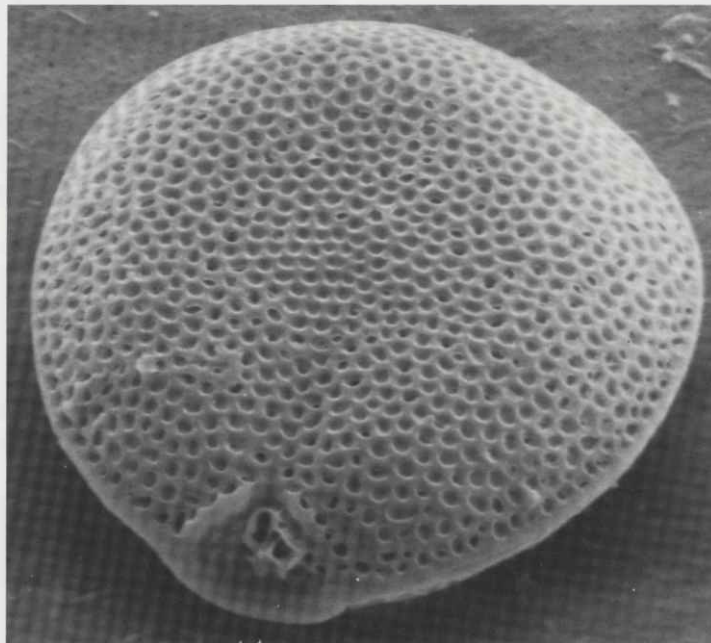


# NATURAL TOXINS in the FOOD CHAIN



*Prorocentrum concavum*

BY JAN McCOY

**W**hen he talks about his research, Douglas Park often starts with the 1981 newspaper story, "Death at the Dinner Table."

A restaurant owner in San Juan, Puerto Rico, was under attack by patrons who claimed the fish he served was harmful. To prove them wrong, the man prepared a meal of freshly caught barracuda, ate it—and died.

The restaurateur died from ciguatera, poisoning caused by a natural toxin produced in microscopic algae called dinoflagellates. Tropical reef fish that feed on the dinoflagellates apparently are unharmed, but humans who eat toxic fish become

seriously ill. More than 400 species of fish are reported to be associated with ciguatera outbreaks. And although outbreaks have been recorded as far back as 1555 A.D., no rapid, reliable test for the toxin exists.

Park's food toxicology research group at The University of Arizona department of nutrition and food science is studying the chemical properties of the toxin and how it is transferred to fish. The ultimate goal of the research is to develop a way to test for the toxin in fish.

Park says ciguatera is the most common disease and non-bacterial food poisoning associated with the consumption of fish in the United States and its territories. Studies

estimate 10,000 to 50,000 persons who live in or visit tropical and subtropical areas suffer from ciguatera each year.

Park grows large quantities of the toxin-producing dinoflagellates, called *Prorocentrum concavum*, in his laboratory. The organisms are harvested, and the toxin is extracted and evaluated.

"We know the ciguatera toxin is absorbed by fatty tissue," Park says. "This turns out to be a big problem for humans with ciguatera because the toxin stays in the body. Symptoms can last for days, weeks, even years, depending on the individual."

Ciguatera affects the cardiovascular, gastrointestinal and neurological

systems of the body. The most distinctive features of ciguatera are severe itching, reversal of the hot and cold sensation, and tingling and numbness of the extremities. The symptoms are exacerbated by alcoholic beverages, which draw the poison from fat cells.

Species most commonly involved in ciguatera outbreaks include amberjack, red snapper, barracuda, grouper, surgeonfish, jack, moray eel, sea bass and Spanish mackerel.

"Not all of the areas of the Pacific or tropical waters contain toxic fish," Park says. "Fishermen learn to stay away from certain areas that are problems. But fish don't always stay in the same place. A toxic fish that moves into a non-toxic area has a greater chance of being caught and offered on the market. We need to have a method to test individual fish."

*The most distinctive features of ciguatera poisoning are severe itching, reversal of the hot and cold sensation, and tingling and numbness of the extremities.*

The type of method Park's group is working on is called an immunochemical assay.

