OPEN SCIENCE IN ACTION

2024 Symposium

Programme Booklet

November 7, 2024 | Jeanne Timmins Amphitheatre

neuro
Montreal Neurological Institute-Hospital
Tanenbaum Open Science Institute

McGill
Centre universitaire de santé McGill
McGill University Health Centre

OPEN SCIENCE IN ACTION

Table of Contents

OPEN SCIENCE IN ACTION

Open Science Throughout the Research Lifecycle

This year's Symposium will highlight how Open Science works through various stages of the research lifecycle, focusing on areas where it is not yet widely practiced, such as data acquisition in laboratories. Interactive sessions will cover open resources enabling better study design, initiatives to increase diversity in research data, open-source hardware for data acquisition and collaborative approaches to catalyze big open data analysis.

Keynote Lecture:

An Open Science Approach to Human Brain Cellular and Molecular Mapping in Health and Disease

Ed Lein, Senior Investigator at the Allen Institute for Brain Science, will kick off the event with the keynote lecture, providing an overview of the open education tools developed by the Allen Institute, which are invaluable for enhancing neuroscience education and strengthening experimental design.

Open Science Prize Ceremony

The day will conclude with the 2024 Neuro-Irv and Helga Cooper Foundation Open Science Prizes Ceremony. The winners of this premier OS competition will accept their awards and present their work. Following the ceremony, symposium attendees are invited to celebrate and network over cocktails.

TOSI: Promoting Open Science Across Canada

The Tanenbaum Open Science Institute (TOSI) was founded to drive the adoption of Open Science across Canadian neuroscience research institutes. In addition to promoting Open Science within The Neuro, TOSI engages in strategic collaborations and partnerships through its Open Science Support and Partnership Framework. TOSI supports and guides other institutes in adopting Open Science practices and principles and establishes an alliance of neuroscience research institutes across Canada committed to Open Science.

PROGRAM

9:00 Opening Remarks

Annabel Seyller
CEO, Tanenbaum Open Science Institute
Chief of Staff, The Neuro

Shari R. Baum
Distinguished James McGill Professor
Vice Dean, Research, Faculty of Medicine and Health Sciences

9:30 Keynote Lecture

An Open Science Approach to Human Brain Cellular and Molecular Mapping in Health and Disease

Ed Lein
Senior Investigator, Allen Institute for Brain Science

10:30 Refreshment Pause

11:00 Session I: Diversity in Data Acquisition

African Ancestry Neurodegeneration Risk Variant Disrupts an Intronic Branchpoint in GBA1

Cornelis Blauwendraat
Chief Data Strategy Officer, Coalition for Aligning Science (CAS)

Advancing Open Science and Sustainable Neuroimaging Research in Resource Constrained Environments

Maruf Adewole
Medical Physicist and Artificial Intelligence Researcher, Medical Artificial Intelligence Laboratory (MAI Lab), Lagos, Nigeria

Sex, Lineage, and Diversity in Alzheimer's Disease Risk: Lessons from Big Data

Chloé Savignac
PhD Candidate, McGill University

12:05 Session II: Poster Highlights

Towards Living Meta-Research in Neuroimaging

Kendra Oudyk
Postdoctoral fellow, The Neuro, McGill University

ElecFeX Is a User-Friendly Toolbox for Efficient Feature Extraction From Single-Cell Electrophysiological Recording

Xinyue Ma
PhD Candidate, The Neuro, McGill University

From Genes to Cells: Expanding Imaging Transcriptomics With Cell Type Applications

Veronika Pak
PhD Candidate, The Neuro, McGill University

PROGRAM

12:30 Lunch

Trainee Poster Session

1:30 Session III: Open Hardware

Open Neuroscience: How Open Hardware Will Improve Research and Education

André Maia Chagas
Lecturer in Open Science & Scientific Officer, University of Sussex, Trend in Africa, BioRTC

Open Hardware for Behavioural Control

Manu Madhav
Assistant Professor, University of British Columbia

Contributions of Open Science in the Field of MRI Hardware Design: Experience From The Neuro's RF Coil Lab

David Rudko
Assistant Professor, The Neuro, McGill University

2:35 Session IV: Collaborative Initiatives Enabling Open Data Analysis

Panelist: Josh Gottesman
Community Director, The Michael J. Fox Foundation for Parkinson's Research

Panelist: Jackie MacDiarmid
Project Manager, Campus Alberta Neuroscience

3:05 Refreshment Break

3:20 The Neuro - Irv and Helga Cooper Open Science Prize Ceremony

Canadian Trainee Prize: Michelle Wang
PhD Candidate, The Neuro, McGill University

International Trainee Prize: Mohamed Abdelhack
Postdoctoral Fellow, Krembil Centre for Neuroinformatics

Main International Prize: Global Parkinson's Genetics Program
Represented by Andrew Singleton, NIH Distinguished Investigator &
Cornelis Blauwendraat, Chief Data Strategy Officer, Coalition for Aligning Science (CAS)

4:05 Closing Remarks

Annabel Seyller
CEO, Tanenbaum Open Science Institute
Chief of Staff, The Neuro

INTERNATIONAL MAIN PRIZE WINNER

Global Parkinson's Genetics Program

Represented by Andrew Singleton, NIH Distinguished Investigator
& Cornelis Blauwendraat, Chief Data Strategy Officer, Coalition for Aligning Science (CAS)

The Global Parkinson's Genetics Program (GP2) is a large-scale, collaborative research initiative aimed at uncovering the genetic underpinnings of Parkinson's disease on a global scale. Supported by the Aligning Science Across Parkinson's Initiative, in partnership with the Michael J. Fox Foundation, and involving scientists, clinicians, and research participants from diverse populations, the project seeks to better understand the genetic factors that contribute to Parkinson's disease. By collecting and analyzing genetic data from hundreds of thousands of people worldwide, especially from underrepresented populations, GP2 aims to identify new genetic risk factors, improve diagnosis, and ultimately pave the way for more personalized treatments for Parkinson's disease. The initiative emphasizes inclusivity and data sharing to ensure that findings benefit people across different ethnic and geographic backgrounds.

Andrew received his B.Sc. from the University of Sunderland, UK and Ph.D. from the University of Newcastle upon Tyne, UK. Andrew is an NIH Distinguished Investigator and Director of the new Center for Alzheimer's and Related Dementias. Andrew has published more than 750 articles. His group works to identify genetic variability that causes or contributes to neurological disease and to use this knowledge to understand the molecular processes underlying disease. He co-leads the Global Parkinson's Genetics Program Andrew serves on several advisory and editorial boards. He has received the Annemarie Opprecht Award for Parkinson's disease research, the Jay van Andel Award for Outstanding Achievement in Parkinson's Disease Research, the American Academy of Neurology Movement Disorders Award, the Robert A Pritzker Prize for Leadership in Parkinson's Disease, an Honorary Doctorate from the University of Sunderland, and the Breakthrough Prize in Life Sciences.

Cornelis Blauwendraat is the Chief Data Strategy Officer of the Coalition for Aligning Science (CAS), where he provides strategic guidance on the organization's data strategy and ensures that data assets are used effectively to achieve CAS's goals across the initiatives under the Coalition's management. He also serves as one of the leads for the Global Parkinson's Genetics Program (GP2) which is a resource initiative of the Aligning Science Across Parkinson's (ASAP), aiming to dramatically expand our understanding of the genetic basis of PD and to make that knowledge globally relevant. Previously, Blauwendraat was a Stadtman Investigator at National Institutes of Health, National Institute on Aging on the Bethesda campus. While there, his lab worked on dissecting the genetic basis of neurodegenerative disorders including Alzheimer's disease and Parkinson's disease using large omics datasets with the goal of understanding disease mechanisms and identifying potential future therapeutic targets.

