

Using Naturally-Occurring Lake Erie Bacteria to Degrade the Microcystin Toxin MC-LR

Jason Huntley, Ph.D.

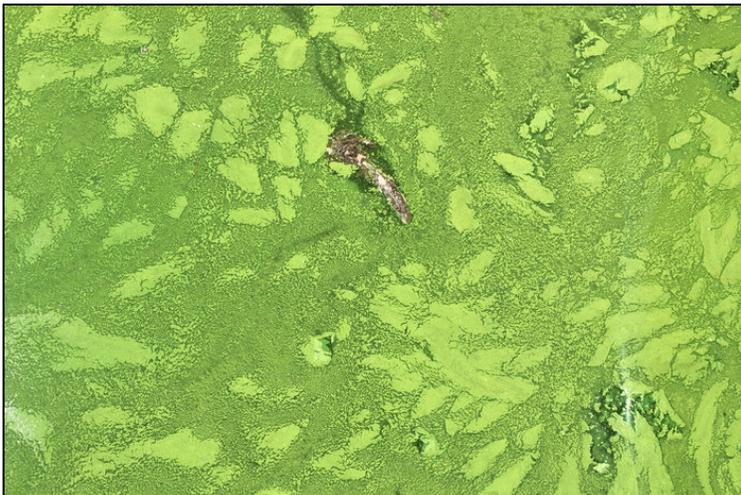
University of Toledo Health Science Campus





Qingdao, China

Easy Bay, San Francisco



Algae's lake effect reveals putrid, pea green disaster

Distribution centers offer free relief to community

Officials won't give test results on 2nd day

By MADOLLA MEDANSKY
LANSING MICHIGAN

Detroit's Adams Island distribution center through the summer heat, sitting at the end of Macomb Road building dimensions to give it the look of a water tower has been reborn.

"It's a disaster," he told the paper.

So it's good for the distribution center, the water is hard to carry with out a car. The water tower barged 500 Adams after the water to get back to the city's distribution center.

The National Health Institute conducted a media tour of the area.

FOR ASSISTANCE
Agencies are offering assistance to those who are unable to get to water or have difficulty with the purchase of bottled water. In Monroe County, call 734-643-8000.

DO'S AND DON'TS
Health authorities have provided the following recommendations until the water restrictions are lifted.

Don't
• Drink any quantity of water
• Eat water
• Brush teeth
• Wash

MORE INSIDE
Some businesses closed in Toledo since without municipal water available.

Page A3
A look at how many organizations available are meeting the needs.

TOLEDO BLADE
August 4, 2014

Toledo Blade
August 4, 2014



Coast of Brittany, France

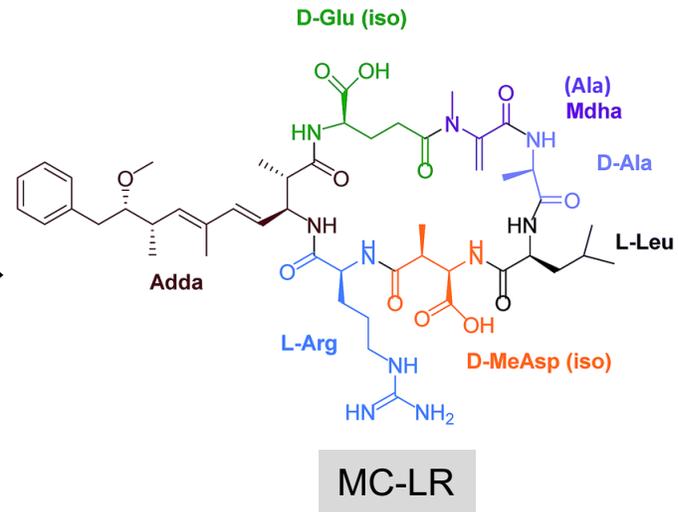
Murray River, Australia



Rationale:



Microcystis sp.



Microcystin-LR (MC-LR) Degradation



APPLIED AND ENVIRONMENTAL MICROBIOLOGY, Nov. 1996, p. 4086-4094
0099-2240/96/\$04.00+0

Vol. 62, No. 11

Int. J. Mol. Sci. 2010, 11, 896-911; doi:10.3390/ijms11030896

OPEN ACCESS

International Journal of
Molecular Sciences

ISSN 1422-0067

www.mdpi.com/journal/ijms

Article

Degradation of Microcystin-LR and RR by a *Stenotrophomonas* sp. Strain EMS Isolated from Lake Taihu, China