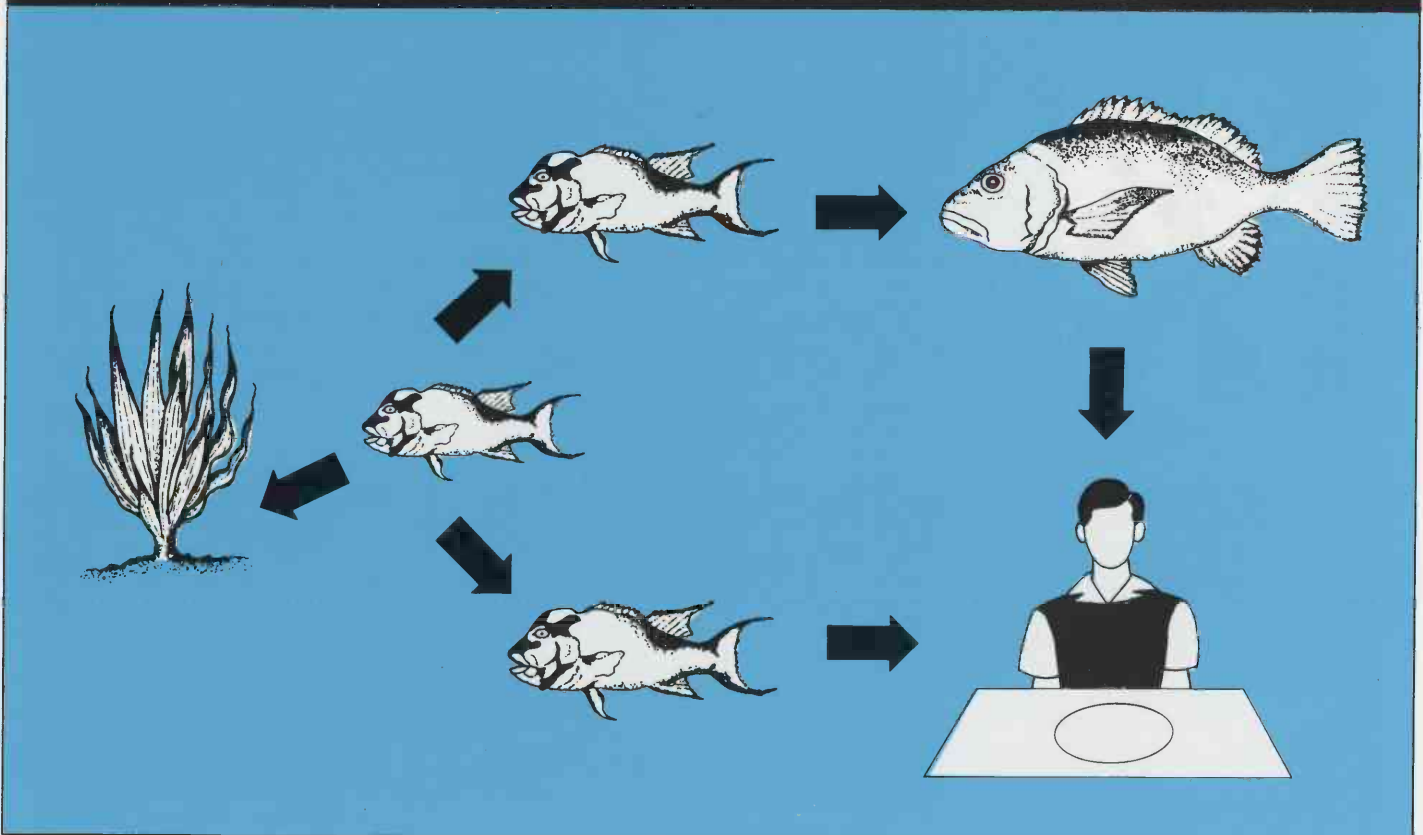
A small amount of the toxin is injected into a mouse or rabbit, which produces an antibody against the toxin. The inside of miniature, glass wells then are coated with the antibody. When a test solution containing the toxin is added to the wells, the antibody binds to the toxin, creating a color change indicating the presence of the toxin.

Park supplies a commercial producer of assay systems with purified ciguatera toxin and is working with the company to develop a ciguatera assay.

The same type of test is used to detect aflatoxin, another natural toxin produced by mold that infects cottonseed, corn, ground nuts, peanuts and tree nuts.