INTERNATIONAL TRAINEE PRIZE

Mohamed Abdelhack

Postdoctoral Fellow, Krembil Centre for Neuroinformatics

INCREASING DIVERSITY THROUGH OPEN EDUCATION AND GRASSROOTS EMPOWERMENT

Mohamed is a Postdoctoral Fellow at the Krembil Centre for Neuroinformatics with Dr Daniel Felsky. He developed his interest in the human brain while studying electrical engineering at Alexandria University in Egypt. He then moved to Japan for his graduate studies, investigating top-down modulation in the human visual cortex and modelling this process using deep neural networks. He previously worked as a Postdoctoral Researcher at Washington University in St. Louis where he was building machine-learning models to predict post-surgical medical complications. He is currently interested in the interface between machine and deep learning and neuroscience for modelling psychiatric disorders. He founded the Arabs in Neuroscience non-profit, a grassroots network of Arabic-speaking scientists across the globe that aims to support scientists and students interested in neuroscience.

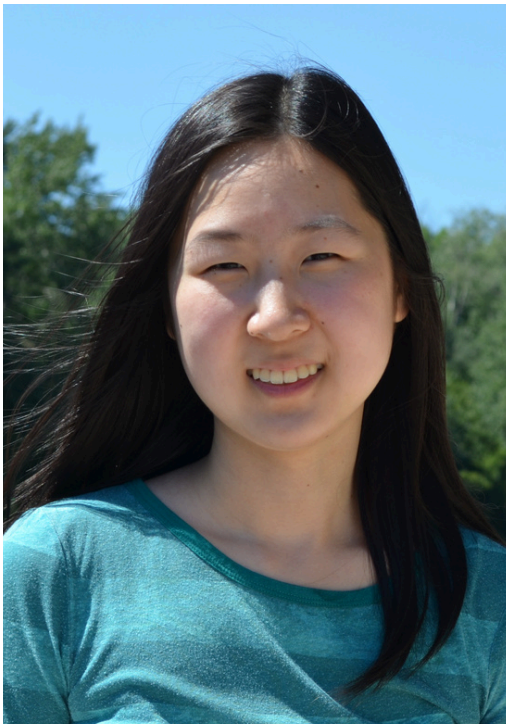
Talk Abstract: Arabs in Neuroscience: Diversity through Grassroots Empowerment

Diversity in the field of neuroscience holds the promise to advance the field by bringing people with different perspectives formulating new ideas. However, the field suffers from a lack of diversity of thought where even diverse voices have to assimilate into a western-centric mindset. Many equity and inclusion initiatives exist but usually suffer from a top-down approach where the flow of information is still one-directional. Arabs in Neuroscience (AiN) attempts to solve these problems through grassroots organization, and thus serving a new model for equity and inclusion initiatives. It creates a network that connects Arab-identifying scientists and students interested in neuroscience across the world. This network creates a need-aware and culture-sensitive environment that aims to self-empower through collaboration and education. To date, AiN has trained over 300 students from over 18 countries with a woman majority. This success speaks to the validity of grassroots models to promote inclusion and equity.

CANADIAN TRAINEE PRIZE

Michelle Wang

PhD Candidate, The Neuro, McGill University



OPEN TOOLS FOR THE ORGANIZATION AND DECENTRALIZED PROCESSING OF NEUROIMAGING–CLINICAL DATA

Michelle is a fourth-year Quantitative Life Sciences PhD student in Dr. Jean-Baptiste Poline's research group at McGill University working at the intersection of neuroimaging and data science. She is interested in leveraging large longitudinal datasets and machine learning methods to develop and validate biomarkers of Parkinson's disease. Michelle is of the lead developer of Nipoppy, a neuroinformatics framework for the reproducible organization and processing of large neuroimaging-clinical datasets. She is passionate about open science and is involved with open-source software projects such as Nilearn as well as the Brainhack community. Her past projects have focused on topics that include low-cost neurotechnology devices, risk prediction for major depressive disorder, and machine learning decoding of neuroimaging data.

Talk Abstract: Nippopy: An Open Framework for the Organization and Decentralized Processing of Neuroimaing-Clinical Data

Organizing and processing neuroimaging-clinical datasets can be time-consuming and error-prone. Adoption of best practices and clear documentation can increase the FAIRness (findability, accessibility, interoperability and reusability) of datasets and the reproducibility of studies. We introduce Nipoppy, an open-source framework that can help achieve decentralized, reproducible data curation and processing of multimodal datasets. Nipoppy facilitates consistent organization and processing of large studies, which can help simplify data sharing between so-called "data silos". The framework consists of a standardized protocol for obtaining imaging-derived phenotypes (IDPs) from raw scanner data, as well as a data organization specification for raw and processed, imaging and non-imaging data. We provide a user-friendly software package to work within the framework, with tools to help convert raw scanner output to the Brain Imaging Data Structure (BIDS) standard, process neuroimaging data with existing or custom pipelines, track processing completion status, and extract IDPs from pipeline outputs.

KEYNOTE LECTURE

Ed Lein
Senior Investigator, Allen Institute for Brain Science

AN OPEN SCIENCE APPROACH TO HUMAN BRAIN CELLULAR AND MOLECULAR MAPPING IN HEALTH AND DISEASE

Talk Abstract

Since its inception 20 years ago, the Allen Institute has practiced and promoted an open science approach to create catalytic data resources to accelerate progress in neuroscience and medicine. More recently this work has focused on harnessing single cell and spatial genomics methods to create brain-wide cell atlases in mouse, monkey and human brain, as part of large-scale consortium efforts sponsored by the NIH BRAIN Initiative. Furthermore, these technologies are now being applied to study Alzheimer's disease, aiming to identify cellular and molecular hallmarks of Alzheimer's and accelerate the discovery of new therapeutic targets. This talk will discuss our big science, open science, team science model and scientific progress on human brain projects currently in progress.

Biography

Ed Lein is a Senior Investigator at the Allen Institute for Brain Science and an Affiliate Professor in the Departments of Neurological Surgery and Laboratory Medicine and Pathology (DLMP) at the University of Washington. He received a B.S. in biochemistry from Purdue University and a Ph.D. in neurobiology from UC Berkeley and performed postdoctoral work at the Salk Institute for Biological Studies. Ed joined the Allen Institute in 2004 and has provided scientific leadership for the creation of large-scale anatomical, cellular and gene expression atlases of the adult and developing mammalian brain as catalytic community resources, including the inaugural Allen Mouse Brain Atlas and a range of developmental and adult human and non-human primate brain atlases. Particular current research interests involve the use of single cell genomics as a core phenotype to understand brain cellular organization, mammalian conservation and human specificity, define cellular vulnerability in disease, and identify regulatory elements that allow cell type-specific targeting and manipulation.

SESSION I: DIVERSITY IN DATA ACQUISITION

African Ancestry Neurodegeneration Risk Variant Disrupts an Intronic Branchpoint in GBA1

Cornelis Blauwendraat | Chief Data Strategy Officer, Coalition for Aligning Science (CAS)

Cornelis Blauwendraat is the Chief Data Strategy Officer of the Coalition for Aligning Science (CAS), where he provides strategic guidance on the organization's data strategy and ensures that data assets are used effectively to achieve CAS's goals across the initiatives under the Coalition's management. He also serves as one of the leads for the Global Parkinson's Genetics Program (GP2) a resource initiative of the Aligning Science Across Parkinson's (ASAP), aiming to dramatically expand our understanding of the genetic basis of PD. Previously, Blauwendraat was a Stadtman Investigator at National Institutes of Health, National Institute on Aging on the Bethesda campus. His lab worked on dissecting the genetic basis of neurodegenerative disorders including Alzheimer's disease and Parkinson's disease using large omics datasets with the goal of understanding disease mechanisms and identifying potential future therapeutic targets.

The Global Parkinson's Genetics Program (GP2) is a worldwide program to genotype >250,000 participants around the world to further understand the genetic architecture of Parkinson's disease (PD). There is still much to learn about genetic risk factors, and the path to further understanding requires working collaboratively and openly sharing data, processes, and results. One of the first proof of principle results of GP2 was identifying a novel PD risk variant specific to African ancestry. This risk variant specific to African ancestry has been found in the GBA1 gene (rs3115534-G), carried by up to 50% of West African PD cases. This non-coding variant differs from the protein-coding mutations linked to Gaucher disease and PD risk in other populations. Using long read RNA sequencing, it appears that risk variant carriers produce intron 8-containing transcripts. CRISPR editing confirmed this variant is the actual causal variant and alters splicing, resulting in reduced protein levels and reduced glucocerebrosidase activity. This discovery highlights a potential new therapeutic target for an underrepresented population, offering insights into disease mechanisms and potential treatments.

