



Summer Scholars  
earn pay, free room,  
even course  
credit for projects  
they propose.

# Investing in students' ideas for research

BY KAREN DOSS BOWMAN

**T**ony Adams '08 found taking on an independent study project transformed him from a fairly weak student into a regular Dean's List contender. While many students thrive in the classroom setting, some – like Adams – find more inspiration through hands-on learning opportunities in the lab. By the summer of 2007, what began as a project to monitor the physiological effects of his personal workouts turned into a full-blown research project supported by Roanoke College's Summer Scholar Program.

During his first two years at Roanoke, the senior admits that he lacked motivation and put little effort into his courses. He missed class often; his grades were well below his ability, and the seasoned runner even quit the cross-country and track teams after sustaining an injury during his freshman year. Going to college had been his expected “next step” after high school, Adams says, but he struggled to find a purpose in his studies.

“By doing this independent study and getting into research, I really started seeing a purpose in what I was studying and really enjoying it,” says the Richmond, Va., native who resumed cross country and track last year. “I guess that's really what changed things around. . . . It gave me the desire to succeed again.”

Adams' change in perspective began in the fall of 2006, when he started an independent study with faculty advisor Dr. Matthew Rearick, an assistant professor of health

and human performance. Rearick asked Adams to tinker with a newly acquired laboratory gadget – a Polar heart rate monitor – to figure out its various functions, such as measuring heart rate variance and determining calories burned and the body's nervous system response. As the pair began reviewing scholarly literature, they became interested in

an exercise science concept called “overtraining,” a condition in which the volume and intensity of a person's workout exceeds his or her capacity to recover.

With Rearick's guidance, Adams designed a research project that would measure the physical and emotional effects of overtraining. Following guidelines from the American College of Sports Medicine, the pair developed an accelerated workout plan for the experimental subjects (who included both faculty and students) and pushed

them close to overtraining, without actually sending them into that state. Each week, the subjects filled out a questionnaire that measured psychological effects, while Adams used the heart rate monitor and the metabolic cart to record physical stats. Though they did detect some psychological effects, Adams and Rearick did not attain the statistical significance needed for valid conclusions. Still, this independent project became part of the Summer Scholar Program, and the project continues with another round of experiments during spring semester. Even so, Adams says hands-on experiences like this are the best way for him to learn.

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“... doing that gave me a much greater understanding of all that I have studied in class. You understand it [better] because you've seen it happen. It definitely puts you on a different level.”

— Tony Adams '08, a senior from Richmond who has continued working on the project he did last summer

*Although their summer project has ended, Dr. Matthew Rearick (center) is still working with senior Tony Adams '08 on research into “overtraining” and in this case how basketball player A. J. Dowell '08 reacts to an accelerated workout plan.*

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class," says Adams, who is considering graduate school and dreams of opening up his own wellness center. "You understand it [better] because you've seen it happen. It definitely puts you on a different level."

Roanoke's Summer Scholar Program, established in 1994, emerged as a response to the faculty's persistent call for the College to provide more research opportunities for students in all academic programs. Each summer it supports a maximum of 13 scholars, who each receive a \$2,500 stipend, a free room on campus and course credit for devoting at least eight weeks to their research. The scholars are selected on the basis of their project proposals and academic records, says program coordinator Dr. Curt Camac. Additionally, the students must write a paper – or produce a collection of creative works, in the case of the fine arts – and present their final results in a session held each fall during Family Weekend.

For the past few years, the Summer Scholar projects have involved students in disciplines across campus. Recent projects include a look at how some classic children's stories originated as stories for adults; a collection of original, computer-assisted compositions; a study of the human rights records of countries trying to get into the European Union, and even an analysis of the mathematics of a tennis serve.