*(Continued on next page)*

## THE CIGUATERA CYCLE



Tropical reef fish are unharmed by eating the toxin-producing algae, but humans who eat toxic fish become seriously ill.

HECTOR GONZALEZ

Park field-tested the first aflatoxin assay kits produced by commercial manufacturers, making sure the tests worked outside of the laboratory.

Human exposure to aflatoxin can come from two sources, direct consumption of the product or consuming products from animals exposed to aflatoxin.

"Here in Arizona, cottonseed is the biggest problem," Park says. "Arizona has many dairies and dairy cows love to eat cottonseed. Milk turns out to be a major commodity that can contain aflatoxin."

The state has a problem with aflatoxin in cottonseed every year, but not all areas are affected, and the toxin shows up in different locations

each year, Park says. Because of this, all Arizona cottonseed now is tested for aflatoxin. Fortunately, aflatoxin can be deactivated with ammonia, which chemically alters aflatoxin molecules. Ammonia treatment has been used in Arizona since 1980. Arizona is one of six states that permit the use of ammonia to reduce aflatoxin.

Park moved his food safety research to the UA in 1987 after 13 years with the U.S. Food and Drug Administration. At the FDA, his work focused on food safety issues, policy, programs and research.

When asked about doing seafood research in the middle of the desert, he says: "Anybody, anywhere in the

world can have ciguatera poisoning, because fish are shipped all over the world. We have fish on the market here in Tucson from species that have been implicated in ciguatera poisoning. Your chances are relatively good that the fish are safe, but there is no way to test them yet. Until there is, you're taking a chance."

Contact Park at the UA department of nutrition and food science, Shantz Building, Rm. 421, Tucson, Ariz., 85721, (602) 621-5107.

*Merle Jensen, College of Agriculture assistant dean for sponsored research, has first-hand knowledge of ciguatera poisoning. He and his wife were poisoned while visiting the Caribbean seven years ago. He tells the following story:*



HECTOR GONZALEZ

Late in March 1983, my wife, Sharon, and I traveled to the small island of Anguilla in the Caribbean, where I was to advise a retired veterinarian on greenhouse vegetable production. During our stay, we took time to go on a fishing trip where we caught a number of fish including a beautiful jack. That evening, we bar-

becued the jack and prepared a wonderful gourmet fish soup that included the head of the jack for flavoring. The meal was sheer delight.

Early the next morning, we woke up to severe nausea, diarrhea, painful joints and shortness of breath. We also had tremendous itching on the bottom of our feet and on the palms of our hands. For Sharon, hot drinks felt cold, while others who had attended the dinner party experienced the above symptoms plus severe chest pains. We had no idea what hit us, but we initially attributed the poisoning to some form of food poisoning. By mid-morning,

the retired veterinarian, was able to consult his medical library and key the disorder to ciguatera. The painful joints prevailed for several weeks, as did the itching of the feet and hands. A glass of wine, or any alcoholic beverage, only accentuated the itching and for weeks, would trigger a mild recurrence of the itching symptoms. Two members of the dinner party were hospitalized on their return to Chicago for chest pains. Another person did not recover until months later, possibly due to having the toxin already in his system, having eaten a toxic fish earlier in his lifetime.

Once we diagnosed our problem as ciguatera, we learned of a number of other symptoms from the natives of Anguilla. We heard about persons having symptoms of slowed pulse, lowered blood pressure, headaches, incoordination, blurred vision and increased light sensitivity of the eyes. In severe cases, loss of hair and nails, blindness, convulsions and coma can occur. In a small percentage of cases, death occurs from respiratory failure.

The natives were familiar with most of the species of fish and the reef areas that posed a danger of being toxic.

Since our 1983 poisoning, our veterinarian friend again was poisoned by eating a toxic fish. It nearly killed him, as the toxin from the previous experience was still within his body, intensifying with the consumption of each toxic fish.

We are often asked whether we will ever eat fish again while in the Caribbean. No way!



# Teaching the "How To's" of Pesticide Use

BY JAN McCOY



ALAN FERTIG

**S**tricter certification requirements for professional pesticide applicators in recent years created an educational demand met by The University of Arizona Pesticide Coordinator's Office.

