Too many nutrients make microbes less responsive

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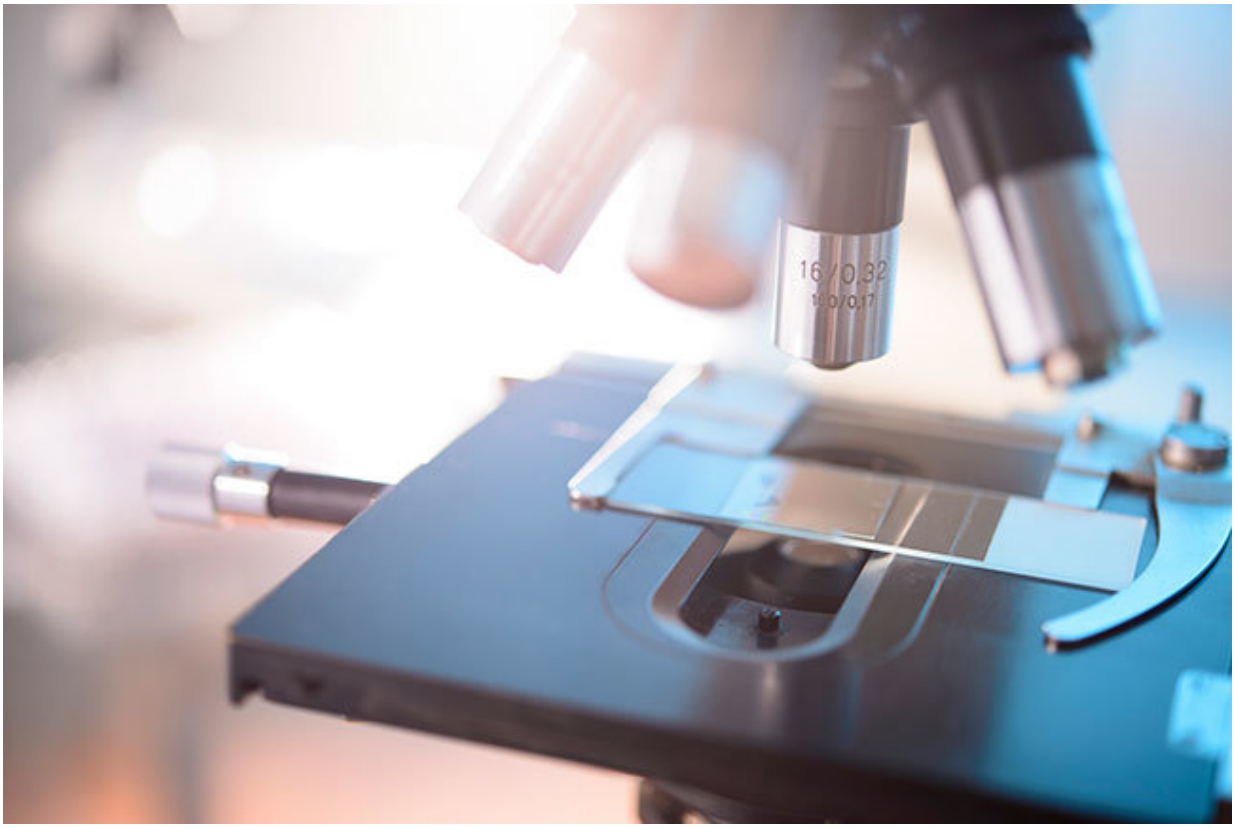

Credit: University of Minnesota

Bacteria in lakes play a key role in maintaining water quality by absorbing excess nitrogen and phosphorus. They also help store carbon, which has implications for our climate. But, as it turns out, their ability

to do these tasks varies depending on the makeup of the lake in which they live, according to a new study by University of Minnesota researchers that was funded by the National Science Foundation. In short, location matters most.

Phosphorus and nitrogen are two nutrients that, when added to lakes through runoff, cause them to become overgrown with algae and have other water quality problems. The study, published in *ISME Journal*, found that lakes with lots of nitrogen and phosphorus seem to have bacteria in the water that are less responsive to additional nitrogen, phosphorus and carbon.

"In some ways, adding too much phosphorus and nitrogen to lakes is similar to what happens with Type II diabetes—our lakes are becoming less able to respond to increasing carbon just as humans with diabetes become less able to respond to insulin in their body," says study author Jim Cotner, a professor at the University of Minnesota. "Too much of a good thing can lead to metabolic dysfunction that can be catastrophic."

Cotner and co-author Casey Godwin, a postdoctoral researcher at the University of Michigan, collected individual bacterial species from 35 lakes throughout Minnesota. They investigated the characteristics of the bacteria present in each lake and examined variables linked to how bacteria in lakes might respond to increased phosphorus and a warming planet.

Other work has shown that lakes with more phosphorus and nitrogen have different species of microbes, plants, insects, and animals than more pristine lakes, but this is the first study to show that the species in polluted lakes are less able to respond to further added nutrients and perhaps more importantly, carbon. If more of the CO2 we produce is absorbed by microbes and plants in lakes, oceans, and other ecosystems, that means less CO2 will accumulate in Earth's atmosphere.

"When we compared the bacteria from the most phosphorus rich lakes to bacteria from lakes that were more pristine, one of the big differences was that the microbes from lakes with lots of phosphorus were less able to remove carbon from the water" says Godwin. As humans burn more and more coal and gas, we are releasing more carbon dioxide (CO2) to our atmosphere, yet the Earth's ecosystems have a limited capacity to absorb these increasing concentrations.

More information: Casey M Godwin et al, What intrinsic and extrinsic factors explain the stoichiometric diversity of aquatic heterotrophic bacteria?, *The ISME Journal* (2017). DOI: 10.1038/ismej.2017.195

Provided by University of Minnesota