

David Morris Johnston-Monje

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Biologist specializing in Microbial Ecology, Plant Agriculture and Molecular Genetics

I am an impact-oriented biologist with 15 years of research experience in agriculture, plant, microbial and molecular sciences. My career has focused on the study of plant-associated microbial ecology and applied research in plant genetics and physiology to help discover answers to humanity's challenges in agriculture and conservation. My research has resulted in 10 publications and 13 issued or published patents, and contributed to the founding of two startup companies and one academic lab.

Education

Ph.D. Plant Agriculture and Microbial Ecology (2011), Supervisor: M. Raizada, U of Guelph, Guelph, ON, Canada

M.Sc. Botany (2006), Supervisor: Carl Douglas, U of British Columbia, Vancouver, BC, Canada

B.Sc. Biology/Biotechnology (2001), Supervisor: John Arnason, U of Ottawa, Ottawa, ON, Canada

Experience

VISITING SCIENTIST

2017

LABORATORY OF CASSAVA GENETICS, CIAT - Cali, *Colombia*

- Generating data for a high impact publication by comparing microbiomes and mycobiomes across a panel of 18 different economically important plant species using next generation sequencing on a Miseq.

SCIENTIST

2013 – 2017

INDIGO AGRICULTURE, DEPARTMENT OF DISCOVERY - *Cambridge, MA, USA*

- Provided the founding scientific hypothesis of the company and helped write and translate it into the majority of its patent portfolio (6 issued, 1 published).
- Developed the company's bioprospecting strategy, acquired thousands of plant samples from around the world and built the company's microbial collection.
- Developed and implemented 14 different high-throughput assays for screening the microbial collection.
- Discovered the company's formulation of choice for inoculation of microbes on seed.
- Planned, executed, analyzed and drafted for publication a very large plant microbiome/mycobiome study which defines the microbial ecology of all microbes inhabiting angiosperm plants (never published).
- Conducted numerous greenhouse trials on new crop species to explore the potential for new business opportunities using the company's microbial collection.
- Developed the company's standard operating procedures for solid state growth of bacterial cultures, isolation of microbes and DNA from plants, microbial community sequencing from environmental samples, and of tracking microbe survival after storage and seed inoculation.
- Worked with contract research organizations to prepare and supervise field trial plantings around the world, including Austria, Argentina, South Dakota, Texas, Nebraska, Illinois and Idaho.
- Served on the Core Values working group and functioned as institutional memory for the company's new hires ranging from research assistants to the Chief Scientific Officer and Director of Intellectual Property.

POST-DOCTORAL RESEARCHER

2011 – 2013

A&L BIOLOGICALS - *London, ON, Canada*

- Developed DNA fingerprinting as a diagnostic test for evaluating the effectiveness of soil amendments and fumigants – today commercially offered as a service to thousands of Canadian farmers.
- Discovered probable cause of "tomato vine decline" - published in the Canadian Journal of Plant Pathology.
- Wrote 10 reports to granting agencies and grower groups and worked on additional projects developing microbial inoculants for strawberry, bioprospecting for endophytic bacteria from wild potato species,

surveying Australian soils for disease suppressive bacteria, and testing of compost teas for their ability to induce systemic acquired resistance in plants.

VISITING SCIENTIST

2011

LABORATORY OF GRAMINEOUS PLANTS, EMBRAPA AGROBIOLOGIA - *Seropédica, RJ, Brazil*

- Raised funding and organized a multi-institute collaboration including IICA Canada, the University of Guelph, A&L Biologicals, EMBRAPA Agrobiologia and the University of North Carolina, Chapel Hill.
- Showed DNA fingerprinting and next generation sequencing can yield similar results and that the most abundant bacteria in rhizospheres come from seed. Published as a paper in Plant and Soil.

DOCTORAL RESEARCHER

2007 – 2011

DEPARTMENT OF PLANT AGRICULTURE, UNIVERSITY OF GUELPH - *Guelph, ON, Canada*

- Gathered a diversity panel of seed and soil in Mexico for pioneering experiments on the microbial ecology of maize using both culture and DNA fingerprinting approaches.
- Discovered that seeds are a rich source of bacterial endophytes, that bacterial populations vary with plant domestication status and that soils are not the major source of endophytic bacteria in plants.
- Experiments were also conducted in bacterial functional genomics, bacterial genetic modification, high-throughput bacterial screening, and fluorescence microscopy.

