# Lake algae: What you don't see can really hurt you

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One of several signs posted along Lake Mendota near the Memorial Union Terrace  warns against swimming during the presence of toxic blue-green algae in the water. Known as cyanobacteria, the algae are photosynthetic bacteria that live in colonies, typically in lakes with excess fertility. Credit: Jeff Miller

(Phys.org) -- The strikingly blue algae that afflicted the Madison lakes last week hardly needs a danger sign to warn of its toxicity.

But this stuff could, in the next days or weeks, be followed by blue-green algae that are much more toxic, says Katherine McMahon, an expert on lake ecology at the University of Wisconsin-Madison.

Surprisingly, the more dangerous algae — technically called cyanobacteria — may not produce slimy gooey mats, but still may contain toxins that attack the liver or nervous system.

Cyanobacteria are photosynthetic bacteria that live in colonies. They look like algae, which are floating organisms with a much closer relationship to plants. Toxic cyanobacteria occur in "eutrophic" lakes that suffer overgrowth of plants and other organisms due to high levels of nitrogen and phosphorus caused by runoff of manure and fertilizer.

McMahon, an associate professor of civil and environmental engineering, says graduate student Lucas Beversdorf has noticed a transition during June or early July that shows "a switch from cyanobacteria that are not so nasty, to the sudden kickoff of some really nasty ones."

The transition, Beversdorf says, occurs when the current cyanobacteria, which can get fertility from airborne nitrogen, "begin to be outcompeted by a genus called Microcystis. This is what we are concerned about. Microcystis are among the most common toxin-producing cyanobacteria worldwide. We are trying to figure out the underlying drivers of the transition."

It's not clear how harmful cyanobacteria are, says McMahon. The only known death in the nation occurred in Madison in 2002, when a teen-age boy died after swimming in a pond at a golf course.

But the symptoms — aches, pain, fever — can have many causes, and are likely to be missed or misdiagnosed.

Although Beversdorf continues to explore how lake nutrients affect cyanobacteria, "The surest way to reduce algal growth is to reduce nutrient loading to the lakes," he says. "But while a good deal of attention focuses on phosphorus, I'm finding that nitrogen may be just as important."

Some toxins, he says, "are built from chains of nitrogen-rich amino

acids, so if you can reduce nitrogen at the same time as phosphorus, hopefully you can reduce the amount of toxin produced."

Both scientists would also like to get a better view of how the current drought affects cyanobacteria in the lake.

McMahon says an innovative project is underway in Dane County to reduce nutrient inflow to Lake Mendota. With leadership from the Madison Metropolitan Sewerage District, several municipalities and point-source dischargers are pooling funds to build systems to reduce nutrient run-off northwest of Lake Mendota.

"The Wisconsin Department of Natural Resources has implemented a progressive 'adaptive management' policy," says McMahon, "that allows polluters to band together and tackle water quality improvement across large areas."

Matching funding from Dane County "would increase the likelihood that the project will have a big impact on the quality of lake water throughout the Yahara Watershed," McMahon says.

Beaches in the Madison area can be closed if a lifeguard notices algae or a blue color in the water; ideally this eyeball test would be followed by a chemical test to identify the toxin. But toxic cyanobacteria take many forms; colonies of Gloeotrichia look like dust on the water, says Beversdorf.

Beyond "obvious public health interest" for studying cyanobacteria, McMahon sees them as a poorly understood ecological element with a fascinating history. Cyanobacteria are related to chloroplasts, which are green structures inside plant cells that release oxygen while making sugar from carbon dioxide. Scientists think chloroplasts originally lived independently, and then were engulfed by the earliest plants around a

billion years ago.

Vast numbers of cyanobacteria in the ocean "are probably responsible for most of the oxygen that we breathe," McMahon adds.

That may be little consolation to people who consider swimming in the Madison lakes during algae season. Cyanobacteria float, and Beversdorf and McMahon have found them all across the lakes.

Water-skiing is particularly hazardous, as it can spray toxins into the air, McMahon cautions.

Finally, toxic algae are exempt from truth-in-advertising. "The lake can look better, and still be worse for you," McMahon says. "People have this instinctive repulsion, when it smells bad and they see mats of slimy things and floating scum, but it can look pretty good and still be toxic."

Provided by University of Wisconsin-Madison