camh
FOUNDATION

The Krembil Centre for Neuroinformatics

Powering Data to Empower People

2024 IMPACT REPORT

A message from CAMH Foundation

Thank you for your continued support of the Krembil Centre for Neuroinformatics (KCNI). Your generosity has helped create the premier hub in Canada for data-driven mental health research here at CAMH, and you are making better mental health care for everyone a reality in our community, across the country and around the world.

It has been an exciting year for KCNI and for CAMH more broadly. In September, we were proud to celebrate five years of innovation and impact led by KCNI. It was incredible to recap the tremendous growth and progress you've made possible in this short amount of time. As you may know, we recently welcomed Dr. Tristan Glatard as the new Scientific Director, who's already hard at work building upon the foundation and momentum generated by your support and the vision and passion of KCNI scientists and team members.

At CAMH, we've achieved several important milestones that are critical to the future work, success and impact of KCNI. Earlier this year, CAMH unveiled our new strategic plan, **Connected CAMH**, which will guide our hospital's efforts to redefine health through 2030. Your investments in KCNI and CAMH's research enterprise will be instrumental in achieving our goals for the people we serve at our hospital and those around the world living with mental illness.

We've taken significant steps in our redevelopment journey this year, thanks to the support of donors like you. Construction continues every day on the Temerty Discovery Centre and the newly named Waverley House Secure Care & Recovery Building, scheduled for completion in 2027 and 2029, respectively. It's amazing to watch the transformation happen right before our eyes and we look forward to sharing updates about this historic redevelopment, and the future home of KCNI.

Once again, I want to extend our gratitude for your support. Your commitment ensures that KCNI and CAMH scientists are uniquely positioned to change mental health research and care forever. Thank you for working with us to build a future where no one is left behind.

Sincerely,

Deborah Gillis

Deborah Gillis
President & CEO, CAMH Foundation

A message from KCNI leadership

Thank you for your generous support of the Krembil Centre for Neuroinformatics (KCNI). Your investment has been a catalyst for data-driven research, innovations in care and improved outcomes for those living with mental illness. Thanks to you, KCNI serves as an engine for mental health discovery, a global hub for collaboration and knowledge exchange, and a magnet for the world's best minds in mental health. We are proud to provide this update on our shared progress and collective impact.

We've evolved in many ways over the past year. In our research output: we've increased our publications by nearly 36 per cent, from 113 last year to 153 this year. In our global presence: team members presented at 137 (and counting) events and conferences, a significant increase from last year. In our people: we've added several new staff and trainees, and we look forward to sharing more about Tristan's arrival and vision within the report.

In its first five years, KCNI has rapidly become a cornerstone of CAMH's research enterprise. As we move forward, our work will play a critical role in advancing Connected CAMH, which comprises three core pillars: Advance Care, Get Upstream and Lift Societal Health. By leveraging resources like the BrainHealth Databank and other neuroinformatics platforms, our expertise in areas such as AI and machine learning, and our commitment to Open Science and data sharing, KCNI is poised to lead CAMH into the future.

In this report, you will read stories of the incredible people and programs that make KCNI such a special place. While unique in their knowledge and skills, our scientists and team members are united by their unwavering commitment to advancing discoveries that improve mental health care and outcomes. We hope you are proud of the work you are making possible and for the part you play as members of our KCNI team.

Thank you for your continued support and partnership.

Sincerely,

Dr. Tristan Glatard
Scientific Director,
Krembil Centre for Neuroinformatics

David Rotenberg
Operations Director,
Krembil Centre for Neuroinformatics

YOUR IMPACT BY THE NUMBERS
2023-2024

91 Total team members including **+5** new team members

61 Trainees including **+16** new trainees

12 Trainees graduated

137 Events/conference speaking engagements

153 Publications **+40** increase from 2023

17 Grants awarded

$4,009,548 Grants awarded revenue (KCNI)

On February 29, 2024, CAMH welcomed Premier Doug Ford, key provincial government officials and project stakeholders to celebrate breaking ground on two new buildings on our Queen Street West Campus. The Waverley House Secure Care & Recovery Building will provide a safe haven where some of the hospital's most vulnerable patients can recover with dignity. With the Temerty Discovery Centre, future home of the Krembil Centre for Neuroinformatics, CAMH will gain a state-of-the-art facility where researchers can make new strides in their understanding of mental illness.

KCNI HIGHLIGHTS

Welcoming a new Scientific Director

CAMH is delighted to welcome Dr. Tristan Glatard as the new Scientific Director of the Krembil Centre for Neuroinformatics (KCNI). He joins CAMH with great enthusiasm for integrating clinical care with Open Science and Artificial Intelligence (AI). Researchers worldwide are discovering innovative ways to achieve groundbreaking advancements in mental health by merging these worlds together. CAMH Public Affairs sat down with Dr. Glatard to learn more about him and his vision for KCNI.

Can you tell us a little about yourself, including your area of research and expertise?

My research in neuroinformatics has focused on developing efficient computational methods for analyzing medical images. I've also explored how to ensure computational environments produce reliable, reproducible results. This work aims to advance both our understanding of the brain and the tools we use to study it. Prior to my role at KCNI, I worked at Concordia University, where I was the Co-Director of the Applied AI Institute.

How do you plan to incorporate new technologies and methodologies, including AI, at KCNI?

KCNI is at the forefront of two key trends in the digital scientific landscape: Open Science and AI. By enabling data sharing at a large scale, it allows researchers to share software tools and identify common goals that AI could potentially address. This approach accelerates scientific progress by providing the necessary infrastructure for the research community to tackle important questions.

What excites you most about joining CAMH?

I'm most excited by integrating the clinical world, clinical data, and the undeniable clinical expertise in mental health! Additionally, the strong and well-supported research capacity at KCNI, along with the robust neuroinformatics infrastructure, make this place unique. I don't think there are many places in the world that can claim to combine a strong IT infrastructure, a powerful research core in brain modelling, and a close connection to clinical expertise.

Are there any specific areas of interest you'd like to explore?

I'm particularly interested in enabling the creation and long-term support of a digital research ecosystem focused on AI, at least for the foreseeable future, while strongly building on Open Science technologies. By that, I mean open data, open software, open publications and open methods. I believe this has tremendous potential, and I envision KCNI, and by extension CAMH, becoming a global hub for this vision. The emergence of a digital ecosystem that embraces both Open Science and AI presents a unique opportunity to globalize how we approach scientific challenges. For mental health, in particular, I see this as a great opportunity.

It sounds like KCNI is pioneering a new approach on a global scale.

The AI ecosystem itself has evolved over the past years, building on the same vision—using common tools, shared data, and therefore addressing common problems that researchers worldwide can tackle together. In mental health, as in other health disciplines, data cannot be shared freely without restrictions. There are significant ethical, legal, and data access requirements around sharing such data, and rightfully so. That's another aspect that attracted me to CAMH and KCNI. Much has been done around the BrainHealth Databank to facilitate the careful and cautious sharing of mental health data, and there's a solid foundation to build upon.

"There is an outstanding group of scientists here at KCNI. The progress that Dr. Sean Hill and David Rotenberg have accomplished over the past five years is remarkable. I feel both excited and humbled to continue their work and contribute to the success of KCNI in the years ahead."

- Dr. Tristan Glatard, *Scientific Director, KCNI*

KCNI: The backbone of research at CAMH

Five years into its existence, KCNI plays an increasingly transformative role at CAMH by harnessing the power of data science, computational modelling and neuroinformatics to advance brain health research. Its mission is to integrate and analyze large-scale, multi-modal datasets to deepen our understanding of mental illness. KCNI bridges the gap between research and clinical practice, promoting personalized care and innovative treatment approaches for patients.

