

ROMAIN DARNAJOUX

Postdoctoral Research Fellow

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EDUCATION

- 2015 Ph.D. in Biogeochemistry, Sherbrooke University, Sherbrooke (QC), Canada
- 2010 M.S. in Chemistry, National Graduate School of Chemistry of Lille (ENSCL), Lille, France
- 2006 B.S. in Biology-Geology, François I College, Fontainebleau, France

APPOINTMENTS

- 2016-present Postdoctoral Research Fellow, Princeton University, Geosciences Department (USA)
- 2015-2016 Postdoctoral Researcher, Sherbrooke University, Biology Department (Canada)
- 2015-2016 Mini-FACE project Coordinator, Sherbrooke University, Biology Department (Canada)
- 2010-2011 Lab Manager, Paris Descartes University, Practical chemistry laboratory (France)
- 2010 Graduate Researcher, University of Kent, Biosciences Department (UK)
- 2007 Technical internship in production quality control, TYK, Tajimi, (Japan)

TEACHING RECORD

- 2015 Soil biology, Sherbrooke University, Biology Dept.
Designed and taught 1h course: “Deciphering the ecological importance of V-based nitrogen fixation in boreal ecosystems.”
- 2014-2015 Analytical chemistry practical, Sherbrooke University, Chemistry Dept.
Designed and taught 4h course: “Error measurement and statistics. ”
- 2014-2015 Analytical chemistry, Sherbrooke University, Chemistry Dept.
Designed and taught 2h course: “Element quantification in biological tissues with Inductively-coupled plasma mass spectrometry. Theory and application. ”
- 2012-2013 General chemistry & Aqueous chemistry practical, Pre-Bsc program, Sherbrooke University, Chemistry Dept.
- 2010-2011 Biochemistry practical lab, B.S. & M.S level, University Paris Descartes, Biosciences Dept.
- 2010-2011 Chemistry, B.S. level, one-on-one private lessons, 80 hours

AWARD AND FELLOWSHIP

- 2016-2019 Life Science Research Foundation Postdoctoral Fellowship, sponsored by Simons Foundation “Deciphering the genomic and metabolic heterogeneity of biological nitrogen fixation in boreal ecosystems” (Prof. Morel, Princeton University and Prof. Lutzoni, Duke University)
- 2016 Registration fellowship “12th Workshop on Cyanobacteria” (Tempe, AZ, USA)
- 2015 Honor’s list of the Dean, Ph.D. Thesis, Faculty of Sciences (Université de Sherbrooke)
- 2015 Chapitre Saint-Laurent: Excellence certificate, Public and Jury Prizes for “*4 minutes to talk about science*” (<https://www.youtube.com/watch?v=V5mmET-T1f8>)
- 2014 “[Gene H. Kruger](#)” Excellence Award (Université de Sherbrooke)

PUBLIC AND PROFESSIONAL SERVICE

Invited speaker

- ESGSA Special Seminar, Rutgers University, NJ, USA, (2014) “Deciphering the ecological importance of V-based nitrogen fixation in boreal ecosystems.”
- EGGS Lecture series, Princeton University, NJ, USA, (2014) “Deciphering the ecological importance of V-based nitrogen fixation in boreal ecosystems.”

Synergistic Activities

- Environmental Geology and Geochemistry Seminar Series, co-coordinator, Princeton University (2017-2018)

Reviewer activity

- Plant and Soil, Environmental pollution, Nature Communication

Society membership

- International Society for Microbial Ecology, International Association of Lichenology, Ecological Society of America, American Geochemical Union.

Outreaches

- [SEPAQ \(Québec Parks\) Blog: “Lichens & Nitrogen ” - August 15, 2017 \(in French\)](#)
- [Magazine Nature Sauvage - no 32 - Summer 2016 - p14: “The pollution line” - June 22, 2017 \(in French\)](#)
- [ASP \(Science Press Agency\) - Environment blog: “The northern limit of air pollution” - January 26, 2016 \(in French\)](#)
- [Chapitre St Laurent, 4 minutes to talk about science: “Discover my PhD, deciphering the ecological importance of V-based nitrogen fixation in boreal ecosystems ” - May 26, 2015 \(in French\)](#)

REFEREES

Prof. Jean-Philippe Bellenger, Ph.D. advisor, Université de Sherbrooke

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Prof. Robert Bradley, Postdoctoral advisor, Université de Sherbrooke

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Prof. Xinning Zhang, Postdoctoral advisor, Princeton University

Department of Geosciences, 152 Guyot Hall, Washington Rd., Princeton, NJ 08544, USA
Phone : +1 609 258 2489, e-mail : xinningz@princeton.edu

