Novel detection method ensures that drinking water is not compromised by algae blooms

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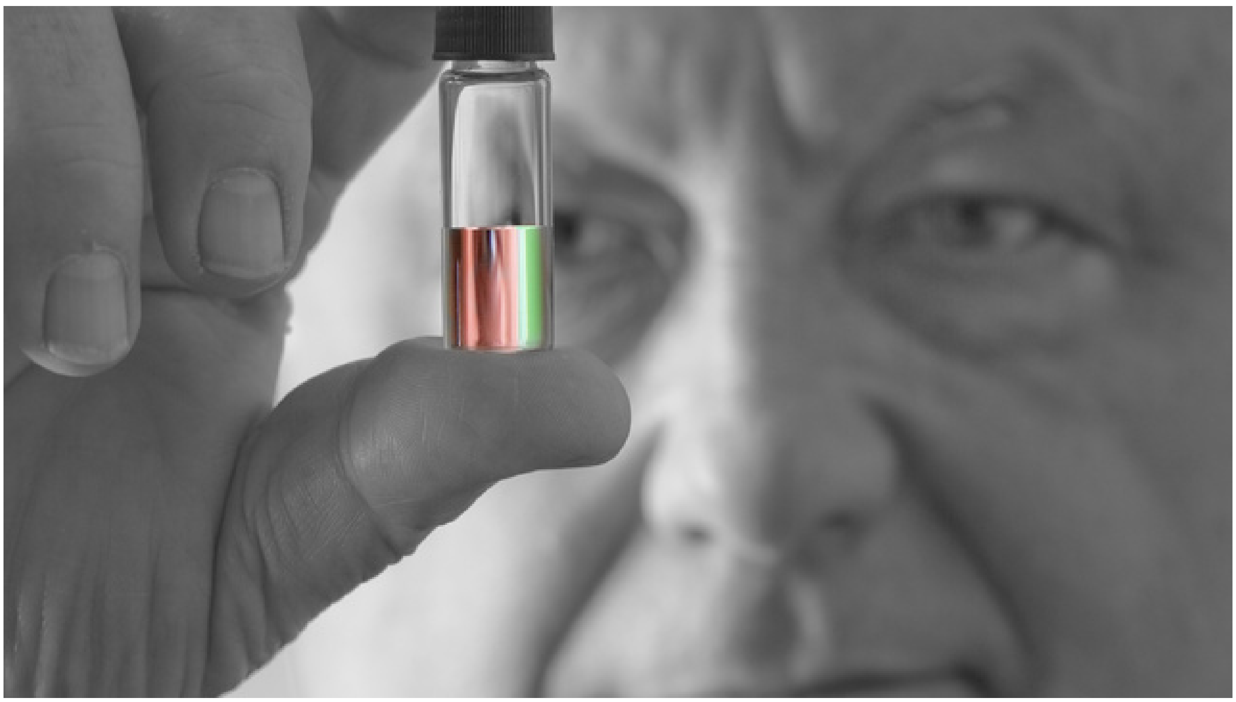

“Translating arcane research results from the lab bench into a product that’s both useful and valuable is very satisfying personally and also beneficial to the university,” says UCI professor and chair of pharmaceutical sciences Richard Chamberlin, who helped design a technology that detects algae toxins in water samples. Credit: Steve Zylius / UCI

Last August, the city of Toledo, Ohio, issued a three-day advisory telling 500,000 people in the area not to drink the tap water. The reason? A large algae bloom in Lake Erie – the city's source of water – had produced unsafe levels of the toxin microcystin, which, when swallowed, can cause nausea, fever and, ultimately, liver damage.

To initially identify and monitor this microcystin outbreak, Ohio officials used a technology invented by Richard Chamberlin, professor and chair of pharmaceutical sciences at the University of California, Irvine, and a group of international collaborators led by Daniel Dietrich, professor of toxicology at Germany's University of Konstanz.