The Environmental Quality Act of 1986 requires that pesticide applicators be certified by examination. Annual recertification is based on completion of a specific number of continuing education units.

"Before 1986, all that was needed for certification was attendance at a training seminar," says Paul Baker, the UA Cooperative Extension pesticide coordinator. "When the law was passed, we scurried to get an educational program in place for both certification and as an information source."

Baker, and assistant Gary Cramer, now conduct nearly 45 certification training courses around the state each year.

Baker and Cramer's day-long initial certification training sessions are attended by both agricultural and structural (urban) pesticide users. The morning general session covers laws and regulation; pesticide labeling; safety; the environment; and pesticide types and formulations. In the afternoon, the class is split into two groups, agricultural and structural users. Concurrent sessions include application equipment and calibration; application techniques; pest identification and other information pertinent to each area.

"We are not regulatory; our primary objective is the transfer of information," Baker says. The UA program is the only program of its kind in the state. Federal law requires Extension to be responsible for the training.

*(Continued on next page)*

Paul Baker and Gary Cramer show some of the safety equipment that should be worn by professional pesticide applicators.

The Pesticide Coordinator's Office also conducts continuing education training for pesticide applicators. In addition to being certified to apply both restricted-use and general-use pesticides, structural applicators must take 12 units of continuing education classes every two years for re-certification. The state Structural Pest Control Commission is responsible for structural examinations and en-

forcement of rules and regulations.

Restricted-use pesticides are those deemed by either the federal or state government as harmful to humans, wildlife or the environment—even when used correctly. Through certification, an applicator theoretically proves competence in handling restricted material. General-use pesticides are those chemicals that can be purchased in stores.

As of Jan. 1, 1991, the new state Department of Agriculture will be responsible for agricultural examinations and enforcement of rules and regulations. Agricultural applicators must be certified to purchase and use restricted-use pesticides. Private agricultural applicators must earn three hours of continuing education a year, and commercial agricultural applicators must have six hours a year to maintain certification.

"Arizona and California are the only two states that require annual re-certification; in most states it's anywhere from three to five years," Baker says. "Here in Arizona, if you don't get your hours of continuing education, your certification lapses and you must be re-certified."

Baker is assembling an agricultural pesticide training manual that contains the information now covered in the certification training class. He plans to develop a training manual for structural pesticide applicators as well, and supplement both with audio tapes and slides.

"The objective of all this is if you come to Arizona and want to be certified here, you can buy a manual with the tapes and slides and don't need to attend a training class before taking the examination," Baker says.

Although the majority of his office's clientele come from the agricultural and structural industries, Baker is enlarging his audience.

With funding from the U.S. Department of Agriculture through the U.S. Environmental Protection Agency, he is designing a slide and videotape presentation on pesticide use and safety for homeowners. The package will be marketed nationally. Baker also is developing a training manual for the nation's turf and ornamental industries.

"The Pesticide Coordinator's role is education; it's the bottom line," Baker says. "My job as an educator is to raise the level of professionalism in the pesticide application industry so the applicators can then take this information back to the consumer."

Contact Baker and Cramer at the UA Pesticide Coordinator's Office, 1109 E. Helen St., Tucson, Ariz., 85719, (602) 621-4012.

## Learn More About ...

### Pesticide Safety for Agricultural Workers and Homeowners

**Instructional videotapes produced by  
The University of Arizona  
College of Agriculture**

#### WORKING SAFELY WITH PESTICIDES

Tips on material safety data sheets, labels and containers, employee safety training, storage and disposal.

**Length: 18 minutes Price: \$30**

#### TRABAJANDO EN UNA FORMA SEGURA CON PESTICIDAS

Spanish language version of "Working Safely With Pesticides."

**Length: 16 minutes Price: \$30**

#### HOMEOWNERS GUIDE TO OUTDOOR PESTICIDE SAFETY

Tips on proper equipment, mixing and loading pesticides, handling spills and accidents, proper disposal and storage.

**Length: 21 minutes Price: \$30**

Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_  
State \_\_\_\_\_ Zip \_\_\_\_\_

Make checks payable to The University of Arizona and mail with this form to:

Office of Agricultural Sciences Communications  
715 N. Park Ave.  
Tucson, Arizona 85719