Vladimir Grouza

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OVERVIEW

I am a research physicist with expertise in advanced quantitative MRI techniques for high-resolution microstructural imaging, particularly of myelin and axonal structures. My recent work includes developing model-free, high-resolution methods for myelin water fraction (MWF) and g-ratio mapping using T2*-based MRI, validated in mouse models with graded hypomyelination. I have extensive experience applying signal processing and machine learning approaches, such as robust PCA and deep autoencoders, to enhance imaging precision and elucidate brain microstructure.

EDUCATION

Ph.D. MRI Physics – McGill University, Montreal, QC **09/2019 - present**

Thesis: Quantitative non-invasive evaluation of myelin g-ratio using 7 Tesla microstructural MRI.

M.Sc. Medical Physics – Toronto Metropolitan University, Toronto, ON **09/2015 - 12/2017**

Thesis: Optimization of dual energy cone beam computed tomography on the Leksell Gamma Knife Icon.

B.Sc. Physiology and Physics – McGill University, Montreal, QC **09/2008 - 05/2013**

Thesis: Vestibular efferent-mediated modulation of afferent response in α9-nAChR null mice.

SKILLS

Programming: MATLAB, Python, C/C++, CUDA, LaTeX typesetting. Generic toolkits: NumPy, SciPy, Pandas, scikit-learn, scikit-image, OpenCV, VLFeat, PyTorch, TensorFlow. Imaging-specific toolkits: FSL, FreeSurfer, ANTs, ITK, DiPy, NiPype, NiLearn.
Technical Competencies: digital signal and image processing, machine learning, medical image analysis, electronic device development. Strong background in neuroscience, electrophysiology, and physics of medical image acquisition.
Other: Familiar with medical linear accelerator quality assurance and operation (Elekta Synergy), XVi and Leksell Gamma Knife Icon CBCT scanner operation. Familiar with Bruker Pharmascan 7 Tesla pre-clinical MRI scanner operation.

RESEARCH EXPERIENCE

Graduate Research Assistant – McConnell Brain Imaging Centre, Montreal Neurological Institute **09/2019 - present**
I am presently involved in several quantitative MRI projects with the broad goal of improving multi-echo gradient-recalled echo myelin water mapping, ex-vivo g-ratio mapping in mouse and human, and neuroimaging software development.

Graduate Research Assistant – Department of Medical Physics, Sunnybrook Odette Cancer Centre **09/2015 - 09/2017**
Conducted optimization of dual-energy cone-beam computed tomography image acquisition and reconstruction for improved brain tumor detection on the Elekta Leksell Gamma Knife Icon system.

Research Technologist – Joint Department of Medical Imaging, The Hospital for Sick Children **02/2015 - 08/2015**
Developed electronic devices for use in the on-site neuroimaging (MEG/EEG/fMRI) facility, including an intercom relay system and a multichannel pneumatic stimulator. Provided technical assistance (programming, device repair) to graduate students and researchers.

Research Technician – Neural Engineering Lab, University of Toronto **09/2014 - 02/2015**

Carried out pre-clinical testing of an implantable neurostimulator for treatment of lower urinary tract dysfunction. Provided surgical support (anaesthesia, electrode implantation) and data acquisition system configuration during animal experiments.

Research Technician – Adaptive Neurorehabilitation Systems Lab, Toronto Rehabilitation Institute **01/2014 - 12/2014**
Investigated a novel electrical impedance plethysmography approach for in-vivo bladder volume sensing. Developed signal processing and machine learning algorithms for bladder volume prediction.

Undergraduate Research Assistant – Vestibular Gaze Control Lab, McGill University **09/2012 - 08/2013**
Carried out single-unit recordings to characterize a transgenic mouse model of vestibular deficiency. Independently developed a surgical procedure to access and record from cranial nerves in mice.

Undergraduate Research Assistant – Muscle Physiology and Biophysics Lab, McGill University **01/2012 - 08/2012**
Integrated existing mathematical models of biological substrate reaction-diffusion dynamics to simulate the effect of spatio-temporal gradients of calcium saturation on tension development in skeletal muscle sarcomere.

