

ABSTRACT

Harmful algal blooms (HABs) have been recorded in Lake Erie for decades, caused by years of eutrophication and nutrient loading, which greatly improved the health of the lake, but HABs eventually returned to Lake Erie. In August 2014, the city of Toledo, Ohio was forced to issue a "do not drink" order that affected nearly 500,000 residents for three days due to the presence of unsafe levels of the HAB toxin microcystin LR (MC-LR) in drinking water. MC-LR and other cyanobacterial toxins pose significant health risks to humans and the increasing incidences of Lake Erie HABs are a major public health concern. Given that MC-LR is composed of seven amino acids (or modified amino acids), we hypothesized that naturally-occurring Lake Erie bacteria could use MC-LR as an energy source. To test this hypothesis, water samples were collected from HABs in western Lake Erie during the summers of 2014-2017, MC-LR was continuously added to each water sample for 3-6 weeks to select for MC-LR degrading bacteria, and MC-LR levels were quantitated during the experiment. A total of 66 individual bacterial clonal populations, for the ability to degrade MC-LR or microcystin congeners MC-RR and MC-LA, and to form biofilms. Selected groups of bacterial clones also were tested for their ability to degrade MC-LR in lab-scale biofilters. Due to previous studies demonstrating that *mlrABC* were responsible for MC-LR degradation, we next examined our MC-LR degraders for *mlrABC* but these genes were not detected, indicating that alternative MC-LR degradation pathways must be present in Lake Erie bacteria. Collectively, these studies isolated and identified bacterial clones that degraded microcystins MC-LR and MC-RR and these bacterial clones formed robust biofilms that degraded MC-LR on lab-scale biofilters. The results of these studies indicate the potential use of bacterial clones to remove and degrade MC-LR from drinking water.

THESIS COMMITTEE

Jason Huntley, Ph.D. (Mentor)

Robert Blumenthal, Ph.D.

Jyl Matson, Ph.D.

R. Mark Wooten, Ph.D.

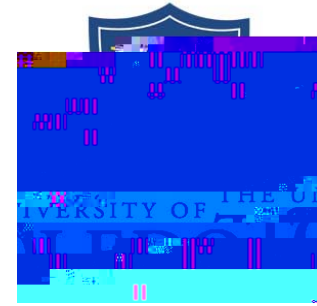
R. Travis Taylor, Ph.D., Graduate
School Representative



The University of Toledo
College of Medicine and Life
Sciences

Medical Microbiology and
Immunology (MMI) Track

Department of Medical
Microbiology & Immunology



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Identification and Characterization
of Lake Erie Bacteria that Degrade
the Microcystin Toxin MC-LR

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Alison Thees," Ealla Atari, Johnna Birbeck, Judy A. Westrick, Jason F. Huntley. Isolation and Characterization of Lake Erie bacteria that Degrade Cyanobacterial Microcystin Toxins. *Applied and Environmental Microbiology* (Under Revision)"
