Maedbh King, **PhD**

· ICoN Fellow · MIT ·

Cambridge, MA

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Summary

Integrative Computational Neuroscience (ICoN) Fellow at MIT developing biologically-driven risk predictors and monitors of neurodevelopmental disorders. 6+ years experience conducting hypothesis- and data-driven research, and using machine learning and statistics to build models of brain function. Strong record of publishing in scientific journals (>500 citations), and presenting at research conferences (>10 proceedings). Passionate about using my experience as an educator and academic mentor to communicate complex ideas to non-expert audiences. Strongly believe in using data-driven solutions to formulate and recommend policy.

Education

2017-2022 **University of California, Berkeley**, Ph.D. in Cognitive Neuroscience (Psychology) (GPA: 3.97/4.00)

2017-2022 **University of California, Berkeley**, Graduate Certificate in Applied Data Science (GPA: 3.98/4.00)

2015-2017 **Western University**, M.Sc. in Neuroscience (GPA: 4.0/4.0)

2010-2014 **Trinity College Dublin**, B.A. with Honors in Psychology and French (Double Major; GPA: 4.0)

Recognition

Scholarships & Fellowships

2022	**Integrative Computational Neuroscience Fellowship**, ICoN Center, MIT	***Link***
2021	**Presidential Management Fellowship Finalist 2022**, U.S. Office of Personnel Management	***Link***
2021	**Mark R. Rosenzweig Graduate Fellowship**, Department of Psychology, University of California, Berkeley	***Link***
2015	**Government of Ireland Postgraduate Scholarship**, Irish Research Council	***Link***
2015	**Ussher Fellowship**, Trinity College Dublin	***Link***
2013	**Biomedical Vacation Scholarship**, Wellcome Trust, UK	***Link***
2010	**Government of Ireland Scholarship (Full-Ride)**, Department of Education and Skills	***Link***

Awards

2020	**Cognitive Computational Neuroscience Travel Award**, CCN Conference	***Link***
2017	**Gordon Cerebellum Student Travel Award**, Gordon Research Conferences	***Link***
2014	**US Fulbright (Shortlisted)**, Fulbright Program	***Link***
2010	**Entrance Exhibition Award**, Trinity College Dublin	***Link***

Research Impact

2020	**The mysterious, multifaceted cerebellum**, Knowable Magazine	***Link***
2019	**Scientists map our underappreciated "little brain"**, University of California, Berkeley	***Link***
2019	**New maps of the cerebellum show how our "little brain" works**, Psychology Today	***Link***

Experience

ICoN Postdoctoral Fellow at MIT

MIT Projects [link]

Using machine learning to identify risk predictors of neuropsychiatric disorders *2022-*

- Adopted a transdiagnostic approach to establish how brain differences relate to cognitive difficulties in childhood. Trained an artificial neural network on a sample of 4,000 participants to capture non-linear relationships in cognitive profiles and cortical morphology data.
- Identified risk predictors for self-harm and suicide attempt in an adolescent population. Used natural language processing (NLP) to decode unstructured electronic health records and predictive modeling to identify critical features from structured clinical profiles. Overall goal is to use models to inform clinical outcomes.

Ph.D. Researcher at UC Berkeley

Berkeley Projects [Link]

Mapping networks of the human brain during learning. Publications in *Nature Neuroscience*, *Neuron*, *Brain* *2017-2022*

- Developed machine learning pipelines to predict cognitive function in the human cerebellum during learning, tested patients with spinocerebellar ataxia on a series of cognitive tasks to assess cerebellar deficits, and analyzed post-mortem brain data to create a transcriptomic map of the cerebellum.
- Prioritized taking classes in advanced statistics and computer science to analyze high-dimensional neural data.
- Led a team of 5 to design and collect 300 experimental hours of functional magnetic resonance imaging (fMRI) data (during COVID-19 pandemic).
- Reviewed and analyzed 30 years of research to propose new theory of cerebellar function. Co-authored subsequent paper *[link]* (>70 citations).
- Co-wrote an R35 grant that received 5-year funding from the NIH. Managed an institutional review board (IRB) protocol for fMRI experiments.
- Created a widely adopted mentorship agreement for research assistants to ensure transparency and accountability in mentoring practices.
- Co-led a journal club for undergraduate research assistants, instructing them on the scientific method, data analysis, and statistics.
- Mentored two undergraduate students in designing and writing up honors thesis projects. One student was awarded a *Swan prize [link]* for their work, and presented at a national conference.

