Randall J. Ellis, PhD

Cambridge, MA 02141
randalljellis@gmail.com
randalljellis.github.io | @randalljellis

My research program is aimed at discovering biologically informed, clinically actionable machine learning models for predicting disease risk using diverse sources of human biobank data.

Education

Icahn School of Medicine at Mount Sinai, New York, NY
August 2017-September 2022
Doctor of Philosophy, Biomedical Science
Focus: Behavioral and molecular neuroscience, computational biology, biomedical informatics
Thesis Advisor: Yasmin L. Hurd, PhD

Florida Atlantic University (FAU), Boca Raton, FL
August 2010-December 2014
Bachelor of Science, *cum laude*, Neuroscience & Behavior
Minor, Psychology

Research Experience

Postdoctoral Fellow, Department of Biomedical Informatics at Harvard Medical School
October 2023-present
Laboratory of Chirag Patel, PhD
Studying aging and neurodegeneration using human biobanks, including electronic health records, multiomics, and neuroimaging

Postdoctoral Fellow, Department of Biology at Tufts University
January 2023-October 2023
Laboratory of Michael Levin, PhD
Studying neuronal signaling and limb regeneration using computational neuroscience, next-generation sequencing, and microfluidics

Graduate student, Friedman Brain Institute at Mount Sinai
July 2018-January 2023
Laboratory of Yasmin L. Hurd, PhD
Studying the clinical, behavioral, and molecular underpinnings of opioid use disorder

Graduate rotation student, Department of Pharmacology at Mount Sinai
October 2017-June 2018
Laboratory of Avi Ma'ayan, PhD
Studying the application of machine learning to predict diagnosis of substance use disorders

Postbaccalaureate Intramural Research Training Award (IRTA), National Institute on Drug Abuse, Baltimore, MD
August 2015-August 2017
Laboratory of Michael Michaelides, PhD
Studying the identification of molecular targets of cocaine and the application of machine learning to decoding natural scenes from neuronal calcium responses

Undergraduate Research Assistant, Center for Complex Systems and Brain Sciences at May 2013-January 2015
Florida Atlantic University
Laboratory of Robert P. Vertes, PhD
Studying the effects of midline thalamic lesions on odor/texture discrimination and the effects of dextromethorphan on depressive-like phenotypes

Undergraduate Research Assistant, Center for Complex Systems and Brain Sciences at Florida Atlantic University
January 2013-May 2013
Laboratory of J.A. Scott Kelso, PhD Studying human-machine motor Coordination

Research Grants

10/01/2024 – 10/01/2026 NIH 5T15LM007092-33 (NLM) Role: Trainee
Title: University Biomedical Informatics Research Training Awards

08/09/2021 – 01/30/2023 (early term.) NIH F31DA051183 (NIDA) Role: PI
Title: Opioid effects on cognition and addiction: Molecular underpinnings

07/18/2019 – 06/30/2020 NIH T32GM062754 (NIGMS) Role: Trainee
07/01/2020 – 06/30/2021 (Reappt.)
Title: Teaching Biomedical and Pharmacological Trainees to Produce FAIR Data for AI & ML Applications

Publications

Google Scholar | ORCID
Ellis, R. J., Ferland, J.-M. N., Rahman, T., Landry, J. L., Callens, J. E., Pandey, G., Hurd, Y. L. Machine learning of the human heroin orbitofrontal cortex transcriptome identifies *Shisa7* as a translational target relevant for heroin-seeking and reversal learning. *Biological Psychiatry*.

Ellis, R. J., Airaud, A., Patel, C. J. Random feature baselines provide distributional performance and feature selection benchmarks for clinical and 'omic machine learning. *ML4H*, Findings track, 2024.

Luo, R., Zeraatkar, D., Glymour, M., **Ellis, R. J.**, Estiri, H., Patel, C. J. Specification curve analysis to identify heterogeneity in risk factors for dementia: findings from the UK Biobank. *BMC medicine* 22 (1), 216, 2024

Ferland, J.-M. N., **Ellis, R. J.**, et al. Long-Term Outcomes of Adolescent THC Exposure on Translational Cognitive Measures in Adulthood in an Animal Model and Computational Assessment of Human Data. *JAMA Psychiatry,* 80(1), 66-76 (2023).

Ferland, J.-M. N., **Ellis, R. J.,** Rompala, G., Landry, J. A., Callens, J. E., Ly, A., Frier, M. D., Uzamere, T. O., Hurd, Y. L. Dose mediates the protracted effects of adolescent THC exposure on reward and stress reactivity in males relevant to perturbation of the basolateral amygdala transcriptome. *Molecular Psychiatry* (2022).

Ellis, R. J.*, Bara, A.*, Vargas, C. A.*, Frick, A. L., Loh, E., Landry, J., Uzamere, T. O., Callens, J. E., Martin, Q., Rajarajan, P., Brennand, K., Ramakrishnan, A., Shen, L., Szutorisz, H. & Hurd, Y. L. Prenatal Δ9-tetrahydrocannabinol exposure in males leads to motivational disturbances related to striatal

epigenetic dysregulation. *Biological Psychiatry* (2021).