The key components of KCNI that facilitate the advancement of mental health research at CAMH are:

BrainHealth Databank (BHDB): A comprehensive data platform that integrates clinical, imaging, genetic and behavioural data, allowing for robust analyses of mental health conditions.

AI and machine learning: These tools allow researchers to create predictive models, uncover hidden patterns, and deliver personalized treatment insights based on large datasets.

Neuroinformatics platforms: Computational resources that allow the integration and modelling of multi-modal data, helping to simulate brain circuits and understand complex mental health disorders.

Open Science and data sharing: KCNI's commitment to Open Science principles accelerates discovery by making data and research tools accessible to the global scientific community, fostering collaboration and innovation.

KCNI is integral to the Connected CAMH strategic plan and will enable it by advancing:

Personalized care: KCNI's use of data science and machine learning models enables the delivery of personalized care, providing clinicians with predictive insights and individualized treatment pathways based on patient data.

Seamless transitions: By integrating research data with clinical systems, KCNI ensures that information flows smoothly across different stages of care, facilitating seamless transitions for patients and improving continuity of care.

Measurement-based care: KCNI supports the development of real-time data analytics and dashboards that allow for continuous measurement of treatment outcomes, aligning with Connected CAMH's focus on data-driven care that adapts to patient needs.

Translating data into better patient outcomes

Data science is changing what we know about mental illness by providing a more holistic view of the brain and uncovering the complex interplay between biological, psychological and social factors. KCNI's data infrastructure supports five major cohort studies currently underway at CAMH. These studies address an array of mental health challenges, bringing together patients, researchers, clinicians and families in powerful new ways to develop new personalized treatments for the right people, right when they need them.

1. Cognitive Dysfunction in the Addictions (CDiA): KCNI provides neuroinformatics platform support for the CDiA project, supporting researchers to integrate genetic, imaging, clinical and cognitive data to investigate the underpinnings of cognitive challenges in substance use disorder, which will inform innovations in practice and policy.

2. The Toronto Adolescent & Youth (TAY) Cohort Study: KCNI supports TAY by integrating data to track mental health outcomes in youth transitioning from adolescence to adulthood. The focus is on identifying risk factors and intervention points to optimize mental health care for this demographic.

3. Suicide Prevention and Crisis Support: KCNI uses machine learning to predict high-risk individuals and supports real-time analytics to improve the efficiency and effectiveness of crisis intervention strategies, helping to prevent suicide.

4. Predictive Treatment Strategies (PREDICTS): KCNI contributes to PREDICTS, a study following 1,000 patients with schizophrenia for five years to understand each person's care journey, by developing predictive models that forecast patient responses to treatments, aiding in personalized mental health care strategies to improve outcomes.

5. Heterogeneity of Neuropsychiatric Phenotypes (HetNP): KCNI facilitates HetNP, a study looking for patterns of symptoms and biological markers across multiple CAMH cohort studies. By integrating neuroimaging and clinical data to better understand the varied presentations of neuropsychiatric disorders, KCNI is helping to classify subtypes and refine treatment approaches.

By contributing to these groundbreaking efforts, KCNI ensures that research insights are rapidly translated into clinical practice, improving patient outcomes and contributing to broader population health initiatives. Through its alignment with Open Science, KCNI shares innovations globally, fostering collaboration and amplifying CAMH's impact on mental health research and care.

"KCNI support of the CDiA is critical in bringing together our multifaceted data and in understanding our participants' experiences in a more holistic way. Centralized storage and harmonization enable us to combine our data and to ensure we follow state-of-the-art procedures in ensuring data security and privacy. Visually engaging dashboards support the team in understanding the key clinical features of our participants as the project grows, which also supports the generation of novel scientific ideas and proposals."

- Dr. Lena Quilty, *CDiA lead and Senior Scientist, Institute for Mental Health Policy Research, CAMH*

Joining a national commitment to Open Science

In December 2023, **CAMH announced a new partnership** with the Tanenbaum Open Science Institute (TOSI) at McGill University's The Neuro, joining a growing network of Canadian institutions transforming neuroscience research through Open Science. CAMH has committed $1 million, matching TOSI's contribution, to advance the adoption of Open Science practices within Canadian research institutes, with the goal of improving neurological and mental health outcomes.

KCNI will be at the forefront of CAMH's Open Science efforts, ensuring that all data, research methods and findings are accessible, reproducible and freely shared with the global scientific community. Open Science has long been a foundational value at KCNI, which prioritizes transparency, collaboration and innovation to accelerate the translation of research discoveries into clinical practice.

"The BrainHealth Databank (BHDB) is on its way to becoming the single largest digital repository of mental health data in Canada. We are proud to make these data widely available to researchers to drive more innovation and discovery and positively impact the lives of people today and in the future," says David Rotenberg, Operations Director, KCNI.

Data from thousands of research participants enrolled in several major cohort studies supported by KCNI will be stored in the BHDB. This secure storage method ensures patient privacy is protected while the data is made available for scientists elsewhere in Canada and around the world to pursue new discoveries and innovations in mental health diagnosis and treatment. KCNI is further developing tools and resources integrating Open Science principles, leveraging big data and AI to glean new patterns and insights to improve care.

Inspired by The Neuro's commitment to Open Science in 2016, CAMH joins the Hotchkiss Brain Institute, The Douglas Research Centre and the Djavad Mowafaghian Centre for Brain Health in this nationwide alliance.

The six principles of Open Science:

1. Publicly release research outputs according to the FAIR principles.
2. Integrate transparency and accountability in our external research partnerships.
3. Ensure adoption of Open Science across CAMH and its research centres.
4. Maximize global impact through Open Science.
5. Respect the autonomy of researchers and participants.
6. Foster Open Science through education and training.

Driving impact beyond CAMH

Data from 9-8-8 after year one

The 9-8-8 national crisis line, available to people across Canada when they are facing their most challenging moments, is approaching its first anniversary since launching in December 2023. In this time, KCNI has collected key performance data such as call volumes, response times and service efficacy. This data is being analyzed to improve crisis intervention strategies and refine predictive models. The KCNI team is preparing for increased demand for data insights, analytics and performance monitoring as the service continues to evolve and expand.

Progress on the Canadian Youth Mental Health Initiative (CYMHI)

The CYMHI initiative has made substantial progress in building a scalable, integrated infrastructure for youth mental health care across Canada. The initiative focuses on creating a pan-Canadian network that enables seamless data sharing among youth service providers, facilitating both clinical care and research. The initiative is enhancing predictive models to assist in early intervention for youth.

Cardio-Neuro-Mind Data Platform

Established in 2021, the Hub in Cardio-Neuro-Mind Research, led from the University of Ottawa, aims to transform care for patients with heart and mind conditions by improving both preventive care and treatment strategies across these interconnected systems. KCNI is leading the technological development of the Cardio-Neuro-Mind Data Platform, a customized data platform to support multi-modal research for the heart and brain. The Platform has advanced in its mission to integrate cardiovascular, neurological and mental health data under a common structure, and is facilitating collaborations across these domains by creating a shared framework for data collection and analysis.

New industry and pharma partnerships

CAMH is actively pursuing new industry and pharmaceutical partnerships, particularly focusing on leveraging the data assets of the BHDB to drive drug discovery and personalized treatment solutions. These partnerships aim to use AI and real-world data from the BHDB to inform clinical trials, predict treatment responses and identify biomarkers. By collaborating with industry leaders, CAMH is strengthening its role as a key player in mental health research, providing actionable insights to improve drug development pipelines.

Dr. John Griffiths, Lead, Whole Brain Modelling Team, KCNI.