M.Sc. Graduate Student Researcher (2015-2017) ***Paper [Link]***

Developing novel brain maps of the human cerebellum. Publications in *Brain*, *NeuroImage*, *Frontiers* *Western University*

- Created a novel and highly downloaded *map [link]* of the human cerebellum using machine learning and advanced statistics.
- Led a team of 2 to design and collect a 26-task, 6-session fMRI and behavioral experiment, totaling 250 hours of data collection *[link]*.
- Initiated a collaboration with scientists from Stanford University to use natural language processing to assign cognitive labels to the human cerebellum *[link]*. Developed programming pipeline for other researchers to replicate my novel approach, and wrote supporting documentation.
- Invested in open-source science. My data, which are publicly available, have been downloaded >200 times *[link]*.

Selected Projects

Technical

SUITPy: Open-source package for the visualization of cerebellum imaging data ***Developer [Link]***

University of California, Berkeley; Western University *Jan. - Sep. 2021*

- Core co-developer of SUITPy, an open-source Python library to visualize brain data. Subsequently worked as project manager to identify best programming practices for improving core functionality, resulting in record monthly installations (4-fold increase).

Evaluating functional boundaries of the brain using a novel distance coefficient ***Paper [Link]***

Jan. - Sep. 2021

- Co-developed a novel statistical metric to evaluate the validity of brain parcellations, an advancement on Homogeneity and Silhouette coefficients.

Predicting human performance using computer vision models ***Github [link]***

Department of Psychology, University of California, Berkeley *Jan. 2019 - Dec. 2021*

- Recorded >15 hours of varsity athletes, and implemented markerless labeling of videos to understand human performance in predicting action.

Low dimensional embedding of genetic gradients in the human cerebellum ***Author [Link]***

Helen Wills Neuroscience Institute, University of California, Berkeley *May 2019 - Sep. 2021*

- Initiated collaboration with incoming faculty at Berkeley to investigate genetic gradients in the human cerebellum. Learned new statistical tools to analyze postmortem human brain data, and developed pipelines to streamline data preprocessing, later adopted by >5 students.

Public Health & Policy

Predicting COVID-19 mortality rates across the U.S. using mobility and census data ***Author [Link]***

School of Information, University of California, Berkeley *Sep. - Dec. 2020*

- Built a statistical model predicting COVID-19 deaths in the U.S. from May - Aug. 2020 using data from the U.S. Census and Google Maps mobility reports. Increased optimization of algorithm by 20-fold. Presented findings in a poster presentation to faculty in the School of Information.

Cross-Functional and Cross-Disciplinary Research Collaboration ***Team Leader***

University of California, Berkeley; Princeton University; Yale University *Jan. 2019 - May. 2020*

- Implemented and maintained data warehousing for clinical research projects, established guidelines for cross-functional collaboration.

Ethics Protocol for MRI projects ***Manager [Link]***

Cognition and Action Lab, University of California, Berkeley *Jan. 2018 - Dec. 2021*

- Drafted guidelines and maintained ethics protocol for institutional review board (IRB) magnetic resonance imaging (MRI) projects. Completed human research program on "Human Research: Biomedical Research Investigators", and trained 3 research assistants on the protocol.