Advancing Open Science and Sustainable Neuroimaging Research in Resource Constrained Environments

Maruf Adewole | Medical Physicist and Artificial Intelligence Researcher, Medical Artificial Intelligence Laboratory (MAI Lab), Lagos, Nigeria

Maruf Adewole is a Medical Physicist and Artificial Intelligence (AI) Researcher. He manages the Medical Artificial Intelligence Laboratory (MAI Lab) based in Lagos Nigeria. A glocal AI focused Laboratory aimed at enabling home grown solutions for healthcare needs of resource constrained environment such as Sub-Saharan Africa. Maruf spearheads many programs in the Lab including the creation of the African Brain Tumour Segmentation dataset and co-organised the first ever BraTS-Africa challenge. He is also co-organising the Sprint AI Training for African Medical Imaging Knowledge Translation (SPARK) and development of an low-resource, open source medical imaging repository (HASKE) In 2023, He won the prestigious International Trainee Prize of Tannenbaum Open Science Institute of McGill University, Quebec, Canada for his work on promoting Open Science practices.

Medical Artificial Intelligence Laboratory (MAI Lab) based in Lagos, Nigeria is at the forefront of advancing open science and sustainable neuroimaging research in resource-constrained environments particularly sub-Saharan Africa. The lab develops homegrown solutions to healthcare challenges through initiatives such as the African Brain Tumour Segmentation (BraTS) dataset and the BraTS-Africa challenge, MAI Lab has fostered the creation of state-of-the-art deep learning methods tailored to African patients. Additionally, the Sprint AI Training for African Medical Imaging Knowledge Translation (SPARK) program has equipped over 270 young Africans with essential skills in medical image computing and AI. By promoting data sharing, reproducibility, and inclusive research practices, MAI Lab is bridging the gap in neuroimaging research capabilities, enriching the global scientific community, and driving equitable healthcare advancements.

Parent-Of-Origin Effects in Alzheimer's Liability Dissociate Neurocognitive and Cardiovascular Traits in At-Risk Individuals

Chloé Savignac | PhD Candidate, McGill University

Chloé Savignac is a PhD student in the Integrated Program in Neuroscience (IPN) at McGill University, specializing in the application of machine learning to dementia research. Her doctoral research integrates Big Data analytics with advanced machine learning techniques to identify factors contributing to Alzheimer's disease (AD) susceptibility within population datasets encompassing up to half a million participants. Her master's thesis harnessed structural brain scans from approximately 40,000 participants in the UK Biobank imaging cohort, uncovering population-level signatures of familial AD risk linked to APOE haplotypes. Building on this foundation, she is now investigating multi-omics approaches to explore sex differences in late-onset AD risk and heritability. Her research is deeply focused on analyzing large-scale biological datasets, including phenomics, genomics, and transcriptomics.

Alzheimer's disease (AD) has a higher prevalence among women. Additionally, AD appears to be more frequently inherited from mothers than fathers. Yet, evidence of father-to-son transmission has been documented by epidemiological studies, challenging the dominant matrilinear narrative. Here, by means of phenome-wide assays, we aimed to reconcile clinical reports with population-based insights as to diverging influences of maternal vs. paternal AD risk on first-degree relatives. We capitalized on the richest single-site cohort (PREVENT-AD) with a family history of AD to extract three distinct intermediate phenotypes of AD susceptibility across the PREVENT-AD phenome. Capitalizing on ~1,000 individual subject visits, we examined how much the derived intermediate phenotypes vary as a function on maternal vs. paternal AD lineage. Our careful cross-generational examination highlighted the influences of matri- vs. patrilinear AD risk on cardiovascular and cognitive risk. We identified sex bias for polymorphisms in the HMGCR and BDNF genes as most explanatory for AD genealogy.

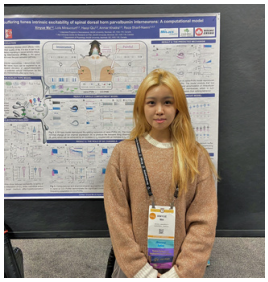
SESSION II: POSTER HIGHLIGHTS

Towards Living Meta-Research in Neuroimaging

Kendra Oudyk | Postdoctoral fellow, The Neuro, McGill University

Kendra recently defended her PhD in neuroscience, specializing in meta-research to enhance research practices and reproducibility in the field. Her work uses text mining to explore scientific literature, aiming to understand and improve how research is conducted and disseminated. Kendra also co-founded Open Science Office Hours, a community-driven initiative at the Neuro that supports researchers in adopting open science practices. Passionate about the intersection of neuroscience, data science, and research transparency, Kendra is dedicated to developing scalable, accessible tools to foster a more open and reliable scientific ecosystem.

When meta-research (research on research) makes an observation or points out a problem (such as a flaw in methodology), the project should be repeated later to determine whether the problem remains. For this we need meta-research that is reproducible and updatable, or living meta-research. In this paper, we introduce the concept of living meta-research, examine prequels to this idea, and point towards standards and technologies that could assist researchers in doing living meta-research. For example, we have adapted the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) for meta-research, arguing that following these reporting guidelines may help make a project more reproducible/updatable; and we introduce technologies like natural language processing, which can help with automation of meta-research, which in turn will make the research easier to reproduce/update. Further, we perform an example of a living meta-research project: an examination of the use of large open neuroimaging datasets over time. It is almost completely automated, and so it will be easy to update the results in the future. Through this narrative review and example project, we encourage the move towards living meta-research in neuroimaging.



ElecFeX Is a User-Friendly Toolbox for Efficient Feature Extraction From Single-Cell Electrophysiological Recording

Xinyue Ma | PhD Candidate, The Neuro, McGill University

Xinyue Ma is a 2nd-year PhD student in the Integrated Program in Neuroscience at McGill, supervised by Drs. Arjun Krishnaswamy, Anmar Khadra, and Erik Cook. Her research focuses on computational neuroscience, with a PhD project aimed at understanding how visual attention emerges from its underlying neural circuits. In addition to exploring research questions, she is dedicated to developing open-source toolboxes to enable standardized and efficient data processing.

Characterizing neurons by their electrophysiological phenotypes is essential for understanding the neural basis of behavioral and cognitive functions. Technological developments have enabled the collection of hundreds of neural recordings; this calls for new tools capable of performing feature extraction efficiently. To address the urgent need for a powerful and accessible tool, we developed ElecFeX, an open-source MATLAB-based toolbox that (1) has an intuitive graphical user interface, (2) provides customizable measurements for a wide range of electrophysiological features, (3) processes large-size datasets effortlessly via batch analysis, and (4) yields formatted output for further analysis. We implemented ElecFeX on a diverse set of neural recordings; demonstrated its functionality, versatility, and efficiency in capturing electrical features; and established its significance in distinguishing neuronal subgroups across brain regions and species. ElecFeX is thus presented as a user-friendly toolbox to benefit the neuroscience community by minimizing the time required for extracting features from their electrophysiological datasets.

From Genes to Cells: Expanding Imaging Transcriptomics With Cell Type Applications

Veronika Pak | PhD Candidate, The Neuro, McGill University

Veronika Pak is a PhD Candidate in Neuroscience, working under the supervision of Yasser Iturria-Medina in the Neuroinformatics for Personalized Medicine (NeuroPM) lab at the Montreal Neurological Institute, McGill University. She holds a Bachelor of Science in Neuroscience from Dalhousie University, where she conducted research at Nova Scotia Health-affiliated hospitals, exploring how brain signals measured by MEG and fMRI reflect dysfunctions associated with post-traumatic stress disorder and chronic pain. Her current thesis focuses on mapping the distribution and interactions of canonical cell types across the whole human brain to enhance our understanding of neurodegenerative diseases. To achieve this, she integrates various data modalities, including transcriptomics, cellular deconvolution, and structural MRI patient data. Veronika is passionate about creating open-access computational tools and resources that empower researchers to uncover exciting new insights in their neuroscience studies.