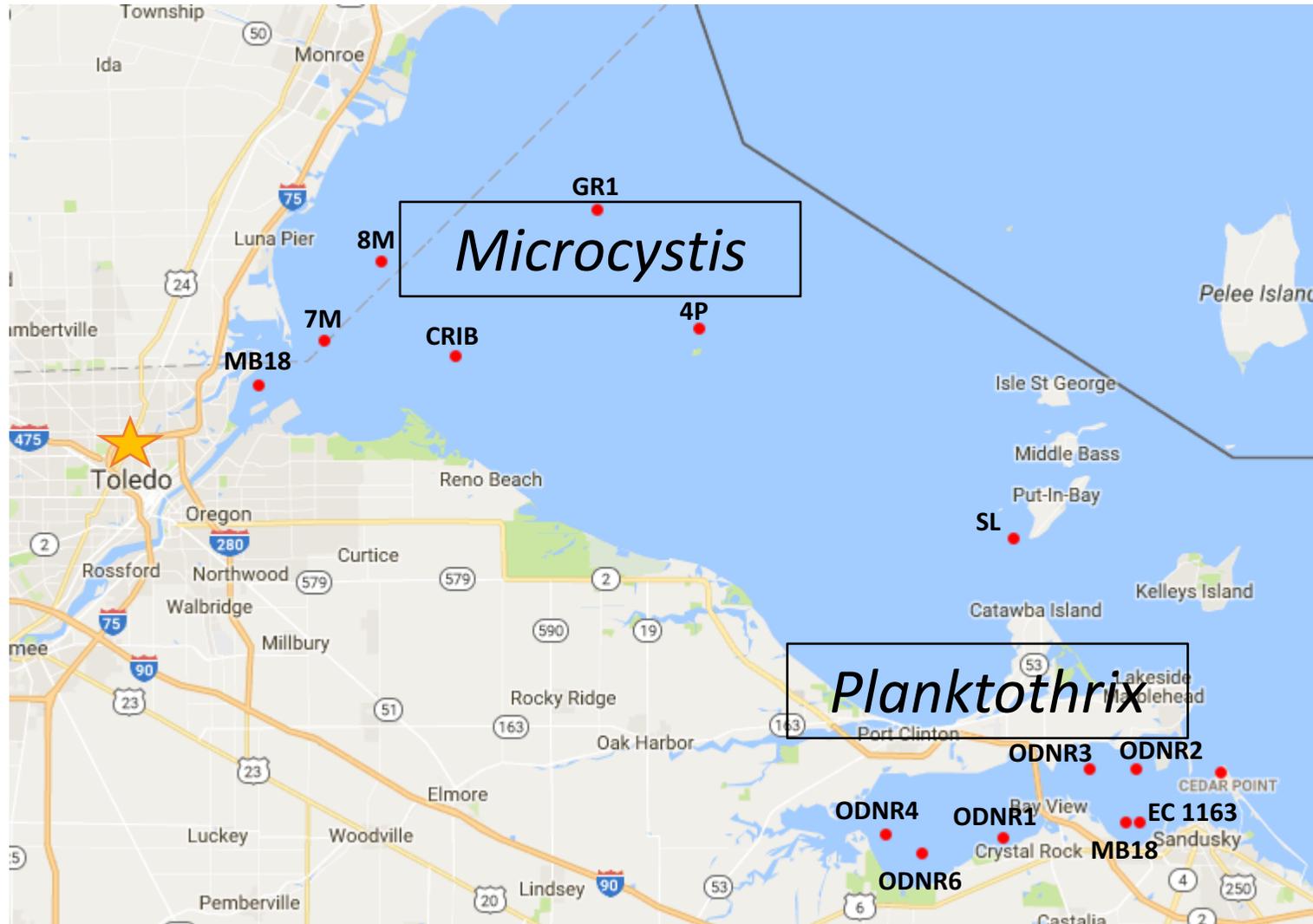
Jian Chen ^{1,3}, Liang Bin Hu ², Wei Zhou ^{1,3}, Shao Hua Yan ^{3,4}, Jing Dong Yang ^{1,3}, Yan Feng Xue ^{1,3} and Zhi Qi Shi ^{1,3,*}

Enzymatic Pathway for the Bacterial Degradation of the Cyanobacterial Cyclic Peptide Toxin Microcystin LR

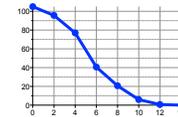
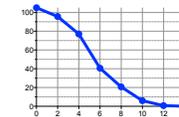
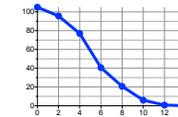
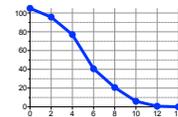
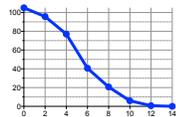
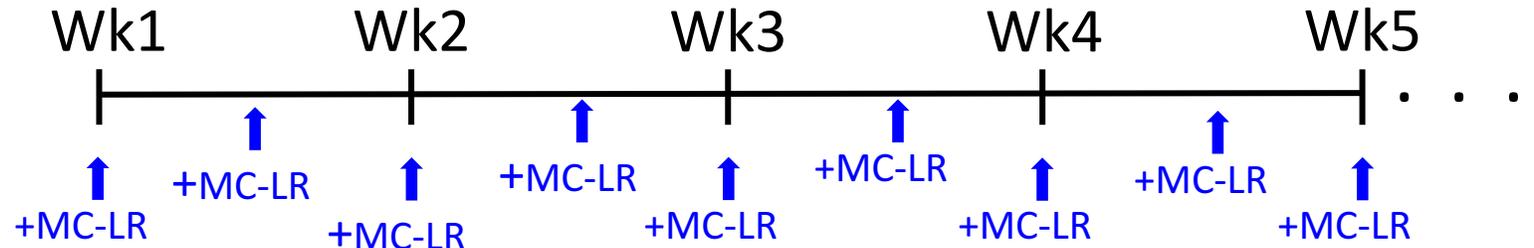
DAVID G. BOURNE,^{1,2,3} GARY J. JONES,^{2*} ROBERT L. BLAKELEY,¹ ALUN JONES,⁴
ANDREW P. NEGRI,^{2†} AND PETER RIDDLES³

Department of Biochemistry¹ and Centre for Drug Design and Development,⁴ University of Queensland, St. Lucia, Queensland, 4072, CSIRO Division of Water Resources, Griffith, New South Wales, 2680,² and CSIRO Division of Tropical Animal Production, Indooroopilly, Queensland, 4068,³ Australia

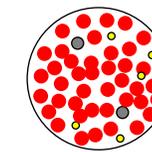
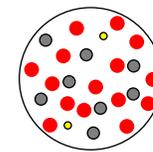
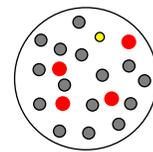
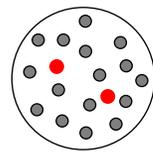
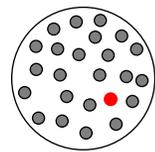
Source of MC-LR Degrading Bacteria



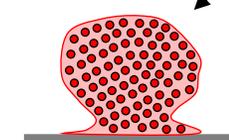
Project Outline:



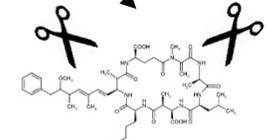
Quantify



Microbiology



Biofilm



MC-LR
Degradation



THE UNIVERSITY OF
TOLEDO
1872



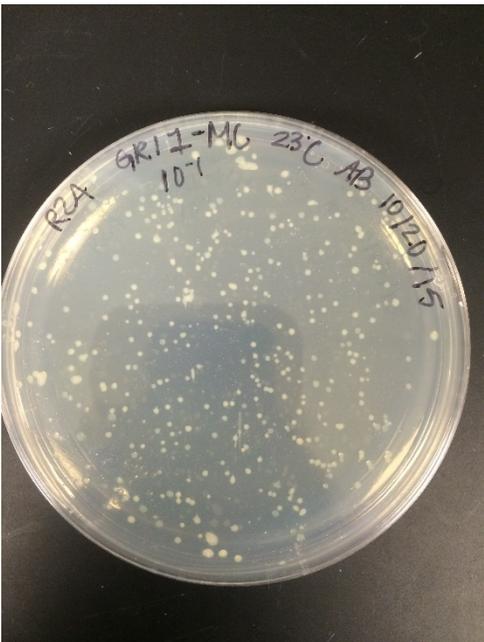
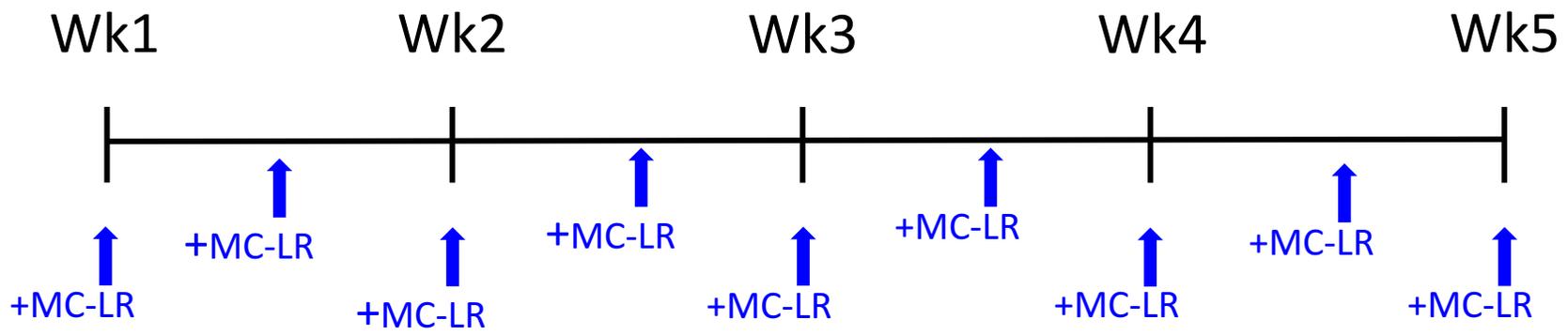
BGSU
Bowling Green State University



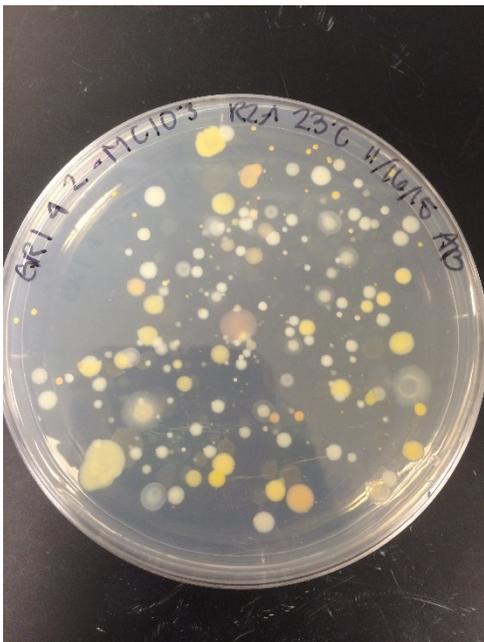
THE OHIO STATE
UNIVERSITY

KENT STATE
UNIVERSITY

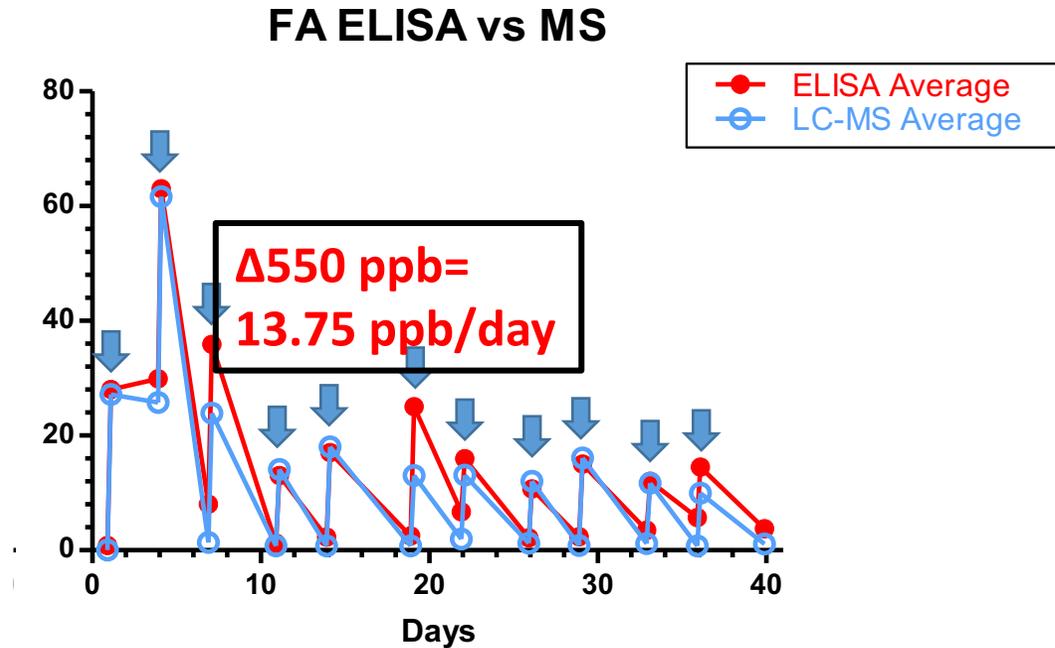
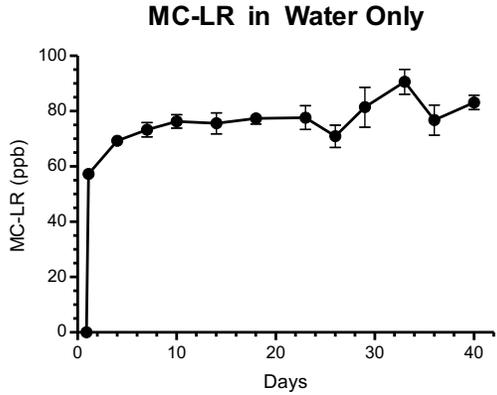
Selection Process