Prof. François Lutzoni, Postdoctoral advisor, Duke University

Department of Biology, 357 Bio. Sci. Bldg, Duke University, Box 90338, Durham, NC 27708, USA
Phone : +1 919 660 7261, e-mail : flutzoni@duke.edu

Selected Conference Presentations

(*speaker)

1. **Darnajoux, R.***, Renaudin, M., Magain, N., Lutzoni, F., Bellenger, J.-P., Zhang, X. “Vanadium nitrogenase in boreal cyanolichens: biome level activity and regulation.”. Oral presentation delivered at the *13th European Nitrogen Fixation Conference, Stockholm, Sweden* (August 2018)
2. **Darnajoux, R.***, Renaudin, M., Magain, N., Lutzoni, F., Bellenger, J.-P., Zhang, X. “Vanadium nitrogenase in boreal cyanolichens: biome level activity and regulation.”. Oral presentation delivered at the *17th International Society for Microbial Ecology Symposium, Leipzig, Germany* (August 2018)
3. **Darnajoux, R.***, Bradley, R., Le Monier, P., Houle, D., Bellenger, J.-P. “Drivers of spatial heterogeneity of biological nitrogen fixation in northeastern Canadian boreal forest.”. Poster presentation delivered at the *Ecological Society of America 2018 meeting, New Orléans, LA, USA* (August 2018)
4. **Darnajoux, R.***, Zhang, X., Magain, N., McRose, D., Miadlikowska, J., Kraepiel, A., Lutzoni, F., Bellenger, J.-P. “Vanadium nitrogenase in boreal cyanolichens: activity and regulation.”. Poster presentation delivered at the *Goldschmidt 2017, Paris, France* (August 2017)
5. **Darnajoux, R.***, Zhang, X., McRose, D., Miadlikowska, J., Kraepiel, A., Lutzoni, F., Bellenger, J.-P. “A glimpse at the lichen symbiosis; from metal homeostasis to ecosystems function.”. Oral presentation delivered at the *Northeastern Geobiology Symposium 2017, Storrs, Connecticut, USA* (March 2017)
6. **Darnajoux, R.***, Zhang, X., McRose, D., Miadlikowska, J., Kraepiel, A., Lutzoni, F., Bellenger, J.-P. “The importance of vanadium-based nitrogen fixation in boreal cyanolichens: a case study using *Peltigera aphthosa* (L.) Willd. s. l.”. Poster presentation delivered at the *8th International Association of Lichenology Symposium, Helsinki, Finland* (August 2016)
7. **Darnajoux, R.***, Bradley Robert and Bellenger, J.-P. “In vivo characterization of nitrogenase kinetics in *Anabaena variabilis* ATCC 29413 using cavity ring-down spectroscopy”. Oral presentation delivered at the *12th Workshop on Cyanobacteria, Tempe, AZ, USA* (May 2016)
8. **Darnajoux, R.***, Houle, D., Bellenger, J.-P and Bradley Robert. “Fixation d’azote dans les pessières à mousse : Quand la couleur importe !”. Oral presentation delivered at the *10^{ème} Colloque du Centre d’Étude de la Forêt, Montréal, Qc, Canada* (May 2016)
9. Jouogo Nounsi C*, **Darnajoux R.**, Pourhassan N., Deicke M., Wichard T., Burrus V. and Bellenger J.P. “Effect of natural organic matter on metal acquisition and nitrogenase use by *Azotobacter vinelandii*”. Oral presentation delivered at the *International Symposium on Interactions of Soil Minerals with Organic Components and Microorganisms (ISMOM), Montréal, Qc, Canada.* (July 2015)
10. **Darnajoux R.**, Miadlikowska J., Lutzoni F. and Bellenger J.P.* “Metal homeostasis in the foliose lichen *Peltigera aphthosa* from northern hemisphere.” Poster presentation delivered at the *European Geology Union, General Assembly, Vienna, Austria* (July 2014).
11. **Darnajoux, R.***, Bellenger, J.-P. (2014). “Investigating temperature dependency of nitrogen fixation in cyanobacteria using acetylene reduction assay cavity ring-down laser absorption spectroscopy (ARACAS).” Poster presentation delivered at the *Mer Bleue Workshop, McGill University, Montréal, Qc, Canada.* (March 2014)
12. **Darnajoux, R.***, Miadlikowska, J., Lutzoni, F. and Bellenger, J.-P. “Determination of baseline contamination of foliose lichens in Eastern Canada (Québec)” Oral presentation delivered at the *96th Canadian Chemistry Conference, Québec, Qc, Canada.* (May 2013)

PUBLICATIONS LIST

Refereed papers

1. **Darnajoux, R.**, Bradley, R., Houle, D., Bellenger, J. P. (2018) Predictable spatial patterns of biological nitrogen fixation in forest floor mosses: Color matters! *Soil Biology and Biochemistry*, 122, 160-62, doi: 10.1016/j.soilbio.2018.04.010

Highlight: This study shows that the phenotype “color” of moss shoots is a good predictor of their nitrogen status and thus can help predict the heterogeneity in the biological nitrogen fixation activity of boreal moss carpet at the plot scale. This is an important variable to consider when testing the effect of environments parameters (nutrient limitation, etc...), and it can also open the possibility of developing remote sensing tools for probing biological nitrogen fixation activity at the biome scale.

