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Juggling Research and Work between Two Campuses: An Undergraduate's Experience in Cellular Research and the Real World

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Commentaries

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—Rebecca Mason (Editor: Jennifer Lee)

Rebecca Mason graduated from the University of New Hampshire at Manchester in 2012 with a bachelor of arts in biological sciences with minors in kinesiology and nutrition.

In order to explain how I ended my undergraduate career in laboratory research with cells instead of practicing sports medicine on the athletic field, I would have to begin with my freshman year. As a high school athlete, I had already chosen to study athletics and was looking to chip away at core classes and save money by commuting the forty minutes from home to the University of New Hampshire campus in Manchester. At the beginning of my sophomore year, the time was right for me to transfer to the athletic training program on the Durham campus and live there for the next two years.

After many hours of clinical work with the UNH team, the Wildcats, and many helpful discussions with my athletic training professors, I found that, as extremely interesting and challenging as the major was, my developing thirst to learn about the microscopic levels of biology was not being quenched. This led me back to UNH Manchester, where I could again commute from home, work to earn money, and study the topics I was interested in. It became clear to me, after taking classes in different chemistries and physiology, that changing my major was a wise choice.

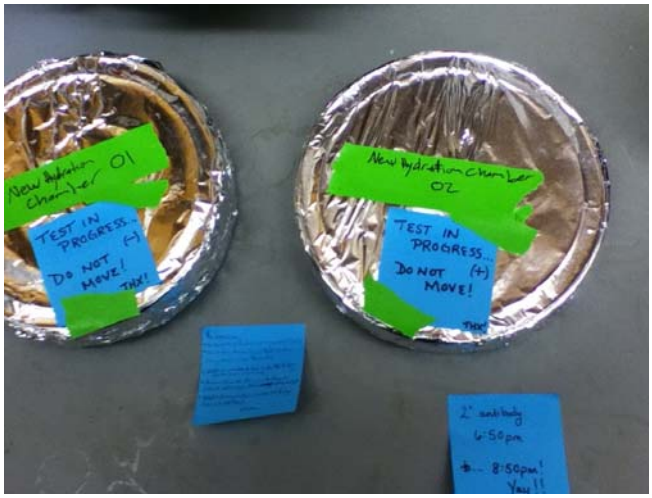
Author as Athletic Director coaching high school soccer players (*Courtesy Larry B.Gray*).

The careful eye of my academic advisor, Dr. Patricia Halpin, lecturer in biology at UNHM, guided me through the logistics of completing a bachelor's degree in biology with a double minor in nutrition and kinesiology. I cannot forget her efforts, in particular, in getting me the capstone opportunity of my undergraduate education: active research in Dr. Charles Walker's lab in Durham the spring of my senior year. This was a chance to get hands-on experience culturing, testing, and observing human cells. My interest in Dr. Walker's lab had been stirred when I learned his research included mitochondria: the part of the cell responsible for energy metabolism, so important in exercise science. The work being done in the lab was to further current cancer research seeking to identify the role of a protein transcription factor, p53, in the cell. I hoped my background in exercise as well as biology would help guide my cellular research in the lab.

First things First: Training and Preparation

Preparation for the lab research began fall semester and required that, after my classes in Manchester, I drive an hour to Durham every other day. Dr. Walker and students in his lab helped train me in cell culture techniques, methods of handling hazardous chemicals, and other important lab procedures. At the same time, I was applying for an Undergraduate Research Award from the Hamel Center for Undergraduate Research to help fund my research.

This semester of travelling between campuses was initially overwhelming and tested my motivation, but pleasant lab partners and visions of the beneficial outcome of this opportunity gave me the endurance to maintain a positive and determined attitude. This outlook was needed the next semester when I was taking two courses on each campus while carrying out my research project an hour away from home.



Author's experiment in progress at the Walker lab.

Dr. Walker's lab was focused on researching a cascade of events within cells that lead to programmed cell death; research was showing that cellular substructures, in particular the mitochondria, could actively participate in this suicide process, called *apoptosis*. My experiment had three steps: First, I would observe what the cells looked like when they were "attacked" by a cancer drug; the hypothesis was that apoptosis would be mediated by p53. Second, I would block the known cascade and travel of p53, with the hypothesis that apoptosis would *still* be observed. Lastly, I would block p53's alternate route through a substructure of the cell, hypothesizing that apoptosis would *not* be observed.

