Matthew McDougall, Ph.D.

Matt.McDougall@prairiescientific.ca
204-791-5048

Education and Employment

Executive Director and Lead Field Scientist,
Prairie Scientific Inc., Winnipeg, MB 2020-

- Designing and Implementing Environmental Sampling Regimens
- Providing Technical Review on Proposed and Existing Projects

Centre for Oil and Gas Research and Development,
University of Manitoba, Winnipeg, MB 2018-2022

- Post Doctoral Fellow managing the Environmental DNA program at COGRAD, including preparing funding proposals
- Continuing Structural Biology work with the Stetefeld group in the Dept. of Chemistry

University of Manitoba, Winnipeg, MB 2018

- **Ph. D.** in Biochemistry (Focussed on Structural Biology)
- Thesis entitled "Non-Enzymatic Extracellular Proteins and Their Role in Growth, Defense, and Metabolism"
- PI Dr. Jorg Stetefeld

University of Manitoba, Winnipeg, MB 2012

- **B.Sc. (Hons)** in Biochemistry (Chemistry/Microbiology Joint Degree)
- Honours project entitled "The Incorporation of Gold Nanoparticle into the Cavities of a Right Handed Coiled Coil Tetramer"

Foreman, Operator
Raymond Vauclair Projects, Winnipeg, MB 2010-2013

- Organized and Completed Heavy Construction Project in Road and Rail Works
- Prepared Tenders and Coordinated with Sub-Contractors
- Trained New Workers and Maintained a Safe Working Environment following COR certified protocols

Labourer, Operator
Mulder Construction, Winnipeg, MB 2007-2010

- Worked on Sewer/Water, Concrete Paving, Rail Yard Maintenance, and Base Work
- Operated Excavator, Tractor-Backhoe, Skid-Steer, Packer, Broom, and Front-End Loader

Research and Professional Experience

Lead Scientist

- Water and Fish Tissue Environmental Sampling
    - Designed a field program in compliance with existing monitoring frameworks in the Kivalliq region of Nunavut
    - Collected robust water and tissue samples in collaboration with the Kivalliq Inuit Association (KIA) technical team
    - Developed and utilized a questionnaire for the collection of Traditional Knowledge from local Elders in parallel with field sample collection
    - Reported all collected data to relevant stakeholders
- Mining Activity Environmental Compliance
    - Reviewing Technical documents and Annual Reports submitted by proponents to governing boards for compliance and communicating findings to the KIA
    - Working with the Agnico Eagle and the KIA to develop mutually agreeable Habitat Offsetting and Water Management Plans
- Nunavut Water Management Steering Committee
    - Attending meetings and reviewing documents on behalf of the KIA
    - Provide Recommendation on Water Management
- Arctic Char Habitat Restoration
    - Coordinating a workforce of community members of Rankin Inlet to alter river flow over the course of one week to allow the passage of Arctic Char
    - Conducting measurements before and after to determine success of the program

Post-Doc/Consultant

- The impacts of mining activity on arctic lakes by eDNA metagenomics
    - Designed and executed the project objectives.
    - Assisted in grant writing internally and in collaboration with the Kivalliq Inuit Association
    - Organized field sampling with Agnico Eagle Mining and the KIA
    - Designed and outfitted an eDNA lab at UofM using Western Economic Diversification (WD) funds
    - Submitted progress and financial reports to AEM, KIA, and WD
    - Prepared a Section for the KIA presentation to the Arctic Framework Policy Senate Committee
- Water Contamination Analysis
    - Designed and Implemented a Metal Contamination Analysis after a dam breach leaked reservoir water into a clean lake
    - Revised the proposed sampling regimen as field conditions did not allow the proposed sampling
    - Maintained Chain of Custody for Sample Analysis
    - Prepared a Report for inclusion in the final Incident Report
- Worked in an ISO and CALA accredited Lab
- Organizing and Teaching Workshops on Water/Sediment Sampling

Ph.D.

