



Infectious Enthusiasm for Student Research at Catawba College

BY CYNTHIA MWENJA, PhD

Jay Bolin, Associate Professor of Biology and Dean of Natural Sciences at Catawba College, is a botanist who continuously seeks to expand undergraduate research opportunities for his students. He promotes Catawba by connecting with people working in various science disciplines at other schools, often developing and deepening the relationships to turn these researchers from contacts to collaborators. These connections have led to the creation of a groundbreaking undergraduate research lab at Catawba as well as the establishment of vital field research projects at North Carolina sites and beyond.

Establishing the Graham Genomics Lab

Bolin has played a big part in brokering a recent partnership between Catawba and Eremid Genomic Services to establish the Bill and Shari Graham Genomics Laboratory on the North Carolina Research Campus (NCRC) near the college. Bolin had already been looking for ways to connect Catawba and the NCRC so that the college's students could gain experience with different types of research. Francisco Camacho, newly hired Director of the Graham Genetics Laboratory and Professor Affiliate at Catawba, says that Bolin has “been a champion for pushing this project forward.”

Bolin underscores the idea that the new next generation genomics lab provides “a one-of-a-kind opportunity for undergrads” since they will be able to sequence genomes in just a day or two in the facility. The machines for such work are expensive to both buy and run, so most students don't get pre-professional experience working with the equipment. Camacho states that assembling the lab has been exciting; they have been able to get new, state-of-the-art equipment through

Erimed's purchasing contracts. Bolin affirms that the partnership was created in “response to demand”; labs around the country need graduates from four-year colleges to be able to do this next generation sequencing work.

Camacho, who has taught at several institutions of higher education previously, will split his time between teaching for the college and running the lab. He confirms that the Spring 2023 genomics class section is already full, with a waiting list, and he asserts that, while it's currently rare for next-generation sequencing to be taught—particularly to undergraduates—this direction “is really where biology is going; it's already commonplace for genes to be sequenced.” Because of how efficient next-generation sequencing has become, he states, “understanding the genome is now an important part of understanding biology.”

In the class, Camacho says, students will learn the lab skills for next generation sequencing, with the goal of training “students to be ready for careers in clinical diagnostics.” These skills, he maintains, will boost students' job prospects because they will have run the machines; getting that

experience otherwise is not easy, according to Camacho. One of the class assignments will ask students to explore their own oral microbiomes to see what's living in their mouths. In doing this work and making comparisons, Camacho states, they may have information to develop for potential publication, as well. He confirms that the type of research they will do in the lab is not only different from academic research, but it also has much higher stakes. Bolin's vision and unflagging work has led to these opportunities for Catawba students.

Moving from Connection to Collaboration

Bolin has made connections at the Plants for Human Health Institute at North Carolina State University, also housed at the NCRC. Bolin is extremely proactive, always looking for new connections and collaborations, asserts Slavko Komarnytsky, Associate Professor of Pharmacogenomics at North Carolina State University and Professor Affiliate at Catawba. Komarnytsky maintains that Bolin has been “critical in extending the reach of Catawba” beyond the campus, giving “visibility to



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Komarnytsky says that he and Bolin met by chance about seven years ago. While researching the evolutionary relationships of plants, Bolin needed a particular piece of equipment and saw that Komarnytsky had the needed equipment in his lab. As their research relationship unfolded, Komarnytsky led the development of a mobile discovery program for students—including Catawba College students—that applied a simple, inexpensive tool to allow anyone to go out in nature to look for novel antimicrobials to collect. The innovation in the mobile test kits is the use of student saliva. Komarnytsky verifies that it can be hard to take microbial cultures, but “the microbes present in the saliva respond to bioactive principles in the samples.”

With this tool in hand, the two started a class called “Antibiotic Resistance and Drug Discovery.” In the class, up to fifteen Catawba students are introduced to microbial cultures and their importance to human health. They are taught how to use the mobile test kits to screen samples from nature. The students can get quite creative with their sampling, Komarnytsky acknowledges, trying such disparate items as a grasshopper, dog hair, and various substances from “a grandmother’s fridge.”

These sample kits are not just educational tools, though; “they are screening tools for real science,” according to Komarnytsky. The student researchers can prioritize “hits” to try to understand the chemical principles behind the activity. They can then take the plant to the lab and test the compound to see if it is novel. All of this student-driven

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research begins as part of this Catawba College class, which in turn, developed from the chance meeting and subsequent partnership between the two men. Additionally, Komarnytsky emphasizes, he is able to offer internships to some of the students he works with, and they often stay in his lab to continue their research.