TEAM LEADER

2008

INTERNATIONAL GENETICALLY ENGINEERED MACHINES (iGEM) COMPETITION - *Guelph, ON, Canada*

- Raised over \$10,000 through academic grants and corporate sponsorship.
- Recruited and trained a group of 6 undergrad students in advanced molecular biology lab technique. Built two different genetically modified machines and presented these at MIT receiving a bronze medal. (More info available at: <http://2008.igem.org/Team:Guelph>)

VISITING SCIENTIST

2006

DEPARTMENT OF BREEDING AND GENETICS, INTERNATIONAL POTATO RESEARCH INSTITUTE (CIP) - *Lima, Peru*

- Conducted a three month study to help characterize how genetic selection by ancient Andean farmers has contributed to tuber carotenoid production in modern yellow and orange potatoes. Three homologues of tomato fruit carotenoid genes were chosen, cloned from a mapping population, and characterized by tissue specific expression in potatoes using RT PCR. Their frequency was then assessed in a panel of genetically diverse Andean potatoes.

GRADUATE RESEARCHER/TEACHING ASSISTANT

2003 – 2006

DEPARTMENT OF BOTANY, UNIVERSITY OF BRITISH COLUMBIA - *Vancouver, BC, Canada*

- Conducted a functional genomics study on the wood forming genes, CTL1 and CTL2, using transgenic poplars and *Arabidopsis* mutants.
- Investigated CTL gene function in a woody tree by making RNAi knockouts of both genes. Poplar leaves in tissue culture were transformed with *Agrobacterium* and grown into trees that were sectioned and analyzed microscopically for changes in cell wall phenotype.
- Investigated the evolution of CTL gene function by transforming *Arabidopsis* mutants with CTL homologues from poplar and spruce to assess potential for genetic complementation, or with the GUS reporter gene to visualize patterns of CTL gene expression.
- Built all RNAi and reporter constructs, screened for transformants in Petri dish based bioassays, and searched for cell wall phenotypes using light microscopy.
- Responsible for conducting twice weekly tutorials in basic or molecular genetics for two semesters per year.

ADDITIONAL PROFESSIONAL EXPERIENCES

- **EDUCATION POLICY INTERN, 2002 – 2003**

DEPARTMENT OF INFORMATION AND TRAINING, BIODIVERSITY INTERNATIONAL - *Rome, Lazio, Italy*

- **RESEARCH TECHNICIAN, 2000**
DEPARTMENT OF BIOLOGY, UNIVERSITY OF OTTAWA - *Ottawa, ON, Canada*
- **RESEARCH TECHNICIAN, 1998**
EASTERN CEREAL & OILSEED RESEARCH CENTER, AGRICULTURE AND AGRI-FOOD CANADA - *Ottawa, ON, Canada*

Research Skills and Techniques

- **Molecular biology:** DNA and RNA extraction from bacteria, fungi, plants and soil, real time PCR, gene expression profiling, gene cloning, gene mapping, GFP and GUS, PCR, RT-PCR, synthetic biology, antisense, RNAi, DNA sequence analysis, site directed mutagenesis, primer design, DNA fingerprinting, TRFLP, next generation sequencing, functional metagenomics.
- **Microbiology:** bioprospecting, bacterial and fungal cell culture, sterile technique, dilution plating, isolation of microbes from environmental samples, flow cytometry, live cell imaging in plant tissues, chemical and electrical transformation of bacterial, high throughput assays, antibiosis assays, solid state fermentation.
- **Plant biology:** plant tissue culture, *Agrobacterium* mediated plant transformation, seed germination assays, seedling vigour assays, plant-microbe interaction assays, plant stress bioassays, disease diagnosis, greenhouse yield trials, field trial planning and planting, harvesting and yield calculation, soil nutrient analysis, automated image analysis, multivariate statistics.
- **Instrumentation:** spectrophotometers, bead mills, liquid seed treaters, lab automation robots, fluorescence microscopy, HPLC, microtiter plate readers, electroporators, vacuum seed planters, box drill seeders.
- **Software:** Geneious, XLStat, Bioedit, tRIFLE, SoftGenetics, Genescan, ARM, Microsoft Word, Excel, and Power Point, Adobe Photoshop, Endnote.

Publications

David Johnston-Monje, Steve Loewen and George Lazarovits. (2017) "Mycobiomes of Tomato Plants with Vine Decline." *Canadian Journal of Plant Pathology*. 39: 184-200.

David Johnston-Monje, Derek S. Lundberg, George Lazarovits, Veronica M. Reis and Manish N. Raizada. (2016) "Bacterial populations in juvenile maize rhizospheres originate from both seed and soil." *Plant and Soil*. 405: 337-355.

Meneses, Carlos, Bruna Silva, Betsy Medeiros, Rodrigo Serrato and **David Johnston-Monje**. (2016) "A Metagenomic Advance for the Cloning and Characterization of a Cellulase from Red Rice Crop Residues." *Molecules*. 21: 831.

Ettinger, Cassandra L., Hanan R. Shehata, **David Johnston-Monje**, Manish N. Raizada, and Jonathan A. Eisen. (2015) "Draft genome sequence of *Burkholderia gladioli* strain UCD-UG_CHAPALOTE (phylum Proteobacteria)." *Genome announcements*. 3: e01462-14.