Relating gene expression to neuroimaging data has opened exciting avenues for discovery, bridging the fields of neuroimaging and bioinformatics. As bioinformatics evolves, the focus has shifted from gene-level to cellular-level insights. To move neuroimaging forward, we developed comprehensive cell type maps of the whole human brain, covering key cell types such as neurons, astrocytes, microglia, endothelial cells, oligodendrocytes, and oligodendrocyte precursor cells. These maps allow researchers to uncover cellular signatures linked to their neuroimaging phenotypes of interest. For example, we previously found that brain atrophy in neurodegenerative diseases strongly correlates with the spatial distribution of astrocytes and microglia. Additionally, we created an R package that simplifies the annotation of gene markers to their corresponding brain cell types, without requiring gene expression data. This tool can benefit researchers working with single-cell data by allowing them to validate their already annotated cell clusters with reference databases and assists those in the neuroimaging field—who often work with bulk data—in labeling their genes of interest. Maps can be found at https://github.com/neuropm-lab/cellmaps, and the gene annotation package for brain cells is available at https://github.com/nikaxpak/braincellann.

SESSION 3: OPEN HARDWARE

Open Neuroscience: How Open Hardware will improve research and education

André Maia Chagas | Lecturer in Open Science & Scientific Officer, University of Sussex, Trend in Africa, BioRTC

Andre is a neuroscientist, open science advocate, and innovator in the field of scientific instrumentation. He holds a Ph.D. in Neuroscience from the University of Tübingen and is currently a Scientific Officer and Lecturer (Assistant Professor) in Open Science at the University of Sussex. He is also a visiting professor at the Yobe State University in Nigeria, and volunteers at Trend in Africa Andre is known for his work in developing open-science hardware (OSH) particularly in neuroscience. His projects include the development visual stimulators, microscopy systems, and behavioural tools. He founded the Open Neuroscience initiative, a community-driven, curated repository of open source neuroscience projects. As a TReND in Africa Open Science coordinator, Andre has organized workshops and courses to promote OSH in resource-limited settings. The courses have been held in eight African countries, hosting over 200 participants. Some of the course's Alumni have gone on to publish their own devices, and host their own workshops training others. Andre's work has been recognized with several awards, including the Mozilla Open Science Fellowship and the Wikimedia Foundation "FreiesWissen" Felloship.

The lecture explores the transformative potential of open hardware in advancing neuroscience research and education. As traditional neuroscience equipment often comes with prohibitive costs and limited customization options, open hardware offers an innovative solution. We will discuss how open-source tools and DIY approaches can democratize access to cutting-edge technology, enabling researchers and educators in diverse settings to conduct high-quality experiments and demonstrations. The presentation will cover successful case studies of open hardware projects in neuroscience, highlighting their impact on cost reduction, experimental flexibility, and collaborative innovation. We'll examine how these initiatives foster a more inclusive scientific community by lowering barriers to entry and promoting knowledge sharing. Additionally, we'll explore the challenges and opportunities in integrating open hardware into established research and educational paradigms. Finally, we'll consider the future prospects of open neuroscience and its potential to accelerate scientific discovery and enhance STEM education worldwide.

Open Hardware for Behavioural Control

Manu Madhav | Assistant Professor, University of British Columbia

Manu Madhav is an Assistant Professor in the School of Biomedical Engineering and the Djawad Mowafaghian Centre for Brain Health at UBC, and the Tier 2 Canada Research Chair in Neural Circuits of Cognition and Control. His lab develops engineering apparatuses, approaches and analyses to quantify the algorithms underlying navigation and planning in the brain.

The Neural Circuits for Computation, Cognition and Control lab has been developing several open hardware projects to enable autonomous behavioural control paired with neurophysiology. I will be covering four projects in our lab at various stages of maturity - the Omniroute Maze, NC4gate, Modular rodent touchscreens, and Phones4Behaviour. Along the way, I will discuss how we approach open hardware design, documentation and publication in a way that encourages low-effort adoption by the neuroscience community.

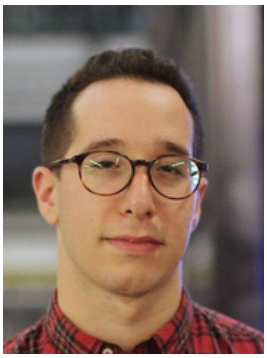
Contributions of Open Science in the Field of MRI Hardware Design: Experience from the Montreal Neurological Institute RF Coil Lab

David Rudko | Assistant Professor, The Neuro, McGill University

David Rudko is an MRI physicist and Assistant Professor of Neurology/Neurosurgery and Biomedical Engineering at the Montreal Neurological Institute of McGill University. His research is focused on the application of novel MRI methodology in conjunction with biophysical modeling to augment the current understanding of brain anatomy and physiology. He has a particular interest in using quantitative MRI and computational neuroanatomy strategies for mapping brain tissue microstructure alterations in MS and related disorders. His lab also designs custom radiofrequency coil technology for ultra-high field (UHF, > 3T) MRI. He is currently the lead principal investigator of research grants from NSERC, the United States Department of Defense, the Multiple Sclerosis Society of Canada and CIHR.

The McConnell Brain Imaging Centre Radiofrequency (RF) Coil Lab regularly undertakes the construction of custom MRI hardware for brain imaging. We are involved in the design, simulation and circuit building for human RF coils applied with 7T human, 3T human and 7T preclinical MRI applications. The coils we construct are used in basic and clinical research applications. In this talk, I will describe our ongoing open science contributions in the field of MRI coil development. I will also discuss how these practices enable multi-site collaborations that both extend the applicability of MRI methods and have significant impacts on the generalizability of modern brain mapping techniques.

SESSION 4: COLLABORATIVE INITIATIVES ENABLING OPEN DATA ANALYSIS



Panelist: Collaborative Initiatives Enabling Open Data Analysis

Josh Gottesman | Community Director, The Michael J. Fox Foundation for Parkinson's Research

Josh Gottesman is a former Fulbright Scholar and research fellow who now sits on the Research Data Resources team at the Michael J. Fox Foundation for Parkinson's Research (MJFF). At MJFF, Josh has held a variety of roles over the last 6 years: working to scale clinical trials, as a data manager, establishing statewide Parkinson's disease (PD) registries, and leading MJFF's efforts to build an online researcher community of practice. This community seeks to collaboratively, equitably, and cost-effectively make it easier for a broader array of stakeholders to engage in PD research, recognizing the many challenges that this presents. It is intended to serve as an open resource where researchers can receive training, expand their research networks, and ask (or answer) questions pertaining to working with PD data (while being recognized for their contributions).

Panelist: Collaborative Initiatives Enabling Open Data Analysis

Jackie MacDiarmid | Project Manager, Campus Alberta Neuroscience

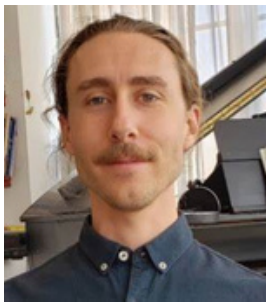
Jackie is the Project Manager for Campus Alberta Neuroscience (CAN), based in Calgary. She has worked in mental health and substance use research and advocacy across Canada and the United Kingdom, including as a consultant at the World Health Organization. Jackie has also worked as a political aide at both the federal and provincial levels of government in Canada, and brings a passion for politics and public policy to her role at CAN.