Graduate Mentoring Policies ***Co-Chair [Link]***

Department of Psychology, University of California, Berkeley *Jan. 2020 - Sep. 2021*

- Recognized need for formal mentor-mentee agreements in the UC Berkeley psychology department. Assembled and co-led working committee to create policy to improve lab culture and mentor-mentee relationships. Recruited panelists from diverse backgrounds.
- Authored 10-page policy document on mentorship and lab policy agreements. Advised leadership on implementation of new departmental policies during quarterly climate and equity meetings. Since Sep. 2021, 35/42 faculty have created lab policy documents.

State of the Department Initiative ***Leader [Link]***

Department of Psychology, University of California, Berkeley *Apr. 2019 - Apr. 2021*

- Advisor on Berkeley Psychology state of the department annual meeting, led team to conduct data analytics and statistics to translate graduate student concerns into policy recommendations. Used data and statistics to highlight funding discrepancy between neuroscience and clinical psychology students, resulting in a 20% yearly increase in graduate student stipends.

Papers

Changes in cerebro-cerebellar connectivity across learning ***In Prep***

M King, J Diedrichsen, R Ivry *2022*

A task-general connectivity model reveals variation in convergence of cortical inputs to functional regions of the cerebellum ***ELife (under review)***

M King, L Shahshahani, R Ivry, J Diedrichsen *2022*

No evidence for semantic prediction deficits in patients with cerebellar degeneration
M King, S Bruinsma, R Ivry
Neurobiology of Language
2022

Continuous manipulation of mental representations is compromised in cerebellar degeneration
SD McDougle, J Tsay, B Pitt, M King, W Saban, JA Taylor, RB Ivry
Brain
2022

Predicting brain activation maps for arbitrary tasks with cognitive encoding models
J Walters, M King, P Bissett, I Ivry, J Diedrichsen, R Poldrack
Journal of Cognitive Neuroscience
2022

Evaluating brain parcellations using the distance controlled boundary coefficient
D Zhi, M King, J Diedrichsen
Human Brain Mapping
2021

Transcriptomic Gradients Of The Human Cerebellum
M King, Z Zhen, RB Ivry, KS Weiner
Cell Reports (Under Review)
2020

Functional boundaries in the human cerebellum revealed by a multi-domain task battery
M King, CR Hernandez-Castillo, RA Poldrack, RB Ivry, J Diedrichsen
Nature Neuroscience
2019

Universal transform or multiple functionality? Understanding the contribution of the human cerebellum across task domains
J Diedrichsen, M King, C Hernandez-Castillo, M Sereno, RB Ivry
Neuron
2019

Visualizing Topographic Independent Component Analysis with Movies
Z Chen, D Parvin, M King, S Hao
arXiv
2019

Unique degeneration signatures in the cerebellar cortex for spinocerebellar ataxias 2, 3, and 7
CR Hernandez-Castillo, M King, J Diedrichsen, J Fernandez-Ruiz
NeuroImage: Clinical
2018

Individual differences in resting corticospinal excitability are correlated with reaction time and GABA content in motor cortex
I Greenhouse, M King, S Noah, RJ Maddock, RB Ivry
Journal of Neuroscience
2017

Towards a multi-function mapping of the cerebellar cortex
M King, C Hernandez-Castillo, J Diedrichsen
Brain
2017

Neural adaptations associated with interlimb transfer in a ballistic wrist flexion task
KL Ruddy, AK Rudolf, B Kalkman, M King, A Daffertshofer, TJ Carroll, R Carson
Frontiers in Human Neuroscience
2016

Registered reports for student research
M King, F Dablander, L Jakob, M Agan, F Huber, J Haslbeck, K Brecht
Journal of European Psychology Students
2016

A critical evaluation of the essentialist debate: do fathers make a unique contribution to child development?
M King
Student Psychology Journal of Ireland
2015

The locus coeruleus-noradrenergic arousal function modulates perceptual decision-making in humans: evidence from pupillometry
M King, R O'Connell
Unpublished Undergraduate Honors Thesis
2014