Kelello Health

Kelello Health is an early-stage start-up, created through KCNI, that uses an AI-powered approach to help individuals and clinicians monitor mental health trends and provide state-of-the-art support when care is needed. Kelello Health continues to grow, receiving funding from multiple investors to advance its mission of improving personalized mental health care. Kelello Health's platform leverages data to support measurement-based care, providing insights that enable clinicians to track patient progress and refine treatments over time. The investment from diverse funding sources is accelerating the development and deployment of Kelello Health's technologies, allowing the company to scale its impact on mental health treatment and personalized care models.

Dr. John Griffiths' Mitacs Grant

Dr. John Griffiths, Lead, Whole Brain Modelling Team, KCNI, has secured a Mitacs (Mathematics of Information Technology and Complex Systems) grant to support ongoing research and development, in collaboration with the BHDB team. This funding will contribute to advancing data-driven research in mental health, supporting innovative approaches in clinical care and patient outcomes. The Mitacs grant aligns with CAMH's broader strategy to integrate research insights into clinical practice, enhancing the effectiveness of personalized mental health care.

Celebrating five years of discovery

On September 19, 2024, approximately 130 partners, collaborators, donors and members of the CAMH Foundation team gathered for the KCNI Open House to celebrate the centre's achievements over the past five years and look ahead to its exciting future. The event began with welcoming remarks from Dr. Glatard, Sarah Downey, Deborah Gillis, Noelle Coombe and Dr. Aristotle Voineskos, setting a tone of celebration for what KCNI has achieved and excitement for what lies ahead.

KCNI scientists followed with presentations highlighting key milestones from the centre's first five years and sharing visions for the next five. Attendees had the opportunity to explore innovations behind the BHDB and engage in networking sessions. These interactions enabled guests to deepen their understanding of KCNI's pivotal role in fostering national and international collaborations, as well as its contributions to advancing mental health research on a global scale.

KCNI: Looking ahead

KCNI's vision from 2024 to 2030 is to become a global leader in neuroinformatics, advancing mental health research and personalized care. The key components of this vision include:

1. **Expanding the BHDB:** Growing the databank into an international resource for brain health research, encompassing diverse datasets and facilitating Open Science collaborations.
2. **Accelerating AI and data-driven discoveries:** Using machine learning and AI to develop predictive models that personalize mental health treatments and improve early intervention strategies.
3. **Championing Open Science:** Promoting transparency and data sharing through collaborations with the global research community, accelerating discoveries and enabling greater impact.
4. **Leading in precision psychiatry:** Developing tools and methodologies that enable highly individualized mental health care based on integrated data from genetics, neuroimaging, behaviour and clinical outcomes.

THE BRAINHEALTH DATABANK UPDATE

Creating a learning health system

Data science is changing what we know about mental illness by providing a more holistic view of the brain, uncovering the complex interplay between biological, psychological and social factors. This leads to earlier diagnoses, personalized treatments and more effective interventions.

The BrainHealth Databank (BHDB) is critical in advancing mental health research at CAMH by enabling researchers to process, analyze and integrate vast amounts of diverse data. This supports the identification of previously unrecognized patterns and relationships that contribute to mental illnesses.

Key priorities for the BHDB in the past year have included:

- **Hiring a manager for data life cycle and standardization:** This new role focuses on ensuring high standards of data quality, organization and readiness for research use, while also overseeing the integration of new data types and projects. Recruitment is underway.
- **Finalization of the data-sharing standard operating procedures (SOP):** A standardized and secure process for data sharing has been developed and finalized. The initiation of the SOP will allow for more effective collaboration between CAMH and external institutions, ensuring that data-sharing partnerships adhere to best practices in security, privacy and transparency.
- **Finalization of the BHDB consent model:** A consent framework has been established to guide the use of patient data ethically and legally within the databank. The consent model will be applied to future data collection efforts, streamlining patient involvement in research and ensuring that patient rights and preferences are respected.

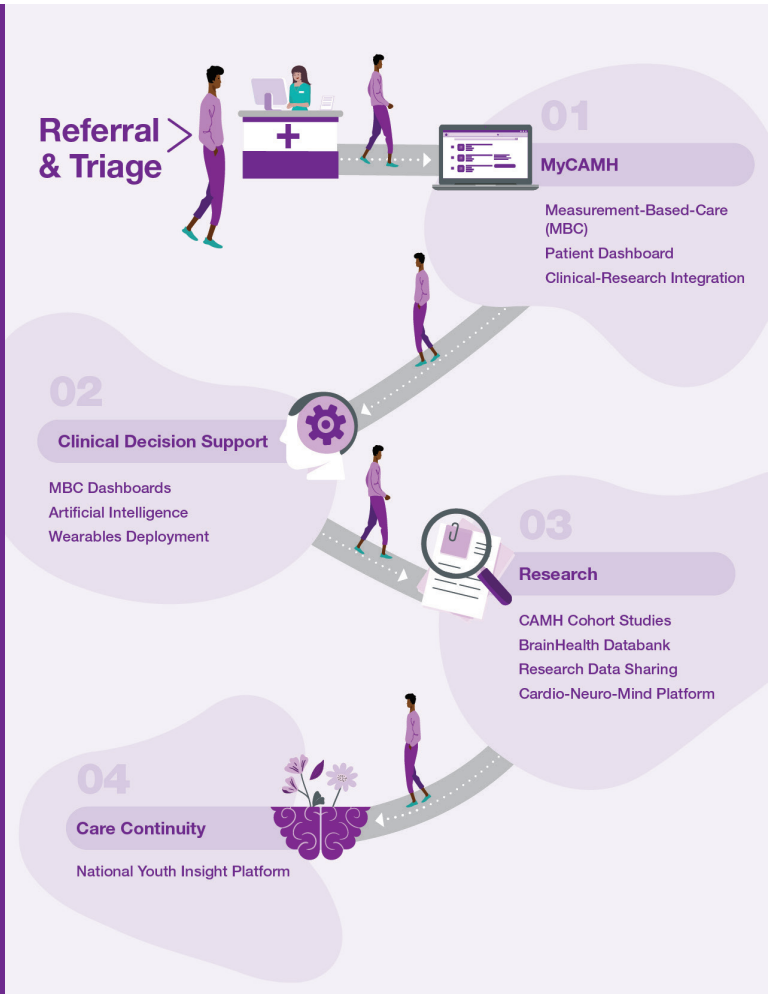
Enhancing the patient journey

The patient journey map outlines key interactions that patients have with the health care system, from diagnosis through treatment and follow-up. The BHDB enhances this journey by:

Improving treatment personalization: The data collected by the BHDB allows for the creation of personalized treatment plans tailored to each patient's unique medical history, genetic profile and behaviour patterns.

Enhancing measurement-based care (MBC): The BHDB ensures clinicians have real-time, actionable insights into a patient's progress, enabling them to adjust care dynamically.

Continuity of care: By integrating data across multiple stages of the patient's journey, from assessment to follow-up, the BHDB helps clinicians deliver more consistent and comprehensive care, leading to better long-term outcomes.



The year ahead

The BHDB is driving discovery and innovation by accumulating data from care and research while laying the foundation to integrate AI into the clinic to advance personalized treatment. Over the coming year, the team will be advancing the following initiatives:

1. **Extend the BHDB beyond the walls of CAMH**

   With the data-sharing SOP finalized, the BHDB is prepared to expand its reach beyond CAMH, fostering collaborations with external institutions. This positions the BHDB as an international resource for mental health research, aligning with Open Science principles and fostering global knowledge sharing.

2. **Continue deployment of digital MBC and actigraphy for sleep measures across the hospital**

   The BHDB continues the deployment of MBC tools across CAMH, including the expanded use of actigraphy, a non-invasive method of monitoring human rest/activity cycles to measure sleep patterns in real-time. With 43 MBC pathways tracking over 50,000 patients, the BHDB is providing invaluable data to optimize treatment strategies for mental health conditions.

