Robert C. Jones Jr.
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Taming a Toxic Stew

For months, the news has been filled with stories of toxic algal blooms fouling Florida's waterways and coastline.

Not only has the algae *Karenia brevis* caused the worst red tide along Florida's southwest coast in more than a decade, darkening Gulf of Mexico waters, killing marine life and triggering respiratory distress and other ailments in locals and tourists, but also a freshwater blue-green algae called cyanobacteria has coated the Caloosahatchee and St. Lucie rivers and other freshwater canals.

In response, a team of biomedical researchers, ocean and atmospheric scientists, and engineers from across the University of Miami has secured Phase II funding via UM's U-LINK initiative for a project titled "Integrating Oceans and Human Health Sciences." Through their efforts, they hope to gain a better understanding of the harmful blooms, potentially giving policymakers new information that will help combat the crisis.

Grace Zhai, Ph.D., an associate professor of molecular and cellular pharmacology at the University of Miami Miller School of Medicine, is one of those researchers.

"It's a difficult problem to study," said Dr. Zhai, who works with fruit flies as models for neurological diseases and was once part of a team that found an algal toxin in the Western Pacific was responsible for a high incidence of a severe neurodegenerative disorder in males on the island of Guam.

"Toxic algae is in our environment and it's getting

concentrated. Not only can you inhale it but it's also accumulating in the food chain," Dr. Zhai explained. "No one has come close to showing toxicity from aerosolized particles, and no other animal model allows us to study this aspect of it, except fruit flies. So this is what we believe to be first-of-its-kind research."

For her study, Dr. Zhai will share a wind wave tank with two researchers from UM's Rosentiel School of Marine and Atmospheric Science – Cassandra Gaston, Ph.D., assistant professor of atmospheric sciences, and Kimberly Popendorf, Ph.D., assistant professor of ocean sciences – who will subject blue-green algae water samples to different wind speeds, and measure the concentration of toxins in any water-to-air transfer that occurs. They will be assisted by two of their students, Michael Sheridan and Kaycie Lanpher.

Dr. Zhai, in turn, will expose fruit flies in the tank to aerosolized blue-green algae, recording whatever ill health effects the flies develop.

"In one sense, algae are the good guys. If you didn't have any algae at all in the ocean, you wouldn't have any other life because it's the basis of the food chain," said team member, Larry Brand, Ph.D., professor of marine biology and ecology at the Rosenstiel School, who will be providing the blue-green algae water samples used for the experiments. "But sometimes the algae get out of control. We know that red tide toxins get into the air and into seafood. The effects are immediate, and that's what most of the research has concentrated on. But now, we're looking at these toxins in blue-green algae that can have long-term effects. And the big question is, could they be getting into the air?"

Dr. Zhai and her colleagues note that most research has focused on human exposure to algal toxins in the water or seafood.

“With the exception of brevetoxin (produced by the Florida red tide), little is known about the health effects of breathing aerosols with other algal toxins in them,” they have written. “Our findings will be used to help devise strategies to lower risks.”

Another member of the team, Alberto J. Caban-Martinez, DO, Ph.D., MPH, an assistant professor in the Miller School’s Department of Public Health Sciences, hopes to use silicon-based wristbands to measure anglers’ exposure levels to harmful algal blooms. The wristbands have already been used on Florida firefighters to test their exposure levels to poly aromatic hydrocarbons, which are produced when coal, oil, gas, wood, and garbage are burned.

“But we’re in the very early stages of determining how the bands can be used to measure exposure to harmful algal blooms,” said Katerina Santiago, an MPH student and research associate in Dr. Caban-Martinez’s lab.

Dr. Brand, who has spoken at county commission, city council, environmental, and citizens meetings in Southwest Florida, noted it is the health effects of harmful algal blooms that most people are concerned about.

“A lot of residents live near canals,” he said, “and a lot of the blue-green algae gets blown by the wind into these dead-end waterways.”

He hopes the results the UM team of scientists produces will

make a difference.

“One would hope that policymakers would take these facts into account and come up with some way of reducing the nutrient sources that are leading to these algal blooms,” said Dr. Brand, who in August spoke at a community meeting in Fort Myers where 200 people had to be turned away because the meeting site was already filled to capacity with 450 attendees. “People are very angry. It’s affecting their lives.”

The original version of this article, which contained additional information about the research being conducted by the Rosenstiel School researchers, can be found here.