Poster Presentations

Cerebro-cerebellar connectivity is dominated by divergent mapping
M King, L Shahshahani, Ivry, J Diedrichsen
Society for Neuroscience Conference
Virtual Conference
2021

Predicting brain activation maps for arbitrary tasks with ontology-based encoding models

J Walters, M King, P Bissett, Ivry, J Diedrichsen, R Poldrack

2021

Organization for Human Brain Mapping Conference

Virtual Conference

Evaluating Brain Parcellations using the Multi-Domain Task Battery

J Diedrichsen, M King, C Hernandez-Castillo, D Zhi, R Ivry

2019

Organization for Human Brain Mapping Conference

Rome, Italy

Evaluating different functional parcellations of the basal ganglia

C Hernandez-Castillo, M King, I Harding, J Diedrichsen, R Ivry

2019

Organization for Human Brain Mapping Conference

Rome, Italy

Transcriptomic Gradients of the Human Cerebellum

M King, R Ivry, K Weiner

2019

Cerebellum Gordon Research Conference

Les Diablerets, Switzerland

A multi-domain task battery reveals the functional topography of the human cerebellum

M King, C Hernandez-Castillo, R Poldrack, R Ivry, J Diedrichsen

2018

The Society for Neuroscience Conference

San Diego, California

A multi-domain task battery reveals the functional topography of the human cerebellum

M King, C Hernandez-Castillo, R Poldrack, R Ivry, J Diedrichsen

2018

Computational and Cognitive Neuroscience Conference

Philadelphia, Pennsylvania

Navigating the ”Little Brain”: Comprehensive mapping of cognitive function in the human cerebellum

M King, R Ivry, J Diedrichsen

2017

Helen Wills Neuroscience Retreat

Lake Tahoe, California

Navigating the ”Little Brain”: Comprehensive mapping of cognitive function in the human cerebellum

M King, R Ivry, J Diedrichsen

2017

Organization for Human Brain Mapping Conference

Vancouver, British Colombia

Mapping the Human Cerebellum

M King, R Ivry, J Diedrichsen

2017

Cerebellum Gordon Conference

Lewiston, Maine

Transcranial magnetic stimulation measures of intrinsic motor system excitability and task-based inhibition exhibit intra-subject stability across weeks

I Greenhouse, M King, R Ivry

2015

Society for Neuroscience Conference

Chicago, Illinois

Electroencephalography (EEG) signatures of impairment in cognitive, sensory and motor networks in Amyotrophic Lateral Sclerosis (ALS) disease

B Nasseroleslami, K Mohr, M King, O Hardiman

2015

Annual ALS Irish Meeting

Dublin, Ireland

Invited Talks

Cerebro-cerebellar connectivity across motor and cognitive circuits

Neurophysiologisches Seminar

2021

Neurologische Uniklinik Essen

Virtual Conference

Bringing a systems level perspective to neuroimaging analyses

Educational Symposium: Neuroanatomy for neuroimaging

2021

Organization for Human Brain Mapping

Virtual Conference [Link]

Transcriptomic gradients of the human cerebellum

Cognitive Neuroscience Colloquium

2020

University of California, Berkeley

Berkeley, California

Mapping the Human Cerebellum Using a Multi-Domain Task Battery

Symposium: New Perspectives on Cerebellar Function: Implications for Mental Health

2019

Society for Neuroscience

Chicago, Illinois

A multi-domain task battery reveals the functional topography of the human cerebellum — *Helen Wills Neuroscience Institute*

UCB Neuroscience Retreat — *Richmond, California*

2018

Mapping the Human Cerebellum — *Cerebellum Gordon Research Conference*

Seminar: Theories and Models of Cerebellar Function — *Lewiston, Maine*

2017

Grants

Transformation of internal representations in multiple task domains. — *NIH R35 (funded)*

Graduate Co-Author — *2020*

Collaboration between University of California, Berkeley; Princeton University; Yale University

