

SEA URCH



HINS

MIGHT HOLD KEY TO SKIN CANCER CURE

BY SUSAN McDONALD



Nikki Adams

BIOLOGIST NIKKI ADAMS DELVES BENEATH THE OCEAN'S SURFACE FOR CLUES

Spiny, purple sea creatures the size of your palm may someday lead scientists to a cure for skin cancer.

That's what Nikki Adams and her student research assistants hope to discover with the experiments they are conducting on sea urchins at the Cal Poly Pier at Avila Beach.

Sea urchins, it appears, produce eggs that contain natural sunscreens. The students and Adams want to find out how these sunscreens protect the eggs and embryos.

Biology Assistant Professor Adams came to Cal Poly in 2002 with a wealth of experience in the field of marine biology, including a National Institutes of Health postdoctoral fellowship to study the molecular effects of sunlight on sea urchins at UC Santa Barbara.

Experience isn't all she has brought to Cal Poly, though. Adams, 40, also has an enormous talent for grant-writing. Since her first year on campus, she has helped

acquire more than \$650,000 in grants for marine science programs, faculty support, and equipment, including a \$375,000 National Science Foundation grant for the sea urchin project.

"The NSF grant is a wonderful example of Nikki's contributions," said College of Science and Mathematics Dean Phil Bailey. "It's a testament to the quality of her research program and her ability to involve students in serious and productive ways."

The aquatic stars in Adams' universe are the sea urchins – echinoderms – or creatures with "spiny skin" found in the water around the pier. Because of their prickly appearance, they're also called "hedgehogs of the sea," Adams said with a grin. But it's not their looks – nor their spines – that interest her. Her focus is on the eggs the females produce.

EGGS AND EMBRYOS

In nature, sea urchin eggs are spawned in the ocean and as embryos, can be exposed

to sunlight for many months. The researchers have found a correlation between ultraviolet exposure and damage to vulnerable embryos. "The sea urchins are model subjects for our work," Adams said. "We can spawn them easily, and when we spawn one, we get millions of eggs."

Out at the pier, graduate student Grace Goschke demonstrates how it's done. She injects a female sea urchin with potassium chloride, then sets the urchin on top of a small glass beaker of sea water. Within minutes, the animal begins expelling streams of yellow ooze – millions of microscopic eggs.

After the eggs are collected, the students "wash" them, apply chemicals, and then fertilize them with sperm collected from male sea urchins. Then they expose the fertilized eggs to various levels of ultraviolet radiation and measure how the radiation affects cell division. "We know development of the embryos is delayed," Goschke said. "We want to know why."

CREATING A PEERLESS PIER FOR MARINE SCIENCE RESEARCH

At about three-quarters of a mile in length, the Cal Poly Pier in Avila Beach is the longest steel-and-concrete pier on the West Coast.

But size isn't the only thing that makes it so impressive.

"This pier offers everything," said Tom Moylan, manager of the pier, "from its location just 15 minutes from campus to its stability in the ocean (no one gets seasick). We have water, power, computers linked to campus. It's a fantastic place to work."

Plus he gets to share it all with his wife, Nikki Adams, biology assistant professor and marine science researcher.

The two are doing their best to turn the former Unocal Pier into a nationally acclaimed marine science center.

Unocal donated the pier, valued at \$18 million, to the College of Science and Mathematics in 2002 for use as a marine science education and research center.

In addition Unocal donated \$4.5 million to endow two marine science professorships and to fund endowments for operations and maintenance. Assistant Professor Mark Moline and Professor Emeritus Tom Richards were the first Unocal Professors of Marine Science.

One major project in the works is a flowing seawater system. Partially funded by a \$200,000 National Science Foundation grant co-authored by Adams and Moline, the 1,500-square-foot laboratory will include a seawater distribution system and will house aquaria for student experiments.

The college is seeking additional funding for the project, which will expand research and teaching opportunities.

"The pier is a great place for senior projects," Moylan said. "By the time our students head to grad school, they're at least a year ahead of students from other places."

Biology senior Michelle Parker likes the fact that she's learning in a natural setting. "Sometimes in a lab, you forget what it's like in the ocean – what these animals go through with predators and the changing environment. The ocean's not forgiving. In the lab, they're just animals in beakers." ■



(Left to right): Brian Wenzel, Nikki Adams, Jessi Kershner, Grace Goschke and Michelle Parker

The students also conduct experiments in a lab on campus. The lab-pier combination is important because it allows students to test techniques in a controlled environment before taking their experiments outside.

Goschke puts in a great deal of time at the lab studying the molecular composition of the embryos. "It's really nice to come out to the pier," she said. "It gives you the big picture. Most everything I do has to do with little, teeny bits."

At the pier, the researchers measure sunlight exposure on the sea urchin embryos.

"We expose them and take different time-points in light," Goschke said. "Then we look at the proteins in the cells to see which protein is activated to make the cell cycle stop."

A similar occurrence is found in human skin. Ultraviolet radiation causes damage to DNA, and that can cause mutations – like cancer – in the cells. "We want to know which protein controls the cell cycle and which protein is activated in response to DNA damage," Goschke said. "There are many different proteins. We're looking for the ones that can help cure skin cancer."

YOU ARE WHAT YOU EAT

What sea urchins eat also affects the amount of sunscreen compounds their eggs produce. "We found that by feeding

urchins different diets, we could get eggs with higher or lower amounts of the sunscreen compounds," Adams said.

Don't count on a similar ingestible sunscreen for humans, though. "We tested it on mice and other mammals and found they can't acquire it through diet," she added. "Some Australians are looking at whether it's something the skin can absorb."

The research team includes Goschke, a 48-year-old mother of three who returned to Cal Poly to earn a master's degree to teach high school science; biological sciences senior Michelle Parker, who plans to earn a Ph.D. and "run a lab like this someday;" Jessi Kershner and Laurie Gay, both applying to graduate school; and Brian Wenzel, a senior ecology major and the team's only male.

Adams recruited the team of students from her upper-division biology classes, where female students outnumber males 2-to-1. She's encouraged by what she sees as a consistent increase in women entering science programs.

"There were far fewer women faculty and students in marine science when I was an undergraduate," she said. "I was fortunate to have wonderful mentors who encouraged me to study math and science at an early age. I believe a key to success is to have positive role models. I hope that's what my students see in me." ■