3. **Expand wearable services and integrate wearable and biomarker collection**

   The expansion of wearable technologies has continued, with an emphasis on integrating biomarker data from devices like heart rate monitors and fitness trackers. This data is funneled into the BHDB, contributing to more comprehensive, real-time patient monitoring and informing personalized interventions.

4. **Enhance AI pipelines for personalized care and pilot implementation in clinics**

   BHDB has been enhancing its AI-driven analytics pipelines, which are currently being piloted in clinical settings to provide personalized care. These models allow clinicians to predict treatment responses, tailoring interventions to the specific needs of each patient.

5. **Become world leaders in Open Science in mental health**

   CAMH has strengthened its leadership in Open Science through its partnership with the TOSI alliance, enhancing transparency and data sharing. The BHDB is positioned as a central repository for openly accessible mental health data, fostering collaborative global research.

6. **Expand international collaborations**

   With the completion of the data-sharing SOP and consent model, the BHDB is now well-placed to engage in international collaborations, further contributing to shared research efforts and advancing global mental health science.

7. **Progress on the Cardio-Neuro-Mind Data Platform**

   The Hub in Cardio-Neuro-Mind Research, led by the University of Ottawa, aims to advance research that transforms care for patients with heart and mind conditions. KCNI developed the Cardio-Neuro-Mind Data Platform, integrating cardiovascular, neurological, and mental health data. Progress continues in creating a common data structure, promoting cross-disciplinary research and collaboration to better understand and treat complex health conditions.

The BHDB continues to build its role as a critical resource in advancing personalized mental health care, enabling global collaboration through Open Science and expanding its reach through data sharing and integration across multiple health domains.

KCNI LAB UPDATES

COMPUTATIONAL GENOMICS

TEAM LEAD: DR. SHREEJOY TRIPATHY

The Computational Genomics team is a multidisciplinary group of 10 research staff, graduate students, postdoctoral fellows, and undergraduates. With a strong focus on fundamental neuroscience, the team explores critical issues, including the influence of gene expression on psychiatric conditions, identifying genetic and environmental vulnerabilities in neurons associated with aging, and developing precision medicine approaches to improve neuropsychiatric therapies.

Leveraging diverse, cutting-edge data types—from spatial genomics and single-cell omics to machine learning and brain imaging—the team has made significant strides, publishing seven papers and sharing their work at conferences across North America.

The team continues to cultivate a wide network of world-leading collaborations with colleagues in Germany, the UK and the US, and includes research in cutting-edge experimental and methodological techniques and innovations in clinical practice. One recent project that the team is especially proud of is work by Keon Arbabi involving cell-specific transcriptomic changes in human cortical microcircuits across neuropsychiatric disorders.

Decoding the genetics that shape brain structure

A recent study of note is a collaboration with CAMH scientists Drs. Colin Hawco and Michael Wainberg, which shed light on the role genetics play in shaping the brain's structure that may open the door to new methods to treat—and even prevent—serious health conditions.

The different regions of our brain are connected by bundles of fibres. Collectively, these connections are known as the brain's "structural connectome." Differences in this map of connections has previously been linked to mental health, cognitive abilities, and neurological disorders like Parkinson's and Alzheimer's disease.

By analyzing data in the UK Biobank from more than 26,000 individuals, the team identified 21 regions of the genome that influence the structural connectome. Additionally, they found that genetic variation that increases the density of connections between certain brain regions tends to increase the risk of major depression, and that genetic variation that increases connection density in other brain regions tends to reduce cognitive function.

They published their findings in the March 2024 issue of *Nature Communications*.

Looking ahead, these results point to key genes and biological processes that are especially important for establishing the brain's patterns of healthy structural connectivity, especially in older adulthood. The team hypothesizes that disruptions of these genes, such as rare gene-deleting or disrupting mutations, might especially affect structural connectivity and thus impact healthy brain growth and function. This points towards an intriguing pathway for future research that could lead to new treatments.

> **"While we think of the brain as exceptionally plastic (and it is!), our work reveals that the map of the physical connections between regions of the brain are also dictated by genetics. Some of these connections are related to different outcomes with aging, including mental health and cognition. Understanding these relationships may help shape preventative medicine or build new treatments in the future, by targeting the implicated brain networks.**
>
> - Dr. Shreejoy Tripathy, *KCNI scientist*

BRAIN CIRCUIT MODELLING

TEAM LEAD: DR. ETAY HAY

The Brain Circuit Modelling team has made tremendous progress over the past year. The team completed several major projects and submitted six papers for peer-review publication, while also embarking on new directions. Frank Mazza completed his PhD and will start medical school, and Kant Yao will defend his PhD before the end of the year. Sana Rosanally completed her master's thesis, and Faraz Moghbel transferred to his PhD. Hannah Seo, a new undergraduate student, joined the team and completed a summer project that received an Undergraduate Research Opportunities Program award. She will continue her research in the lab next year.

The lab received funding from several sources, including a team grant from Brain Canada that will support a collaborative project with Weizmann Institute of Science in Israel. In this collaboration, researchers will study brain activity on a large scale by using advanced electrode probes to record electrical signals from many neurons at once and use detailed computer models to analyze these recordings. The goal is to understand how a decrease in activity from a specific type of brain cell, called somatostatin interneurons, might affect overall brain function, especially in cases of chronic stress. The researchers hope to gain insights into how chronic stress impacts the brain.

In February, Dr. Hay and his team published a paper in *Communications Biology*, highlighting the results of research that tested the ability of a new, CAMH-developed drug called α5-PAM to boost the connections of certain brain cells that are linked to depression. Working in collaboration with CAMH scientists Drs. Etienne Sibille and Thomas Prevot, and Damona Pharmaceuticals, a preclinical pharmaceutical company founded by Dr. Sibille, Dr. Hay's team used detailed computer models to simulate α5-PAM's effects on human brain cells and networks.

These simulations demonstrated that α5-PAM can recover function in depression brain networks, indicating that it would lead to cognitive recovery in patients. The project also identified biomarkers in electroencephalogram (EEG) brain signals that can predict dose response and help measure the drug's efficacy. This information will facilitate the development and testing of α5-PAM for clinical translation and depression treatment.

Dr. Hay's lab completed several other projects and submitted papers for peer-review publication including:

1. Linking EEG biomarkers of schizophrenia with reduced parvalbumin-expressing (PV) interneuron inhibition.
2. Characterizing EEG biomarkers of new drugs for depression (developed by Drs. Etienne Sibille and Thomas Prevot) that target somatostatin-expressing (SST) interneuron inhibition, as measured in animal models.
3. Simulating the effect of spine loss in depression on signal processing, a study that also pioneers modelling dendritic properties as measured in human neurons.
4. Improving methods for deriving neuronal connectivity from spiking activity in large-scale neuronal networks, with possible immediate applications in deriving network connectivity changes in aging.

The team will present the results of these projects in the upcoming Society for Neuroscience international conference, at which Dr. Hay was invited to give a talk.

Finally, the team is currently finishing an important project that applied their EEG biomarkers of SST interneuron inhibition to stratify depression patients. The team is also in the process of filing a related patent to facilitate translating the method to clinical use. The method will enable a more accurate patient stratification and identifying patients that would benefit from the new drugs that target this mechanism.

WHOLE BRAIN MODELLING

TEAM LEAD: DR. JOHN GRIFFITHS

It has been another exciting and productive year for the Whole Brain Modelling Group. A key highlight was the extensive representation of the team's work in Seoul at the annual meeting of the Organization for Human Brain Mapping (OHBM), the premier international conference for advances in neuroimaging and systems neuroscience. Building on the success at last year's OHBM Montreal, the group once again took a leadership role in teaching computational neuroscience to the international neuroimaging community, by designing, organizing and running an extensive educational program for conference attendees and society members.

