reactions. Only Daly and his colleagues at the NIH Laboratory of Bioorganic Chemistry agreed to help. "As soon as I saw the mass spectra," Daly tells C&EN, "I recognized a compound that I had worked on 20 years before, from a frog."

What Daly saw was the signature of batrachotoxin alkaloids. These unusual alkaloids are potent neurotoxins, previously found only in poison-dart frogs. Their discovery in *Pitohui* birds was reported in *Science* in 1992 (**258**, 799).

"People were stunned by that first report," says Paul J. Weldon, a research zoologist at the Conservation & Research Center of the Smithsonian Institution, in Front Royal, Va. "No one thought that birds had anything like alkaloids on them. It floored the heck out of me."

The unusual alkaloids are found mostly in the feathers, the first line of defense for birds, Weldon notes. Many predators, he observes, pluck the feathers before feeding on a bird carcass.

Chemical defense among vertebrates other than poison-dart frogs is little studied. Many anecdotal reports of toxic or unpalatable birds can be found in the literature, but no toxin had been isolated and identified other than the bactrachotoxins in *Pitohui*, and now *I. kowaldi*, birds. That the same type of toxins has turned up in two diverse organisms—birds and frogs—is "quite interesting," Daly says, but the bigger mystery is their source.

Work in Daly's lab suggests that the bactrachotoxins in poison-dart frogs are dietary in origin. But the exact source still has not been established, Daly says. It is likely that *Pitohui* and *Ifrita* birds get their alkaloids from dietary sources, too. But, he notes, "we have been looking now for the past eight years at what these birds eat. We have not discovered the alkaloids in any of the food samples."

"It's beginning to look like birds are more interesting chemically than anyone had thought," Weldon says. Researchers have assumed that the only compounds birds had on them were lipids, he explains, because work on avian natural products had been mainly on the oils birds secrete to waterproof their feathers. "I don't think anyone seriously thought about taking polar solvents and applying them to bird feathers."

Toxic birds harboring unusual natural products may be just the tip of the iceberg, Weldon says. Reptiles and mammals, too, could turn up interesting compounds. "People just have not taken the time to look at vertebrates."

Maureen Rouhi

Catalytic DNA Used To Make Lead Biosensor

In an eclectic study, a research group has combined catalytic DNA, in vitro selection, and fluorescence technologies to come up with a new type of analytical biosensor for the determination of lead ions.

Lead can cause neurological damage and other health problems in those exposed to it. The researchers believe the new biosensor could make it possible to detect and measure lead more simply and less expensively than with current analytical methods. The technique has potential applications in clinical toxicology and environmental and industrial process monitoring.

The technique was developed by graduate student Jing Li and associate professor of chemistry Yi Lu of the University of Illinois, Urbana-Champaign, with support from the National Institutes of Health [*J. Am. Chem. Soc.*, **122**, 10466 (2000)].

"This represents a new class of simple and environmentally safe sensors and is the first example of a catalytic DNA-based biosensor for metal ions," Lu says. "It combines the high metal-ion selectivity of catalytic DNA with the high sensitivity of fluorescence detection" to enable lead detection over a three-order-of-magnitude concentration range.

The researchers used in vitro selection (iterative screening, modification, and amplification) to identify a DNA oligonucleotide that, in the presence of a lead-ion cofactor, cleaves an RNA link in an oligonucleotide substrate. They labeled the catalytic DNA with a fluorescent quencher and hybridized it to a partially complementary oligonucleotide substrate that contained the RNA link and a fluorescent tag.

The quencher is close to the fluorescent tag in the bound duplex and thus suppresses its fluorescence. But in the presence of lead cofactor, the catalytic DNA goes to work, cleaving the substrate strand at its RNA link and releasing a DNA fragment carrying the fluorescent tag into solution, where it is free to glow.

The biosensor shows 80-fold selectivity for Pb^{2+} over other divalent metal ions, and it is sensitive to Pb^{2+} over a 10-nM to 4-µM concentration range.

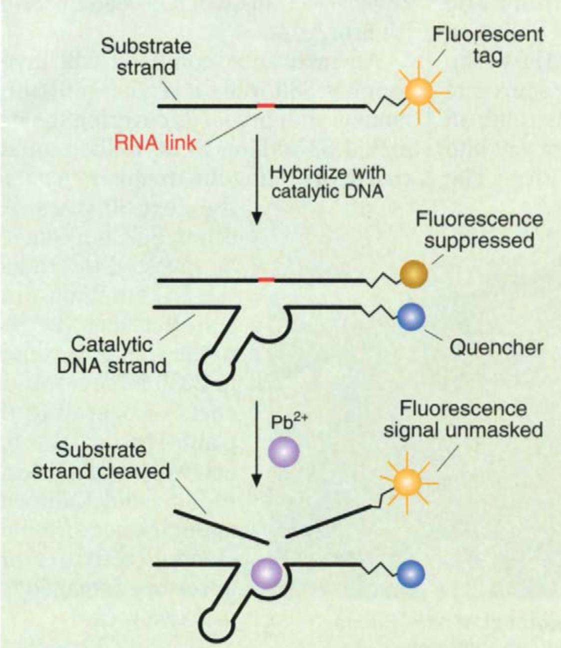
DNA- and RNA-based systems that bind metal ions or that fluoresce in the presence of small-molecule analytes have been demonstrated before. But the combination of Pb^{2+} recognition and fluorescent detection is significant and novel, says *Journal of Combinatorial Chemistry* Editor Anthony W. Czarnik, a specialist in fluorosensing.