- Mechanism of basement membrane reorganisation by Netrin-4

- Interruption of the blood clotting response by the snake venom protein Rhodocetin
- Uptake of sulfur by the archaea *Staphylothermus marinus* for respiration
- Exploration of the capacity of archaeal S-layer proteins to bind PAHs and the development of a novel passive sampler media
- Examining the chemo-repellant and –attractant properties of Netrin-1 through interactions with its receptors
- Environmental DNA analysis of fish in hyperoligotrophic lakes in Canada's tundra

B.Sc.

- Using the truncated S-layer protein RHCC to reduce metal cations and stabilize small metal clusters

Areas of Expertise

- Sample Handling under ISO and CALA Regulations
- Analyze and Interpret Sampling Results, including Performing Statistical Analyzes
- Coordinating Field Sampling with Multiple Interests
- Designing and Budgeting Field Sampling Regimens
- Preparation of Research Proposals
- Communication with Regulators or Researchers
- Sediment, Water, and Tissue Extraction for a variety of Sample Analyzes
- Providing comments on Technical or Scientific Documents
- Collation of Large amounts of Data into Single Reports
- Safe Field Work, with Daily Safety Briefings and Job Hazard Assessments
- Working Safely in and Industrial Setting especially around Heavy Equipment
- Elemental analysis by Optical Emission Spectroscopy
- Extraction of low MW hydrocarbons from soil and tissue for Mass Spectrometry analysis
- Sampling water bodies for eDNA and subsequent DNA extraction and analysis
- Generation of publication quality figures with QTIplot and pymol

Supervisory Experience

- **Graduate Students-** Trained new students in basic lab practice, as well as in more advanced techniques, such as Xray crystallography. Supervised students during field sampling. Also helped the students develop their thesis projects and design experiments.
    - Shubleen Sidhu (MSc 2019)
    - Haben Gabir (MSc 2019, PhD 2020-2022)
    - Monika Gupta (2017-2022)
    - Fabian Heide (2018-2022)
    - Scott Legare (2019-2022)
    - Faride Rafiei (2019-2022)
    - Wesley Johnson (2019-2022)

- **Summer Trainees & 4th year honours students** – Provided training in basic laboratory safety and standard laboratory practice. Developed and assigned a small sub-project for each trainee and taught the theory and practice of techniques used in the work. Assisted in troubleshooting and interpretation of results. Students include:
    - Camila Aprosof (2018-2020)
    - Fabian Heide (2017-2018)
    - Oluwadamilola Daramola (2017)
    - Shubleen Sidhu (2016-2017)
    - Kayla Neumann (2016)
    - Sydney Loewen (2015-2016)
- **Other Supervisory Experience** – While completing my undergraduate degree I worked in heavy construction during the summers. In 2011 I assumed the role of foreman, where I supervised crews of between 2 and 12, both new hires and experienced workers. As foreman, my duties included workplace safety and other training, scheduling, conflict resolution, ensuring compliance with local and provincial ordinances as well as company policy, organisation of subcontractors and material suppliers, submitting tenders and keeping jobs within budget, and coordination with our customers.

Scholarships and Awards

- University Of Manitoba Distinguished Dissertation Award, 2019, $3000
- Hugh J. Anderson Graduate Award in Chemistry, University of Manitoba, 2015, $2375
- Delbaere Pauling Prize, American Crystallographic Association, 2015, $330
- Department of Chemistry Scholarship, University of Manitoba, 2014, $2000
- Faculty of Science Graduate Studentship, University of Manitoba, 2013, $10000
- Hugh J. Anderson Graduate Award in Chemistry, University of Manitoba, 2013, $500

Publications

Heide F, Aprosoff C, Peters L, Palace V, Tomy G, Stetefeld J, **McDougall M.** A novel passive sampling device for low molecular PAHs with a proteinaceous medium. *Water Research X*. Submitted 2020.

