

Barcoding Bee DNA

by Claire Rogers



Bruce Taubert

The pallid bee, or *Centris pallida*, is a native bee of Southern Arizona that tolerates and functions well at a very high body temperature.

The Tucson Bee Collaborative (TBC) is a multidisciplinary effort to document the native bees of Southern Arizona. TBC arose as a partnership between faculty and staff of the University of Arizona's Entomology Department, Pima Community College's Department of Biology, and the Arizona-Sonora Desert Museum's Conservation Education and Science Department.

Through the TBC, introductory biology students at Pima Community College and some Flowing Wells High School biology students are getting real-world research experience and contributing to the understanding of our natural world.

"This is not what is sometimes referred to as a cookbook lab," says Jennifer Katcher, biology instructor at Pima Community College, referring to the formulaic lab experiments that first-year students follow in order to get expected results. "This is real research."

Before TBC was founded, Katcher's students were doing lab work in which the results never went beyond the lab. Katcher asked Wendy Moore, professor and insect collection curator at the University of Arizona, if there was any research for her students to do at the

University of Arizona Insect Collection (UAIC). In the process of reorganizing the collection, Moore found many specimens from donated collections that had not had DNA extractions yet. Shortly thereafter, she connected with the Arizona-Sonora Desert Museum (ASDM) to help identify bees it collects as part of a long-term population study of wild bees in the Tucson area.

"[ASDM] had been collecting every two weeks, year-round, to find out what bees are active in each season," explains Katcher. "It's interesting because you would think we'd already know these things, but nobody has systematically studied them. It's a baseline study of phenology, or the life cycle of an organism."

The role of Pima Community College biology lab students is to identify the bees that ASDM has collected. "The thing that is unique about this [research opportunity] is there are people outside of the class that are interested in the results," says Katcher. "Once you can name the species, you can connect the dots within the environment, using the information provided by ASDM."

Rather than comparing images to

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determine a species, researchers now use the international database known as the Barcode of Life to compare DNA samples.

"When we first started the project, there were very few specimens from Arizona in the database," recalls Katcher. "In many cases, my students were the first ones to publish the bee DNA for those bees. Now, if you look on the Barcode of Life database, 75% of the information on bee species in Southern Arizona came directly from efforts of the Tucson Bee Collaborative."

The TBC is now considering alternative methods of acquiring bee DNA.

"Sometimes the students will ask, 'If we're trying to save biodiversity, why are we killing bees?'" says Katcher, noting that the bees that students are currently analyzing had already been collected and were in a backlog of bees to be identified.

She describes one of the new approaches: "We know that bees are pollinators, and they are visiting flowers, and so with ... new technology, instead of collecting the bee, we can collect the flower and the tiny bit of DNA that the bee may have left behind. We can now find out what species has pollinated that flower. That's our next step with the students. We're seeking funding to do that."

According to Katcher, this project will give students more flexibility in posing scientific questions, because they will get a better understanding of each bee species' niche.

The TBC received a grant from the National Science Foundation for education research to determine how the TBC project impacted students. "We found that students had significant gains in science self-efficacy," explains Katcher. "That's just another way of saying that students felt competent and capable of doing science."

Students from PCC have presented their work at three national conferences. This has helped to build their résumés, their confidence, and their network. Many have gone on to attend the University of Arizona and continued to work with Moore at the UAIC. "Because they already have research skills, it is easier for them to get a research position with the university," says Katcher. "It's an equity issue, because PCC students don't normally have access to working in research labs. And researchers want to hire younger students because they can work through their college career, requiring less training for new recruits."

"Here at Pima, they are getting that hands-on research experience," concludes Katcher, "and when they transfer, they're not starting fresh. Our project bridges high school, community college, and university students, all doing similar work." 🌱

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