Dr. Griffiths' group also led discussions in computational modelling of brain stimulation at the conference, giving multiple poster presentations and chairing a feature symposium session on the topic. Work presented there was also relayed in several invited talks by lab members across North America and Europe. These talks, and recent publications, covered a range of interconnected topics, including brain rhythms, sleep, neural plasticity, neural excitability and brain network structure in relation to psychiatric and neurological illness.

Postdoctoral fellow Davide Momi made a groundbreaking discovery this year, identifying an "excitability gradient" in the brain. His research revealed that lower-order brain regions (e.g., primary sensory and primary motor) show less responsiveness to brain stimulation than higher-order regions (e.g., frontal and limbic areas). Dr. Momi's research involved stimulating specific brain regions and recording electrical activity in epilepsy patients preparing for surgery. The study, conducted with a European partner and soon to be published in *Nature Communications*, builds on previous lab findings suggesting that feedback loops in the brain help sustain later responses to stimulation, an insight initially uncovered by the lab last year using Transcranial Magnetic Stimulation (TMS) and EEG data.

This group has seen many personal milestones over the past year as well. Andrew Clappison and Taha Morshedzadeh successfully defended their master's theses—one focused on machine learning algorithm development for brain network models and the other on mapping activity of the corticothalamic system in wearable mobile EEG data. By the end of the year, three more PhD and MSc students will defend their theses on resting state and TMS stimulation-evoked brain responses in relation to ageing and depression, in EEG, functional magnetic resonance imaging, and functional near-infrared spectroscopy. Several lab alumni have secured positions in the tech sector, academic research labs and medical schools in Canada and

the US. The hard work of these individuals and other group members has been acknowledged with numerous awards and recognition.

New funding has enabled the initiation and continuation of several research projects. Most recently, the team received U of T Joint EMHSeed funding to support a collaboration with scientist Milad Lankarany at UHN Krembil Research Institute, focused on developing closed-loop repetitive transcranial magnetic stimulation (rTMS)-EEG. Three lab members received major grants to support their research and professional development. Taha Morshedzadeh received a Mitacs Accelerate fellowship to fund his industry internship at Toronto-based wearable EEG company Muse InteraXon Inc, where he is enhancing data analysis pipelines in consumer-oriented EEG devices. Mohamed Abdelhack received a two-year postdoctoral fellowship award for a new collaborative project co-supervised with fellow KCNI Scientist Dr. Daniel Felsky, which will explore new computational modelling approaches to characterizing the cognitive impacts of cardiovascular disease processes. And finally, Dr. Momi, with support from a CAMH Discovery Fund international postdoctoral fellowship, spent several months at the Stanford University Neuroscience Institute studying brain stimulation therapies for major depression.

In parallel with these important outputs from the group—which included submitted and published papers, research talks and conference presentations, and successful grants and student graduations—the team has made significant progress on longer-term research efforts. Much of this work is represented through the experimental arm of the Whole Brain Modelling Group research program, which complements the team's more theory-oriented mathematical and computational neuroscience work.

COGNITIVE NETWORK MODELLING

TEAM LEAD: DR. ANDREEA DIACONESCU

The Cognitive Network Modelling (CogNeMo) group, under the leadership of Dr. Andreea Diaconescu, has made significant progress in the field of computational psychiatry over the past five years. By integrating mathematical models with noninvasive measures such as fMRI and EEG, the CogNeMo group has developed innovative approaches to predict functional outcomes in mental illness. Notably, their work has led to the identification of cognitive and neuroimaging-based transdiagnostic predictors of suicidality and reduced psychosocial functioning in youth at risk and adults with psychosis and schizophrenia spectrum disorders.

The group's success is highlighted by the substantial research funding secured this year. In August 2024, Dr. Diaconescu received the prestigious Brain and Behavior Research Foundation NARSAD Young Investigator Award, providing $70,000 (USD) to support research on cognitive network modelling for suicide prevention in borderline personality disorder. In addition, Dr. Diaconescu was awarded the Reasons for Hope Grant, totalling $244,000, which focuses on identifying electrophysiological biomarkers to predict functional outcomes and characterize neurocognitive pathophysiology in youth at clinical high risk for psychosis. These awards, along with project grants including the $627,300 Canada Institute for Health Research (CIHR) Project Grant for computational modelling in help-seeking youth, underscore the team's strong leadership in securing funding for pioneering research aimed at psychosis prevention in at-risk populations.

In terms of academic dissemination, the Cognitive Network Modelling group has been highly productive, with 12 peer-reviewed publications in the last 12 months in high-impact journals such as *Biological Psychiatry*, *Trends in Cognitive Science* and the *Computational Psychiatry* journal. These publications demonstrate the group's significant contributions to advancing psychosis prevention research. Dr. Diaconescu and her trainees have led pioneering studies looking at the impact of the antipsychotic drug haloperidol on interpersonal judgments, the role of environmental volatility in social learning and the association of hierarchical prediction errors with the transition to psychosis.

Additionally, the group, and in particular PhD student Milad Soltanzadeh, contributed to multiple longitudinal studies, most notably the EEG arm of the TAY Cohort Study, published in *Biological Psychiatry: CNNI*, which provided early data on psychosis spectrum symptoms, functioning and suicidality in at-risk youth. Milad showcased this research at the Cognitive Neuroscience Society meeting in Toronto and the Precision Child and Youth Mental Health Conference in Ottawa. New publications in 2023 and 2024 highlight the team's critical role

in studies focused on characterizing functional outcomes, particularly through innovative protocols in major cohort studies like TAY and PREDICTS Characterization and Prediction of Individual Functional Outcome Trajectories in Schizophrenia Spectrum Disorders.

The research of the CogNeMo team has also been widely disseminated through invited talks and trainee presentations at major national and international conferences. In 2024, Dr. Diaconescu delivered a keynote talk at the prestigious Society of Biological Psychiatry conference in Austin, Texas, where she discussed "Formalizing Pavlovian Biases During Probabilistic Aversive Learning for Suicide Prevention." In 2024, Dr. Povilas Karvelis delivered presentations at the Organization for Human Brain Mapping in Seoul, Korea, and at the same Society of Biological Psychiatry conference in Austin as Dr. Diaconescu, highlighting Dr. Karvelis' work on the importance of test-retest reliability when interpreting group effects in computational psychiatry research.

Additionally, Pamina Laessing presented at the Society of Biological Psychiatry on the identification of suicidal subtypes using computational modelling. Other PhD students, including Yi-An Chen and Milad Soltanzadeh, presented their findings at the Organization for Human Brain Mapping and the Cognitive Neuroscience Society, highlighting their accomplishments in brainstem nuclei localization with MRI and electrophysiological modelling, respectively. This year, Master's students Yi (Jason) Yang and Gabrielle Allohverdi successfully defended their theses, graduated and were subsequently nominated for the prestigious Whiteside Award in recognition of the outstanding quality of their thesis work and defense.

In recognition of her work, Dr. Diaconescu received the 2024 Institute of Medical Science Faculty Recognition Award for Strong Mentorship and Exceptional Citizenship from U of T. This award highlights her commitment to fostering a supportive and collaborative research environment, as well as her dedication to advancing graduate mentorship within the academic community.