My job was to carry out tests on the cancer cell type, IMR-32 human neuroblastoma. The lab tests used fluorescing dyes to track p53's movement as the cell self-destructed in response to stress induced by the cancer drug, Etoposide. My personal interest was on the mitochondria and whether they were involved in this apoptotic cell death or not. In order to treat the cells with the cancer drug, I had to count out a specific number of cells that I had cultured in treatment flasks, administer the appropriate concentration of the drug, and then extract samples at specific time intervals. These samples I put on microscope slides, observed cell shape by staining, and then viewed for the characteristics of apoptosis.

Long Trips and Long Nights: Investigations and Troubleshooting

Everything was going well until it was time to begin the staining for observation of p53. A staining technique, the Vectastain, allowed me to tag p53 with a reactive dye that would undergo a color change to indicate p53's location within the cell. The trouble, in my case, was that the dye was completely washing away; p53 was not visible and I could not track its location.

At first, I took the failed results as a minor setback in need of simple corrections to technique. Researchers make mistakes in protocols, and I was certainly capable of such mistakes. My plan was to run the procedure again; however, the protocol for this staining technique spanned two days—convenient for a student living on campus but difficult for a commuter living an hour away with a weekend job.

Resisting discouragement, I ran the staining process again, referring to my lab notebook and making sure to cover every possible error I could have made. No results. Panic set in; now I was getting behind in my schedule of experiments because I could not move on to experimental testing without having results from this baseline test. I discussed possible errors with my helpful lab partners and ran the test again. To my dismay, still nothing.

A Sigh of Relief: Some Positive Results and Affirmation

By this time, four weeks had passed, and I was losing time and getting discouraged because my troubleshooting was unable to pinpoint the error. My lab partners supported my efforts and ran the test two more times, but they could not yield results either. Our conclusion was that the dye complex was not working as it should. I was relieved to know that I was not the incompetent addition to the lab I had thought myself to be.

With one of my lab partners I completed a second baseline test that helped me view the cells using different criteria. This work took an additional few weeks and put me very close to the end of the semester. Fortunately, this second test did give me some results to present about the cells I was studying, and I was able to put together a poster for the Undergraduate Research Conference (URC) held that spring. To my delight, I won the UNH Manchester URC poster contest.

After experiencing a semester like mine, some students might have thrown in the towel for research and never looked back. Although I was disappointed that I did not meet my proposed schedule, the experience forced me to

think critically, troubleshoot, and persevere. I followed the examples of inventor, Thomas Edison, and biological pioneers, James Watson and Francis Crick, who never gave up and went on to make groundbreaking discoveries. I am confident that my experiences in the Walker lab will help me immensely as I plan to go on in my studies. I hope, not only for myself but also for other young researchers, that what I faced and how I faced it can be encouragement to push through challenges and not be afraid to learn something new!

Author (left) explaining her project at the Undergraduate Research Conference in Durham, April 2012 (*Courtesy Dr. Charles Walker*).

It is with great joy that I attribute my success to those around me who have mentored me throughout my endeavors. My academic advisor, Dr. Patricia Halpin, and research advisor, Dr. Charles Walker, along with lab partners, Cameron Vergato, Sarah Yunes, and Hannah Eldred, have demonstrated the patience needed to push scientific investigations forward; and they have all given me sound advice. I would also like to thank the Hamel Center for Undergraduate Research for the funding to make this project a reality, and for their mission to help undergraduate students gain research experience. Last but certainly not least, I thank my alma mater*, the University of New Hampshire, for this opportunity to write for* Inquiry*. Go Wildcats!*

Author and Mentor Bios

Rebecca Mason of Litchfield, New Hampshire, graduated from the University of New Hampshire at Manchester in 2012 with a bachelor of arts in biological sciences and minors in kinesiology and nutrition. She is currently athletic director for the Nashua Christian Academy in Nashua, New Hampshire, as well as a junior high school physical education teacher and a soccer and cheerleading coach. Rebecca plans to apply for a master's program to become an orthopedic physician's assistant and also to continue cellular research related to metabolism, mitochondria, exercise, and nutrition. She was encouraged by her UNHM academic advisor, Dr. Patricia Halpin, to publish in *Inquiry* as an opportunity to reflect on and share the unique opportunities afforded her by UNH.

Professor **Charles W. Walker** is a member of the Molecular, Cellular and Biomedical Sciences Department at the University of New Hampshire, where he has been teaching and conducting research for thirty-seven years. His current research interests are the biology of animal cancer and sea urchin gametogenesis. Throughout his time at UNH, Professor Walker has mentored many students who are now academics, work in industry, are science educators, or have become physicians. He notes that he finds each student who passes through his lab "unique and interesting," and he always learns from them. He found Rebecca to be a "highly motivated, driven, very pleasant, intelligent individual," who even mentored other students in the lab. "Rebecca was a delight," Professor Walker concluded.

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