

## Research Brief 213

### Widely Used Antibacterial Agents May Lead To Significant Health Concerns

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**NIEHS**  
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#### Exposure To Triclosan Linked To Impairment Of Heart And Muscle Activity

Triclosan (TCS), a chemical widely used for its antibacterial properties, was shown to weaken heart and skeletal muscle activity in animal models in a study performed at the University of California, Davis (UC Davis) Superfund Research Program (SRP) Center.

“Triclosan is found in virtually everyone’s home and is pervasive in the environment,” said Isaac Pessah, Ph.D., professor of molecular biosciences, and principal investigator of the study. TCS is commonly found in antibacterial personal-care products, such as hand soap, deodorant, toothpaste, and mouthwash, as well as cleaning supplies, bedding, clothing, and trash bags. Although TCS was first developed for hospitals to prevent bacterial infections, it has become widespread in antibacterial products in the home, with more than 1 million pounds of the chemical produced annually in the United States. TCS from household products has been detected in treated wastewater, raising additional concerns for human and environmental health. TCS in surface and groundwater could contaminate drinking water supplies and enter the food chain.

Researchers studied the effects of TCS on muscle activity at doses similar to those that people and animals might be exposed through the use of consumer products and in the environment. The research is reported in Proceedings of the National Academy of Sciences of the United States of America.

Investigators found that TCS impaired muscle contractions of isolated human heart muscle cells and skeletal muscle fibers. They also observed a 25 percent reduction in heart function of anesthetized mice with 20 minutes of exposure to TCS, demonstrating a severe weakening of cardiovascular function. In another experiment, mice given a single dose of TCS had an 18 percent reduction in grip strength, a common measure of mouse limb strength, for up to 60 minutes. These effects occurred at blood concentrations of free triclosan ranging from 0.2 to 0.3  $\mu\text{M}$ , concentrations approximating those measured in the blood of human volunteers after swallowing 2/3 tablespoon of liquid mouthwash containing triclosan<sup>1</sup>.

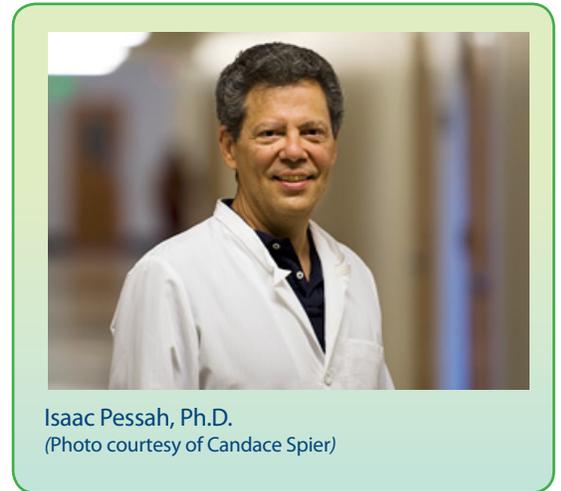
Researchers examined the effects of TCS on fathead minnows, a small fish used to study the potential impacts of pollution in aquatic environments. When compared to the controls, the fish exposed to TCS for up to 7 days displayed significant reduction in swimming activity.

Experimental results demonstrated a large degree of muscle activity impairment in both cardiac and skeletal muscle in different model organisms. Researchers at UC Davis have previously linked TCS to disruption of reproductive hormone activity and of cell signaling in the brain.

“These findings provide strong evidence that the chemical is of concern to both human and environmental health,” said Pessah. “Regulatory agencies should definitely be reconsidering whether it should be allowed in consumer products.”

#### Other Studies Show Health Impacts Of Triclocrban

UC Davis researchers and collaborators have also investigated exposure to and effects of triclocarban (TCC) which, like triclosan, is a broad-based antimicrobial commonly added to personal hygiene products. A recent study led by Bruce Hammock, Ph.D., Director of the UC-Davis SRP Center, found significant absorption of TCC from soap during showering by utilizing whole blood sampling to measure concentrations of TCC. Other studies, in collaboration with SRP-funded researchers at UC-San Diego, showed that exposure to TCC activated important regulatory pathways both in mice and in



Isaac Pessah, Ph.D.  
(Photo courtesy of Candace Spier)

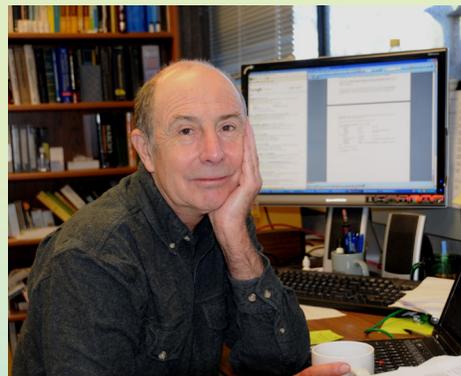
<sup>1</sup>Sandborgh-Englund G, Adolfsson-Erici M, Odham G, Ekstrand J. Pharmacokinetics of triclosan following oral ingestion in humans. J Toxicol Environ Health A. 2006 Oct;69(20):1861-73.

human cells, suggesting that long term exposure to TCC has the potential to alter normal hormone homeostasis. Hammock's research team has also demonstrated the ability of TCC to metabolize to a more reactive molecule in the body and bind to human proteins in skin cells, which may contribute to allergic contact dermatitis or lead to other toxic effects.

While Hammock explains that, "The risks from triclosan seem much greater than the risks from triclocarban," his research team has found significant health effects associated with TCC.

Researchers at UC Davis have contributed to the current body of knowledge questioning the widespread use of TCS and TCC in personal hygiene products. "With chemicals in the environment we seem to treat them as all evil or perfectly safe," said Hammock. "Since triclosan is used in high volume products that cause low levels of exposure, such as hand soap, it may be more important to phase out those high volume products than to phase out low volume products, such as surgical scrubs, even though those products may create higher individual exposures."

Through these studies, researchers have confirmed the need for further research on the effects of TCS and TCC in humans, as well as the need for additional research related to products that expose us to the chemicals.



Bruce Hammock, Ph.D.  
(Photo courtesy of Candace Spier)

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#### To learn more about this research, please refer to the following source:

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