WHOLE PERSON AND POPULATION MODELLING

TEAM LEAD: DR. DANIEL FELSKY

The Whole Person and Population Modelling team continues to have significant impact. In the past year, among the 17 papers published—with an additional 19 in review and submission—two landmark studies appeared in the prestigious journal *Nature Communications*. The first paper revealed, for the first time, how sleep patterns manifest as unique brain signatures linked to cognition and depression. This paper was among the top-25 downloaded at *Nature Communications in Social Science & Human Behaviour* for all of 2023 and was the topic of a joint plenary presentation by Drs. Dan Felsky and Mohamed Abdelhack at the 2024 U of T Department of Psychiatry Research Day.

The second landmark paper, led by Dr. Peter Zhukovsky, represents the largest-ever analysis of the genetic foundations of brain structure. This study revealed how different genetic backgrounds influence susceptibility to depression over time, advancing our understanding of gene-environment interactions in cognitive aging. The paper was chosen as the ImPACT paper of the month by the U of T Department of Psychiatry. Also of note, Amin Kharaghani's thesis project paper titled "Association of whole-person eigen-polygenic risk scores with Alzheimer's disease" was accepted for publication in the journal *Human Molecular Genetics*.

In 2024, the team secured their first two major national and international grants as Lead Principal Investigator. The first, a CIHR Project Grant ($810,900/5yrs), will support the evaluation of a blood biomarker panel for the prediction of psychosis spectrum symptoms in youth. The second, a National Institutes of Health (NIH) grant ($5M/5yrs), will be the first study to create a multi-modal biomarker AI-driven tool for predicting treatment remission in late-life treatment-resistant depression and test it with a clinical trial. This project is in collaboration with co-lead PI Dr. Ginger Nicols at Washington University in St. Louis and several researchers at CAMH (Drs. Aristotle Voineskos and Benoit Mulsant) and the University of Pittsburgh (Dr. Meryl Butters).

Dr. Felsky's contributions to the field have been recognized through his appointment to the CIHR College of Reviewers (Biological and Clinical Aspects of Aging) for a three-year term. He has also been invited to serve a four-year term as a reviewer for the Banting Research Foundation's prestigious Discovery

Award Grant submissions. He recently became a founding invited member of the Statistics and Data Science in Aging Interest Group at the American Statistical Association (ASA) and delivered a talk on health policy statistics and AI at the ASA Joint Statistical Meeting in Portland, Oregon in August 2024.

Over the past five years, 52 trainees have been supervised by this team, with eight joining in fall 2023. These trainees continue to impress: Dr. Abdelhack was awarded the CAMH Discovery Fund Fellowship, the Neuro-Irv and Helga Cooper Foundation Open Science Prize, the Canadian Neuroanalytics Scholars Program, Campus Alberta Neuroscience (Cohort 1) and the CAN-CIHR-INMHA Brain Star Award; Tara Henechowicz was awarded an Ontario Graduate Scholarship and STAGE Travel Award; Mary Anne Panoyan was awarded the Novo Nordisk Network for Healthy Populations Graduate Award; and several students received U of T Institute of Medical Science (IMS) conference grants and awards for attending international conferences including the Society of Biological Psychiatry (Austin, Texas), Religious Orders Study (ROS) and the Memory and Aging Project (MAP) (Chicago, Illinois), European Society for Socially Symbolic Biology (Rome, Italy), Neurosciences and Music (Helsinki, Finland), and American College of Neuropsychopharmacology (Tampa, Florida).

In summer 2024, Denise Sabac successfully defended her MSc degree at IMS and was nominated for a dissertation award for outstanding scholarly contributions. After their tenure in the lab, Denise and Melissa Misztal have both been accepted to medical school (London, ON and Vancouver, BC, respectively) and will be starting their training immediately.

DIGITAL HEALTH & ARTIFICIAL INTELLIGENCE

TEAM LEAD: RECRUITMENT ONGOING

As the central data hub for CAMH and with expertise in big data and analytics, KCNI is ideally positioned to be the hub for machine learning (ML) and AI development. In 2023, KCNI established the Health Intelligence Program, a cross-disciplinary team that manages all potential ML and AI use cases at CAMH. This team collaborates closely with physicians, patients and stakeholders to ensure these innovations align with clinical needs.

The Health Intelligence Program partners with subject matter experts in various fields, including health equity, to develop protocols to minimize potential bias in all AI algorithms. Throughout the development of new algorithms, there are regular checkpoints to assess their fairness and equity. The team has focused on several key initiatives over the past year, making significant strides in transforming clinical and operational processes through data-driven approaches:

Governance development

A major focus has been on the development of data and analytics governance frameworks, ensuring that data management, access and usage for AI follow ethical and secure protocols. This governance structure promotes responsible use of data in both research and clinical applications, prioritizing transparency, privacy and compliance with legal and ethical standards.

Machine learning operations infrastructure and processes

The program has invested heavily in building out the infrastructure and processes necessary for machine learning operations. This includes the establishment of systems for developing, deploying and maintaining AI models in a clinical environment. These processes ensure that machine learning models are scalable, reliable and integrated into clinical decision-making, allowing for the rapid application of AI insights to improve patient outcomes.

Introduction of central intake and feasibility review

A new central intake and feasibility review process was introduced to streamline the integration of data-driven projects into clinical operations. This process ensures that new initiatives, particularly those involving ML and AI, are aligned with clinical needs and are feasible within the existing infrastructure. By centralizing intake, the program ensures consistency and efficiency in how new data projects are evaluated and implemented.

Development of predictive indicators for clinical and operational use-cases

The program has been working on the development of predictive indicators for a range of clinical and operational use cases. These indicators are being designed to assist in real-time decision making by predicting patient outcomes, treatment responses and operational needs such as resource allocation and patient flow management. The application of these predictive tools is already improving the precision of mental health care and operational efficiency at CAMH.

EVENTS AND KNOWLEDGE SHARING

KCNI Research Summit

This year, the KCNI Research Summit replaced the KCNI Summer School and took place on September 20 and 21.

Day 1: Networking & brainstorming with internal and external labs

The first day of the summit focused on the theme, "Multi-Scale Neuroinformatics & Computational Neuroscience Approaches for Understanding & Improving Mental Health." The event brought together diverse research teams from within KCNI and 15 Toronto-based collaborators from CAMH, U of T and University Health Network (UHN). Designed to foster collaboration and idea generation, the sessions facilitated networking and brainstorming among attendees.

The program was divided into two key tracks: "Mechanisms & Applications" and "Clinical Translation & Implementation." Presentations from KCNI labs highlighted cutting-edge research and practical applications in these areas. The summit also encouraged rich academic exchange within KCNI's own teams, aligning with the centre's ongoing Bi-Weekly Rounds series, which focuses on advancing collective research efforts. Presentations included:

- Computational Genomics: Dr. Shreejoy Tripathy
- Brain Circuits Modelling: Dr. Etay Hay
- Whole Brain Modelling: Dr. John Griffiths
- Cognitive Network Modelling: Dr. Andreea Diaconescu
- Whole Person & Population Modelling: Dr. Daniel Felsky
- Digital Mental Health: Dr. Gillian Strudwick
- Predictive Care: Drs. Laura Sikstrom and Marta Maslej
- Data Integration & Analytics: The Research Informatics Team

Day 2: "Day in the life" event

The second day offered a more informal and immersive experience, providing students with an opportunity to explore the Centre's facilities, engage with researchers and learn about cutting-edge neuroinformatics. Led by Dr. Felsky with support from U of T's Community of Support program, the event kicked off with a welcome talk by Drs. Glatard and Felsky, which set the tone for the day.

The attendees participating in-person represented a wide range of educational backgrounds. Participants included undergraduates, graduate students and continuing education students from institutions such as U of T, York University,

Dr. Daniel Felsky presents at the Research Summit.

Western University, Dalhousie University, University of Waterloo, Nipissing University, Adult Education Centre and Georgian College.

