

“ For nations struggling with huge health problems, a simple way to detect harmful water could be a critical weapon against disease. ”

TYRONE HAYES
BIOLOGIST, HERPETOLOGIST



For biologist and herpetologist Tyrone Hayes, scientific breakthroughs don't begin and end in the laboratory. They also come from the field. Which is why, more often than not, you'll find Hayes wet, muddy, and knee-deep in an African swamp at 2:00 in the morning, the time when the frogs come out. Hayes grew up in South Carolina, and, as a boy, one of his favorite pastimes was tracking down the region's abundant turtles, snakes, and toads. That abiding fascination led Hayes to earn an undergraduate degree in organismic and evolutionary biology from Harvard University. He later received a Ph.D. in integrative biology from the University of California, Berkeley, where he currently serves as a professor.

Hayes says an interest in frog hormones, specifically those of a tiny reed frog common in Ethiopia and Uganda, sparked his interest in his current fieldwork. "Surprisingly, frog hormones are very similar, and in some cases identical, to human hormones," he says. "So what affects a frog, may also affect humans."

It was during a night in the boggy African bush that Hayes's flashlight revealed an unexpected discovery: Several members of the reed frog genus had changed color. Males, which are normally green, had taken on the reddish background and white spots of females.

Seeking to understand why, Hayes arrived at a theory: During the metamorphosis from tadpole to adult, frogs are very sensitive to changes in their environment including chemicals in the water or in their food supply. So the change in coloration indicated that the frogs' extremely thin, sensitive skin was reacting to contaminants in the water. Thousands of frogs later, Hayes and his research team have proved the theory correct. Reed frogs, indeed, serve as tiny red flags that can warn when dangerous, even cancer-causing, chemicals are present in a water source. These harmful substances may contain or act like hormones, triggering the color transformation. Contaminants include plastic by-products, pesticides in crop sprays such as DDT, and synthetic hormones such as DDS. Because they cannot be broken down during sewage treatment, the toxins flow into marshes and lakes.

"This is the same water people cook and bathe with," Hayes notes. "We've found developmental changes in tadpoles when water contains contaminants 50 times lower than what's allowed in U.S. drinking water. If chemicals in such low concentrations can impact amphibians, mammals may also be affected."

Hayes realized his simple observation can have enormous practical applications: Reed frogs could become a low-cost way to test for water pollution in developing countries. Local residents would only need to raise the frogs in questionable water sources and observe their color as adults to check for contaminants.

Hayes's findings reveal a crucial new link between conservation and health.

(<http://www.nationalgeographic.com/emerging/tyroneHayes.html>)

...On the way to San Francisco, Hayes had told me about an epiphany he'd had. When his paper on hermaphroditic frogs was published in Nature, he'd called his mom to tell her. The next day, she called back and said, "Honey, I don't want to hurt your feelings, but I went down to the Barnes & Noble and they've never heard of that magazine."

"She made me realize that the things that counted the most for me—getting tenured and published—are the least relevant," Hayes says. "Here you have this important information, but so very few people have access to it." In his new role as a public scientist, he wants to change

that. He speaks to groups all over the country and beyond—his recent favorite was the Used Oil and Household Hazardous Waste Conference.

"Look, the people who we're poisoning are our country; they're our economy. They're paying my salary. But they're not at that EPA hearing. They're not invited to any scientific conferences." So this summer, he's planning a scientific conference on atrazine that will include farm laborers and others directly affected by the herbicide.

Academics are known for narrowing their vision to a tiny field of study, but Hayes has expanded his fascination with frogs into a window on the world. "I like frogs, but amphibians are a marker," he tells the breast cancer group. "Living organisms are all connected to the environment, the water especially. We're using an animal that develops in an aquatic environment to tell us something about another animal that develops in an aquatic environment." As Hayes speaks he points to a slide of a human fetus in the womb.

"I don't know why we're continually surprised that pesticides, which are designed to take away life, create these kinds of effects," says Hayes. "It's not just that environmental health is related to public health. They are one and the same."

(excerpt from Profile: Hopping Mad, Sierra Magazine July/August 2004)