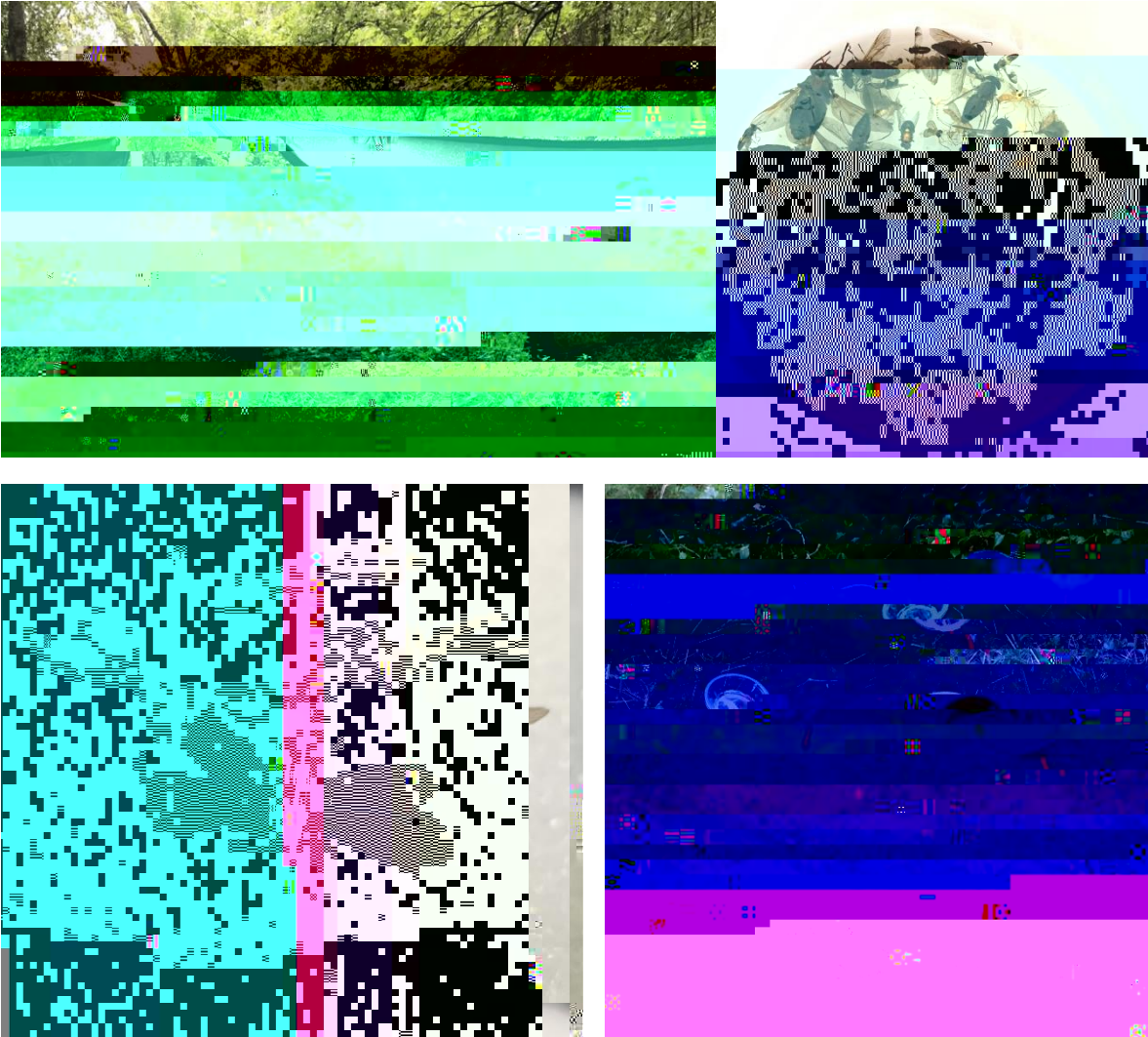


**From Proposal to Publication:
Implementing a Graduate Level Research Experience
in an Undergraduate Course (Bio 301: Invertebrate Zoology)**



Newell Innovative Teaching Award Application 2021

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Description of the project

In popular culture, a “scientist” is often caricatured as little more than a big brain brimming with obscure facts. In reality, successful scientists are well-rounded people who deeply understand the complexities of their field, the motivations for their personal research, and who are able to effectively articulate the importance of their work. In many institutions, undergraduate biology majors are educated in ways that reinforce the notion that knowledge is of singular importance—the actual practice of science is left to be discovered and muddled through during graduate school. My vision for Invertebrate Zoology (Bio 301) was to design a course that brings the experience of authentic scientific practice into the undergraduate classroom by embedding two novel, high quality research projects into the course curriculum beginning with grant proposals and ending with scientific presentations and peer-reviewed publications.

In doing so

One downside to the extra effort in presenting to the department was a shift in priorities from preparing for publication to presenting at the end of the semester. The biodiversity project and pollinator project both produced more than enough interesting data for at least one publication each, but we ran out of time at the end of the semester to completely finish a polished version of either. However, this semester I have been working with several students to complete our drafts and plan on submitting both papers for peer-review this summer. The papers will include these students as first authors—a remarkable feat for an undergraduate—and all eleven students as coauthors. In future years, I will prioritize writing the paper during the class and presenting at conferences later. The students would have loved to actually submit these projects for peer-preview during the semester that we worked on them.

One major change I will make in the future involves the sorting of fungus gnats from the Malaise trap samples. Fungus gnats are very tiny flies that we collected in the thousands. For the first two weeks, I required students to sort through the entire trap contents and they tediously did so, sorting and counting almost 25,000 insects (~20,000 of which were just fungus gnats!). After a small nonviolent revolt, I decided it would be best to filter out all specimens <4mm before sorting and counting the rest. This change made the work much more realistic to accomplish and did not detract from the overall narrative we were constructing. In future classes we will have the “only count insects >4mm rule” in place from the beginning.

The writing assessments can be improved as well. Students enter the class with a diverse range of writing abilities which makes providing constructive feedback difficult and time-consuming for the class as a whole. Encouragingly, our seniors usually do very well and it is typically our sophomores and transfer students who struggle. I need to create a detailed rubric and/or writing guide for each assignment that will help the less well-trained students understand what scientific writing is and the quality of work I am expecting.

Due to the nature of the projects, students were forced to study aspects of the world we inhabit that usually go unnoticed. In each jar of specimens filled with tiny creatures there exists great beauty, intricate designs, fascinating anatomical features, and surprising discoveries. Their curiosity was ignited each week with new discoveries (like the incredibly rare forceps flies on the cover page), students became confident experts within their own taxonomic focus groups, and through the practice of researching and writing become well-versed in the *whys* of studying biodiversity. Working together, we achieved in a semester what usually takes many years and I am looking forward to seeing what else the students of Bio 301 will accomplish in future semesters.