Students hailed from diverse fields, predominantly in health-related disciplines like neuroscience, life sciences, health sciences and medical science, but also from computer engineering and MBA programs. Participants had varying levels of research experience, from advanced to beginner, but shared common motivations: exploring careers in neuroscience, neuroinformatics and computational genomics; expanding professional networks; and gaining insights into the latest developments in the field. Many saw the event as a stepping stone toward further research opportunities, graduate studies or internships.

To ensure continued engagement, all participants received follow-up materials summarizing key information, including lab details, relevant programs and scholarships and a request for feedback.

KCNI Bi-Weekly Rounds

KCNI is organizing "Bi-Weekly Rounds" for collaborative presentations and discussions among its research laboratories. This series has scheduled presentations from February to December 2024. The purpose of these rounds is to provide a platform for trainees to present their work, while also promoting cross-lab dialogue, socializing and collaboration.

Each session consists of a scientific talk by undergraduates, graduates and postdoctoral students and a Q & A session involving students and researchers from all KCNI labs. The event began on February 1 with a presentation from the Whole Person and Population Modelling group led by Dr. Felsky, followed by talks from other groups within KCNI.

THANK YOU

Thank you for your continued support of the Krembil Centre for Neuroinformatics (KCNI) and CAMH. We hope you are proud of the difference you are making in mental health research, care and outcomes for patients and families at CAMH and people around the world.

As we look toward the future, we see so much opportunity and hope because you are on this journey with us. Together, we will continue accelerating the growth and impact of KCNI, transforming it into a global centre of innovation and excellence and changing the future of mental health forever.

APPENDIX - PUBLICATIONS

KCNI SCIENTIST PUBLICATIONS - OCTOBER 1, 2023 TO SEPTEMBER 30, 2024

1. EEG biomarkers of GABA α5 positive allosteric modulators in rodents.
2. Rybnicek, J. et al. CHRNA5 links chandelier cells to protection against amyloid pathology in human aging and Alzheimer's Disease. Research Square (2022) doi:10.21203/rs.3.rs-2011761/v1.
3. Tio, E. S., Misztal, M. C. & Felsky, D. Evidence for the biopsychosocial model of suicide: a review of whole person modelling studies using machine learning. Front. Psychiatry 14, 1294666 (2023).
4. Guet-McCreight, A. et al. In-silico testing of new pharmacology for restoring inhibition and human cortical function in depression. bioRxiv (2023) doi:10.1101/2023.02.22.529541.
5. Rosanally, S., Mazza, F., Yao, H. K. & Hay, E. Linking reduced prefrontal microcircuit inhibition in schizophrenia to EEG biomarkers in silico. (2023) doi:10.1101/2023.08.11.553052.
6. Chameh, H. M. et al. Distinctive biophysical features of human cell-types: insights from studies of neurosurgically resected brain tissue. Front. Synaptic Neurosci. 15, 1250834 (2023).
7. Hawke, L. D. et al. Swept under the carpet: a qualitative study of patient perspectives on Long COVID, treatments, services, and mental health. BMC Health Serv. Res. 23, 1088 (2023).
8. Kennelly, C. E. et al. The lived experience of long COVID: A qualitative study of mental health, quality of life, and coping. PLoS One 18, e0292630 (2023).
9. Brown, A. et al. A motivational interviewing chatbot with generative reflections for increasing readiness to quit smoking: Iterative development study. JMIR Ment. Health 10, e49132 (2023).
10. Jiang, X. et al. Association of polygenic risk for bipolar disorder with grey matter structure and white matter integrity in youth. Transl. Psychiatry 13, 322 (2023).
11. Yu, J. et al. A holistic approach to integrating patient, family, and lived experience voices in the development of the BrainHealth Databank: a digital learning health system to enable Artificial Intelligence in the clinic. Front. Health Serv. 3, 1198195 (2023).
12. Shin, H. D., Zaheer, J., Torous, J. & Strudwick, G. Designing implementation strategies for a digital suicide safety planning intervention in a psychiatric emergency department: Protocol for a multimethod research project. JMIR Res. Protoc. 12, e50643 (2023).
13. Jiang, X. et al. Association of polygenic risk for bipolar disorder with resting-state network functional connectivity in youth with and without bipolar disorder. Eur. Neuropsychopharmacol. 77, 38–52 (2023).
14. Abdelhack, M. et al. Opposing brain signatures of sleep in task-based and resting-state conditions. Nat. Commun. 14, 7927 (2023).
15. Misztal, M. C., Tio, E. S., Mohan, A. & Felsky, D. Interactions between genetic risk for 21 neurodevelopmental and psychiatric disorders and sport activity on youth mental health. Psychiatry Res. 330, 115550 (2023).
16. Ling, S., Kassam, I., Haider, S., Lo, B. & Strudwick, G. Pre-implementation perceptions of clinicians regarding a patient portal in inpatient addictions settings: A qualitative descriptive study. Int. J. Med. Inform. 180, 105278 (2023).
17. Cabral, J. & Griffiths, J. D. Dynamic brain network models: How interactions in the structural connectome shape brain dynamics. in Computational and Network Modelling of Neuroimaging Data 209–228 (Elsevier, 2024).

18. Lopez, C. J. et al. A pre-implementation examination of barriers and facilitators of an electronic prospective surveillance model for cancer rehabilitation: a qualitative study. BMC Health Serv. Res. 24, 17 (2024).

19. Hauke, D. J. et al. Altered perception of environmental volatility during social learning in emerging psychosis. Comput. Psychiatr. 8, 1–22 (2024).

20. Hassan, M., Santisteban, J. A. & Shen, N. Implementation of a clinical, patient-level dashboard at a Mental Health hospital: Lessons learned from two pilot clinics. Stud. Health Technol. Inform. 312, 41–46 (2024).

21. Kemp, J. et al. Assessing suicide prevention apps' responsiveness to help-seeking needs of individuals connected with mental health services. Stud. Health Technol. Inform. 312, 101–106 (2024).

22. Pape, C. et al. Towards meaningful engagement with clinician advisors: Lessons learned co-creating a digital mental health tool. Stud. Health Technol. Inform. 312, 16–21 (2024).

23. Scott, E. Y. et al. Integrating single-cell and spatially resolved transcriptomic strategies to survey the astrocyte response to stroke in male mice. Nat. Commun. 15, 1584 (2024).

24. Guet-McCreight, A. et al. In-silico testing of new pharmacology for restoring inhibition and human cortical function in depression. Commun. Biol. 7, 225 (2024).

25. Momi, D. et al. Stimulation mapping and whole-brain modelling reveal gradients of excitability and recurrence in cortical networks. (2024) doi:10.1101/2024.02.26.581277.

26. Cleverley, K. et al. The Toronto Adolescent and youth Cohort Study: Study design and early data related to psychosis spectrum symptoms, functioning, and suicidality. Biol. Psychiatry Cogn. Neurosci. Neuroimaging 9, 253–264 (2024).

27. Quilty, L. C. et al. Cognition and educational achievement in the Toronto Adolescent and youth Cohort Study: Rationale, methods, and early data. Biol. Psychiatry Cogn. Neurosci. Neuroimaging 9, 265–274 (2024).

28. Ainsworth, N. J. et al. Cognitive outcomes after antidepressant pharmacotherapy for late-life depression: A systematic review and meta-analysis. Am. J. Psychiatry 181, 234–245 (2024).

29. Morshedzadeh, T. et al. Corticothalamic modelling of sleep neurophysiology with applications to mobile EEG. (2024) doi:10.1101/2024.02.28.582655.

30. Morshedzadeh, T. et al. Corticothalamic modelling of sleep neurophysiology with applications to mobile EEG. bioRxiv 2024.02.28.582655 (2024) doi:10.1101/2024.02.28.582655.