Their invention was patented and licensed to Abraxis LLC, a Pennsylvania-based biotech firm, through UCI's Institute for Innovation. The product, known as the Abraxis Microcystins-ADDA ELISA kit, detects microcystins and nodularins (another algae toxin) in water samples and is considered the most effective and readily available test currently on the market. Abraxis offers the ELISA format for laboratories as well as an on-site dipstick test.

Algae blooms are becoming more common in freshwater lakes – a common source of drinking water for communities – which increasingly threatens public health. In response to the Toledo outbreak, the Environmental Protection Agency issued a health advisory for these toxins in which it identified testing methods, specifically naming the ADDA ELISA technology. The timing couldn't be more prescient; an algae bloom is currently re-forming on Lake Erie.

Transforming discoveries for the public's benefit is a UCI mission, and the Institute for Innovation fosters faculty-industry partnerships and the commercialization of UCI technology. It works to ensure that federal, state and private investments in UCI research have the greatest possible positive impact on people and the economy.

A highly acclaimed organic chemist who joined UCI in 1980, Chamberlin discusses the development of the Abraxis detection kit.

How was this technology created?

In the early 2000s, I was approached by Dan Dietrich, based on some work my group had published on the synthesis of some algal toxins known as microcystins. He had an idea for developing a simple and sensitive method of detecting these toxins in bodies of water using a well-known general procedure known as an enzyme-linked immunosorbent assay. His group had the expertise and experience to develop such an assay but not to make the molecular fragments of toxins needed to come up with a really useful product. These unique molecules are our contribution.

How does it work?

With ELISA, an antibody that's been prepared in the lab to recognize any substance of interest is used to search for that substance in samples that may or may not contain any. An enzymatic reaction produces a dark color when there's little or none of the substance and a lighter color when there's more. This type of assay can detect substances at very low levels, in this case down to about 0.1 parts per billion for common microcystin toxins. The allowable amount in drinking water is about 10 times that.

How did this technology get patented and licensed?

Previously, this technology was licensed nonexclusively to various companies in the U.S. and abroad. One of the licensees, Abraxis, designed and promoted a commercial product, ADDA ELISA, that turned out to be the best among several alternatives. As a result of the EPA action after the Toledo incident, sales of ADDA ELISA are expected to increase. UCI this year executed a comprehensive exclusive licensing agreement with Abraxis. Maria Tkachuk, the life sciences licensing officer, says that UCI expects to receive additional revenue from this commercial deal.

What makes it such a novel product?

Most ELISA tests are, by design, as specific as possible toward a single substance. This high selectivity is generally very desirable to minimize the possibility of "interference" – other substances causing a positive response even when the target substance of the assay is totally absent. Our assay is novel because it's designed to recognize only the part of the microcystin structure that all the family members (more than 100 of them) share and that's believed to be largely responsible for the toxicity. Thus, the assay can, in principle, detect any microcystin likely to be toxic. It's much faster, simpler, more general and less expensive than the alternatives.

How does it feel knowing that something you helped create is being used for something so important?

Transforming basic scientific results into tangible and immediately useful products or procedures is relatively rare – which is why there's a growing emphasis on this sort of "translational" research in academics. Translating arcane research results from the lab bench into a product that's both useful and valuable is very satisfying personally and also beneficial to the university.

How important is it for a public research university to have an efficient method of getting scientific discoveries patented, licensed and linked with companies to bring them to market?

With federal support for academic basic research continuing to dwindle, it's more important than ever. Synthetic organic chemists have been spectacularly successful over the past 40 years at developing ways to make almost any molecule one can imagine. There's increasing interest among many of them in applying their skills and tools to solve more practical, real-life problems. Commercialization is less important to most academic chemists than the pursuit of new fundamental knowledge, but it's clearly in their best interests – and those of the university – to translate discoveries into products whenever possible, and to do that requires a vigorous technology transfer effort on campus.

Provided by University of California, Irvine

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