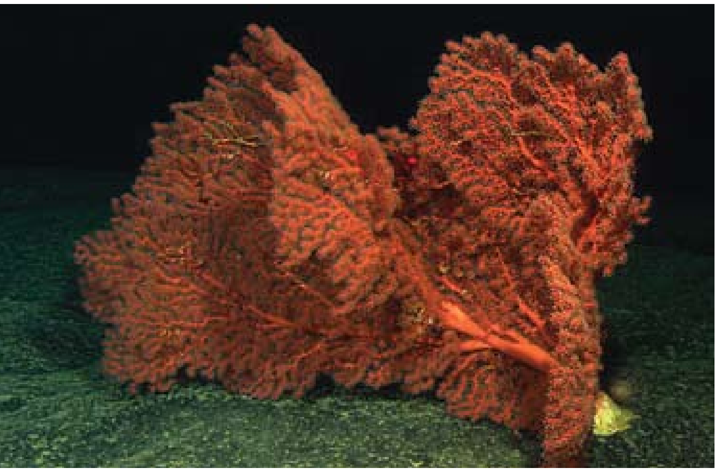
RESEARCH

Into the Dark

Researchers shine a light in an unexplored world • *by Sarah Spell*

LAURE CORBARI

Dr. Scott France and graduate students Jana Thoma and Eric Pante take a closer look at freshly collected bubblegum coral. The trio, on board the F. G. Walton Smith, used a remotely operated submersible, the Global Explorer, to collect samples at a depth of almost 4,600 feet in the Bahamas.



DEEP ATLANTIC STEPPING STONES SCIENCE PARTY, IFE, URI-IAO, AND NOAA

A colony of *Paragorgia* grows more than a mile below the surface of the Atlantic Ocean, southeast of Cape Cod, Mass. *Paragorgia* are also called bubblegum corals, because of their sometimes pinkish color and lumpy texture.

THE DEEP. It is a place inhabited by fantastic creatures: fish with see-through heads and multi-directional eyes, giant sea spiders, polka-dotted squids. The ocean floor has its own geography, undersea mountain ranges and volcanoes, sloping hills, canyons and trenches. A seemingly infinite variety of corals occupy the seascape.

Branches of flamingo-colored corals reach out like gnarled, arthritic fingers. Corals that look like earthly fringe trees bear a profusion of frilly, lavender blossoms on dark, delicate stems.

Yet, corals are not rocks or plants. They are living animals.

"It's a Dr. Seuss world down there," observed Dr. Scott France, a UL biology professor. He and three graduate students, Mercer Brugler, Eric Pante and Jana Thoma, are pioneers in one of the world's last frontiers.

"We are explorers, going places where no one has gone before and finding new species," said France.

The oceans are vast, covering more than 70 percent of the earth's surface. The sea is dark, deep, cold and highly pressurized. Using even the best available equipment, submersibles called remotely operated vehicles or ROVs, fitted with lights and cameras, scientists can only explore a tiny bit of the deep sea at a time. According to the National Oceanic and Atmospheric Administration, 95 percent of the world's oceans remain unexplored.

France, Pante and Thoma recently got a glimpse of that world. They spent 18 days in March aboard a research vessel, the F. G. Walton Smith, collecting corals in the previously unexplored waters of the northern Bahamas. Guided by scientists on board the ship, the ROV Global Explorer combed the ocean floor more than a mile deep, collecting sea life and capturing high-definition video. France, chief scientist for the mission, acquired a $715,500 grant from NOAA for the expedition. Scientific teams from other institutions also participated.

There are only a handful of deep-sea ROVs available worldwide for scientific research. So, for marine biologists — especially students — the chance to study at sea is both rare and valuable. "If I'm training students for the future, I don't want them to wait for the future to have this kind of experience," France said.

Pante has participated in three research cruises. They took him to the North Atlantic Ocean; southwest Pacific Ocean, near

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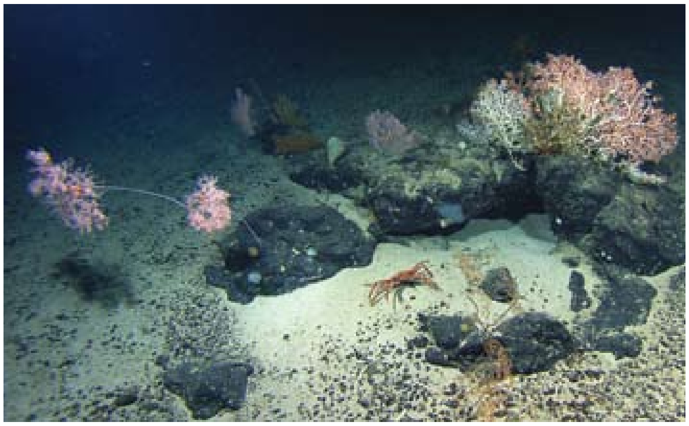

MITS RESEARCH GROUP IFE, AND NOAA

Top: UL Lafayette researchers collected a fragment of this colony of *Iridogorgia magnispiralis* off the coast of New Jersey in 2005. The sample was used to describe this new species. Center: *Metallogorgia melanotrichos* takes its name, in part, from its metallic sheen. A brittle star, a close relative of the starfish, clings to the coral's inner branches. Bottom: A deep-sea red crab rests in an undersea garden of corals.