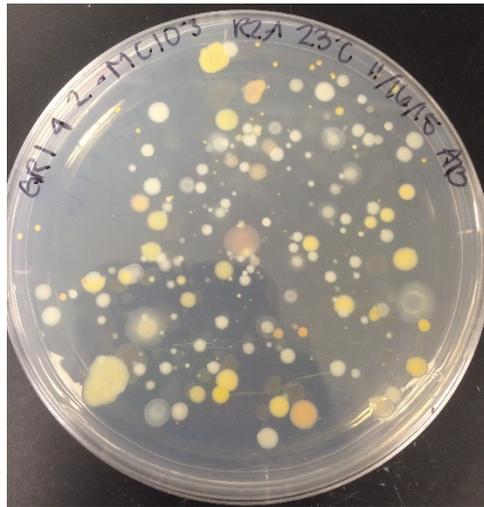
Four weeks later



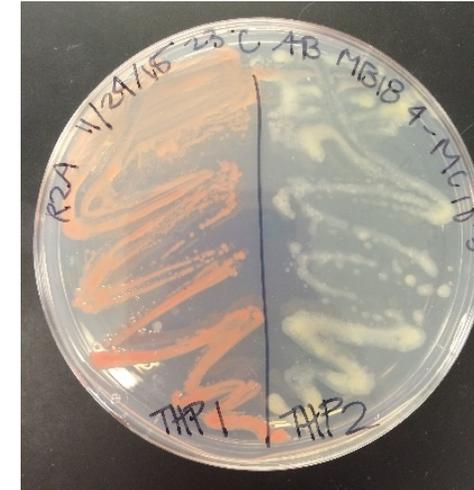
MC-LR Degradation: ELISA vs. Mass Spectrometry



MC-LR Degradation By Individual Clones



Isolation of
Individual
Bacterial Clones



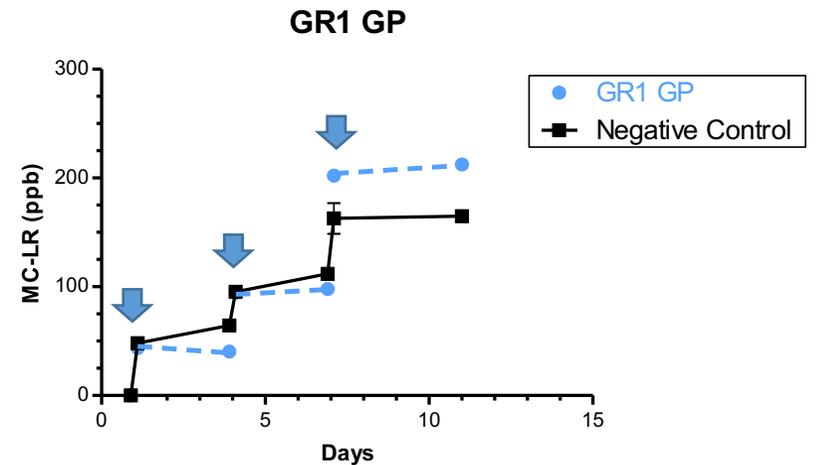
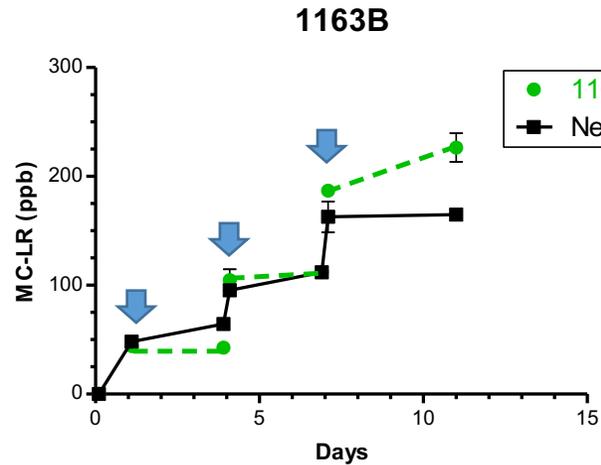
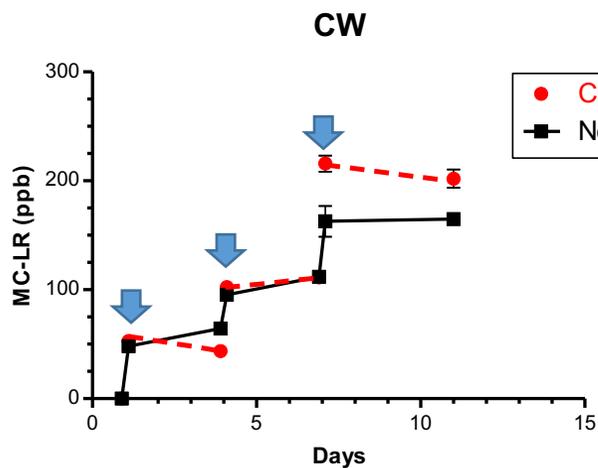
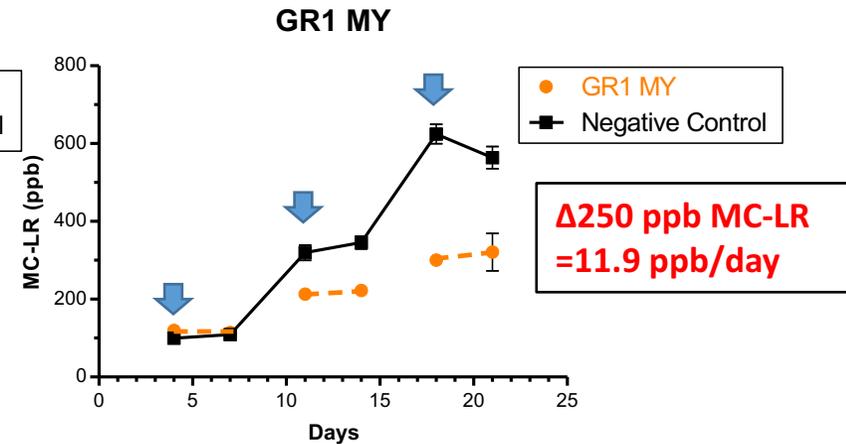
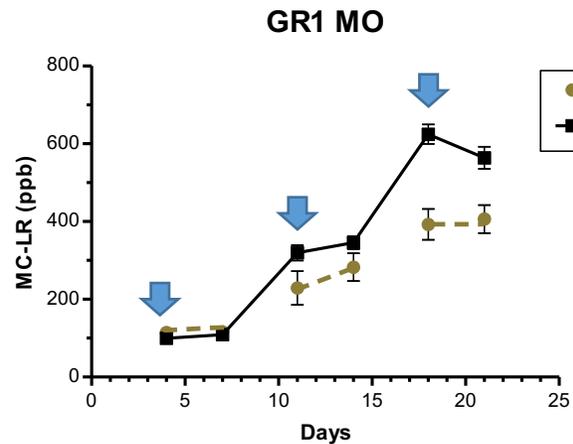
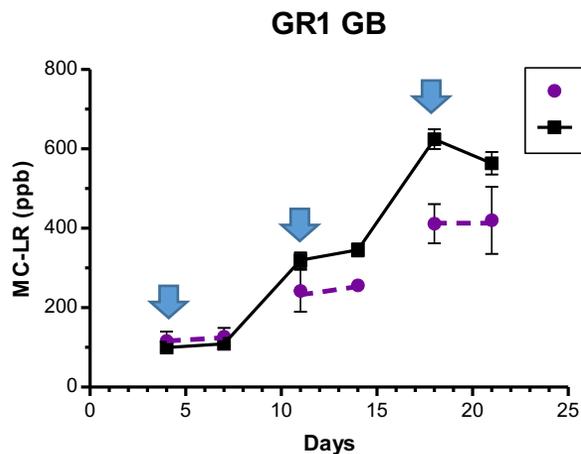
Are These Lake Erie Bacteria Safe?

