

“Things that Go Bump in the Night:” An Interdisciplinary Research Team at Wheaton College

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On a cold March Midnight in New England—

A soft rain has begun to fall, and a thick mist is forming as rain meets the winter-chilled ground. The mist coils eerily around dirty patches of snow still lying unmelted at the base of dripping trees. The air is filled with ghostly noises, as though the woods were possessed. In the frigid darkness, several shadowy figures loom. They are gathered around a mossy pool still partially covered with a thin sheet of ice. Their talk is quiet and hushed. A coven of witches? A gang of hoodlums preparing for a night's destruction?

No—just a group of college students, armed with dip nets, buckets, flashlights, and a portable scale. They are hunting salamanders, and their cold, wet night has only just begun.

In the fall of 1995, we formed an interdisciplinary research team to study a vernal pool on the Wheaton College campus. Through brightly-colored posters, word-of-mouth, an in-house electronic bulletin board, and in-class announcements, we recruited a dozen students from a variety of disciplines, including art history, biology, psychology, environmental science, chemistry, and philosophy. A handful of undeclared first-year students were also included in Wheaton's "Vernal Pool Research Team."

A vernal pool is a unique wetland, filling with water during fall and spring, but drying out over the summer. Vernal pools have no inlet or outlet and rely on rainfall and snow to replenish their water. The temporary nature of the vernal pool is part of what makes them ideal breeding grounds for amphibians, whose larvae need water free of predatory fish in which to develop. Three species of salamanders (Jefferson's,

marbled, and yellow-spotted) are obligate vernal pool breeders, meaning that they can reproduce successfully in no other kind of wetland. These animals have evolved to be dependent on the higher-than-usual oxygen content and seasonal drying of vernal pools.

Wheaton's pool is home each spring to breeding yellow-spotted salamanders. The yellow-spotted salamander is ordinarily secretive, keeping a subterranean lifestyle for all but a few days of the year. At the first sign of the spring thaw, however, they move up out of their dark dwelling places in search of mates, and vernal pools. They are sizable animals—7-10 cm long from snout to vent, and brightly decorated with yellow spots on a chocolate body. It is hard to imagine how they can disappear so completely during all other times of the year. The spot patterns are persistent and unique to each individual, making it possible to recognize them as though they were wearing name badges on their backs. Much is known about the use of vernal pools by this species for mating and larval development, but little is known about long term patterns of population dynamics and visitation to vernal pool breeding grounds by salamanders and other amphibians.

Our interest in Wheaton's vernal pool stemmed in part from this puzzle of the salamanders, and began with the interdisciplinary thesis of a student, Heidi Preston '95. As part of her thesis, Heidi followed Massachusetts state requirements to certify for protection a vernal pool that lies a mere 200 yards from the Wheaton College Science Center, between a campus parking lot and a college-maintained running path. She also compared wetland protection policies in neighboring states, and created a master plan for a vernal pool documentation program in her home state of Maine. Heidi's efforts to document Wheaton's

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vernal pool were successful, and the pool became a protected Massachusetts wetland in the spring of 1995.

In the fall of that year we began our efforts to establish an interdisciplinary team of students to conduct a long-term study of the ecology of this unusual wetland. To our delight, our organizational meeting was well-attended and included students from disciplines in the Humanities and Social Sciences, as well as the Natural Sciences.

The group broke into subteams to work on particular subsets of the overall research project. These subteams were truly interdisciplinary, drawing on the skills and knowledge of the students from the different disciplines to complete the various phases of data collection. For example, several students were responsible for weekly assessments of water quality, including pH and dissolved oxygen content. In this task, students with chemistry backgrounds trained others to use equipment and to interpret their measurements. Biology majors trained their naive peers to use microscopes and keys for identification of the countless species of invertebrates living in the pool. The psychology majors were experts at compiling data, and taught their peers to be meticulous notetakers.

Students from all disciplines worked with Dr. Morgan every evening during March and April to capture, weigh, measure, and photograph yellow-spotted salamanders. The goal of the "Amphibian Research Subteam" was to begin a catalog of individual animals, to which captures in subsequent years could be compared. DNA for future "fingerprinting" was also obtained by snipping the tip of each animal's tail (these tail tips regenerate quickly). Since the salamanders do not begin to leave their lairs and migrate to the pools until well into the night, team members' work did not begin until midnight, and could continue until 3:30am. It may not be uncommon for a college student to be up and about at 3a.m., but for them to be actively and enthusiastically doing science at that hour is novel! They wore their mudstained sneakers as a badge of honor to classes the next morning, discussing the night's "catch" like seasoned fisherman.

All of the Vernal Pool Research Team's members came together for particular projects: setting out flagging to mark square meter sections in the pool, digging and setting pitfall traps and drift fence for catching amphibians, or surveying other pools under consideration for state documentation. The team also continued to meet weekly to discuss how the subteams were progressing, to swap stories, and to plan the next week's work. The project continued to

