Getting Involved in Biological Research

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Every concept taught in a biology course was uncovered due to the power of research. 60% of biology majors at the University of Iowa are involved in research on campus. Since research is so important, why are there not more students involved in research? My project focuses on the undergraduate experience in biological research to reach the 40% not involved. My goal was to reach first- and second-year undergraduates who are interested in biological research. First- and second-year undergraduate students feel that since they are not proficient in lab techniques and have taken only one or two biology courses. But it has been shown that starting research early in your undergraduate career promotes better relationships and can lead to more success in the lab.

**Implementation & Process**

My project’s activity was fairly simple. There are five parts to my activity; interviewing the undergraduates, interviewing the professors, the writing up the interviews, uploading the documents, and marketing. When developing the project, I had originally just wanted to interview different professors in the STEM departments about their research to make students in other fields understand it. Thankfully, Dr. Lori Adams advised me to look at a webpage on the biology department’s webpage that mirrored my goal but was more realistic.

During the process of implementing, I reached out to more than seven
professors. Once the professors agreed to meet with me, I reached out to their undergraduate research assistants. I interviewed the professors and their undergraduates separately. During the undergraduates’ interviews, I asked them a series of questions; When do they start working in the lab, what is their major, had they worked in any research labs before joining their current lab, why did they reach out to this lab, what they do in the lab, what they want to do in the future, and what they had wished they known before beginning research. After the interview, I take photos of the students doing normal lab tasks. During professors’ interviews, I asked them one question to get the interview started; how many undergraduates work in your lab, and let the main question start a discussion between the professor and me.

The process of writing and editing the interviews to convert them into text was difficult. The writing process was complex because I had to decide on a perfect format to keep my audience’s attention and match their comprehension. Once the format was chosen, the writing process was easy.

The editing process included checking with the undergraduates and professors and reviewing with the Writing Center. The next part included uploading the writing onto the webpage and marketing it. Uploading the writing took a week and I worked with Steve Kehoe, who is granted access to edit the department’s webpage (figure 1). During the uploading process, I marketed the webpage by putting up flyers in the biology buildings and the Iowa Memorial Union (figure 2).

Impact
I collaborated with the biology department to update the webpage. Through this collaboration, I have a permanent webpage on a website that has high web traffic. I am hoping to analyze the traffic in June 2018 and continually monitoring the traffic to see if the traffic on the webpage gradually increases to understand the digital outreach. Since my project is continual and long-term, I hope to monitor the webpage for six months.

**Future Direction & Sustainability**

Since I was only able to interview seven professors, I hope someone could continue my project in the biology department and interview all the professors. I feel this project is ubiquitous in any science department because the undergraduate profiles’ questions do not contain biological language and could easily be applied in a chemistry or physics lab.

**Conclusion**

From this project, I learned to be patient when it comes to scheduling and interviewing people. I had originally thought I was going to able to finish the project in a month but due to scheduling, it took me two and half months to finish the project.
Research Summary

Alternation of generations in land plants; Vegetative phase change in maize

All land plants progress through a life cycle that alternates between two multicellular generations, the haploid gametophyte and the diploid sporophyte. In ferns, seedless vascular plants of the Monilophyta clade, both generations are free living. In addition to the normal life cycle using meiosis to generate spores and sexual union to form zygotes, in nature many fern species can switch from one generation to another asexually. In the sexual pathways, a gametophyte is generated from sporophytic cells without meiosis and a sporophyte is generated from gametophytic cells without fertilization, respectively. The model fern *Ceratopteris richardii* does not reproduce asexually in nature but both pathways can be induced in the laboratory using specific culture conditions. The independence of the two generations in ferns and the ease of switching from one generation to the other through the asexual pathways offer a system suitable for studying how each generation is initiated. This developmental plasticity of crossing generation barriers, i.e., meiosis and fertilization, is not unique to ferns and is manifested in the complex pathways leading to apomixis in some seed plants. My lab has identified genes potentially important in the asexual pathways in *C. richardii*. We are interested in learning how the functions of these genes are evolved between the fern and the seed plant *Arabidopsis*.

Meet an Undergrad in the Lab: Brad Orpano

**Research Description:**

Dr. Cheng's research lab works on the model fern, *Ceratopteris richardii*. In her lab, undergraduates learn lab techniques for working with plants in a research setting. Currently, all of her undergraduate students work on their own projects. Each of these projects are unique in their own way but contributes to the main question in her research. Dr. Cheng's lab group also participates in a journal club where graduate and undergraduate students give presentations on recently published scientific journal articles.

**When did Brad start in the lab?**

The fall of 2015

**Major:**

Biology with a concentration in plant biology.

**Background before Brad started working in the lab:**

"I didn’t have any research background. I was originally a biochemistry major but for research, I wanted to work on plants. I went to talk to a professor working on plant research, and she told me that I had to change my major to biology if I wanted to do plant research."

**Why Brad chose this lab?**

"I knew I wanted to work with plants, so I emailed Dr. Cheng. Later, I met with her and our interests matched."

**Projects Completed in the lab:**

"I started cleaning dishes and growing wild-type fern. By growing wild-type plants, I was able to observe the morphology and get accustomed to working with plants."

My projects, for the most part, have been individual but I have had assistance from the graduate students working in the lab. I made a plant line containing genetic material from an unrelated organism (transgenic) causing a knockout of a transcription factor for meristem development and asexual reproduction.

For my third project, I made a different transgenic plant line that caused the ferns to be tetraploid (nucleus containing four sets of chromosomes). From this line, I started staining the tetraploids using in situ hybridization and DNA fluorescent dye.

Lastly, I have been utilizing bioinformatics with the transcriptome for the fern and its gene expression analysis data."

**What Brad wants to do in the future:**

"I am hoping to stay in the Cheng lab for my master’s in biology."

**What Brad wishes he knew before starting in a lab:**

"I wish I had known that research work wasn’t as formal as it’s perceived to be."

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**Figure 1:** Before and after on the website. The top is still included on the webpage but it is hyperlinked on the professor’s name and the profile featuring the undergraduate is on its own webpage. The update version focuses on the experiences of current undergraduate student and contains less text and a lower level of writing.
Figure 2: Flyer posted in the biology buildings and the Iowa Memorial Union. The flyer highlights the positives of doing research as an undergraduate.