~80 clones genotyped to date. Representative genus and species listed here

Colony Phenotype	Genus and Species	# of Times Identified
Elongated white	<i>Acinetobacter johnsonii</i>	3
Donut-shaped	<i>Sphingobium yanoikuyae</i>	3
Small yellow	<i>Sphingobium xenophagum</i>	1
Large white	<i>Pseudomonas alkylphenolia</i>	1
Tiny hot pink	<i>Runella slithyformis</i>	3
Beige undulating	<i>Pseudomonas alcaligenes</i>	1
Pale orange	<i>Leadbetterella byssophila</i>	1
Small beige	<i>Agrobacterium albertimagni</i>	2
Small white	<i>Rhizobium selenitireducens</i>	2
Yellow	<i>Pseudomonas putida</i>	4
Small white	<i>Bacillus cereus</i>	1
Medium creamy orange	<i>Emticicia sediminis</i>	1
Tiny clear	<i>Asticcacaulis biprosthecium</i>	1
Small yellow	<i>Acinetobacter haemolyticus</i>	1
Medium jelly orange	<i>Derxia gummosa</i>	1

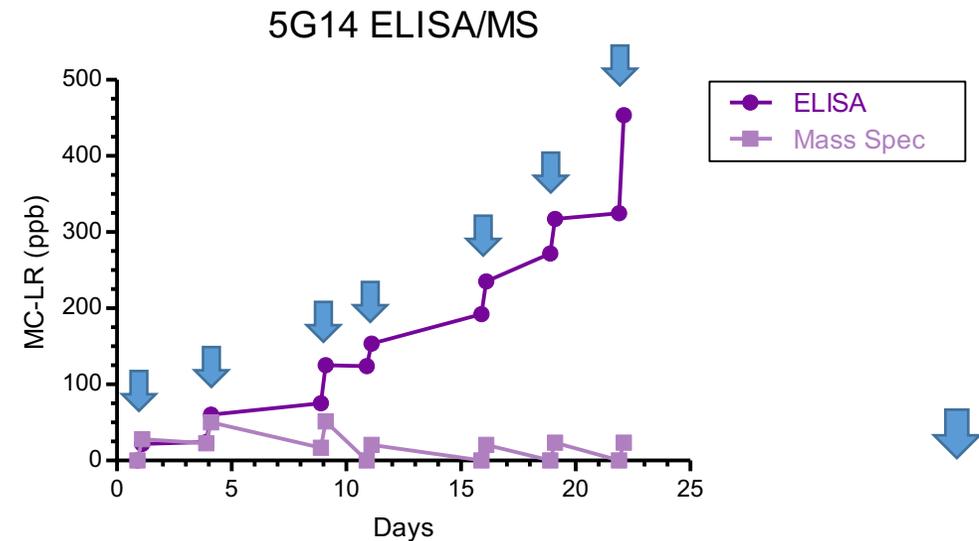