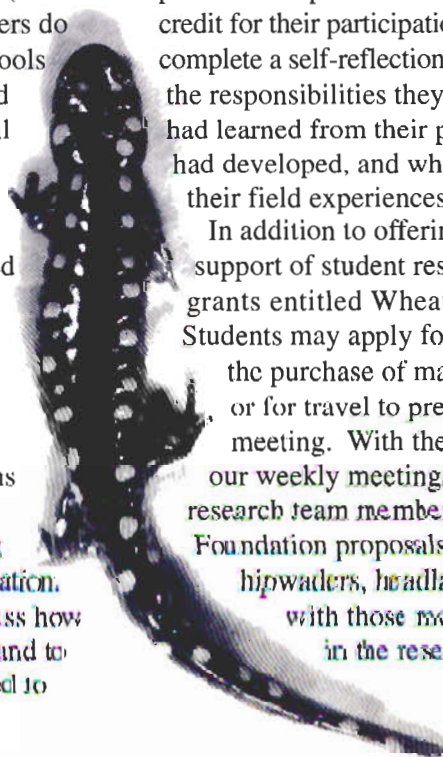
benefit from the interdisciplinary nature of the group. For example, the art majors offered wonderful suggestions for improving documentation of the spot patterns of the salamanders, and the psychology students had great ideas about how best to sort and analyze the data as they came in. At other meetings, advanced students who knew more about a given topic (e.g., psychology students who were experienced in behavioral analysis, or biology students who were experienced in invertebrate identification) gave presentations to their peers.

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Some students participated in the research team for the sheer love of it, while others carried academic credit in the form of independent research units. To earn academic credit, a student had to commit to a minimum of 9 hours/week spent on the research, including the weekly meeting. They had to keep a research journal and present an analysis of some of their data in the form of a research paper or other professional presentation. Finally, all students earning credit for their participation on the team were required to complete a self-reflection essay in which they discussed the responsibilities they had on the project, what they had learned from their participation, what skills they had developed, and what relation they saw between their field experiences and their classroom learning.


In addition to offering academic credit, Wheaton's support of student research includes competitive grants entitled Wheaton Foundation Awards. Students may apply for up to \$250 to be used toward the purchase of materials necessary for their work or for travel to present the work at a professional meeting. With the help of peer reviewers at our weekly meetings, several of our vernal pool research team members wrote successful Wheaton Foundation proposals, and we were able to purchase hipwaders, headlamps, nets, and other materials with those monies. In addition, the students in the research team gained experience

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with the artificial data and analysis software that my collaborator has developed during the past few years. Although the second phase of funding for the JOVE program is delayed, I have received my Cottrell Science Award money from the Research Corporation. I have ordered a powerful PC workstation along with necessary extra disk space and tape reading capabilities. I expect to receive my equipment at any time, and I look forward to modifying the analysis system for operation on the larger images from the Solar Oscillation Investigation (SOI) and toward analyzing new data that continues to pour in from GONG. During the coming months scientists and technicians with both observing programs will increase understanding of their detectors, improving both their calibration methods and this analysis of standard large-scale velocity patterns. I have also developed, as my own separate research goal and with full support from my collaborator, an investigation of the possibility that the convective blueshift may vary with time. I believe that all the new data plus this versatile analysis tool make the future look bright for many successful results from this research. All my work in searching for and finding an active collaborator and the money to build a successful on-campus research program is yielding rich opportunities to me and my students at Birmingham-Southern College. 


With the start of the fall semester, we have already begun the next year's team. We have been approached by town selectmen who are interested in having the group document a vernal pool on local conservation land. Slathered with bug spray and wielding our shovels and flashlights, a group of us have already been out to our own pool in hopes of finding rare fall-breeding marbled salamanders and to map the pool for the coming season. Among us were newly declared science sophomores who were undecided freshmen last year when they joined the group. Wheaton's interdisciplinary Vernal Pool Research Team is here to stay! 

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primarily upon my colleagues at Vassar because I hoped to interest local girls in science at Vassar. However, I also enlisted the support of scientists in the well-developed environmental industry in our local area, some of whom were alumnae of Vassar College. I arranged with the principals of Poughkeepsie Middle School and High School to visit those schools and recruit participants. Also, I sent press releases to the local media and mailed flyers about the event to community service organizations in the mid-Hudson Valley.

Response to the conference was positive. A lovely article was spotlighted in the Poughkeepsie Journal which discussed the conference and its goal of encouraging girls to engage with science. The conference was funded by the Vassar College Dean of the Faculty, the Vassar College Women's Studies Program, and the Association for Women Geoscientists Northeast Chapter.

I worked with a budget of \$1500 that was provided by the Office of the Dean of the Faculty at Vassar. In order to make sure that students who might not have the resources to participate could come, we charged no fee and provided free lunch and transportation from local schools to the conference site. The Dean was happy to fund the project, and did so with alacrity because Vassar is fortunate to have the resources and eagerly reaches out to embrace the larger community in Poughkeepsie, New York. Though we would have liked to pay the workshop leaders, all volunteered their time. We did provide a modest honorarium to a keynote speaker.

The project was a success. In addition, it served a worthy purpose, and met a need of not only the scientific community, but also the community of Poughkeepsie. I have already received many phone calls inquiring about the date of the next conference, and all participants enthusiastically indicated that they would return for a second year. 



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writing and reviewing research proposals, determining appropriate budgets, and allocating spending.

The Vernal Pool Research Team's first year of work culminated in the establishment of two catalogs of vernal pool denizens to be used in the coming year. One included over 20 species of invertebrates and the other contained photographic and DNA records of 42 individual yellow-spotted salamanders. The students who carried academic credit for their participation presented a summary of their work in the form of two poster papers at Wheaton's yearly "Academic Festival," a day of special presentations showcasing scholarly work of our students.

In our view, the interdisciplinary nature of this team was part of what made it such a huge success. Students from different disciplines had something unique to contribute to the work, and sharing their expertise gave them a chance to be teachers as well as learners.