"I'm a real enthusiast for the development of 'dual sieve' sensing molecules like these that achieve their selectivity by coupling a binding selectivity with a subsequent reaction selectivity," he adds, explaining that, "while multiple analytes may bind in the first step, only one goes on to catalyze a reaction. This is an important way in which enzymes achieve selectivity in catalysis. We need to employ this paradigm in next-generation biosensors and chemosensors, and the Lu work exemplifies it strikingly.

"I think this work could serve as the basis for real-world Pb^{2+} sensors," Czarnik notes. Whether 80-fold selectivity for Pb^{2+} in the presence of other divalent metal ions is good enough "as is" for use in practical blood lead analysis is uncertain, but "many metal ions can be sequestered selectively in the presence of Pb^{2+}. I'm bullish," Czarnik says.

In future work, Lu and

Catalytic DNA-based biosensor



coworkers hope to extend catalytic DNA-based biosensing to other metal ions. Other research groups are currently trying to design more broadly applicable systems in which binding of a small molecule to an oligonucleotide would induce catalytic activity in an adjoining structure. By eliminating the need for metal cofactor-based initiation, such systems might be capable of detecting a wide range of analytes, such as steroids and sugars.

"DNA has robust chemical stability and great potential for selective molecular recognition, and new functional DNAs can be engineered in the test tube," says associate professor of biology Ronald R. Breaker of Yale University, whose research interests include catalytic DNA. "I think it is clear that DNA and its analogs can be made to serve a role in biosensing."

Stu Borman

Superfund Mine Cleanup Assured

A new $160 million Superfund settlement will ensure that what was the largest single source of heavy-metal pollution in the U.S. will be controlled for decades.

Aventis CropScience USA is legally responsible for the cleanup, but a subsidiary of AstraZeneca plc is footing the bill.

The agreement, reached between the companies and U.S. and California agencies, addresses pollution from the Iron Mountain Mine Superfund site near Redding, Calif. Before pollution controls were imposed in 1994, the mine was the largest single source of toxic metals in the U.S., discharging an average of a ton of metals per day into tributaries of the Sacramento River. The site produces the most acidic mine drainage in the world, according to the Environmental Protection Agency.

From the late 1800s through 1963, Mountain Copper Co. Ltd. mined the site for iron, gold, silver, copper, zinc, and pyrite. EPA listed the mine as a federal Superfund site in 1983. A treatment plant built in 1994 removes 99.99% of the metals from polluted mine runoff, according to EPA.

The mine's ownership history—and liability for its pollution—is convoluted.

Stauffer Chemical purchased Mountain Copper in the 1960s, planning to mine pyrite as a raw material for sulfuric acid production, says Thomas A. Bloomfield, EPA's lead attorney in the case. Stauffer sold the mine in 1976 but still retained liability.

In 1987, Rhône-Poulenc bought Stauffer from ICI. As part of the sale, ICI indemnified Rhône-Poulenc for Stauffer's existing liabilities, which included pollution from the Iron Mountain Mine.

Aventis CropScience's parent, Aventis S.A., was formed through the merger of Rhône-Poulenc and Hoechst. This merger made Aventis CropScience legally responsible in the settlement because it is the successor to Stauffer. But Aventis is not paying the $160 million settlement.

Ponying up the money is Stauffer Management Co., says its president, Brian Spiller. Stauffer Management was formed in 1987 to manage certain assets and liabilities of Stauffer Chemical. Stauffer Management is a wholly owned subsidiary of AstraZeneca, which was formed last year through the merger of Zeneca—a spin-off of ICI—and the Swedish firm Astra.

An insurance company will invest roughly $80 million of the settlement money, with proceeds covering the estimated $3 million to $6 million annual cost of operating the treatment plant for the next 30 years. Another $62 million will be invested to produce the $514 million lump sum that must be paid to the U.S. government in 2030 to cover future costs of operating the plant. The final $18 million will be paid directly to U.S. and California agencies for previous cleanup activities and to restore damaged natural resources.

Cheryl Hogue


AP Photo/Rich Pedroncelli

High-density sludge pit from treatment of acidic mine waste sits at top of Iron Mountain in California.

Here's What's Cooking For National Chemistry Week 2000

The American Chemical Society and its local sections are all whipped up about National Chemistry Week (NCW). Festivities will start on Nov. 5, and by the time the celebration is over on Nov. 11, all 188 local sections will have participated and millions of people will have had the chance to hear positive messages about chemistry, to experiment in the kitchen, to sample ACS publications online, and to help their local communities with a food drive.

The unifying event this year, "Chemists Reacting to Hunger," has been promoted to all local sections, which have been urged to coordinate food drives to benefit local organizations. This is the first time NCW has featured this kind of activity.

Also a first, the ACS Publications Division will make electronic editions of all ACS journals online available to the public free of charge—all week long.

The National Chemistry Week program office at ACS headquarters has been busy. "We have sent 150,000 copies of our new publication, 'Get Cooking With Chemistry,' to the local sections, along with 60,000 copies of *ChemMatters*. And, as an added bonus, the October issue of the *Journal of Chemical Education* features NCW," says Kathleen M. Thompson, manager of the Office of Community Activities.

Local sections are planning a variety of activities. Latching onto the Pokémon craze, the ACS Cleveland Section is sponsoring "PokéChem: The Real Power of Chemistry" at local libraries, with hands-on activities and demonstrations that illustrate the mysterious characteristics of matter and energy. And in keeping with the kitchen chemistry theme, the ACS Monmouth County (N.J.) Section is sponsoring a "Kids & Chemistry" workshop for fourth-grade students. They're also sponsoring the event "What's Cooking: It's All Chemistry," which will look at chemistry as it relates to food, cooking, and the kitchen.

Those are just two examples. To learn more about events that are planned for your area, contact the ACS Office of Community Activities at (800) 227-5558 ext. 6097—while there's still time.

Linda Raber