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NSF Bets Big on David Angelini

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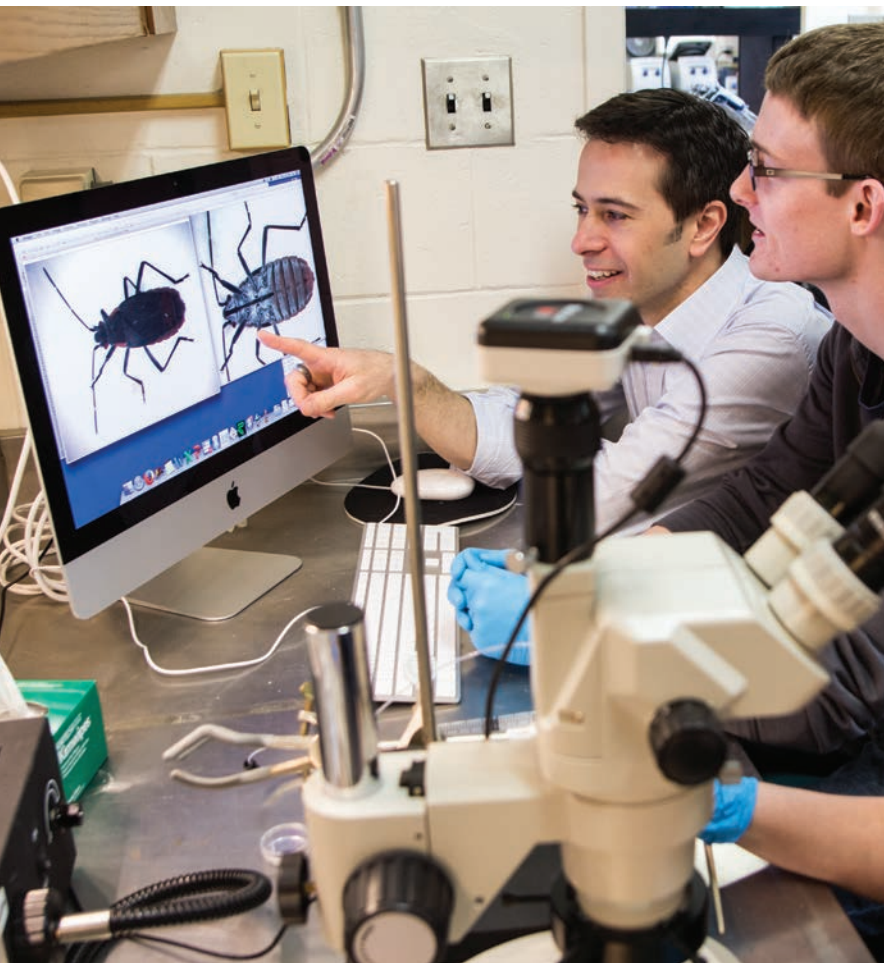
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David Angelini explains the soapberry bug to student researcher Will Simmons '17.

Delving into a Bug's Secrets

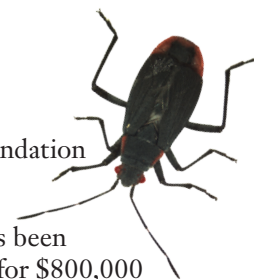


Geneticist David Angelini awarded \$800,000 research grant to study how organs are formed

Something has been bugging Colby geneticist David Angelini.

How, Angelini wonders, can a single species (in this case the soapberry bug) produce two distinctly different forms, one with long wings and one with short, that are not linked to sex? What is the genetic mechanism that causes the wings to develop differently?

"Why does it not overshoot the long form?" he asked. "Why doesn't it undershoot the short form? Why doesn't it end up somewhere in the middle? That's an open question."



And a question that the National Science Foundation wants him to answer.

An assistant professor of biology, Angelini has been awarded a prestigious NSF CAREER Award for \$800,000 (\$160,000 a year for five years) to intensify research on the soapberry bug's unusual development (wing polyphenism, in scientific terms). The project includes sophisticated genetic experiments in the lab, conducted largely by Colby student researchers. Assisting the study will be public-school K-12 students who will do field studies to see if the long-winged version has led the bug's northward expansion from Florida to Maryland.

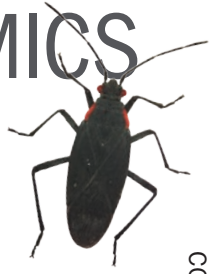
In March NSF officials announced they had selected Angelini's request for funding through the foundation's Faculty Early Career Development (CAREER) program. Angelini is the second member of the Colby faculty to win a CAREER grant; Associate Professor of Chemistry Jeffrey Katz was awarded funding through the program in 2007.

Russell Johnson, associate professor of biology and chair of Colby's Division of Natural Sciences, has served on NSF panels that evaluate proposals and said in his experience as few as 9 percent of the proposals were funded. "Seventy or eighty percent were worthy of support," he said. "A person really has to have a very convincing project."

Angelini's project is part of his career-long interest in how genes function and control the development of structures that animals have. Angelini traces his curiosity to an undergraduate class in molecular evolution that looked at genetics in a larger context. "It was this wonderful time in biology where people in development genetics started talking to people who were in ecology and evolution," he said. "It was this great synergy of the two different fields."

After graduating from St. Mary's College of Maryland, he went on to earn his Ph.D. at Indiana University and arrived at Colby in 2012. He had already developed an interest in the soapberry bug, whose life cycle appealed to Angelini's interest in both genetics and ecology. The centimeter-long black and red bug is native to South Florida, where it feeds on the seeds of a swamp plant called the balloon vine. Introduction of the golden rain tree, an ornamental plant, provided an alternative food source, and in the span of 50 years the bug had begun to produce the long-winged version of itself and started moving north. "Humans have been really good to them," Angelini said.





But how did this happen?

“We don’t have a good handle on to what degree a single bug’s wing form, whether it’s long or short, has to do with their genetics,” he said. “Is there a genetic component to their being long- or short-winged?” Or is it nutrition or some other factor?

The research at Colby, already underway, involves manipulation of genes in soapberry bugs that Angelini has collected in the field. His student researchers “knock out” specific genes in the bugs and then observe the effect that the gene has on development. In one recent instance, a group of bugs failed to develop complete abdomens after a specific gene was manipulated.

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—David Angelini

This knowledge has implications far beyond the bugs themselves. The Colby study of how genetics may regulate organ growth and cell division could have implications for human health, he said, as cancer is essentially uncontrolled cell division.

Colby students, with a full-time lab technician financed by the NSF grant, will learn the principles and practices of molecular biology research, useful for work in biodiversity or entomology but also in other science fields. “The tools that we’re using to do this are not that different from what they would use in a medical or biotech setting,” Angelini said.

In addition, he said, the public-school side of the research will involve college students interacting online with the younger students to show how scientific research works.

Angelini said he has already learned something from the process.

Just before Christmas he received a call from Steven Klein, a program director at NSF. Klein left a message asking Angelini to call. It was early January before Angelini heard the message and got back to Klein, who delivered the then-unofficial good news.

“I was floored,” Angelini said. “I’m not great at checking my voice mail. Since this episode I’ve gotten a lot better.”

—Gerry Boyle ’78



David Angelini oversees an injection administered to a soapberry bug.