New Caledonia; and the Bahamas, in the Atlantic Ocean.

He said finding animals in their natural setting adds an important dimension to research. "Material is very different when it has been sitting in ethanol for months or years. It's colorless, it's retracted, it's wrinkly. So, it's very interesting to see the animal when it's freshly collected, when it has all of its colors."

Pante is poised to do something some young scientists only dream of — name a new species. During the expedition in New Caledonia, he discovered a coral with branches like golden lace. He's writing a scientific paper that will both describe and name the newly found coral.

Binomial nomenclature — the formal system of naming species — has given living creatures some memorable monikers. There are spiders named for comedian Stephen Colbert and for actor/director Orson Welles; a jellyfish named for rocker Frank Zappa; and a narrow-waisted wasp whose name pays homage to Elvis Presley, *Preseucoila imallshookupis*.

It remains to be seen whether the name of Pante's coral will be frivolous or formal. What's more important, says France, is the training Pante is receiving.

"Many people, including myself, may discover a new species, but then send it on to an expert in the field who gives it a name. Eric is training to become one of those experts. So, the process of describing and naming a species is an invaluable experience that goes far beyond classroom training."

Grad student Mercer Brugler has studied corals on the sea floor in a manned submersible and is also describing a new species of coral.

France is not surprised by those achievements. "I fully expect all of my students to have described new species by the time they complete their studies."

The odds are good that Jana Thoma will also make a discovery. A pair of New Zealand biologists have calculated that 50 percent to 100 percent of the samples collected in previously unexplored areas turn out to be new species. But figuring out whether a species is truly new cannot be determined at sea; it requires time-consuming detective work in the laboratory.

Just because specimens look alike doesn't necessarily mean they are related. Likewise, species that are far apart genetically may have some of the same physical characteristics. So, in addition to looking at physical traits, France and his team also use DNA analysis and comparison.

Thoma, Pante and Brugler carry out the painstaking process. First, DNA is chemically extracted from the coral. Then, a particular gene is isolated in the DNA and that gene is copied, perhaps millions of times, to ensure that there is enough sample material available.

The DNA material goes through another series of chemical reactions, which yield a final product that can be read by a DNA sequencer. Now, the genetic material can be described as a unique pattern of four chemical bases. But researchers still can't know whether they are looking at a new species.

"Once we have the DNA sequenced, there are hours and hours of editing and running various kinds of software to analyze that," France said. "As you collect new species, you have go back and compare each of them to everything that came before."

The National Center for Biotechnology Information maintains a DNA sequence database; however, that database is incomplete, because the DNA of all known species in the world has not yet been sequenced. So, "finding a match does not necessarily mean that we have found a new species," France said.

It's a process that can leave scientists with lots of unanswered questions. France and his students are also trying to find out how species are related and where they are found.

"One of the things that genetics could allow you to do, if you were looking at the right genetic marker, is to be able to take it further and say, 'Are these corals that we're looking at isolated to specific places? Are they only found in that canyon? Are they only found on that seamount?' Ultimately, those are the kinds of questions we would like to be able to answer," France said.

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Bone Structure

Tissue engineer builds new framework for cell growth

CRAWFISH, CRABS AND SHRIMP — they're not only tasty staples on Louisiana tables, they're also potential ingredients for replacing bone through tissue engineering.

UL Lafayette's Dr. Wah Wah TheinHan is a physician and research scientist working in the Biomaterials and Biomedical Engineering Research Laboratory. The lab is part of the Center for Structural and Functional Materials within the Department of Chemical Engineering.

TheinHan's work begins with a substance called chitin. Translucent, flexible and tough, it is the basis of insect exoskeletons and crustaceans' hard shells.

Proteins and calcium are chemically removed from the shells, turning chitin into chitosan, a substance that is proving useful, especially in biomedical applications. For instance, it is used in battlefield bandages that stop hemorrhaging within seconds. Non-toxic and non-allergenic, with anti-fungal and anti-bacterial properties, chitosan also has the ability to rapidly clot blood. Because chitosan molecules carry a positive electrical charge and human DNA is negatively charged, they have a natural affinity for one another. Chitosan is also biodegradable, so it is eventually absorbed by the body.

TheinHan is using chitosan to build a three-dimensional framework, or scaffolding, for a substance that could eventually replace bone in the human body. "Natural bone is a composite of both organic and inorganic materials," said TheinHan. She combines chitosan with nanohydroxyapatite, a form of calcium phosphate that is created, atom by atom, in the lab. "We are trying to mimic the bone, to make this nanocomposite material as close as possible to natural bone."