Each year, several Summer Scholars are invited to present their research at conferences off campus, Camac adds. Two recent students have been invited to present their posters at the Undergraduate Research Poster Session on Capitol Hill, sponsored by The Council of Undergraduate Research. Overall, about 60 students from across the nation are invited to this event, which gives them the opportunity to showcase their work to federal legislative officials. In 2005, **Hanan Dahche '05** presented the work she'd done at NASA at the Poster on Capitol Hill event, and the year before **Pamela Armata '04** had highlighted her work called "Prisoner's dilemma in parallel." Traveling even further, **Mason Vines '06** and **Christopher Smith '07** presented their summer scholars projects at the 2005 International Workshop on Frequency Assignment Problems in Siena, Italy. **Jeremy Stegall '09**, a junior from Fieldale, Va., worked

last summer with associate professor Dr. Gary Hollis on the synthesis, purification and characterization of a highly fluorinated dendrimer, a term describing any large, highly symmetric molecule. "He's making a molecule that no one on the Earth has ever made before," Hollis explains. Stegall learned new scientific techniques, such as silica gel chromatography and nuclear magnetic resonance (NMR) spectroscopy, and gained experience with various lab instruments.

Although Stegall participated in the program following his sophomore year, when he'd only taken two semesters of major chemistry courses, he thrived in the research environment and continues working on the project. Now that

he's immersed in his junior-level chemistry courses, the information is starting to click, he says. That intersection of classroom theory and hands-on application is one of the positive outcomes the program, Hollis says.

"The students see that the science they're learning in the classroom has practical applications. It's a *doing* of science," Hollis says. "When students

have a research project that they're working on, they find out that you have to try different things and see what results you get, alter what you tried last time – it's real science."

**Amanda Smolinsky '08**, a senior biology major from Fredericksburg, Va., presented the results of her 2007 Summer Scholar experience at the fall meeting of the Mid-Atlantic Regional Conference of Undergraduate Scholarship (MARCUS), held at Sweet Briar College. Her project, which involved experimenting with zebra fish, was a part of an ongoing study being conducted in assistant professor Dr. Christopher Lassiter's laboratory.

Lassiter's research examines how hormones, specifically testosterone, are used in zebra fish embryos. One of his earlier student assistants had identified the testosterone receptor (known to biologists as the "androgen receptor") and mapped out its normal expression. Smolinsky's project was to study the impact of chemicals on the gene and track how those effects would be expressed in zebra fish embryos that were treated with vinclozolin, a fungicide that is used on crops and golf courses. She determined that vinclozolin antagonizes the gene, preventing it from functioning normally.

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*Dr. Rama Balasubramanian, on right, is faculty advisor for Jake Bennett '08, a double major in physics and mathematics. Jake did a Summer Scholar project on "the mathematics of a tennis serve" in 2005 and has since received several national awards and spent last summer in research at Cornell University. He plans to pursue a Ph.D. and a career in physics research.*

"We found really high concentrations of the gene in the fish," Smolinsky explains. "The research shows that the body isn't capable of using testosterone because vinclozolin is binding to the androgen receptor in the place where testosterone would [normally]. So the body isn't picking up the signals from testosterone, and it's trying to compensate by making more of the gene."

Considering that the gene sequence in fish is nearly identical to that of humans, the implications for the human impact of chemicals in water or food may be significant, Lassiter and Smolinsky explain. "If the genes are so similar, then the effects we saw in fish are going to be similar to what's going to happen in humans as well," Smolinsky says.

Through their summer research experiences, students Adams and Smolinsky say they learned how to design and carry out experiments and to read scientific literature. These days, they are continuing the research on their own, with guidance from faculty Rearick and Lassiter, who both came to Roanoke College in part because they wanted to have

close interaction with their students.

"The mentorship aspect of the Summer Scholar Program is fantastic," Lassiter says. "The relationships that you get to develop one-on-one with the students when you're working with them in the lab over the summer, I think, helps them grow as scientists – and it helps me grow as a mentor."

In the case of Adams, it has been especially rewarding for Rearick to observe his student becoming energized and excited about his research project – and about learning. He thinks the summer research experiences are ideal for talented students who, like Adams, get pegged as "unmotivated" primarily because they are searching for direction for their academic studies.

"It's not like I'm plugging Tony into some project that I've already got started," Rearick says. "This is his baby – they're his questions. It's what he wants to do, and thankfully, we have the means to make it happen.... It totally changes the motivation and work ethic of the student." •