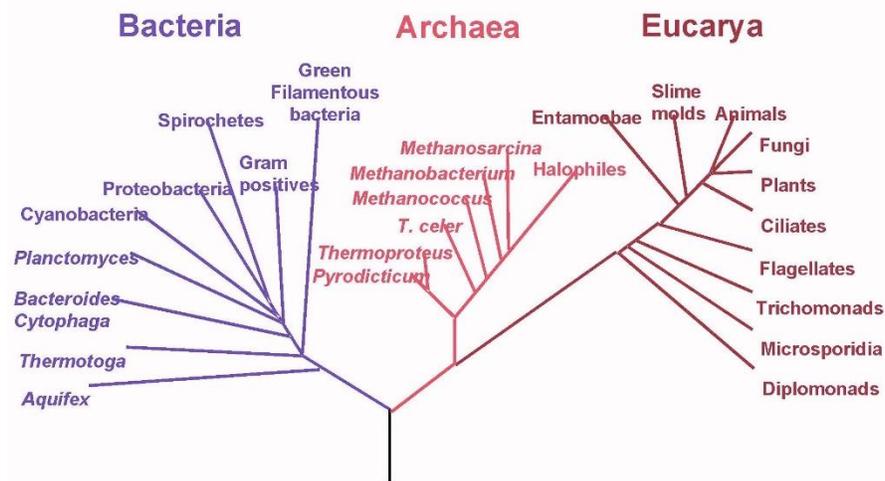


# Phylogenetic Tree of Life



## Soil & Water Conservation Society of Metro Halifax (SWCSMH)

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**To:** Chair & Members, North West Community Council, Halifax  
**From:** S. M. Mandaville Post-Grad Dips.  
 Chairman and Scientific Director  
**Date:** March 30, 2016  
**Subject:** Cyanobacterial toxins in lakes- medical implications

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Cyanobacteria, formerly known as blue-green algae, can be found in freshwater lakes throughout the world. Their blooms may produce many toxins including microcystins (liver toxins) and  $\beta$ -N-methylamino-L-alanine (BMAA-nerve toxins). Basic info on cyanobacteria can be read in one of our web pages with the URL, <http://lakes.chebucto.org/cyano.html>

The following are excerpts from leading scientific and Government sources, inserted in no particular order:-

"Few studies have examined the risk to wildlife and humans from exposure to airborne cyanotoxins. However, recent research has indicated that cells may be transported as aerosols from lakes with high concentrations of cyanobacteria and microcystins. Since aerosols may be a more direct route of exposure to public health for those recreating or living by a contaminated body of water, we set out to design a method that could address the aerosolization of cyanobacteria released from lake water," Haney said.

Jim Haney, professor of biological sciences, who directs the UNH Center for Freshwater Biology, and Amanda Murby, a doctoral student, are among the 50 scientists working on the project.

**Are cyanobacterial blooms a new problem?** No. The earliest reliable account of a cyanobacterial bloom dates back to the 12th century; the toxic effects of cyanobacteria on livestock have been recognized for more than 100 years. Since cyanobacterial bloom formation seems to be linked to nutrient-rich water bodies (for example, water that contains a lot of phosphates from detergents and phosphate fertilizers), the problem is not likely to go away in the near future.

Doctors and scientists at Dartmouth College and the University of New Hampshire are among a team exploring whether environmental toxins may be related to neurodegenerative diseases. They have found that cyanobacteria may be linked to amyotrophic lateral sclerosis (ALS), or Lou Gehrig's disease.

"We found that people who live next to lakes with persistent cyanobacterial blooms have up to a 25-fold increased chance of developing ALS," Stommel said. "These results have been of deep concern to me and my colleagues."

The report, published a study Jan. 20 in the Proceedings of the British Royal Society indicates that chronic exposure to the environmental toxin BMAA, derived from cyanobacteria, may increase the risk of ALS and other neurodegenerative illnesses in certain individuals.

It is exciting to begin to explore whether there is an environmental trigger to these illnesses, particularly because there is so little known and so little doctors can now do to help patients.

At UNH, they have developed a system to collect aerosols produced by cyanobacteria and are working with state officials to help them test for its presence.

Exposure to large amounts of microcystins can cause liver damage. Exposure to smaller amounts can cause breathing problems, skin irritation, upset stomach and other gastrointestinal problems.

Haney said, "Our preliminary research results raise concerns over potential exposure of humans and wildlife to aerosolized cells of cyanobacteria and their toxins. The methods we have developed could be useful for monitoring air in proximity to bodies of water for toxic cyanobacteria for public health purposes."

Another area of study is whether this can be transferred to crops growing near blooms of cyanobacteria.

**Does the presence of a cyanobacterial bloom always mean the water is contaminated?** No. Researchers generally agree that between 30 and 50 per cent of cyanobacterial blooms are harmless because they contain only non-toxic species of freshwater cyanobacteria. Blooms containing even one species of toxic cyanobacteria will be poisonous and potentially dangerous. Because there's no obvious way to tell if a

particular bloom is toxic, samples have to be analysed in a laboratory before a body of water can be declared safe.

**Why do blooms sometimes appear overnight?** Even if you can't see a cyanobacterial bloom floating on the surface of the water, that doesn't mean one isn't present in the water - the bloom could be suspended at various depths in the water where you can't see it.

The depth at which cyanobacterial blooms float depends on a number of factors. The most important of these are light, phosphorus and nitrogen, which cyanobacteria need in order to survive. As the availability of these elements can change quickly with the time of day and the weather, most cyanobacteria have evolved to be able to control their buoyancy. By being able to sink and rise at will, they are able to move to where nutrient and light levels are at their highest.

In order to activate the mechanism that allows them to move, cyanobacteria need light. At night, when there is no light, cells are unable to adjust their buoyancy and often float to the surface, forming a surface scum. This scum literally appears overnight and lingers until the wind and waves scatter the cells throughout the water.

**Are children more vulnerable than adults?** Yes. Children are at greater risk than adults of developing serious liver damage should they ingest high levels of microcystins, because of their comparatively lower body weight.

**What should I do if I suspect water has been contaminated by toxic cyanobacteria?** Because all cyanobacterial blooms are potentially toxic, it's always best to stay away from contaminated water until it has been tested and declared safe. Even after the bloom is gone, it's a good idea to wait until health authorities declare the water safe before swimming in it. For example, in one study in which a bloom was treated with algicide, the toxins released by the dead cells took more than three weeks to disappear.

**Where do all of the nutrients that fuel the algae come from?** Some lakes are naturally rich in nutrients. Others have become polluted with nutrients from sewage and septic fields and runoff from agricultural fields, manicured lawns and livestock operations.

Schindler also points to septic tanks as a source of phosphorus. The tanks eventually leak the nutrient, and some are poorly installed and maintained. Failing to clean up after pets and activities along a shore, such as when homeowners chop down trees and then fertilize grass or flowers they've planted, can be harmful as well.

**Trying to control a nutrient problem is more complicated than you might think, Schindler says. "If you let a lake get too far, I'd say it's equivalent to trying to get toothpaste back into a tube."**