SYMPOSIUM HOSTS & MODERATORS

Annabel Seyller

CEO, Tanenbaum Open Science Institute, Chief of Staff, The Neuro

Annabel Seyller serves as Chief Executive Officer of the Tanenbaum Open Science Institute, established to crystallize practice of Open Science at The Neuro and to engage the scientific community to embrace these principles for greater and lasting impact. Before joining The Neuro, Annabel Seyller worked with Quebec's Chief Scientist at the Health Research Funding Agency on several projects aimed at promoting research within Quebec's health and social services network. She was the Associate Director for Academic Affairs and Development at the Ste. Justine University Health Centre Research Institute, where she also acted as the Executive Director for the Canadian Council for Child Health Research. Ms Seyller started her career at Innovitech, where she led numerous mandates focused on implementing and promoting large-scale life sciences projects, along with regional strategies on economic development and research enhancement.



Gabriel Pelletier

Open Science Alliance Officer, Tanenbaum Open Science Institute

Gabriel is the Open Science Alliance Officer with the Tanenbaum Open Science Institute (TOSI) at The Neuro. In this role, he coordinates a growing network of neuroscience research institutes committed to Open Science. He interfaces with the national and global open science communities to promote the uptake of open science tools and practices in Canadian neuroscience research and beyond. Before taking on that role, Gabriel served as the Open Data Manager at TOSI, where he supported Neuro research teams in utilizing Open Science tools and best practices. Prior to working with TOSI, Gabriel obtained in PhD in Neuroscience from McGill University, and worked as a Research Associate in the Cognitive Neuroscience Unit at The Neuro.

Luisa Pimentel

Open Science Community Officer, Tanenbaum Open Science Institute

Luisa is a trained neuroscientist with over 20 years of experience, including five at The Neuro. She completed her PhD in the Department of Pharmacology and Therapeutics at McGill University. Prior to joining the Tanenbaum Open Science Institute (TOSI), she served as a Project Coordinator for Outreach and Training Programs at The Neuro's Early Drug Discovery Unit (EDDU). In her current role as the TOSI Open Science Community Officer, Luisa fosters and supports The Neuro's Open Science community by organizing training sessions, webinars, workshops, seminars, career incentives and awards programs, and initiatives that promote peer-to-peer knowledge transfer. Additionally, she mentors the TOSI Trainee Council and advises the Open Science Office Hours initiative.

Thomas Durcan

Associate Professor, Prize Chair, The Neuro, TOSI Prize Committee

Thomas M. Durcan is an Assistant Professor in the Department of Neurology and Neurosurgery at McGill University and is a member of the Centre for Neurodegenerative disease group at the MNI. Durcan received his Bachelor of Science from University College Dublin, Ireland, before moving to the USA where he obtained his PhD in Cell and Molecular Biology from the University of Notre Dame in 2007. For his postdoctoral research, Durcan joined the Parkinson's research group of Dr Edward Fon, were he focused on the function of deubiquitinating enzymes in Parkinson's disease and other neurodegenerative disorders.

Roberta La Piana

Assistant Professor, Prize Co-chair, The Neuro, TOSI Prize Committee

An Assistant Professor in McGill's Department of Neurology and Neurosurgery, Roberta La Piana has worked on rare genetic white-matter disorders since she was a medical resident in pediatric neurology and psychiatry at the University of Pavia, where she completed her clinical training. At The Neuro, Dr. La Piana's primary area of research examines late-onset undiagnosed forms of leukoencephalopathies. This research focusses on applying MRI pattern-recognition to define and characterize genetic white-matter diseases; to identify genes responsible for new forms of adult hereditary white-matter disorders using next-generation sequencing techniques; and to understand the clinical and MRI overlap between atypical multiple sclerosis and genetic leukoencephalopathies. Dr. La Piana's interdisciplinary profile combines a clinical background with expertise in neuroradiology and genetics.

SYMPOSIUM HOSTS & MODERATORS

Udunna Anazodo

Assistant Professor, The Neuro, McGill University

Udunna Anazodo completed her doctoral training in Medical Biophysics at Western University and was a MITACS Accelerate Fellow at The Lawson Health Research Institute. She leads the Multimodal Imaging of Neurodegenerative Disease (MiND) Lab at The Montreal Neurological Institute where her group develops PET and MRI techniques for quantitative neuroimaging. Prof. Anazodo is very passionate about improving access to diagnostic imaging with focus on population and global health. She is the current Chair of the International Society for Magnetic Resonance in Medicine (ISMRM) PET-MRI Study Group. She is also the founder and Chair of the Consortium for Advancement of MRI Education and Research in Africa (CAMERA), a global network of MRI experts working to establish sustainable access to high-value MRI in Africa through local capacity building.

Christine Tardif

Assistant Professor, The Neuro, McGill University

Prof Tardif is an Assistant Professor in Neurology & Neurosurgery and Biomedical Engineering. She is an FRQS Research Scholar (Junior 2), Killam Scholar, and co-director of the Magnetic Resonance (MR) unit at the McConnell Brain Imaging Centre. Prof Tardif's lab develops MR imaging techniques to generate high-resolution quantitative MR images to study the anatomy, microstructure, and connectivity of the brain in vivo. Methodological developments include novel contrast mechanisms, high-resolution imaging, non-cartesian imaging, multi-modal biophysical modelling, and tract-based image processing. Her lab has a translational approach, working on both small animal (7 Tesla) and human (3 and 7 Tesla) MRI systems. She uses these advanced techniques to study map the myelination of brain networks and study how myelination modulates spatiotemporal patterns of brain activity.

Jennifer Dotchin

Senior Manager, Innovation, Partnerships and Strategy, Hotchkiss Brain Institute, University of Calgary

Jennifer Dotchin is the Senior Manager of Innovation, Partnerships, and Strategy at the Hotchkiss Brain Institute, University of Calgary. With over 25 years of global experience in strategic, policy, and project management, she has led transformative health initiatives across four continents. Jennifer holds a Master of Arts in Political Studies and various certifications in public relations, project management, and business management to name a few. A passionate advocate for open science, her expertise spans health policy analysis, innovation, and entrepreneurship, including venture capital creation. Committed to shaping a future driven by innovation and collaboration, Jennifer leverages data and partnerships to support high-impact initiatives that advance healthcare and benefit the broader community.

Matthew Loukine

PhD Candidate, The Neuro, McGill University

Matthew Loukine is a Russian-Canadian originally from Ottawa, Ontario. He recently graduated from McGill University with an Honours Bachelor of Arts and Science, majoring in Cognitive Science. Over the past few years, Matthew has enjoyed serving as a TA for Computer Science classes at McGill, where he developed a love for teaching. Currently, he is embarking on his PhD journey with the Integrated Program in Neuroscience (IPN) at McGill as a first-year rotation student. His passion lies in neuroscience, particularly in leveraging computational tools to unravel the complexities of the dynamic brain. He eagerly anticipates the Open Science in Action Symposium to explore the latest advancements in open science initiatives.

Open Science in the Literature- A Review

Cathy Fang | Douglas Research Centre, McGill University

A growing number of institutions, government, and funding agencies are mandating or adopting Open Science (OS) principles to make science accessible to all. Numerous articles highlight many benefits of OS; however, empirical evidence supporting the general impact of OS is lacking. We reviewed research outputs reporting evidence-based effects of OS practices to: provide an overview of and identify knowledge gaps surrounding the impact of OS to guide future research. Our literature review (keywords: open science & impact/advantage/effect/benefits) spanned three databases: "OS in the Literature" repository (OSF), PubMed, and Academic Search Complete (EBSCO). Included references were in English and accessible via open access (OA) or institutional license. Papers were categorized by OS activity (OA, open data sharing/reuse, open peer review, open education, citizen science, and pre-registration) and area of impact (research, general public, and policy-making/infrastructure). We found 174 relevant articles (2016-2024), of which 134 were included. 41 (30.6%) articles investigated OA in increasing research visibility. Fewer (8-17) were on other OS practices. Notably, we only found one paper on the societal impact of OS. Preliminary findings suggest OA and citizen science increase research visibility, credibility and community engagement. Future research investigating the impact of other OS practices is needed.