Harder-Viddal C, **McDougall M**, Roshko RM, Stetefeld J. Energetics of Storage and Diffusion of Water and Cyclo-Octasulfur for a Nonpolar Cavity of RHCC Tetrabrachion by Molecular Dynamics Simulations. *Computational and Structural Biology.* 2019 May; **(23)** 675-683

McDougall M, Francisco O, Harder-Viddal C, Roshko R, Heide F, Sidhu S, Khajehpour M, Leslie J, Palace V, Tomy GT, Stetefeld J. Proteinaceous Nano-container Encapsulates Polycyclic Aromatic Hydrocarbons. *Nature Scientific Reports*. 2019 Jan; **(9)** 1058

McDougall M, McEleney K, Francisco O, Trieu B, Ogbomo KE, Tomy G, Stetefeld J. Reductive power of the archaea right-handed coiled coil nanotube (RHCC-NT) and incorporation of mercury clusters inside protein cages. *Journal of Structural Biology*. 2018 Sept; **(203)** 281-297.

Meier M, Moya-Torres A, Krahn NJ, **McDougall M**, Orriss GL, McRae E, Booy EP, McEleney K, Patel TR, McKenna SA, Stetefeld J. Structure and hydrodynamics of a DNA G-quadruplex with a cytosine bulge. *Nucleic Acid Research.* 2018 May; **(46)** 5319-5331

McDougall M, Francisco O, Viddal C, Roshko R, Meier M, Stetefeld J. Archaea S-layer nanotube from a "black smoker" in complex with cyclo-octasulfur (S8) rings. *Proteins: Structure, Function, and Bioinformatics.* 2017 October 11; **(85)** 2209–2216

Francisco O, Idowu I, Friesen KL, **McDougall M**, Choi SS, Bolluch P, Daramola O, Johnson W, Palace V, Stetefeld J, Tomy GT. Absorption of polycylic aromatic hydrocarbons by a highly absorptive polymeric medium. *Chemosphere*. 2018 June; **(201)** 441-447

McDougall M*, Eble J*, Orriss GL, Niland S, Johanningmeier B, Pohlentz G, Meier M, Karrasch S, Estevão-Costa MI, Lima AM, Stetefeld J. Dramatic and concerted conformational changes enable rhodocetin to block α2β1 integrin selectively. *Plos Biology.* 2017 July 11; **(9)** e1002613

* Shared first author

McDougall M*, Reuten R*, Patel TR*, Rama N, Nikodemus D, Gibert B, Delcros JG, Prein C, Meier M, Metzger S, Zhou Z, Kaltenberg J, McKee KK, Bald T, Tüting T, Zigrino P, Djonov V, Bloch W, Clausen-Schaumann H, Poschl E, Yurchenco PD, Ehrbar M, Mehlen P, Stetefeld J, Koch M. Structural decoding of netrin-4 reveals a regulatory function towards mature basement membranes. *Nature Communications.* 2016 Nov 30; **(7)**13515.

* Shared first author

Krahn N, Spearman M, Meier M, Dorion-Thibaudeau J, **McDougall M**, Patel TR, De Crescenzo G, Durocher Y, Stetefeld J, Butler M. Inhibition of glycosylation on a camelid antibody uniquely affects its FcγRI binding activity. *European Journal Pharmaceutical Sciences.* 2017 Jan 1; **(96)** 428-439.

Thanasupawat T, Bergen H, Hombach-Klonisch S, Krcek J, Ghavami S, Del Bigio MR, Krawitz S, Stelmack G, Halayko A, **McDougall M**, Meier M, Stetefeld J, Klonisch T. Platinum (IV) coiled coil nanotubes selectively kill human glioblastoma cells. *Nanomedicine.* 2015 May 11; **(4)** 913-25.