TRAVIS GAUTHIER

Dr. Wah Wah TheinHan uses chitosan, a byproduct of crustacean shells, to help create bone-replacement material.

The scaffolding is freeze dried, so that all moisture is removed. TheinHan then places small sections of the scaffold in a Petri dish and adds a broth of special cells and nutrients. The cells are "preosteoblast cells from mice," she explained. These are early-stage cells, which, if left in the mouse, would become bone cells. It takes about a month for the scaffold and cells to become engineered tissue.

TRAVIS GAUTHIER

For decades, researchers have recognized the value of chitosan, but it has one major drawback: it is not as strong as bone. So, TheinHan is trying to find the right combination to create the ideal scaffolding material, one that equals the strength of natural bone and also serves as a fertile medium for growing cells.

TheinHan compared the growth of cells on the nanocomposite scaffolds she developed to that of cells grown on scaffolds made of pure chitosan. After seven days, there were 150 times more cells growing on the nanocomposite material. The results of the study, which TheinHan co-wrote with Dr. Devesh Misra, director of the Center for Structural and Functional Materials, were published in the scientific journal *Acta Biomaterialia* in December.

TheinHan is also exploring the use of chitosan to heal wounds and deliver drugs to specific sites in the body.

Nest Success

National Geographic takes note of pelican preservation effort

SCOTT T. WALTER IS EARNING HIS PH.D. the hard way, spending four months a year beneath the blazing sun on barrier islands in the Gulf of Mexico. He is studying the nesting grounds of Louisiana's state bird, the brown pelican. His efforts caught the attention of *National Geographic* magazine, which plans to include an article about his work in its August issue.

Walter said his job is both challenging and rewarding. Befuddled brown pelican chicks snap at him with their hooked beaks as he helps tag and relocate them to potential nesting grounds. For three weeks, he feeds them fish by hand, slinging hundreds of pounds of pogy into their gaping mouths.

After Hurricane Katrina laid waste to the Louisiana coast, funding began to flow from Washington, D.C., to learn more about the impact of hurricanes on coastal saltwater ecosystems. The University of Louisiana at Lafayette, in collaboration with the U.S. Fish and Wildlife Service and the Louisiana Department of Wildlife and Fisheries, began a $200,000, multi-year study in 2006 to explore ways to help ensure the survival of brown pelicans in an environment vulnerable to powerful storms. Dr. Paul Leberg, a biology professor, directs the ecology and conservation research aspects of the study.

Walter works on the Isles Dernieres, "the last islands," Louisiana's western-most barrier island chain, about 75 miles southwest of New Orleans. "Almost half of all the brown pelicans in Louisiana are nesting in my study site, so if a really strong hurricane comes over that region . . . that could wipe out a large portion of the Louisiana population," he said.

Of the four islands, only two are nesting grounds. Brown pelicans built about 5,500 nests last year on Raccoon Island and another 500 on Wine Island. Walter is trying out two management techniques to encourage the birds to spread out a bit: moving young, still flightless birds to Whiskey Island; and setting out pelican decoys on Trinity Island, hoping to attract adult couples looking for a suitable place to nest.

The study seeks to answer an important question: Will adult birds make their nests on the island where they were born, or the island where they first took flight?

"Brown pelicans have strong fledge-site fidelity," explained Walter. They have a tendency to return to the area where they "fledged," that is, left the nest. Walter is moving the young birds about six miles from their birthplace; the study will reveal whether translocation is an effective way to create new coastal colonies.

Until now, biologists have studied pelicans from the air. Walter says his work is "on a finer scale." He and an assistant comb the islands' beaches, monitoring 300 nests and documenting them with digital photos.

KYLE PATTON

KYLE PATTON

Scott T. Walter holds a nine-week-old chick.

"It's a very laborious process of using photo plots. To see into the colony, I drag around this enormous ladder all summer. I have stakes in the sand, so I know exactly where to put the ladder, so that my photos line up every time I'm surveying the nests."

The study is now in its third year. So far, Walter has helped place identification tags on 1,000 birds; 500 more will be tagged this season. Each of the birds is banded and has a blood sample taken. This year, the researchers achieved a biological first, determining the gender of the birds through those samples.

Twice a week, Walter looks for the banded birds, recording their movement patterns. "The survey will tell us whether there are any differences in movement patterns by gender."

Because brown pelicans take three years to reach reproductive maturity, the researchers won't be able to fully measure the success of their efforts until next year, when the first batch of translocated birds returns to the area to nest.

Walter is on track to earn his doctorate in May 2011, so he'll be able to see the project through to its conclusion. He says he hopes all the hours spent in the Gulf will pay off for the brown pelican.

"These islands are being degraded rapidly, so the sooner we can establish more populations, the more likely it will be that we have a total population of birds that is more spread out and less susceptible to any one storm."