A research team in The University of Toledo College of Medicine and Life Sciences is taking an in-depth look at Lake Erie algal bloom toxins and the impact they can have on your liver. “No one knows what safe limits are for a large segment of the public,” said Dr. David Kennedy, assistant professor in the Division of Cardiovascular Medicine. “Previous studies only focused on healthy animals.”

During the heart of this algal bloom season, researchers are using mice as a model to study the impact of microcystin exposure on patients who have the most common and often undiagnosed form of liver disease that is tightly linked to obesity.

“Microcystin is a toxin that specifically targets the liver, a vital organ that needs to be healthy in order to process the food you eat,” Kennedy said. “And non-alcoholic fatty liver disease is the most prevalent type of liver disease nationally — particularly in northwest Ohio. Whether diagnosed or undiagnosed, a third of northwest Ohioans have this disease that is silent at first, but predisposes you to big problems down the road, such as the liver becoming scarred and inflamed.”

According to the National Institutes of Health, obesity is a major risk factor for the development of non-alcoholic fatty liver disease, which causes the organ to swell with fat. Unchecked, the disease can lead to liver failure and the need for a transplant.

“There is a large population of people who may be susceptible to the effects of microcystin exposure, whether it’s swallowed while swimming at the beach or through the tap should toxic algae once again contaminate the public water supply,” said Dr. Steven Haller, assistant professor in the Division of Cardiovascular Medicine and co-leader of the project that began in the spring. “The Toledo water crisis inspired us to re-evaluate what levels we’re calling safe.”

Two years ago this month, the city of Toledo issued a Do Not Drink advisory for half a million water customers due to the level of microcystin detected in the drinking water. The state awarded UT researchers a $45,000 grant, which is matched by the University, for the project to discover if a pre-existing liver disease makes a person more susceptible to damage from the toxin released by algal blooms.

The goal is to help inform local, state and international health organizations as they form guidelines for safe limits of exposure.
“By focusing on people who may be at risk, we feel we are doing something beneficial to protect them if, in fact, we detect a damaging connection where microcystin causes the liver disease to progress,” Haller said.

“A healthy animal wouldn’t produce symptoms of liver failure at this level of exposure,” Kennedy said.

Haller and Kennedy have enlisted the help of several UT students in their experiments that use a breed of mouse predisposed to non-alcoholic fatty liver disease.

Second-year medical student Aaron Tipton helped develop the standards to measure liver function after injecting mice with low doses of microcystin through a tube in their stomachs over the course of a month.

“We developed that from scratch because a big issue that came to light during the water crisis is that the only validated way to measure microcystin is expensive and takes a long time,” Tipton said. “Our work is one of the many ways that University of Toledo researchers are attacking the water quality issue to protect our community.”

“I’m honored to be involved in water quality research that is so important for the health and safety of families not only in our community, but in other places across the world also affected by toxic algal blooms,” said Dalal Mahmoud, a UT junior majoring in biology. “It’s a great opportunity to expand my studies and what I want to do in the future.”

Mahmoud and Tipton were the inaugural beneficiaries of a recent philanthropic gift to the lab, the David and Helen Boone Research Award, which helped fund their summer research.

The toxicity project is expected to be completed next June, but Kennedy and Haller hope this is only the first phase.

“Over the long term, we want to come up with a better diagnostic test that patients can take at the emergency room or doctor’s office — such as a simple blood test — to measure the microcystin levels in the body, for example, if you get sick after swimming in the water during algal bloom season,” Haller said. “Even further, we want to find out if there is a preventative or therapeutic strategy where someone can be treated so they don’t keep going down the road of liver disease progression.”