

## **Zebrafish developmental assays test the safety of new chemicals**

By Sara Mishamandani

A group of molecules developed to break down pollutants in water is one step closer to commercial use, thanks to developmental tests led by [Robert Tanguay, Ph.D.](http://emt.oregonstate.edu/roberttanguay), of the Oregon State University (OSU) Superfund Research Program. Tanguay's study, using developing zebrafish embryos, showed that the molecules designed to remove hazardous substances from water, called TAML activators, are not harmful themselves.

### **Green chemicals to clean up contaminated water**

According to a [press release](http://www.eurekalert.org/pub_releases/2013-07/cmu-cmco72213.php), from Carnegie Mellon University, TAML activators, created by chemist and study co-author [Terrence Collins, Ph.D.](http://www.chem.cmu.edu/groups/Collins/about/members/collins.html), provide an environmentally friendly method for breaking down toxic compounds that contaminate water, including endocrine disruptors.

Endocrine disruptors, which are found in almost 25 percent of streams, rivers, and lakes, can disrupt normal functions of the endocrine system and impair development, by mimicking or blocking the activities of hormones in wildlife. Several animal studies suggest that endocrine disruptors can also affect human health, and may be involved in cancers, learning disabilities, obesity, and immune and reproductive system disorders.

Previously, Collins and his collaborators showed that TAMLs, used with hydrogen peroxide, can easily and effectively remove steroid hormones, common endocrine disruptors, from water after just one treatment.

"Quite a few common commercial chemicals cause endocrine disruption," said Collins. "Before TAML activators are commercialized for treating municipal water, it is important to be sure that they aren't introducing, into the water, the very problem they were designed to reduce or eliminate."

### **Using zebrafish as a model system**

Tanguay's group tested several TAML activators to determine whether they exhibit endocrine disrupting capability. Researchers exposed zebrafish embryos to seven different types of TAML activators. At concentrations typically used for decontaminating water, none of the TAML's impaired embryo development.

### **Linked Video**

[Watch Chapell Miller, Ph.D., describe the high-volume automated screening that takes place in Tanguay's lab at OSU \(05:36\).](#)

The zebrafish tests represent just one step in a series of tests that can be used to confirm that a chemical is free of endocrine disrupting activity. The test is part of a five-part testing system called the Tiered Protocol for Endocrine Disruption (TiPED), which was developed to determine potential endocrine disrupting activity in a chemical. The zebrafish tests are in tier four of the system, which ranges from computer-based approaches to tests in fish, animals, and human cells.

"In early development, as we develop from a single cell into a complex organism, the process by which a human does that is



*Tanguay assesses the health of adult zebrafish. (Photo courtesy of Robert Tanguay)*



*Collins is a leading proponent of green chemistry who won a 2010 Heinz Award for his work to improve environmental health. (Photo courtesy of Heinz Family Foundation)*



*Tanguay's lab tests the impacts of chemicals on zebrafish, a small fish popular in home aquariums and even more useful for research. They reproduce in a matter of hours and, as they grow, changes are visible in their transparent embryos. (Photo courtesy of Robert Tanguay)*

almost exactly the same as in zebrafish," said Tanguay. "So when we are asking if a compound could be hazardous to human development, we obviously can't do those studies in humans, but we can do them using zebrafish."

## **Moving forward**

Collins and collaborators have already conducted, or are currently conducting, tests on TAMLs using assays in other TiPED tiers. In all cases, thus far, the tests demonstrated that TAML activators can be designed to treat water and not cause developmental disruption in aquatic organisms.

"These collaborative studies collectively provide a model that can be copied, time and time again, by chemists interested in producing chemicals known to be free of developmental disruption by the highest standards of contemporary science, as a way to advance the sustainability of our global civilization," Collins said.

*Citation: [Truong L, DeNardo MA, Kundu S, Collins TJ, Tanguay RL.](#)*

*(<http://pubs.rsc.org/en/content/articlelanding/2013/gc/c3gc40376a>)*

*2013. Zebrafish assays as developmental toxicity indicators in the green design of TAML oxidation catalysts. Green Chem; doi:10.1039/C3GC40376A [Online 15 July 2013].*

(Sara Mishamandani is a research and communication specialist for MDB Inc., a contractor for the NIEHS Superfund Research Program and Division of Extramural Research and Training.)

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