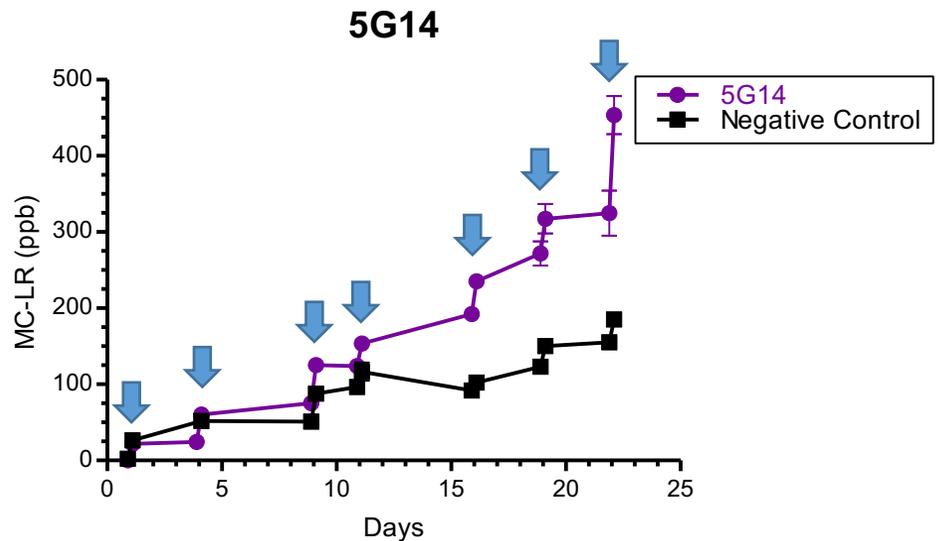
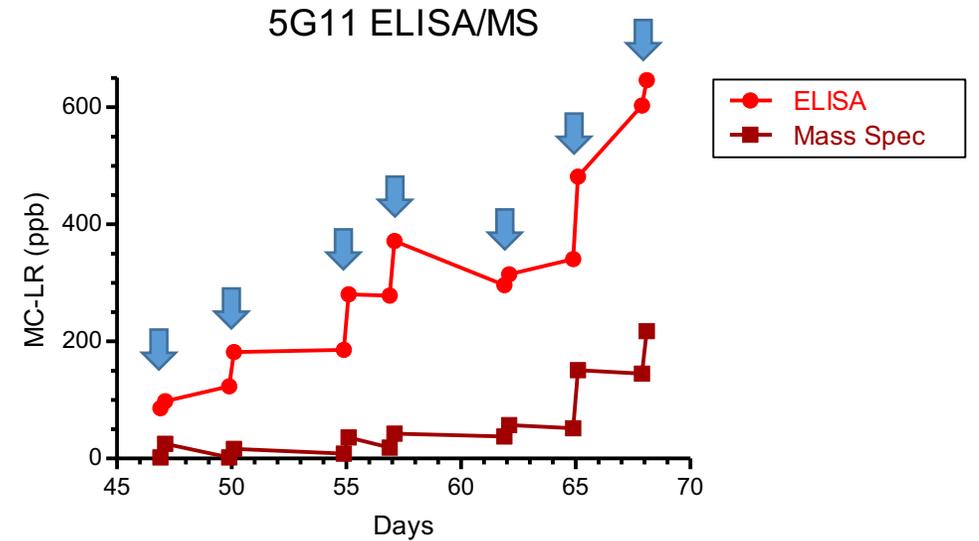
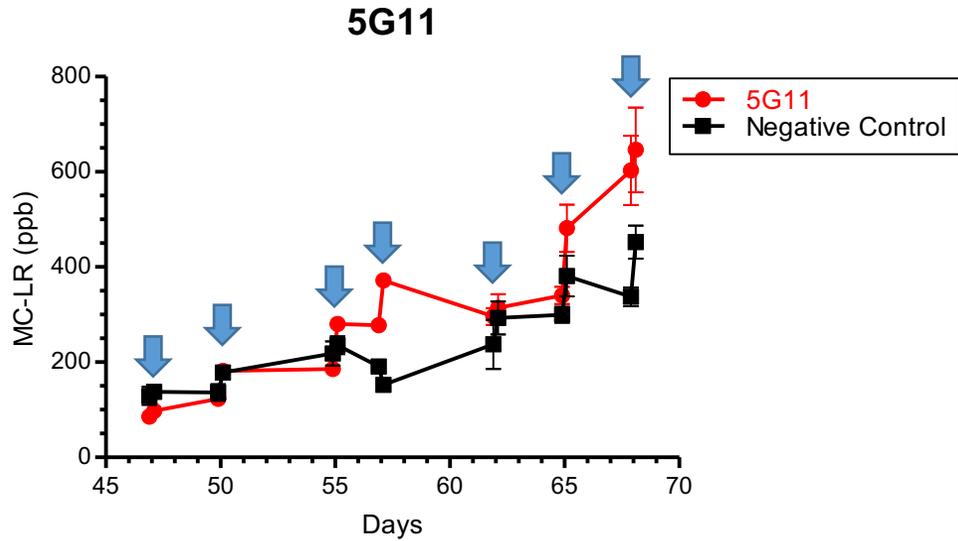
Colony Phenotype	Genus and Species	# of Times Identified
Large pink	<i>Emticicia oligotrophica</i>	1
Large white	<i>Pseudomonas fluorescens</i>	4
Rigid white	<i>Bacillis mycoides</i>	1
Small light yellow	<i>Flavobacterium akiainvivens</i>	1
Pink/gooey light orange	<i>Flectobacillus major</i>	4
Large yellow	<i>Microbacterium testaceum</i>	1
Small bright yellow	<i>Hydrogenophaga intermedia</i>	2
White indented	<i>Brevundimonas nasdae</i>	1
Medium white	<i>Rhizobium naphthalenivorans</i>	1
Tiny white	<i>Pseudomonas mugulae</i>	1
Medium beige foggy	<i>Aquincola tertiaricarbonis</i>	1
Small orange	<i>Brevundimonas subvibrioides</i>	1
Pale yellow	<i>Dyadobacter fermentans</i>	1
Transparent	<i>Variovorax paradoxus</i>	1
Foggy white	<i>Pseudomonas parafulva</i>	1