Energy metabolism architecture of the human brain

Moohebat Pourmajidian | The Neuro, McGill University

The brain relies on substantial energy to maintain its structure and function. Altered energy metabolism is increasingly implicated in aging and neurological disorders. Beyond energy production, glucose metabolic pathways provide building blocks for cellular growth. Despite extensive studies on glucose and oxygen uptake in the brain, energy pathways and their correspondence to cortical organization remain largely unexplored. Here, we produce maps of key energy metabolism processes using distinct pathway gene sets and microarray data from the Allen Human Brain Atlas. We show that energy pathways exhibit heterogenous distributions across the cortex, with glycolysis and oxidative phosphorylation genes showing higher expression in the motor cortices and lower expression in the visual cortex. We further correlate our energy maps with a set of brain maps including PET metabolic maps, cell type distribution and neurophysiological oscillations. Our results suggest that the main energy-producing and anabolic pathways such as the pentose phosphate pathway capture different aspects of brain's micro-organization. Finally, we study the expression trajectory of our energy pathways across the lifespan using the BrainSpan dataset. We show that these pathways have various trajectories from fetal to adulthood, with the main ATP-producing pathways peaking in childhood and the pentose phosphate declining through later development.

SingloCell: An interactive web platform for single cell data exploration

Alexis Allot | The Neuro, McGill University, Stratton Lab

Open access to single cell data is essential for the global scientific effort to understand the role of individual cells in various diseases and design effective treatments. Unfortunately, while several existing platforms (Single Cell Portal, Single Cell Expression Atlas, etc.) offer interactive access to published datasets, their lack of flexibility in manipulation and analysis of these datasets fails to make them truly open. To address these limitations, we have created SingloCell, an interactive web platform dedicated to the visualization, manipulation and analysis of single cell datasets. SingloCell simplifies the customization of existing datasets for personal needs, allowing users to rename existing clusters, delete individually selected groups of cells, and reassigning specific cells from one cluster to another. Once the dataset has been tailored to a user's needs, users can perform various advanced analysis on any selections of cells, and visualize results with numerous plot options. Both analysis outputs and plots can be downloaded for further analysis or publication. A "receipt" lists libraries, versions, and parameters for reproducibility. We believe that by making single cell data more accessible and easier to interact with, SingloCell can open single cell datasets to a larger public

HippoGenes Toolbox: Transcriptomic Cartography of the Human Hippocampus

Alexander Ngo | The Neuro, McGill University, MICA Lab

Unravelling its complex organization of the hippocampus requires the integration of multiscale data, linking molecular features to macroscale hierarchies. Gene expression is a fundamental molecular phenotype. However, post-mortem samples are often spatially discontinuous and biased towards coarse brain parcellations, thus potentially overlooking fine-grained information. Here, we charted gene expression patterns within the hippocampus with unprecedented resolution, provided a unified atlas of the hippocampal transcriptome. We used the structural T1w magnetic resonance imaging (MRI) and microarray expression data of six deceased human donors from the Allen Human Brain Atlas. Tissue sampled within the hippocampus (n=170) were mapped to subject-specific hippocampal surfaces derived from HippUnfold. Gene expression values were interpolated across the hippocampus, weighted by the geodesic distance of a given vertex to its nearest sampled neighbour. As a result, we generated an atlas of vertex-wise maps of hippocampal expression for 13,561 genes (Fig 1a). Two main axes of transcriptomic organization were identified, differentiating anterior from posterior and medial from lateral regions as in previous multiscale literature (Fig 1B). Capitalizing on recent imaging-transcriptomic initiatives, this continuous atlas may advance our understanding of human brain organization and offers a bridge to link multiple neural scales across the hippocampus, both in health and disease.

Brain Imaging Essentials: an Educational Open Science Tool for Neuroscience and Medical Student

Joyce Fangyi Li | The Neuro, McGill University, White Lab

Objective: We aim to create an Open Access brain imaging introduction course targeting neuroscience and medical students without prior training in normal brain Magnetic Resonance (MR). Methods: This course will be delivered in a hybrid format with: 1) Open-Access website: content organized into bite-sized pages with specific learning objectives supported by MR images available to students across the world. 2) In-person workshop: Lectures covering the website content with additional emphasis placed on methodology. Small group sessions will enable student participation with facilitators available to offer feedback on their learning. 3) Recordings of the workshop will be uploaded on the website. The endpoints are the mean difference in students' knowledge (primary) and comfort levels (secondary) regarding normal brain MRI, which will be assessed with a survey circulated before and after the workshop. Results: We present the project outline, mind map, and examples of the material that will be included in the teaching. Conclusion: Brain Imaging Essentials is an Open Science tool aimed to provide students in neuroscience or medical school across the world with an introduction to brain MR imaging. Its hybrid format facilitates both in-person interaction with trainers and permanent accessibility to the learning material.

Interpretable machine learning classifiers implicate novel Parkinson's disease gene from single nuclei midbrain transcriptomes

Michael Fiorin | The Neuro, McGill University

Parkinson's disease (PD) is a progressive and fatal neurodegenerative disease. An incomplete understanding of its genetic architecture remains a major barrier to the clinical translation of targeted therapeutics, necessitating novel approaches to uncover elusive genetic determinants. Single-cell RNA sequencing (scRNAseq) can help bridge this gap by profiling individual cells for disease-associated differential gene expression and nominating genes for targeted genomic analyses. Here, we introduce a machine learning framework to identify molecular features that characterize diseased cells. We train classifiers to distinguish between PD and healthy cells, then decode the models to unravel the 'reasons' behind the classifications, revealing key genes that characterize diseased cells. Application of this framework to three publicly available scRNAseq datasets characterizing the post-mortem midbrain identified cell-type-specific gene sets that accurately classify PD cells across all datasets, demonstrating our approach's capacity to identify robust molecular markers of disease. Targeted genomic analyses of the key genes characterizing PD cells revealed a previously undescribed association between PD and rare variants in GPC6, replicated in three separate case-control cohorts. Our approach promises to enhance understanding of the genetic architecture in complex diseases like PD, representing a critical step toward targeted therapeutics. Our publicly available framework is readily applicable across diseases.

Improving Brain Simulation Accuracy: Sensitivity Analysis and Realistic Time Delays in Neural Mass Models

Anisleidy Gonzalez-Mitjans | The Neuro, McGill University

We have enhanced the classical Jansen and Rit Neural Mass Model to better capture complex neural dynamics by reformulating it with Algebraic Random Differential Equations and Local Linearization for more efficient integration. Our approach introduces a biologically realistic framework for distributed conduction delays, accounting for axonal properties like length, diameter, and myelination. This allows the simulation of interconnected cortical columns on a large scale, improving the model's ability to represent brain dynamics. Following Open Science principles, all code, data, and methods are openly accessible, with sensitivity analysis using open-source machine learning (e.g., decision trees, Random Forests) to identify key parameters—EPSP, IPSP, maximum firing rate, and axonal diameter—that shape neural behavior. Our model also integrates real-world data (electrophysiology, neurotransmitter dynamics, BigBrain Project) for multiscale analysis, aligning simulations with experimental findings. This framework enhances brain modeling capacity, offering insights into neural function and disorders and supporting collaborative advancements in computational neuroscience.

An Open Science imaging-based diagnostic algorithm for hereditary spastic paraplegias (HSPs) with associated white matter abnormalitie

Ruwan Bedeir | The Neuro, McGill University, White Lab

Hereditary Spastic Paraplegias (HSPs) are a group of genetic disorders marked by progressive damage to the pyramidal tracts, often involving white matter abnormalities (WMA). Due to these imaging features, HSP patients are sometimes misdiagnosed with conditions like multiple sclerosis (MS). WMAs are valuable diagnostic markers that can help track disease progression and guide future studies and treatments. An extensive literature review (128 articles) on HSPs with WMAs identified 33 forms, with MRI findings classified using 20 criteria covering regional and structural involvement. For each form, relevant data (gene, inheritance, symptoms, etc.) was recorded in a database. Based on the database an Open Science imaging-based algorithm was developed using Python. The algorithm allows for selective searches based on MRI features, retrieving data tied to each individual gene. Testing and validation began with in-house cases confirmed by molecular diagnosis, with plans to collaborate with the C-BIGR, CanHSP, and the Spastic Paraplegia Foundation for broader validation. Currently, as the algorithm is in its final development stages, with a user interface and sorting features integrated, the code has been posted on GitHub in keeping with our lab's commitment to Open Science. We here present the initial results and preliminary interface of the tool.

