facility at UAB as a junior in high school. Given my experience with labs at the time, replicating similar procedures for a whole summer didn't seem all that appealing. But I was encouraged to apply and work at the research lab anyway, with the idea that I would be exposed to a "real" research facility at UAB. The summer before entering college, I entered my first research facility at the Atherosclerosis Research Unit (ARU) at UAB, placed to work as a laboratory assistant under Dr. Vinod Mishra.

I soon realized that Dr. Mishra is an excellent laboratory mentor who has made astounding achievements in the biochemical sciences. He is a researcher who was previously involved in the development of different biophysical methods in India that allow for the study of peptides and lipids. At UAB, Dr. Mishra is part of the Atherosclerosis Research Unit, headed by Dr. G.M. Anantharama. The unit is divided into different areas of expertise but specializes in studying a cardiovascular disease known as atherosclerosis. Dr. Mishra's areas of study include the functions of lipoproteins, specifically the effect of High Density Lipids (HDL) on atherosclerosis. Working under Dr. Mishra, I was able to learn about his line of work and perform many sub-projects that relate to his project as a whole. Although many of these tasks do require me to follow a set of instructions, to the best of my knowledge, most of these instructions were probably not completed previously, since most of the protocols were instructions that I had created myself.

My first day working at the lab was quite an experience. I was asked to prepare a diluted chemical sample of peptides that was to be analyzed in a spectrometer. I realized that I needed the knowledge of past high school chemistry lectures for me to be able to perform this task. Without knowing about molarity or stoichiometry, I would not have known how to perform this simple task. In addition, a spectrometer was needed to find the absorption spectrum of a peptide sample. Since I had learned how to operate one in my high school chemistry class, I could perform the task with ease. To make an agarose gel, for example, I needed to know the concept of molarity for measuring the exact amount and concentration of agarose. Dr. Mishra routinely made sure I understood the necessary background information before a test was performed. This in turn has helped me to understand the reasons why the test was performed at all for a given sample and what was happening as I followed the protocol.

Of course, if all tests were conducted the way they are in high school, research would take forever. At the lab, many tedious steps of calculation are simplified with new techniques and methods, oftentimes performed by computers rather than by hand. For instance, it is reasonable to find an absorption spectrum of one sample with a spectrometer manually. However, by using a computer, multiple absorption spectrums can be found for different samples in less time. In high school labs, there's no rush to produce results from simple replicated experiments with a known outcome. Each technique is performed and explained thoroughly such that the concept is comprehendible. Many errors will be made, though they are acceptable as long as they are understood by the student. But in a research facility, experiments are performed to answer specific research questions that are possibly unknown to the scientific community. Unlike high school labs, errors in procedures will not only affect the reliability of the results, but will also waste valuable resources. Each procedure must also be performed swiftly so that the results can be evaluated to produce the next set of research questions that needs to be answered. Therefore, many basic methods are maximized by machines in order to reduce experiment time and produce relatively quick and errorless results.

During my time at the research facility, I've learned several different techniques that have helped me to obtain the data necessary for different types of analysis for lipids and peptides. Many of these techniques include the makeup of different assays that test the concentration of factors added to the lipoprotein samples. Some of these assays include PON, PAF-AH, and DCFA assays that test for different factors such as cholesterol and phospholipids for each sample. Many of these new techniques are not taught in high school laboratories, and the samples don't come readily available.

In a professional lab, each sample is made separately each time to avoid contamination and chemical changes over time. Precision takes a great deal of time and is needed to obtain satisfactory results. Even with the technology today, some samples take hours to prepare and usually come in small volumes. In addition, some tests take hours to complete at a time. Making one mistake could require a repetition of an experiment, which may take up a lot more time than needed to finish the experiment!

Science as a Team

Working in a research laboratory at UAB gave me a new perspective on laboratory work and research in general. Many other student lab assistants and researchers also worked in other labs within the ARU. It's interesting how the concept of teamwork is seen in real life settings within the lab. I used to think research was something performed by a single person. But if that was the case, then science would hardly be advancing at the rate it is now. The Atherosclerosis Research Unit best portrays the elements of teamwork within a research environment. Different areas of expertise are separated into their respective groups to study the different factors that may influence cardiovascular diseases. However, even with different perspectives of study, it is the interactions between the different groups that essentially show the dependency between labs. . For instance, Dr. Mishra might prepare peptide samples that may potentially have an effect on the disease, while Dr. Handattu, a researcher in a separate lab within the Atherosclerosis Research Unit, would verify the sample by testing them on mice. The level of collaborative effort within the lab has shown me what it means to work as a team and how much more efficient the process of research can be than when working individually.

From a career perspective, I've always thought of scientific research as a long and tedious process, repeating the same tests over and over again. But while some of that is true, research also allows researchers to think independently about which steps to take. Unlike high school laboratories where old experiments are repeated, I learned to think critically about a completely new procedure in order to obtain the necessary results to progress. In short, I think research is almost like a never-ending challenge, always looking for ways to advance to the next step in an experiment. As Dr. Handattu from the ARU would say, "For every one step you take in research, you'll have to take three steps back."

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According to Dr. Mishra, it is important and highly recommended for undergraduates to be actively engaged in research, regardless of their major. Research experience is a benefit for students working in the sciences because they are exposed to multiple areas of sciences. Dr. Mishra proposes to anyone who is interested in the sciences to find a few categories of interest before finding a mentor. This way, the best match for a research mentor can be found. Entering UAB as a Science and Technology Honors Program student, I realized the vast amount of research opportunities and resources there were available to me as a freshman. Although I am currently not working in a laboratory with a mentor, I will be looking forward to my next lab experience at UAB!