Undergraduate Research Assistant – Goodman Cancer Research Centre, McGill University **01/2010 - 08/2011**
Investigated the role of phosphorylation of a tumor suppressor protein on migration and invasion human cells. Performed molecular biology experiments and prepared reagents for laboratory use.

HONORS AND AWARDS

Multiple Sclerosis Society of Canada - EndMS Personnel Award	CAD $44k	**2023**
Fonds de recherche du Québec – Santé - Doctoral Training Award	CAD $41.7k	**2023**
Healthy Brains for Healthy Lives - PhD Fellowship	CAD $15k	**2022**
Healthy Brains for Healthy Lives - PhD Fellowship	CAD $15k	**2021**
Graduate Research Enhancement and Travel Award - McGill University	CAD $833	**2022**

PUBLICATIONS

Journal Articles

1. **Vladimir Grouza**, Hooman Bagheri, Hanwen Liu, Marius Tuznik, Zhe Wu, Nicole Robinson, Katherine A. Siminovitch, Alan C. Peterson, David A. Rudko. Ultra-high resolution mapping of myelin and g-ratio in a panel of Mbp enhancer-edited mouse strains using microstructural MRI. *NeuroImage*, 2024. https://doi.org/10.1016/j.neuroimage.2024.120850

2. Hooman Bagheri, Hana Friedman, Amanda Hadwen, Celia Jarweh, Ellis Cooper, Lawrence Oprea, Claire Guerrier, Anmar Khadra, Armand Collin, Julien Cohen-Adad, Amanda Young, Gerardo Mendez Victoriano, Matthew Swire, Andrew Jarjour, Marie E. Bechler, Rachel Pryce, Pierre Chaurand, Lise Cougnaud, Dajana Vuckovic, Elliott Wilion, Owen Greene11, Akiko Nishiyama, Anouk Benmamar-Badel, Trevor Owens, **Vladimir Grouza**, Marius Tuznik, Hanwen Liu, David A. Rudko, Jinyi Zhang, Katherine A. Siminovitch, Alan C. Peterson. Myelin basic protein mRNA levels affect myelin sheath dimensions, architecture, plasticity, and density of resident glial cells. *Glia*, 2024/ https://doi.org/10.1002/glia.24589

3. Mackenzie A Michell-Robinson, Kristin Watt, **Vladimir Grouza**, Julia Macintosh, Maxime Pinard, Marius Tuznik, Xiaoru Chen, Lama Darbelli, Chia-Lun Wu, Stefanie Perrier, Daryan Chitsaz, Nonthue A Uccelli, Hanwen Liu, Timothy C Cox, Christoph W Mueller, Timothy E Kennedy, Benoit Coulombe, David Rudko, Paul A Trainor, Genevieve Bernard. Hypomyelination, hypodontia and craniofacial abnormalities in a Polr3b mouse model of leukodystrophy. *Brain: A Journal of Neurology*, 2023. https://doi.org/10.1093/brain/awad249

4. Hanwen Liu, **Vladimir Grouza**; Marius Tuznik; Hooman Bagheri; Alan Peterson; David A. Rudko. Self-Labelled Encoder-Decoder (SLED) for multi-echo gradient echo-based myelin water imaging. *NeuroImage*, 2022. https://doi.org/10.1016/j.neuroimage.2022.119717

5. Sayed Masoud Hashemi, William Y Song, Arjun Sahgal, Young Lee, Christopher Huynh, **Vladimir Grouza**, Håkan Nordström, Markus Eriksson, Antoine Dorenlot, Jean Marie Régis, James G Mainprize, Mark Ruschin. Simultaneous deblurring and iterative reconstruction of CBCT for image guided brain radiosurgery. *Phys. Med. Biol.* 2017; 62(7):2521. https://doi.org/10.1088/1361-6560/aa5ed2

6. José Zariffa, **Vladimir Grouza**, Milos R Popovic, Magdy M Hassouna. A phase-based electrical plethysmography approach to bladder volume measurement. *Ann. Biomed. Eng.* 2016; 44(4):1299-1309. https://doi.org/10.1007/s10439-015-1397-1

