Jesse C. McNichol

Ph.D. Student, Massachusetts Institute of Technology/ Woods Hole Oceanographic Institution (2011-present)

+ Contact information

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+ Research Interests

Microbially-mediated elemental cycling

A quantitative understanding of the connections between sulfur oxidation, nitrate reduction and carbon fixation at deep sea hydrothermal vents is currently lacking. I am working to characterize autotrophic metabolism on both a community and single cell level. These complementary measurements will allow for estimations the contributions of deep sea vent microbes to global denitrification and dissolved organic matter fluxes. Currently, I am investigating these processes on cultures, and will apply the results to inform similar in-situ experiments at vents.

Biochemical adaptations to chemosynthetic lifestyles

The adaptations sulfur oxidizing microbes use to adapt to a dynamic and changing environment are largely uncharacterized on a molecular level. Using cultures of the sulfur oxidizing denitrifier *Sulfurimonas denitrificans*, I am investigating its growth with hydrogen sulfide, hydrogen gas or thiosulfate as a substrate, and working with Dr. François Thomas using qPCR to monitor expression of key metabolic genes. Interestingly, cells growth with hydrogen as a substrate show unusual morphology and subcellular structures, which may be a result of growth rate or metabolic stress.

Modelling cellular metabolism

In silico analyses of sequenced genomes allow us to model microbial metabolism and can offer insight into the evolution and adaptation of different species. I am currently working on constructing a metabolic model of *Sulfurimonas denitrificans* with Dr. Ying Zhang. This will be the first metabolic model of an obligate chemolithoautotroph and will allow for a detailed description of the core metabolism of this organism. This work complements the growth experiments, which can be used to validate the model. Similarly, model results may suggest questions that can be answered in culture.

+ Education

2003-2008 **B.Sc. in Biology, First-class Honours with Distinction, minor in Chinese Studies**

- Mount Allison University, Sackville, NB, Canada and Zhejiang University, Hangzhou, Zhejiang, China

Thesis: *Endophytic fungi of liverworts (Bryophyta) in a copper-contaminated environment*.
Co-advisors: Dr. Felix Baerlocher and Dr. Robert Thompson

+ Publications

1. **McNichol, J.**, McGinn, P, MacDougall, K. and Melanson, J. (2012) *Suitability of Soxhlet Extraction to Quantify Microalgal Fatty Acids as Determined by Comparison with In-Situ Transesterification*. Lipids. 47(2): 195-207. DOI 10.1007/s11745-011-3624-3.
2. **McNichol, J.** & Gordon, R. (2012) *Are we from outer space? A critical review of the panspermia hypothesis*. In: Origins: Genesis, Evolution and Diversity of Life. Eds.: J. Seckbach & R. Gordon. Dordrecht, Springer.
3. **McNichol, J.** and McGinn, P. (2012) Adapting mass algaculture for a northern climate. In: Gordon, R. & J. Seckbach, Eds. The Science of Algal Fuels: Phycology, Geology, Biophotonics, Genomics and Nanotechnology. Dordrecht, Springer.
4. MacDougall, K., **McNichol, J**., McGinn P.J., O'Leary, S.J.B, and Melanson, J. (2011) *Comprehensive lipid profiling of algal strains for biofuel feedstock by high resolution mass spectrometry*. Analytical and Bioanalytical Chemistry. 401(8): 2609-2616. DOI 10.1007/s00216-011-5376-6.
5. Park, K.C., Whitney, C., **McNichol J.**, Dickinson, K.E., MacQuarrie, S., Skrupski, B.P., Zou, J.T., Wilson, K.E., O'Leary, S.J.B and McGinn P.J. (2011) *Mixotrophic and photoautotrophic cultivation of 14 microalgae isolates from Saskatchewan, Canada: potential applications for wastewater remediation for biofuel production.* Journal of Applied Phycology. DOI 10.1007/s10811-011-9772-2
6. **McNichol, J.** (2008) *Primordial soup, fool's gold, and spontaneous generation: a brief introduction to the theory, history and philosophy of the search for the origin of life*. Biochemistry and Molecular Biology Education. 36(4): 255-261.

+ Research/Field Experience

July 2009 – July 2011 **Technical Officer**, National Bioproducts Program, Algal Biofuels – National Research Council of Canada, Halifax NS

- Developed lipid-analysis methodology for microalgal strains for the production of biodiesel.
- In collaboration with Dr. Shabana Bhatti, isolated new microalgal strains by single-cell picking, plate isolation and filtration techniques.
- Cultured, harvested and lyophilized kilogram quantities of microalgal biomass from photobioreactors.

Jan 2009– May 2009 **Environmental Technician**, Atlantic Lab for Environmental Testing – Environment Canada, Moncton NB

- Maintained laboratory cultures of sea urchins, *Hyalella azteca, Rana pipiens, Oncorhynchus mykiss,* and *Gasterosteus aculeatus.*
- Used light microscopy to assess the effect of metal toxicity assays on sea urchin embryo development.

May 2007- May 2008 **Summer Research Assistant**, Marine Macroecology and Biogeochemistry Lab, Sackville NB

- Conducted a research project on metal accumulation in cyanobacteria under different growth irradiances. Worked under the supervision of Dr. Zoe Finkel, and in collaboration with Dr. Christophe Six.
- Developed an experimental design for avoiding metal contamination and processing samples with Atomic Absorption Spectroscopy.

July 2008- Sept 2008 **Assistant Field Botanist**, Atlantic Canada Conservation Data Centre, Sackville NB

- Identified plant species and recorded population data in the field from the St. John river valley, P.E.I. national park, and southern Nova Scotia.
- Discovered a new stand of COSEWIC-listed species *Lophiola aurea* (Golden crest).

+ Teaching Experience

2010 **Mentor –** Assisted high-school and exchange students with science fair projects on lipid extraction and transesterification of microalgal biomass with bio-compatible solvents (as part of work for NRC).

2007 **Teaching Assistant** – Under the supervision of Dr. Robert Thompson, taught plant identification and ecology for *Native Flora* (BIO 3501, Mount Allison).

2008 **Invited lecturer** – Presented my first peer-reviewed publication ("Primordial soup, fool's gold and spontaneous generation") to Dr. Zoe Finkel's *Earth Systems Science* class (GENS 3451, Mount Allison).

2008 **Chinese Camp Instructor** – In collaboration with Karen Chung, developed a language immersion camp for teaching Mandarin Chinese to native English speakers ages 8-16 (As part of *Mount Allison Summer Language Villages*).

2007-2008 **Instructor, *Planet Performers* environmental drama** – Under the direction of Karen Chung, taught and discussed environmental issues (biofuels, global warming) with students (grades 6-8), and created two public performances.

+ Memberships / Affiliations

- Member, American Society of Microbiology (2013-present)
- Member, Canadian Association of Science Writers (2009-2010)

+ Awards

- NSERC PGS D3, Doctoral scholarship award (2012), $63,000
- NSERC PGS M, Master's scholarship (2011), $17,000
- Mount Allison Entrance Scholarship (2003), $1,000