MC-LR Degradation by Individual Clones



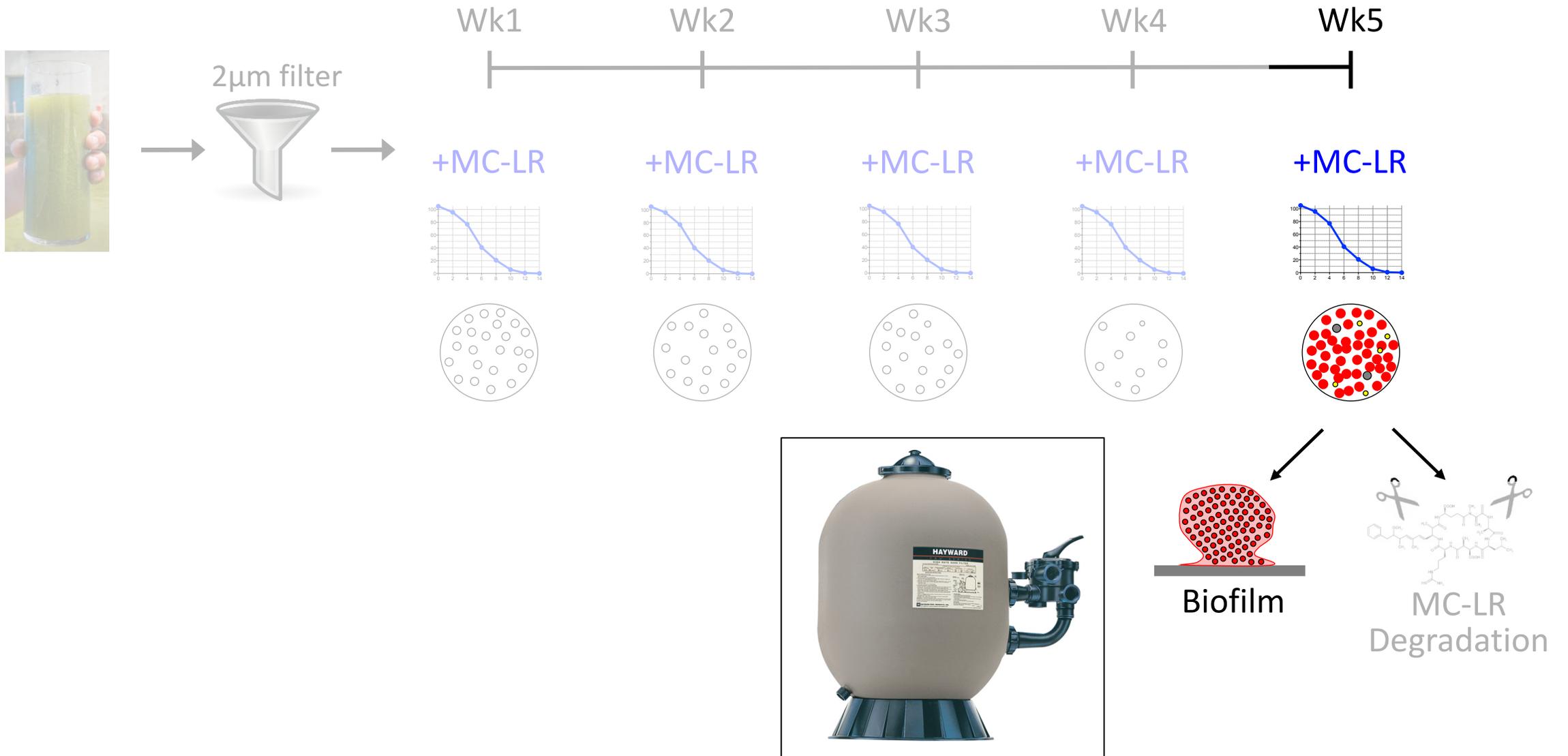
↓ = MC-LR Addition

MC-LR Degradation by Groups of Clones

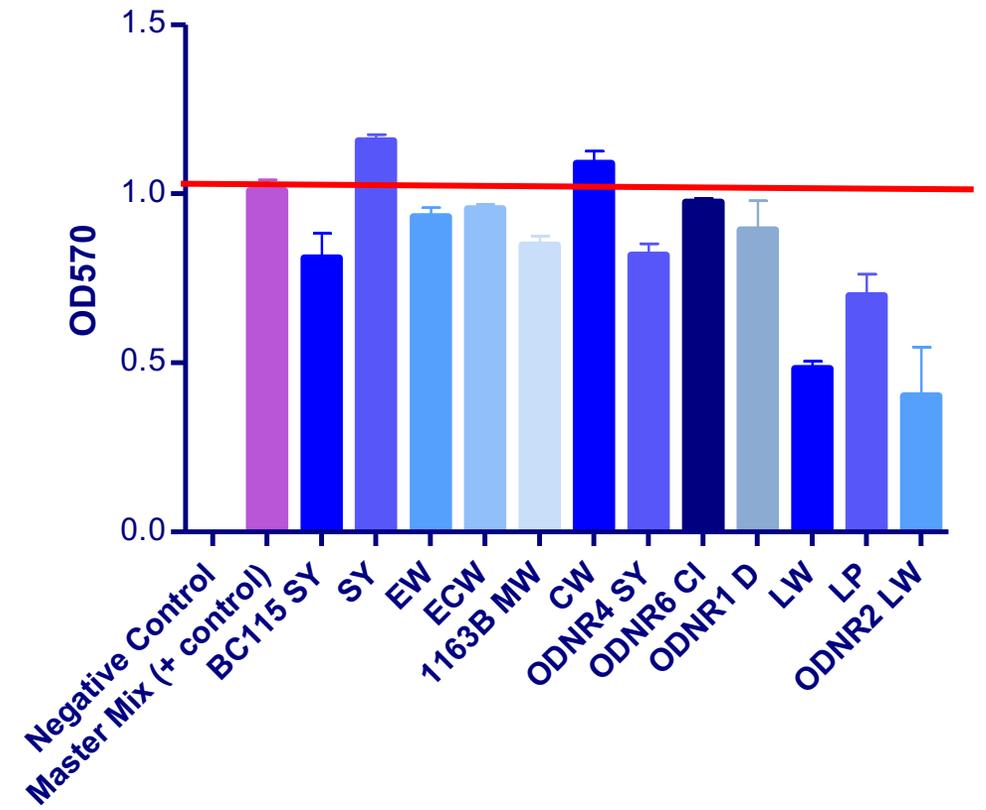
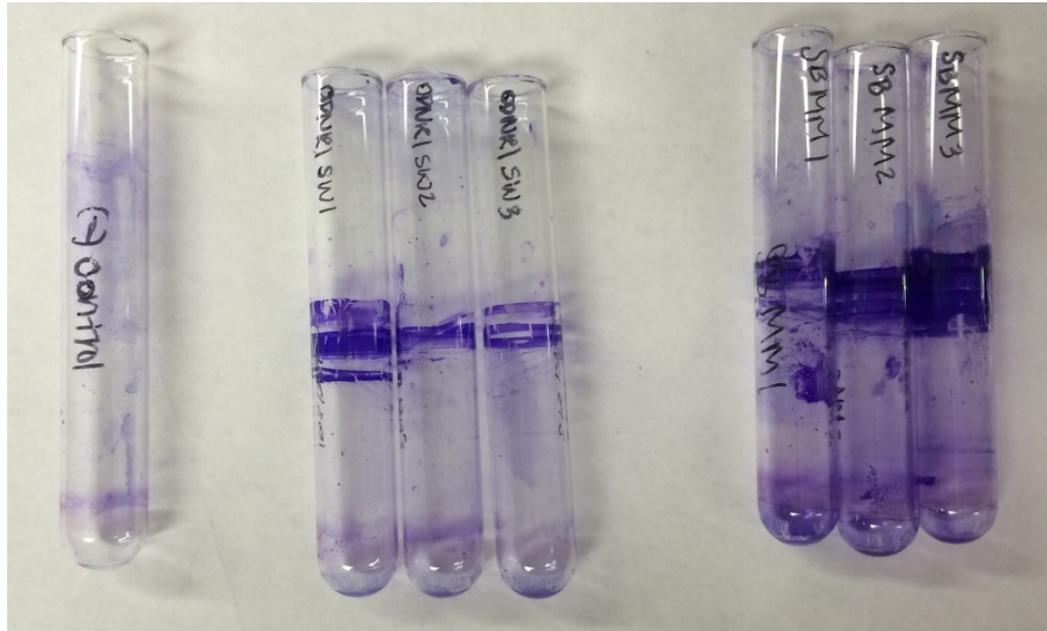