31. Wainberg, M. et al. Genetic architecture of the structural connectome. Nat. Commun. 15, 1962 (2024).

32. Bastiaens, S. P., Momi, D. & Griffiths, J. D. A comprehensive investigation of intracortical and corticothalamic models of alpha rhythms. (2024) doi:10.1101/2024.03.01.583035.

33. Harita, S., Momi, D., Wang, Z., Bastiaens, S. P. & Griffiths, J. D. The role of inhibition in fMRI resting-state negative correlations. (2024) doi:10.1101/2024.03.01.583030.

34. Oveisi, M. P., Momi, D., Morshedzadeh, T., Bastiaens, S. P. & Griffiths, J. D. Assessing the validity and reliability of HD-DOT TD-fNIRS resting-state measurements in rapid succession data collection settings. (2024) doi:10.1101/2024.03.04.583362.

35. Kundu, A. et al. An overview of systematic reviews on predictors of smoking cessation among young people. PLoS One 19, e0299728 (2024).

36. Oliver, L. D. et al. Bayesian Optimization of neurostimulation (BOONStim). bioRxivorg (2024) doi:10.1101/2024.03.08.584169.

37. Hsieh, Y.-C. et al. Person-specific differences in ubiquitin-proteasome mediated proteostasis in human neurons. Alzheimers. Dement. 20, 2952–2967 (2024).

38. Martin, J. et al. Digital interventions to understand and mitigate stress response: Protocol for process and content evaluation of a cohort study. JMIR Res. Protoc. 13, e54180 (2024).

39. Secara, M. T. et al. Heterogeneity in functional connectivity: Dimensional predictors of individual variability during rest and task fMRI in psychosis. Prog. Neuropsychopharmacol. Biol. Psychiatry 132, 110991 (2024).

40. Sriharan, A. et al. Addressing the health human resources crisis: Strategies for retaining women health care professionals in organizations. PLoS One 19, e0293107 (2024).

41. Ling, S., Sproule, B., Puts, M. & Cleverley, K. Predictors of patient-initiated discharge from an inpatient withdrawal management service: A sex-based study. J. Addict. Nurs. (2024) doi:10.1097/JAN.0000000000000569.

42. Tang, S. X. et al. Functional phenotypes in schizophrenia spectrum disorders: defining the constructs and identifying biopsychosocial correlates using data-driven methods. Schizophrenia (Heidelb.) 10, 58 (2024).

43. Husain, M. O. et al. A mixed-methods study to evaluate the feasibility and preliminary efficacy of delivering the optimal health program (OHP) for youth at clinical high risk (CHR) for psychosis: A study protocol. PLoS One 19, e0306968 (2024).

44. Shen, N., Jilka, S. & Sawchuk, K. Editorial: World mental health day 2022: key drivers of risk to mental health services and innovative solutions. Front. Health Serv. 4, 1456603 (2024).

45. Diaconescu, A. O., Karvelis, P. & Hauke, D. J. Rethinking interpersonal judgments: dopamine antagonists impact attributional dynamics. Trends Cogn. Sci. 28, 693–694 (2024).

46. Risling, T. et al. Implementation of a population mental health and wellness text-message service: a mixed-methods study. BMC Digit Health 2, (2024).

47. Durocher, K., Shin, H. D., Jackson, K. T. & Strudwick, G. Women's experiences of using patient portals in healthcare settings: a rapid review. BMC Womens. Health 24, 449 (2024).

48. Demchenko, I. et al. Target engagement of the subgenual anterior cingulate cortex with transcranial temporal interference stimulation in major depressive disorder: a protocol for a randomized sham-controlled trial. Front. Neurosci. 18, 1390250 (2024).

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50. Ortiz, A. et al. Multidimensional analysis of heart rate variability and burden of illness in bipolar disorder. Psychiatry Res. Commun. 4, 100192 (2024).

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52. Lam, I. et al. Rapid iPSC inclusionopathy models shed light on formation, consequence, and molecular subtype of α-synuclein inclusions. Neuron 112, 2886-2909.e16 (2024).

53. Yu, J.-C. et al. Multivariate association between functional connectivity gradients and cognition in Schizophrenia Spectrum Disorders. Biol. Psychiatry Cogn. Neurosci. Neuroimaging (2024) doi:10.1016/j.bpsc.2024.09.001.

54. Dolling-Boreham, R. M. et al. Identifying psychosocial and ecological determinants of enthusiasm in youth: Integrative cross-sectional analysis using machine learning. JMIR Public Health Surveill. 10, e48705 (2024).

55. Simmons, S., Arbabi, K., Felsky, D., Wainberg, M. & Tripathy, S. Reported race-associated differences in control and schizophrenia post-mortem brain transcriptomes implicate stress-related and neuroimmune pathways. Front. Mol. Neurosci. 17, 1450664 (2024).

APPENDIX - AWARDED GRANTS

AWARDED GRANT APPLICATIONS - OCTOBER 1, 2023 TO SEPTEMBER 30, 2024

PI	In Collaboration With	Organization/Grant Opportunity Title	Grant Title	Submitted Date	$ KCNI PIs
Daniel Felsky	Nicol, Lenze, Miller, Ercal, Dickie, Mulsant, Vieira, Voineskos, Zhukovsky, Butters, Gebara, Adjelore, Kannampallil, Andreescu, Karp, Brown, Lavretsky, Diniz, Torous	NIH	Biotype-assigned Augmentation Approach in Resistant late life Depression (BAARD)	October 2023	$2,000,000 (USD)
Laura Sikstrom	Maslej Ratto Zaheer Buchman Ling Muirhead	SSHRC Insight	Productive Mistrust: Examining the limits of human-AI teaming in acute psychiatry	October 2023	$251,719
Daniel Felsky	Abdelhack M	CAMH DF PDF	Uncovering progression of shared neural signatures of sleep and depression phenotypes through longitudinal trajectory analysis	November 2023	$65,000
Andreea Diaconescu	Ruocco A, Kasper L	NARSAD	Cognitive Network Modeling for Suicide Prevention in Borderline Personality Disorder	March 2024	$70,000 (USD)
Erin Dickie	Sarah Nkouta	CIHR-USRA	Summer Student support	March 2024	$6,000
John Griffiths	Milad Lankarany	EMHSeed	Enhancing closed-loop noninvasive neurostimulation with neuroimaging and personalized whole-brain neurophysiological modelling	March 2024	$60,000
Etay Hay	Alex Guet-McCreight	CIHR Postdoctoral award	Linking cellular and synaptic changes in human aging to clinically-relevant brain signal biomarkers of age-related cognitive decline	April 2024	$135,000

PI	In Collaboration With	Organization/Grant Opportunity Title	Grant Title	Notice Date of Decision	$ KCNI PIs
Etay Hay	Sibille E, Lampl (Weizmann)	Brain Canada - Weizmann Institute of Science Team Grant	Linking reduced cell-specific inhibition to abnormal brain activity in chronic stress	April 2024	$178,000
Laura Sikstrom	Hailey Rocha	University of Toronto Excellence Award	Predictive Care: An Intersectional Thematic Analysis of Incident Reports of Violence and Aggression in Acute Psychiatry	April 2024	$5,200
Daniel Felsky	Abdelhack M	Canadian Neuroanalytics Scholars Program	Uncovering shared neural signatures of cognition in neurodegenerative disorders	May 2024	$140,000
John Griffiths	Abdelhack M	Canadian Neuroanalytics Scholars Program	Uncovering shared neural signatures of cognition in neurodegenerative disorders	May 2024	$140,000
Shreejoy Tripathy	Arbabi K	Koerner Graduate award	Identifying drug candidates that reverse the molecular signatures of brain disorders	June 2024	$35,000

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