Snake Charmers

Martha Wohlfeil ’13 and biology professor Matt Rand study the genes that influence pigmentation in snakes

By KAYLA McGRADY ’05
Martha Wohlfeil '13 thinks snakes are cute. "I never expected to believe it," she says, "but some of them are. Each one has its own personality."

As their primary caregiver for the past year, Wohlfeil has become well acquainted with Carleton's 40 bullsnakes, which live in glass tanks in a climate-controlled room in Hulings. She's also studying their DNA as part of a team of student research assistants who are working with associate professor of biology Matt Rand.

"We're trying to identify the genes that are responsible for the so-called pigment mutants," says Wohlfeil, a biology major from Oconomowoc, Wisconsin. To do that, team members are comparing DNA that Wohlfeil extracts from the shed skins of both typically colored snakes and those that are missing all or part of their pigmentation due to genetic mutation.

The project has given Wohlfeil an opportunity to perform her first polymerase chain reaction, a process by which she amplifies a specific region of DNA that they suspect is part of a gene responsible for the mutant coloration. The result—a tube full of the gene that Rand and Wohlfeil wish to study—can then be sent to a commercial lab for DNA sequence analysis.

"No one knows what specifically causes the differences in snake pigmentation," says Wohlfeil. "I'm excited to be on the cusp of new research."

Rand chose Wohlfeil as one of his research assistants after she impressed him with her enthusiasm for lab work—and her ability to handle the bullsnakes—in an animal physiology class he taught last year.

"It's great to work with students because they're looking at a problem for the first time," says Rand, "and they ask questions that aren't clouded with preconceived notions. Those questions can lead down interesting and unique paths."

His goal is to teach his student researchers to "think like a biologist" by breaking down problems into basic parts and learning to ask answerable questions.

"When you pose a problem to students, they'll often design an experiment that's worthy of three PhDs," Rand says. "I have to teach them to shave it down to one variable that they can test. The resulting experiment may seem mundane and easy, but in reality it might be a step toward understanding a complex problem."

Rand knows this lesson all too well. His current research is just one step in a career-long goal to uncover the genetic link between sexual coloration and reproductive behavior in Colorado's red-lipped plateau lizard. Adult males have either orange or yellow facial coloration and orange males usually dominate their yellow-pigmented counterparts in conflicts.

"Twenty years ago, when I told the committee members reviewing my dissertation that I wanted to understand the genetics behind the lizards' coloration, they said it would never happen," says Rand. "Today we have the technology to isolate and identify the genes responsible for color, but we've got a ways to go, so the challenge will be getting this work done before I retire."

Because the red-lipped plateau lizard is sensitive to its environment and therefore difficult to keep and breed in captivity, Rand is currently focusing on bullsnakes. "Lizards and snakes are closely related and have similar kinds of pigment differences," says Rand. "If I can identify the mutated gene that causes different colors in snakes, I can compare it to the same gene in the lizards and see if it's a match. That would be a great shortcut, since right now all we can do with the lizards is search the genome for gene differences that are related to variability in color, which is slow and painstaking."

Rand's enthusiasm for his research has rubbed off on Wohlfeil, who plans to earn a PhD and conduct her own research someday. She hasn't decided yet what specialty she wants to pursue, but this experience has opened her eyes to possibilities she hadn't considered before. "I've always loved animals, but I was surprised by how much I like working with the snakes," says Wohlfeil. "Before this, I didn't have much interest in herpetology, but now I'm fascinated by the kinds of biological questions that can be answered with reptiles and amphibians—questions that can't be answered with more common laboratory animals like mice."

Wohlfeil admits that she was afraid of the snakes in the beginning. "The first time I had to feed them on my own, I thought, 'I can't do it!'" she says. But after months of handling and feeding the snakes, Wohlfeil has grown so fond of them that she plans to return to campus for this summer's hatching. "I've never seen a snake hatch. I'd like to see that."