7. Mackenzie A Michell-Robinson, Craig S Moore, Luke M Healy, Lindsay A Osso, Nika Zorko, **Vladimir Grouza**, Hanane Touil, Laurence Poliquin-Lasnier, Anne-Marie Trudelle, Paul S Giacomini, Amit Bar-Or, Jack P Antel. Effects of fumarates on circulating and CNS myeloid cells in multiple sclerosis. Ann. Clin. Trans. Neurol. 2016; 3(1):27-41. https://doi.org/10.1002/acn3.270

Conference Papers and Abstracts

1. **Vladimir Grouza**, Yawen Shi, Sean Goldfarb, Klaudia Bednarz, Hooman Bagheri, Alan C. Peterson, Thomas Stroh, David A. Rudko. Quantitative comparison of multi-echo spin echo and multi-echo gradient echo myelin water imaging in a panel of Mbp-enhancer edited mouse strains. Submitted to the Proceedings of the International Society of Magnetic Resonance in Medicine (ISMRM) Annual Meeting, Honolulu, Hawai'i, 2025.

2. **Vladimir Grouza**, Christian Ramos-Jiménez, Kankana Aji, Chris Hung-Hsin Hsiao, Robert Hopewell, Carolin Jaworski, Gassan Massarweh, Jean-Paul Soucy, Daniel Chartrand, Ralf Schirrmacher, Alexey Kostikov, Pablo M Rusjan, Alexander Thiel. Regional uptake of 18-F-TRACK, a TrKB/C ligand in the healthy brain. Neuroreceptor Mapping conference, Montreal, QC, Canada, 2024.

3. Hannah Bernstein, **Vladimir Grouza**, Joseph S. Gati, Sarah Morrow, Ravi S. Menon, Sridar Naranyan, Douglas L. Arnold, David A. Rudko. Imaging tract-specific effects of lesion loading on normal appearing white matter microstructure in relapsing and secondary progressive MS. ACTRIMS forum, February 2024, West Balm Beach, Florida, USA.

4. **Vladimir Grouza**, Hooman Bagheri, Hanwen Liu, Marius Tuznik, Alan C. Peterson, David A. Rudko. Histological validation of rPCA-based myelin water imaging in a panel of variably hypomyelinating mice. endMS Conference, Toronto, ON, Canada, 2023.

5. Hannah Bernstein, **Vladimir Grouza**, Joseph S. Gati, Sarah Morrow, Ravi S. Menon, Sridar Naranyan, Douglas L. Arnold, David A. Rudko. Imaging the effects of lesion load on normal-appearing white matter damage in patients with multiple sclerosis using NODDI. endMS Conference, Toronto, ON, Canada, 2023.

6. Mackenzie A Michell-Robinson, Kristin Watt, **Vladimir Grouza**, Julia Macintosh, Maxime Pinard, Marius Tuznik, Xiaoru Chen, Lama Darbelli, Chia-Lun Wu, Stefanie Perrier, Daryan Chitsaz, Nonthue A Uccelli, Hanwen Liu, Timothy C Cox, Christoph W Mueller, Timothy E Kennedy, Benoit Coulombe, David Rudko, Paul A Trainor, Genevieve Bernard. PDGFRα-dependent Polr3b Exon Loss Recapitulates POLR3-related Hypomyelinating Leukodystrophy Phenotypes in vivo. American Academy of Neurology Annual Meeting, Boston, MA, USA, 2023.

7. Sriparna Mukherjee, **Vladimir Grouza**, Alex Tchung, Moein Yaqubi, Amandine Even, Marius Tuznik, Sherilyn Junelle Recinto, Marie-Josee Bourque, Pedro Rosa-Neto, Heidi McBride, Samantha Gruenheid, Jo Anne Stratton, Michel Desjardins, David Rudko, Louis-Eric Trudeau. Citrobacter rodentium infection in Pink1 WT and knockout mice leads to regional blood-brain-barrier dysfunction. Society for Neuroscience Annual Meeting, San Diego, CA, USA, 2022.