Presentations

McDougall M, *Kivalliq Inuit Association One Voice Cumulative Effects Monitoring* ICCE 2023 Conference. Ottawa, Ontario. May 29, 2023. Presentation

McDougall M, *The Principles of environmental DNA Sampling*. eDNA Sampling Workshop 2019. University of Manitoba, Winnipeg, Manitoba. February 18-21, 2019. Lecture

McDougall M, Reuten R, Patel TR, Meier M, Nikodemus D, Koch M, Stetefeld J. *The Regulatory Function of Netrin-4 and Interactions with Netrin-1 Receptors.* 24th Congress and General Assembly of the International Union of Crystallography. Hyderabad International Convention Centre, Hyderabad, India. August 21-28, 2018. Poster

McDougall M, Reuten R, Patel TR, Meier M, Nikodemus D, Koch M, Stetefeld J. *Structural insight into Netrin-4 mediated basement membrane assembly.* Protein Structure, Function, and Malfunction Meeting 2016. University of Saskatchewan, Saskatoon, Canada. June 23-24, 2016. Poster

McDougall M, Francisco O, Halldorson T, Bestvader L, Tomy G, Stetefeld J. *Monitoring PAHs with deep-sea archaebacteria surface proteins*. 7th Annual Prairie Northern Chapter SETAC Meeting. University of Manitoba, Winnipeg, Canada. June 16-17, 2016. Oral

McDougall M, Reuten R, Patel TR, Meier M, Nikodemus D, Koch M, Stetefeld J. *Structural insight into Netrin-4 mediated basement membrane assembly.* 2nd Annual Meeting of the Biophysical Society of Canada. University of Manitoba, Winnipeg, Canada. June 1-3, 2016. Poster

McDougall M, Meier M, Ferens F, Halldorson T, Stetefeld J. *The Incorporation of Polyaromatic Hydrocarbons into an S-layer Protein of the Hyperthermophilic Archaeon Staphylothermus marinus.* 65th Annual American Crystallographic Association Meeting, Sheraton Philadelphia Downtown Hotel, Philadelphia, PA, USA. July 25-29, 2015. Poster

McDougall M, Meier M, Ferens F, Halldorson T, Stetefeld J. *The Incorporation of Polyaromatic Hydrocarbons into an S-layer Protein of the Hyperthermophilic Archaeon Staphylothermus marinus.* Protein Structure, Function, and Malfunction Meeting 2015, University of Saskatchewan, Saskatoon SK, Canada. May 7-8, 2015. Poster

McDougall M, Meier M, Patel TR, Reuten R, Nikodemus D, Poole K, Orriss G, Okun N, McEleney K, Bernards C, Koch M, Stetefeld J. *The Crystal Structure of Netrin-4.* Protein Structure, Function, and Malfunction Meeting 2014, University of Saskatchewan, Saskatoon, Canada. June 14-15, 2014. Oral

McDougall M, Meier M, Stetefeld J. *The Incorporation of Elemental Sulfur into an S-layer Protein of the Hyperthermophilic Archaeon Staphylothermus marinus.* Protein Structure, Function, and Malfunction Meeting 2013, University of Saskatchewan, Saskatoon SK, Canada. July 15-16, 2013. Oral

McDougall M, Meier M, Stetefeld J. *The Incorporation of Elemental Sulfur into an S-layer Protein of the Hyperthermophilic Archaeon Staphylothermus marinus.* Chemical Biophysics Symposium 2013, University of Toronto, Toronto ON, Canada. April 19-21, 2013. Poster

McDougall M, Meier M, Stetefeld J. *The Incorporation of Gold Nanoparticles into the Cavities of a Right Handed Coiled Coil Tetramer.* Manitoba Materials Conference 2012, University of Manitoba, Winnipeg MB, Canada. May 9, 2012. Poster

McDougall M, Meier M, Stetefeld J. *The Incorporation of Gold Nanoparticles into the Cavities of a Right Handed Coiled Coil Tetramer (RHCC).* Western Canadian Undergraduate Chemistry Conference 2012, University of Alberta, Edmonton AB, Canada. May 3-5, 2012. Oral

References

- Available upon request