TRAINEE POSTER SESSION

An Open-Source R Package for Streamlining Longitudinal Latent Growth Modeling

Olivier Percie du Sert | Douglas Research Centre, McGill University

The substantial phenotypic heterogeneity of psychiatric disorders presents challenges in accurately diagnosing individuals, predicting treatment responses, and prognosticating outcomes. Longitudinal latent growth modeling (LGM) is an effective data-driven approach to address this complexity by identifying latent (unobserved) trajectories of a given outcome. Recent guidelines offer recommendations for standardizing model specification, selection, and reporting to ensure transparency and replicability. This involves a systematic, iterative model-fitting process to identify the best-fitting and most parsimonious solution while minimizing the risk of overfitting, which can lead to an excessive number of latent trajectories. However, practical application of these recommendations remains limited. To streamline latent growth modeling (LGM) analyses and ensure best-practice reporting, we developed an open-source R package, MplusLGM, leveraging the MplusAutomation package. Released under the MIT license, it is available on both OSF and GitHub. This presentation will demonstrate the practical use of our script in analyzing clinical and functional trajectories during a 2-year follow-up of early intervention services for first-episode psychosis, while investigating predictors of trajectory membership and trajectory differences in distal outcomes, using the PEPP-Montréal databank. This approach offers a valuable resource for researchers navigating the complexities of LGM, making data-driven approach more accessible while promoting standardization, transparency, and reproducibility.

How Cognitive Load Affects Empathy Avoidance

Alexandra Dion Parent | McGill Department of Psychology

Empathy is often viewed as a gold standard of goodness; however, individuals frequently choose to avoid it. Building on Cameron et al.'s (2019) work that highlights the cognitive costs associated with empathy, this study aims to replicate their findings of their first test (Study 1) by employing the same methodology with two additional questionnaires on chronotype and cognitive load. Using the empathy selection task, we will investigate whether undergraduate psychology students (sampled from the SONA pool) prefer to empathize or pursue alternative actions. This research aligns with the principles of open science by prioritizing replication as a means to validate existing findings and enhance the robustness of psychological research. Additionally, this research introduces an alternative question, underrepresented in the literature: if time of day (and perceived cognitive load) alters the desire to engage in empathetic behaviors. While we have yet to finalize our results and sample size, we anticipate that understanding these dynamics will offer valuable insights into the interplay of cognitive effort and empathy, ultimately contributing to the broader discourse on empathy in psychological research.

Brain Activity Simulation through Integration of Structural Connectivity Data and High-Density Surface Meshes in Brain Region-Specific Network Models

Alejandro Salinas-Medina | The Neuro, McGill University

This project introduces a Region-Specific Brain Network Model (RSBNM) that combines high-resolution multimodal data to simulate brain dynamics, illustrated by a case study of the hippocampus. The model leverages high-density surface meshes from BigBrain, integrates MRI-based structural connectivity from EBRAINS, and creates detailed regional mappings. To balance resolution with computational efficiency, we developed the BigBrain Network Model (BBNM) within The Virtual Brain (TVB), incorporating averaged structural connectivity maps from 200 Human Connectome Project (HCP) subjects, reconstructed from diffusion MRI data. The RSBNM framework uses multiple parcellation schemes to enable precise, region-specific simulations of EEG activity, offering insights into brain structure-function relationships and validating the RSBNM approach's feasibility and accuracy for brain network modeling.

Open Cattle Hub: A Framework for Open Science in Cattle Monitoring with Computer Vision

Navid Ghassemi | Douglas Research Centre, McGill University

The cattle sector accounts for more than 70% of the global farmed animal asset value and is crucial to Canada's economy, contributing $24 billion to the GDP. Monitoring cattle behavior is essential for ensuring their health and healthy growth, productivity, and waste management, similar to how behavioral monitoring in neuroscience helps detect abnormalities and irregularities. Identifying early changes in behavior can reveal potential health problems or environmental stressors. A notable issue is lameness, which affects 16% of cattle and can cause a 70% loss in farmers' income, with treatment costs reaching up to $1391 CAD per case. Detecting lameness early can significantly reduce expenses for farmers. In response to this need, we are launching the Open Cattle Hub (www.opencattle.com), a platform promoting open science within cattle monitoring. Our aim is to bring together computer scientists, animal scientists, and farmers to enhance the accessibility of advanced monitoring technologies. We are focused on several key initiatives: reviewing scientific research, standardizing and sharing datasets, compiling toolboxes for data analysis, and highlighting future directions for research. The Open Cattle Hub will provide the industry with the tools and resources to advance cattle monitoring and improve overall animal welfare and productivity.

TRAINEE POSTER SESSION

BigBrain Image blind restoration and alignment with generative priors, U-Net and structural similarity

Mingli Zhang | The Neuro, McGill University

We presented a novel approach for blind restoration and alignment of BigBrain images, addressing challenges posed by unknown degradation and resolution differences. High-quality brain atlases are critical for neuroscientific research, but degradation in image resolution can hinder accurate analyses. Our proposed pipeline leverages a blind super-resolution model to upscale low-resolution images when the mapping function between high- and low-resolution images is unknown. The model consists of three key components: (1) a degradation-aware U-Net network that synthesizes high-resolution images from low-resolution inputs, (2) a pre-trained generative adversarial network (GAN) used as a prior, integrated through latent code mapping and channel-split spatial feature transforms (CS-SFTs), and (3) a image interpolation method embedded in deep convolutional neural networks (CNNs) to retain image details. For image alignment, our approach optimizes the Gram matrix loss, which measures feature correlations, and employs unsupervised learning using the structural similarity index (SSIM) to improve alignment between images. This method is effective for scenarios involving large motions, such as aligning frames from videos or near duplicate scenes. Our results show improved image quality and alignment for BigBrain data, providing a more robust foundation for future neuroscientific studies

Open Neuro PET: opening PET data workflows

Eric Ceballos | The Neuro, McGill University, Network Neuroscience Lab

Here, we present Open Neuro PET (ONP), an open science initiative designed to standardize and streamline the sharing and processing of positron emission tomography (PET) imaging data. ONP has established the Brain Imaging Data Structure (BIDS) for PET, enabling consistent data organization and enhanced reproducibility in the PET community. Further, tools developed by ONP like PET2BIDS and PETprep facilitate seamless conversion and processing of data from raw format to publication-ready analyses. Through platforms such as OpenNeuro and PublicNeuro, ONP provides a data sharing base where researchers can access PET datasets as well as group templates in the form molecular atlases. Altogether, these efforts seek to promote transparency, reproducibility, and collaboration within the neuroimaging community, pushing PET imaging to the forefront of open science.

Detection and Pose Estimation of Mice in Homecages: A Comprehensive Open Dataset and Annotation Tool

Amirhossein Mohammad | Douglas Research Centre, McGill University

Homecage monitoring enhances reproducibility in mice behavioral studies by reducing external stressors, notably those from relocating animals for testing. Automated video-based analysis is preferred due to the vast amount of data generated from continuous 24/7 recordings. Machine learning and computer vision techniques, such as object detection, tracking, and pose estimation, offer methods for analyzing this data. However, training these models requires extensive and diverse datasets to account for variations in lighting and environmental conditions. To address this challenge and contribute to Open Science, we are releasing a comprehensive open dataset of over 10,000 annotated frames, each containing 1-3 mice, capturing variations in mice coloring, environments, and lighting. Each frame includes bounding box annotations and seven keypoint markers: head, neck, tail, ears, and back paws. Additionally, we provide access to our open-source annotation software, which accelerates the annotation process using a deep learning-based assistance tool that identifies and presents the most relevant data for annotation, significantly streamlining dataset creation. By openly sharing our dataset and tools, we aim to facilitate further research in automated behavioral analysis, promote reproducibility, and encourage collaboration within the neuroscience community.