Working with Students, on and off Campus

In another of his endeavors, Bolin has directed undergraduate research at Catawba’s Center for the Environment. This 189-acre living laboratory includes forests, wetlands, and streams; it is recognized by the state of North Carolina Natural Heritage Program as being ecologically significant. Under Bolin’s guidance, students have been studying the impacts of the invasive emerald ash borer (EAB); the research is now in its fourth year of data collection. In six plots within the ecological preserve, they have tagged trees to track the decline of the ash tree.

In the fall of 2020, Bolin invited Arilyn Lynch to join the EAB research; she is now a 2022 Catawba graduate in Biology and Environment and Sustainability. Lynch explains some background on the research: While the

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EAB had arrived in the U.S. in 2002, it had reached North Carolina in 2013, and the research at Catawba began just as the pest had invaded Rowan County. Female EAB lay eggs in crevices in the bark of ash trees, mainly targeting the green ash. As the larvae grow, they feed on the tree's cambium layer, destroying the tree's ability to move sugars and water, thereby disrupting its nutrient flow. Students are monitoring the status of all of the trees, even the non-ash, to see how the forest is changing as the ash is eliminated. Unfortunately, Lynch states, there is nothing to do to save the affected ash trees at the forest scale. As a result, the study is not to stop the spread of the pests but to see what will change when the ashes are gone.

The research sites are within the swampy area of Catawba's ecological preserve, where now, due to the EAB, many ash trees are falling. In the first year, the student researchers did not expect to see such high infection rates, but they saw a jump from 20% infected in 2019 to 53% infected in 2020; no tree mortality was observed in 2019, but there was 11% mortality by 2020. In 2021, Lynch confirms, 56% were infected, with 37% mortality. These numbers, Lynch acknowledges, "are staggering." In 2021, Lynch states, the students needed hard hats to conduct their research; trees were "falling like crazy. You could put your hand on a tree for balance, and it just went right down." While 100% of trees with EAB larvae die, the saplings are not affected; EAB only lay eggs in trees over about a few inches in diameter. As a result, Lynch asserts, there is potential that saplings could survive after EAB move on.

Despite this small hope, Lynch says that living in a world where this sort of science is coming out can be "sobering" and "a lot to handle." The research, however, make her more passionate about applied science because "discovery science like this is important." She appreciates the opportunity to participate in this research with Bolin, saying that he is a kind and supportive mentor who "enjoys research, even falling down in a muddy swamp!" Drawing on this work with Bolin, Lynch's research presentation won recognition as the best at the annual Beta Beta Beta National Biological Society regional meeting, and it went on to win the Frank Brooks award at the national meeting, as well. Lynch provides one example of the importance of giving students the opportunity to conduct real research with genuine stakes in the world outside of the classroom.

Even within his classes, Bolin seeks out connections to extend his students' experiences beyond the campus. Bolin is teaching field botany this term; each Friday, the class takes excursions to learn about plant communities. They will also take a longer trip to camp in western North Carolina; Bolin lights up when discussing student field trips. He is also co-teaching a marine science class which culminates this term in a trip to the Caribbean island of Bonaire; this class is generally scheduled every other year. As part of the curriculum, students learn to

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scuba dive at a local dive shop so that they are ready to explore the waters off the island. They also study the vegetation ecology of the island and read *What a Fish Knows: The Inner Lives of Our Underwater Cousins* as one of the texts. Another class Bolin teaches, Natural Resource Ecology and Management, leads to travel a little closer to home. In this class, offered every other spring, students camp at the Atlantic coast near Norfolk to work with the Elizabeth River Project, on a wetland restoration project on one of the historically most polluted rivers in the U.S. Bolin states that working in places like the Elizabeth River that “really look like they need help and smell like petroleum” gives students perspective.

Infectious Enthusiasm

Above all, Bolin’s gusto for pursuing and expanding opportunities stands out to those he works with. Camacho says that Bolin’s “enthusiasm is infectious. Jay’s excitement for teaching students is the thing I love most about him.” Komarnytsky asserts that two things are critical to Bolin’s success: “working hard to extend the reach of the school, and seeking opportunities for the students.” Bolin verifies that this is an exciting time for the college. Last year, an anonymous donor gave \$200 million to its endowment; last month, another \$42 million was anonymously donated. The most recent gift comes in the middle of developing a new Quality Enhancement Plan and renewed strategic planning. Bolin emphasizes the incredible opportunity that these gifts offer in the strategic planning process; they allow faculty decision-makers to envision programs of national prominence. They can think about improving student life and creating innovative student experiences, including travel and service learning. Additionally, he says, they can give careful thought to how to continue to support their large population of first generation students while meeting the needs of a growing number of international students. These financial gifts will certainly help the school, but Bolin’s sense of possibility and boundless enthusiasm for new ventures will truly enrich the final results.

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ABOUT THE AUTHOR: Dr. Cynthia Mwenja teaches Composition and Rhetoric at the University of Montevallo.

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