2. **Darnajoux, R.**, Zhang, X., McRose, D., Miadlikowska, J., Lutzoni, F., Kraepiel, A.M.L., & Bellenger, J. P. (2017) Alternative nitrogenase contribute to biological nitrogen fixation in boreal cyanolichens. *New Phytologist*, 213(2), 680-89, doi: 10.1111/nph.14166

Highlight: This report uses evidences from genomics, metal homeostasis and isotopic biogeochemistry to demonstrate the first proof of activity of V-nitrogenase in the environment (concomitantly with Zhang et al. 2016, that describe the isotopic method that discriminate alternative Nase activity from Mo nitrogenase) as well as an indirect link of this activity to Mo availability. The activity of the V-Nase in the *Nostoc* partner of boreal cyanolichens is significant enough (20-30% of total nitrogen fixation) to call for a re-evaluation of our conceptual model of the coupling between trace metal (Mo, V, Fe) and major nutrient (N and C) cycles.

3. Zhang, X., McRose, **Darnajoux, R.**, Bellenger, J. P., Morel, F.M.M., & Kraepiel, A.M.L. (2016) Alternative nitrogenase activity in the environment and nitrogen cycle implications. *Biogeochemistry*, 127(2), 189-98, doi:10.1007/s10533-016-0188-6.
4. Jouogo-Noumsi, C., Pourhassan, N., **Darnajoux, R.**, Deicke, M., Wichard, T., Burrus, V. & Bellenger, J. P. (2016) Effect of organic matter on nitrogenase metal cofactor homeostasis in *Azotobacter vinelandii* under diazotrophic condition. *Environmental Microbiology Report*, 8, 76-84 doi:10.1111/1758-2229.12353
5. **Darnajoux, R.**, Lutzoni, F., Miadlikowska, J., & Bellenger, J. P. (2015). Determination of elemental baseline using peltigeralean lichens from Northeastern Canada (Québec): Initial data collection for long term monitoring of the impact of global climate change on boreal and subarctic area in Canada. *Science of the Total Environment*, 533, 1-7.

Highlight: This study demonstrates that most part of northeastern Canadian boreal forest floor receive very low input of important micronutrient of the N and C cycle (Mo, Fe, Cu, etc...) from atmospheric deposition, with values as low as for remote or high elevation areas of the world (Antarctica, Patagonia, Alps). This finding has important implication for our understanding of global nutrient cycling in the boreal ecosystems, where up to 50% of the total nitrogen input occurs in moss carpet, which solely rely on atmospheric deposition for their micronutrient sources.

6. **Darnajoux, R.**, Constantin, J., Miadlikowska, J., Lutzoni, F., & Bellenger, J. P. (2014). Is vanadium a biometal for boreal cyanolichens. *New Phytologist*, 202(3), 765-71.
7. Allard, P., **Darnajoux, R.**, Phalyvong K., & Bellenger J.P. (2013). Effects of tungsten and titanium oxide nanoparticles on the diazotrophic growth and metals acquisition by *Azotobacter vinelandii* under molybdenum limiting condition. *Environmental Science & Technology*, 47(4), 2061-2068.

In preparation

- **Darnajoux, R.**, Bradley, R. & Bellenger, J.-P. Temperature dependency of molybdenum and vanadium nitrogenase in *Anabaena variabilis*. Journal: *Environmental Science and Technology*.

Highlight: This study demonstrates that the V nitrogenase become as efficient as the Mo nitrogenase below a temperature of around 15°C, and partly attribute this phenomenon to a change in the affinity constant with temperature. The temperature threshold, close to the mean temperature at the surface of the earth, highlight that the V nitrogenase will be as efficient as the Mo nitrogenase to sustain the growth of an organism at environmentally relevant temperature.

- **Darnajoux, R.**, Renaudin, M., Magain, N., Lutzoni, F., Bellenger, J.-P., Zhang, X. Biome scale activity of vanadium nitrogenase in boreal cyanolichens.
- **Darnajoux, R.***, Bradley, R., Le Monier, P., Houle, D., Bellenger, J.-P. “Drivers of spatial heterogeneity of biological nitrogen fixation in northeastern Canadian boreal forest.”