Mechanisms of Transdiagnostic Dysfunction: A Multiscale, Open-Science Approach

Isabella Di Matteo | Douglas Research Centre, McGill University

Open science promotes transparency, reproducibility, and collaboration across the scientific community. Adopting an open science approach, this project focuses on cognitive dysfunction, particularly memory deficits, which are hallmarks of psychiatric disorders across diagnostic categories. Our group recently proposed a multiscale model of disease progression in psychosis, linking reduced hippocampal-cortical connectivity to impaired episodic memory, elevated negative symptoms, and poorer functional outcomes. Using Subtype and Stage Inference (SuStaIn)—a machine learning technique that identifies subtypes of disease progression—this model has been validated with structural and functional MRI data. We now aim to extend this model to a transdiagnostic sample using openly available UK Biobank data accessed through NeuroHub, a data management platform provided by The Neuro and McGill University. We hypothesize identifying subgroups with disease trajectories characterized by decreased hippocampal-cortical connectivity, leading to impaired episodic memory, negative symptoms, and functional decline. In alignment with open science principles, all analysis code will be shared on the Open Science Framework and GitHub, promoting transparency and reproducibility. This project introduces the first transdiagnostic multiscale model of psychiatry, offering a novel framework for understanding mental illness beyond traditional classifications, and provides insights into the mechanisms linking brain function, cognitive processes, and symptoms to functioning.

NestedMorph: Leveraging Multi-Scale Attention for Improved Deformable Medical Image Registration

Gurucharan Marthi Krishna Kumar | The Neuro, McGill University

This study introduces NestedMorph, a novel Nested Attention Fusion network for deformable image registration, designed specifically to align T1-weighted (T1w) MRI and diffusion MRI (dMRI) data. Deformable registration is essential for achieving non-linear spatial alignment between imaging modalities, ensuring accurate anatomical correspondence. NestedMorph utilizes a multi-scale fusion framework that combines high-resolution spatial details from the encoder with semantic-rich features from the decoder, effectively capturing both local and global features for enhanced deformation field estimation. Evaluations using the Human Connectome Project (HCP) dataset demonstrate that NestedMorph outperforms state-of-the-art methods, including VoxelMorph, MIDIR, CycleMorph, TransMorph, and ViT-V-Net, as well as traditional registration techniques such as NiftyReg and SyN. The model achieves an SSIM of 0.89, HD95 of 2.5, and SDlogJ of 0.22, showcasing superior accuracy and robustness. These findings highlight NestedMorph's ability to balance fine-grained local details with long range dependencies, making it a powerful tool for clinical research and diagnostic workflows. While this study focuses on intra-subject registration, future work will explore inter-subject and cross-modality applications, broadening its clinical relevance. In alignment with Open Science principles, we will share the source code on GitHub, including data splits and preprocessing details for the Human Connectome Project (HCP) dataset, ensuring transparency and reproducibility.

Advancing Alzheimer's Research Through Open Data Sharing: Multimodal biomarkers from the PREVENT-AD Cohort

Mohammadali Javanray | Douglas Research Centre, McGill University

Alzheimer's disease (AD) is a leading cause of disability, with global healthcare costs projected to reach US$1.1 trillion by 2050. While clinical diagnosis typically occurs during the late symptomatic stage, pathological processes start decades earlier. This provides an optimal window for identifying people at risk that could be enrolled in clinical trials. Here we describe an extension to one of the largest available cohorts of participants at risk of AD, aiming to openly share these resources with researchers all around the world. The PREVENT-AD (PRe-symptomatic EValuation of Experimental or Novel Treatments for Alzheimer's Disease), is an ongoing longitudinal cohort launched in 2011, including 387 cognitively unimpaired individuals with a family history of AD. The overarching goal of the cohort is to investigate the biological and behavioral processes that characterize the preclinical phase of AD, and to contribute to developing early diagnostic tools. PREVENT-AD participants undergo annual cognitive assessments (RBANS, TMT, Stroop, RAVLT), biofluid collection (blood, CSF), MRI (T1w, T2w, DWI, FLAIR, ASL, fMRI) and, since 2017, amyloid- and tau-PET, and Magnetoencephalography (MEG). Our work consists in processing and curating these data to make it openly accessible to the scientific community an promote the advancement of global preclinical AD research.

Modeling the retinotopic extent of the cortico-cortical connections among lower visual areas V1, V2, and V3 using high-resolution diffusion MR

Ziqi Hoa | The Neuro, McGill University

Our study investigates the cortico-cortical connections between visual areas V1, V2, and V3 using high-resolution diffusion MRI. We employed gSlider-SMS diffusion MRI (dMRI) on a 3T scanner to acquire 1 mm isotropic voxels with a high signal-to-noise ratio from 40 healthy subjects. Our analysis reveals that inter-areal connections between V1, V2, and V3 are retinotopically organized, with denser connectivity in central visual field representations compared to the periphery. We observed an approximate Gaussian distribution of projection eccentricities, indicating retinotopic divergence of connections. These findings align with previous invasive anatomical tracer studies in animals and highlight the extensive resources allocated to central visual field processing in the human visual cortex. Open Science: To promote reproducibility and transparency, we will share our analysis code via a public repository (https://github.com/AS-Lab). Processed dMRI data and raw data will be made available through a suitable neuroimaging data-sharing platform, ensuring compliance with data protection regulations and ethical approval. This comprehensive approach to data sharing will enable the validation of our findings and facilitate further research into the hierarchical organization of the visual cortex, potentially advancing our understanding of vision-related disorders.

Exploring Low-HD Excitatory Cells in the Postsubiculum: An Open-Source Analysis of a Distinct Neural Population

Selen Calgin | The Neuro, McGill University

The postsubiculum (PoSub) serves as the brain's navigational compass, within which almost all excitatory neurons are head direction (HD) cells. HD cells are sharply tuned to the animal's head orientation. While we expect all excitatory neurons in the PoSub to be HD cells, electrophysiological recordings from the mouse PoSub reveal a subset of putative excitatory cells (~10%) that are not tuned to the animal's head-direction, what we refer to as "low-HD" cells. In this study, we begin to uncover the dynamic characteristics and population-wide correlations of this subset of cells using an entirely open-source pipeline. We analyzed our data, which is publicly available on the DANDI Archive, using the open-source neural analysis software, Pynapple. The full analysis pipeline is available online on GitHub, and is intentionally simple and modular, allowing any user to easily reproduce our findings and conduct their own analysis. Our findings show that low-HD cells form a separate phenotype, evidenced by a bimodal HD modulation distribution among putative excitatory cells. This is further supported by their distinct population-wide properties when compared to HD cells and fast-spiking interneurons. Further investigation into low-HD cells can reveal their distinct roles in the HD system and shed light on how critical networks represent internal and external environments. Our open-source analysis pipeline promotes collaboration and accelerated discovery as we attempt to uncover the intricacies of the HD system.

COMMITTEES

Organizing Committee

Annabel Seyller
Chief of Staff, The Neuro and CEO, TOSI

Debbie Rashcovsky
Events Lead, The Neuro

Gabriel Pelletier
Open Science Alliance Officer, TOSI

Leah LeFort
Research Administrator, TOSI

Luisa Pimentel
Open Science Community Officer, TOSI

Roberta La Piana
Assistant Professor, The Neuro and Co-Chair, TOSI Prize Committee

Thomas Durcan
Associate Professor, The Neuro and Co-Chair, TOSI Prize Committee

Abstract Selection Committee

Stuart Trenholm, Assistant Professor, The Neuro
Katie Lavigne, Assistant Professor, Douglas Research Center
Ed Ruthazer, Professor, The Neuro

Trainee Poster Session Committee

Judy Chen, MD-PhD student, Bernhardt lab, McGill University
Sophie Hoyer, Undergraduate student, Gold lab, McGill University
Willemien Miller, MSc student, Gruenheid lab, McGill University
Luisa Pimentel, Open Science Community Officer, Tanenbaum Open Science Institute (TOSI)