Evaluating a Novel Model of Cerebellar Function Using Harmonized Online-Testing of Patients with Cerebellar Degeneration in the Bay Area and Oslo Communities — *Sather Grant (unfunded)*

Graduate Co-Author — *2019*

Collaboration between University of California, Berkeley; University of Oslo

Understanding cortico-cerebellar contributions to cognition — *NIH R01 (unfunded)*

Graduate Co-Author — *2018*

Collaboration between University of California, Berkeley; Western University (Canada)

Teaching

Mount Tamalpais College — *Lecturer [Link]*

General Psychology — *10 hrs/week; Sep. - Dec. 2019*

- Designed and lectured course on general psychology to incarcerated students. Topics included "the brain and nervous system", "classical conditioning", and "mood disorders". Devised trauma-informed learning objectives, catering to students with diverse educational needs.

University of California, Berkeley — *Instructor [Link]*

Biological Psychology, PSYCH 110; Cognitive Neuroscience, PSYCH 127 — *15 hrs/week; Aug. 2017 - Dec. 2018*

- Instructed weekly seminars for 120+ students on topics including "memory and learning" and "ethics of artificial intelligence", under the supervision of UC Berkeley professors. Evaluated and supervised student research and wrote professional references for promising students.

Western University — *Instructor [Link]*

Biology/Statistics, STAT 2244; Probability and Statistics, STAT 2857 — *15 hrs/week; Jan. 2016 - May. 2017*

- Instructed undergraduate students in a statistics and data science laboratory using the programming language "R". Topics included "central limits theorem", "hypothesis testing" and "conditional probability". Wrote and administered exams and evaluated student work.

Mentorship

Undergraduate Research Assistants at MIT — *Alyson Brown, Shreya Ravikumar*

Sep. 2022 - — *Psychology; Computer Science*

- Shreya Ravikumar is building predictive models of neuropsychiatric disorders.
- Alyson Brown is doing a meta-analysis on neuroimaging and neurodevelopmental disorders.

Honors Thesis Students at Berkeley — *Shannon Lee; Sienna Bruinsma*

Sep. 2019 - May 2021 — *Cognitive Science; Psychology*

- Shannon Lee's thesis developed eye-tracking and context models to inform social learning.
- Sienna Bruinsma's thesis evaluated the functional role of the cerebellum in linguistic processing using neuropsychology.

Undergraduate Research Assistants at Berkeley — *Zanib Naaem; Yiling Kao*

Jan. 2021 - May 2021; Sep. 2019 - May 2020 — *Psychology; Computer Science*

- Zanib Naaem tested healthy college-aged students on a multi-session eye-tracking and behavioral learning project.
- Yiling Kao developed a verb generation task and used machine learning to study speech envelopes.

Ph.D. Rotation Students at Berkeley — *Amanda LeBel; Jacob Ziontz; Mark Gorenstein*

Sep. - Dec. 2020; Jan. - May 2020; Sep. - Dec. 2018 — *Neuroscience*

- Amanda LeBel developed encoding models using speech features to study task-evoked cerebellar activity.
- Jacob Ziontz set up fMRI preprocessing scripts (BIDS and fMRIPrep) on multi-session cerebellar data.
- Mark Gorenstein worked on preprocessing pipelines for cerebro-cerebellar connectivity models.

Post-Baccalaureate Students at Berkeley — *Dylan Benkley*

Sep. - Dec. 2018 — *Psychology*

- Dylan Benkley conducted a literature review on the role of the cerebellum in social cognition.

Public Service & Outreach

Committees & Policy

Science Policy Group - Executive Visit — ***Member***

MIT — *Sep. 2022 -*

- Selected to attend an executive visit trip to Washington, DC to meet with agency leaders from NSF, USDS, EPA, NASA to discuss science policy.
- Led a meeting at the White House office of science and technology policy (OSTP) with Obama's former CTO, Megan Smith.