↓ = MC-LR Addition

Project Outline:



Biofilm Formation



Lab Scale Biofilter

Biodegradation of the cyanobacterial toxin microcystin LR in natural water and biologically active slow sand filters

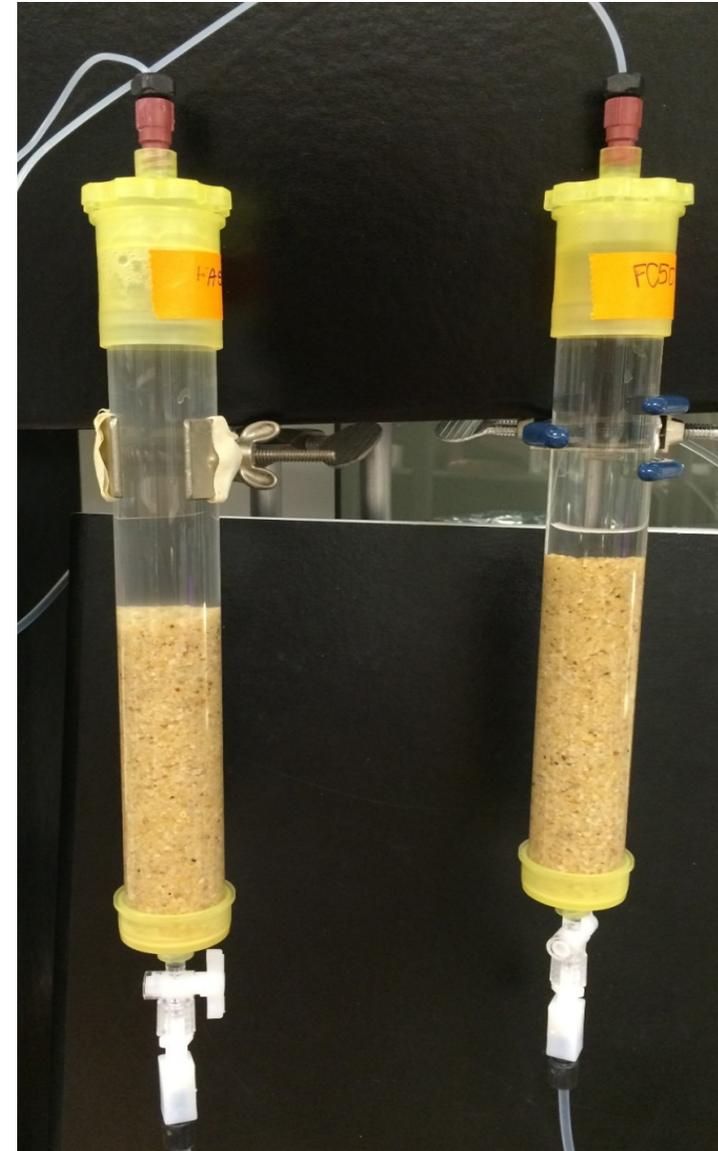
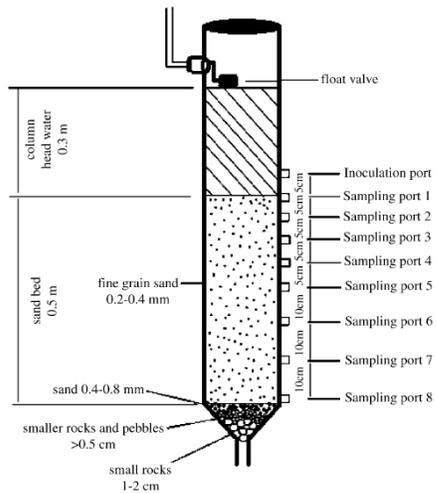
David G. Bourne^{a,b,c,*}, Robert L. Blakeley^b, Peter Riddles^{c,1}, Gary J. Jones^{a,d}

^aCSIRO Land and Water, PMB 3, Griffith, NSW 2680, Australia

^bDepartment of Biochemistry and Molecular Sciences, The University of Queensland, St Lucia, QLD 4072 Australia

^cCSIRO Tropical Agriculture, Indooroopilly, QLD 4068, Australia

^dCooperative Research Centre for Freshwater Ecology, University of Canberra, ACT 2600 Australia



Acknowledgements



THE UNIVERSITY OF TOLEDO
MEDICAL CENTER

Huntley Lab

- [Alison Brandel](#)
- Ealla Atari
- Briana Zellner



Funding: R/HHT-5-BOR and R/PPH-4-ODHE

The Ohio State University

- Justin Chaffin

The University of Toledo

- Thomas Bridgeman
- Dragan Isailovic
- Sanjee Palagama

Bowling Green State University

- George Bullerjahn
- Taylor Tuttle

Kent State University

- Jen Mou

Wayne State University

- Judy Westrick
- Johnna Birbeck