8. **Vladimir Grouza**, Hooman Bagheri, Marius Tuznik, Hanwen Liu, Alan C Peterson, David Rudko. Sensitive Quantifcation of Hypomyelination and Axon g-ratio Using Ultra High Resolution 7T Multi-Echo Gradient Echo MRI with BSS-rPCA. Proceedings of the International Society for Magnetic Resonance in Medicine (ISMRM) Annual Meeting and Exhibition, May 2022, London, UK.

9. Hanwen Liu, **Vladimir Grouza**, Marius Tuznik, David Rudko. Application of SAME-ECOS to 7T gradient-echo based myelin water imaging: a comparison of model-free and model-based approaches. Proceedings of the International Society for Magnetic Resonance in Medicine (ISMRM) Annual Meeting and Exhibition, May 2022, London, UK.

10. Sriparna Mukherjee, **Vladimir Grouza**, Marius Tuznik, Sherilyn Junelle Recinto, Pedro Rosa-Neto, Jo Anne Stratton, Heidi McBride, Samantha Gruenheid, David Rudko, Louis-Eric Trudeau. Investigating blood brain barrier damage and immune cell entry post Citrobacter rodentium infection in Pink1 KO mice. Aligning Science Across Parkinson's Celebration of Scientific Achievement Virtual Conference 2021.

11. Alan C Peterson, Hooman Bagheri, Celia Jarweh, Amanda Hadwen, Jiarui Ao, Lawrentiu Oprea, Anmar Khadra, Ellis Cooper, **Vladimir Grouza**, David Rudko, et al. A panel of Mice Demonstrating Widely Different but Stable Levels of CNS Myelin. American Society for Neurochemistry Virtual Annual Meeting 2021.

12. **Vladimir Grouza**, Zhe Wu, Marius Tuznik, Hooman Bagheri, Dan Wu, Alan C Peterson, David Rudko. Characterization of a Novel Hypomyelination Mouse Model Using Microstructural Imaging of Myelin Volume Fraction and Axon g-ratio. Proceedings of the International Society for Magnetic Resonance in Medicine Annual Meeting and Exhibition (ISMRM), May 2021, Vancouver, BC, Canada.

13. Sayed Masoud Hashemi, Young Lee, Markus Eriksson, Håkan Nordström, James Mainprize, **Vladimir Grouza**, Christopher Huynh, Arjun Sahgal, William Y Song, Mark Ruschin. Cone-beam CT image contrast and attenuation-map linearity improvement (CALI) for brain stereotactic radiosurgery procedures. Proc. SPIE 10132: Medical Imaging 2017: Physics of Medical Imaging. 2017. https://doi.org/10.1117/12.2250371

14. **Vladimir Grouza**, Sayed Masoud Hashemi, William Song, Arjun Sahgal, Young Lee, Chris Huynh, Hakan Nordstrom, Markus Eriksson, James Mainprize, James Grafe, Mark Ruschin. Optimization of Dual Energy Image Acquisition On the Gamma Knife Icon CBCT System for Improved Detection of Residual Gadolinium MRI Contrast Agent in Brain Tumors: SU-E-201-07. Medical Physics. 2017; 44(6).

15. Chris Huynh, Mark Ruschin, Sayed Masoud Hashemi, Young Lee, James Mainprize, Hakan Nordstrom, Markus Eriksson, **Vladimir Grouza**, Arjun Sahgal, James Grafe, William Song. Improving Brain Soft-Tissue Contrast with Iterative Reconstruction of Volume-Of-Interest Cone-Beam CT: SU-F-201-03. Medical Physics. 2017; 44(6).

REFERENCES

Dr. David Rudko, PhD. Assistant Professor, Department of Neurology and Neurosurgery,
Department of Biomedical Engineering, McGill University, Montreal, Quebec, Canada.
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Quantitative Microstructure Imaging Lab
Role: doctoral thesis supervisor

Dr. Ives Levesque, PhD. Assistant Professor, Medical Physics Unit, Department of Oncology, McGill University.
MRI Physicist, McGill University Health Centre, Montreal, Quebec, Canada
ives.levesque@mcgill.ca
MR Methods Research Group
Role: doctoral supervisory committee member

Dr. Alexander Thiel, MD. Professor, Department of Neurology and Neurosurgery, McGill University.
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Role: project supervisor