Graduate Assembly Students of Psychology — ***Member and RSO Signatory***

University of California, Berkeley — *Sep. 2018 - Mar. 2020*

- Provided data analytics to improve efficiency of phone banking for Psychology "Big Give". Contacted 10-fold more donors than previous year.
- Liaison officer between Berkeley development office and external donors. Organized faculty fundraisers in Silicon Valley.

European Federation of Psychology Students' Association — ***Editor [Link]***

European Union — *Jan. 2016 - May 2016*

- Spearheaded initiative to pre-register scientific results in the Journal of European Psychology Students, a first for student journals worldwide.
- Advised organization leadership on best practices for successful implementation of pre-registration and authored journal article (>3500 views).

Schulich School of Medicine Graduate Council — ***Secretary***

Western University — *Sep. 2015 - Sep. 2016*

- Provided budget evaluation of graduate student insurance plan to council. Served as student liaison officer.

Niteline (Student Helpline) — ***Publicity Officer***

Trinity College, Dublin — *Sep. 2011 - May 2014*

- Provided practical program consultation to student helpline *[link]*.

Communication & Administration

Graduate Assembly Students of Psychology — ***Writer/Contributor [Link]***

University of California, Berkeley — *Sep. 2019 - May 2021*

- Created, managed, and edited Berkeley Psychology blog to spotlight graduate student research.
- Co-founded and co-operated Twitter account for Berkeley Psychology *[link]*. Increased follower count to >1500 after 2 years.
- Co-Writer of Psychology newsletter *[link]* (>2000 circulation). Included profiles on graduates to strengthen ties with alumni community.

Journal of European Psychology Students — ***Editor/Contributor [Link]***

European Union — *Jan. 2014 - May 2016*

- Managed peer review process for 30 papers including paper submission, reviewer recruitment, copy editing, and publication.
- Contributor to popular psychology and neuroscience blog post, aimed at engaging aspiring psychology students.

Education & STEM Outreach

Prison University Project — ***Lecturer [Link]***

San Quentin State Prison — *Jan. - May 2019*

- Designed and lectured a new curriculum in General Psychology for incarcerated students. I brought human brains into the classroom to teach neuroanatomy, mirroring the UC Berkeley student experience. Provided executive board with formal analysis of organizational operations.

Bay Area Scientists in Schools (BASIS) — ***Team Member [Link]***

University of California, Berkeley — *Jan. 2018 - Jan. 2020*

- Deployed neuroscience curriculum, "Know Your Brain", that has been presented to students in >20 Bay Area public schools.

Inspiring Young Women in STEM Inaugural Conference — ***Organizing Member [Link]***

Western University — *May 2016*

- Organizing member of first conference to encourage female students in STEM (>150 attendees), recruited keynote speakers, and evaluated research.

Western Women Neuroscientists in Schools — ***Team Leader [Link]***

Western University — *Oct. 2015 - May 2017*

- Developed and lectured curriculum to explore neuroscience misinformation ("Myths and the Brain"). Presented to >2000 high-schoolers in Ontario schools.

Brain Bee — *Volunteer*

Western University — *May 2016 and May 2017*

- Member of the organizing committee for the London Brain Bee, a neuroscience event that introduces high school students to neuroanatomy.

Student-to-Student (S2S) — ***Peer Mentor***

Trinity College, Dublin — *2011 - 2012*

- Provided after-school homework support to children on the autism spectrum.

Skills & Interests

Programming Languages	Python, SQL, R, MATLAB, HTML, Bash
Frameworks and Tools	Keras, OpenCV, Git, Vim, Blender, Nipype, Deeplabcut, PsychoPy, Pandas, NumPy, Scikit-learn, Scipy
Conceptual	High performance computing (Savio), Grant Writing and IRB Ethics Protocols, MRI technician certificate
Interpersonal	Project management, Organizational leadership, Resourcefulness, Problem solving, Conflict resolution
Languages	English (Native), Irish (Native), French (Proficient), German (Basic)