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Cover Story

## The Quest for Drug Discovery

**Coral reef organisms in Fiji may hold cures to cancer and other diseases.**

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by Jane M. Sanders

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**T**HE SPECIES-RICH CORAL REEF along Fiji's coast hosts a battle between chemically defended organisms and the predators, competitors and pathogens that attack them. This natural struggle may yield unique compounds to fight cancer, the HIV virus and other diseases.

Researchers from the Georgia Institute of Technology are analyzing extracts from about 200 marine plant and invertebrate animal samples they collected from the Fijian coral reef in June 2004. The [National Institutes of Health](#) is funding the project, which also includes environmental conservation and economic development initiatives to benefit the Fijian government and villages that own their local natural

courtesy of Julia Kubanek



resources.

“We believe these organisms might yield drug

molecules because marine organisms make molecules for their own purposes that we might co-opt for our own use as pharmaceutical agents,” says Julia Kubanek, a Georgia Tech assistant professor of biology, chemistry and biochemistry. “The organisms’ purposes include defense against predators, the ability to fight diseases, and the production of chemical

photo courtesy of Mark Hay



Researcher Julia Kubanek and her colleagues collected baseball-sized samples of Fijian coral reef species that exhibit unusual growth and/or behavioral phenomena. Among their collection were soft corals, marine sponges, slugs, and green, red and brown seaweeds. ([300-dpi JPEG version - 760K](#))



Top to bottom: A mushroom coral, *Sarcophyton* sp.; a marine bryozoan, *Reteporellina* sp., and a green seaweed, *Valonia utricularis* – all from Fiji – are some of the samples that scientists are examining for potential pharmaceutical use.

[\(300-dpi JPEG version - 458K\)](#)

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cues, such as those used for sex recognition.”

With the permission of the Fijian government and local resource owners, researchers led by Professor Mark Hay collected baseball-sized samples of reef species that exhibit unusual growth and/or behavioral phenomena. Among their collection were soft corals, marine sponges, slugs, and green, red and brown seaweeds. Back in the lab, researchers tested extracts from the specimens against a battery of pharmaceutical drug targets.

To date, researchers have discovered 10 new molecular structures in a species of red seaweed. Some of these chemical compounds showed the potential to kill cancer cells, bacteria and the HIV virus. In fact, two of the new compounds exhibit anti-bacterial activity towards antibiotic-resistant *Staphylococcus aureus* at concentrations worth pursuing, Kubanek notes. Researchers don't know yet whether the required concentrations of these compounds would be harmful to humans.

“We're only at the test-tube level so far,” Kubanek explains.

“The next step is to discover how these compounds work and

then to study them in a more complex model system.”

The U.S. pharmaceutical company Bristol-Myers Squibb is collaborating with researchers to determine how some of these 10 compounds kill cancer cells. Meanwhile, Georgia Tech has filed a provisional patent to protect the discovery of these structures and small variations of them.

“These molecular structures are curious in the way carbon atoms are attached,” Kubanek explains. “It's very unusual. They represent a new category of organic molecules. It's exciting as a biochemist to observe that living organisms have evolved the ability to synthesize such unique and exotic structures compared to other molecules typically produced by seaweeds.”

The source of these new molecular structures is a red seaweed collected from four Fijian sites. Among the sites, researchers found variations in the molecular structures produced by the species.

“There are chemical differences among populations of this seaweed species, even though two of the sites where it was collected are only about 2 kilometers apart,” Kubanek notes. “... This shows us there are small, but valuable differences within species, and this genetic biodiversity is important to protect as a resource for the future.”

Much research is left to do before any of these compounds are used to formulate a drug available on the market, Kubanek says. It typically takes at least a decade from the discovery of a compound to the marketing of a new drug. If that does happen in this case, Fijian villagers and the Fijian government would benefit financially from the discovery because of an

agreement that is already in place, she added. Because of the long timeframe in getting a drug to market, the project in Fiji provides other immediate conservation and economic development benefits to villagers and the government.

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