David Johnston-Monje, Walaa Kamel Mousa, George Lazarovits and Manish N. Raizada. (2014) "Impact of swapping soils on the endophytic bacterial communities of pre-domesticated, ancient and modern maize." *BMC plant biology*. 14: 233.

George Lazarovits, Amy Turnbull and **David Johnston-Monje**. (2014) "Plant health management: Biological control of plant pathogens." In: Cook RJ, editor. *Encyclopedia of Agriculture and Food Systems*. 2nd ed. 388-399.

David Johnston-Monje and Manish N. Raizada (2013) "Surveying Diverse Zea Seed for Populations of Bacterial Endophytes." In: de Bruijn F, editor. *Molecular Microbial Ecology of the Rhizosphere*. Volume 1. 445-455.

David Johnston-Monje and Manish N. Raizada (2011) "Plant and endophyte relationships: Nutrient management." In: Moo-Young M, editor. *Comprehensive Biotechnology*. 2 ed. 713-727.

David Johnston-Monje and Manish N. Raizada (2011) "Conservation and Diversity of Seed Associated Endophytes in Zea across Boundaries of Evolution, Ethnography and Ecology." *PLoS ONE* 6(6): e20396.

A. C. Bily, L. M. Reid, J. H. Taylor, **D. Johnston**, C. Malouin, A. J. Burt, B. Bakan, C. Regnault-Roger, K. P. Pauls, J. T. Arnason, and B. J. R. Philogène. (2003) "Dehydrodimers of Ferulic Acid in Maize Grain Pericarp and Aleurone: Resistance Factors to *Fusarium graminearum*." *Phytopathology*. 93:712-719.

Patents

Agricultural endophyte-plant compositions and methods of use. WO 2015035099 A1. Published Jan 26, 2017

Plants containing beneficial endophytes. WO 2015/100431 A8. Published Jan 19, 2017

Methods of use of seed-origin endophyte populations. US9288995B2, US9295263B2, US9532572B2, US9532573B2. 4 separate patents issued Jan 3, 2017

Penicillium Endophyte Compositions and Methods for Improved Agronomic Traits in Plants. WO 2016/210238 A1, Published Dec 29, 2016

Streptomyces Endophyte Compositions and Methods for Improved Agronomic Traits in Plants. WO 2016/200987 A1, Published: Dec 15, 2016

Seed Endophytes Across Cultivars And Species, Associated Compositions, And Methods Of Use Thereof. WO 2016/109758 A3, Published: Jul 7, 2016

Endophytes, associated compositions, and methods of use thereof. US9408394 B2 and AU2015279557B2. Issued Aug 9, 2016

Bacterial endophytes for biocontrol of fungus. WO2016044954A1. Published Mar 31, 2016

Method for propagating microorganisms within plant bioreactors and stably storing microorganisms within agricultural seeds. WO 2015100432 A3. Published Sept 3, 2015

Seed-origin endophyte populations, Compositions, and methods of use. US 9113636 B2, WO 2014/210372 A1, and AU2014302296B2. Issued Aug 25, 2015

Conference Presentations

- Identifying Tomato Vine Decline Pathogens – Ontario Processing Vegetable Industry Conference, London, Ontario. 2013.
- Zea seed bacterial endophyte discovery and characterization - American Society of Plant Biologists Meeting, Montreal 2010 and Congress of International Molecular Plant Microbe Interactions, Quebec City 2009.
- A survey of maize endophyte diversity and potential – Canadian Society of Plant Physiologists, Guelph 2009.
- Plant development today, Biofortification tomorrow – CIP Visiting scientist seminar series, Lima, Peru, 2006.
- Functional genomics of plant chitinase-like genes – International Plant Development, Vancouver, 2006.
- Chitinase-like genes in the model tree: Functional characterization of poplar CTL1 and CTL2 through phenotype rescue, gene silencing and promoter studies - American Society of Plant Biologists, Seattle 2005 and Boston 2006
- Modulation of Lipophilic Secondary Metabolites in *Echinaceae* Species by Induction of the Jasmonic Acid Pathway – University of Ottawa undergrad research symposium, 2001

Skills and Interests

- Professional experience in Italy, Syria, Lebanon, Brazil, Peru, Mexico, Austria, Argentina, Canada, and USA
- Native proficiency in English and Spanish, Intermediate French, Italian and Portuguese
- PADI advanced open water diver, St. John's Ambulance First Aid, child CPR and Bronze Medallion training
- Grade 3 and 4 Royal Conservatory certificate in guitar and piano
- Hiking, biking, squash, tennis, SCUBA, camping, travel, house, ska, salsa, reading, movies, dance