Gomez, J. L., Bonaventura, J., Keighron, J., Wright, K. M., Marable, D. L., Rodriguez, L. A., Lam, S., Carlton, M. L., **Ellis, R. J.,** Jordan, C. J., Bi, G., Solis, O., Pignatelli, M., Bannon, M. J., Xi, Z.-X., Tanda, G. & Michaelides, M. Synaptic Zn2+ potentiates the effects of cocaine on striatal dopamine neurotransmission and behavior. *Translational Psychiatry* 11, 570 (2021).

Suprun, M., **Ellis, R. J.,** Sampson, H. A. & Suárez-Fariñas, M. bbeaR: an R package and framework for epitope-specific antibody profiling. *Bioinformatics* 37, 131–133 (2021).

Egervari, G., Akpoyibo, D., Rahman, T., Fullard, J. F., Callens, J. E., Landry, J. A., Ly, A., Zhou, X., Warren, N., Hauberg, M. E., Hoffman, G., **Ellis, R.,** Ferland, J.-M. N., Miller, M. L., Keller, E., Zhang, B., Roussos, P. & Hurd, Y. L. Chromatin accessibility mapping of the striatum identifies tyrosine kinase FYN as a therapeutic target for heroin use disorder. *Nature Communications* 11, 1–15 (2020).

Ellis, R. J., Wang, Z., Genes, N. & Ma'ayan, A. Predicting opioid dependence from electronic health records with machine learning. *BioData Mining* 12, 3 (2019).

Michaelides, M., Miller, M. L., Egervari, G., Primeaux, S. D., Gomez, J. L., **Ellis, R. J.,** Landry, J. A., Szutorisz, H., Hoffman, A. F., Lupica, C. R., Loos, R. J. F., Thanos, P. K., Bray, G. A., Neumaier, J. F., Zachariou, V., Wang, G.-J., Volkow, N. D. & Hurd, Y. L. Striatal Rgs4 regulates feeding and susceptibility to diet-induced obesity. *Mol Psychiatry* 25, 2058–2069 (2018).

Ellis, R. J. & Michaelides, M. High-accuracy Decoding of Complex Visual Scenes from Neuronal Calcium Responses. *bioRxiv* 271296 (2018).

Gomez, J. L., Bonaventura, J., Lesniak, W., Mathews, W. B., Sysa-Shah, P., Rodriguez, L. A., **Ellis, R. J.,** Richie, C. T., Harvey, B. K., Dannals, R. F., Pomper, M. G., Bonci, A. & Michaelides, M. Chemogenetics revealed: DREADD occupancy and activation via converted clozapine. *Science* 357, 503–507 (2017).

Commentaries/Book chapters/Reviews

Ellis, R. J. Questionable research practices, low statistical power, and other obstacles to reproducibility: why preclinical animal research would benefit from registered reports. *eNeuro* (2022).

Ellis, R. J., Sander, R., Limon, A. Twelve key challenges in medical machine learning and solutions. Invited commentary for Special Issue on Challenges in Machine Learning Research, *Intelligence-based Medicine* (2022).

Ellis, R. J., Rahman, T., Sherman, J. & Hurd, Y. L. SnapShot: Neurobiology of opioid use disorder. *Cell* 184, 1648-1648.e1 (2021).

Ellis, R. J., Michaelides, M. & Wang, G.-J. Neurodysfunction in Addiction and Overeating as Assessed by Brain Imaging. in *Processed Food Addiction: Foundations, Assessment, and Recovery* (CRC Press, 2017).

Reviewer Experience

Editorial Board member of Intelligence-Based Medicine (Elsevier)
September 2020-present
Reviewed 120+ papers on clinical machine learning

Reviewed for JAMA Network Open, Annals of Medicine, Nature Scientific Reports, eNeuro, Drug and Alcohol Dependence, Age and Ageing, npj Digital Medicine, Journal of Substance Use and Addiction Treatment

Professional Experience

Teaching Assistant, Neuromatch Academy Computational Neuroscience, July 2021
Facilitated ten graduate, undergraduate, and postdoctoral students through three weeks of online tutorials and group projects

Freelance grant consultant on NIH grants involving neuroscience, computational biology, and machine learning, 2020-present

Instructor, two 6-week Python courses for middle school students, Summer 2020-2021

Private tutor, Python and machine learning for data scientists, postdocs, and students at graduate, undergraduate and high school levels, 2018-present

EEG Neurofeedback Technician, Caron Renaissance, Boca Raton, FL *Conducted EEG neurofeedback as part of a clinical team treating addiction and other psychiatric and behavioral disorders,* January-August 2015

Awards & Honors

GENEWIZ NextGenSeqers Grant, $5000 for next-generation sequencing, May 2021

Interviewed by the Allen Institute for Brain Science about work on decoding natural scenes from neuronal calcium responses (video), November 2018

NIH Postbaccalaureate Intramural Research Training Award: Two-year fellowship at the National Institute on Drug Abuse under Michael Michaelides, PhD. August 2015-August 2017

2nd Place in the Biological Sciences, Oral Presentation category at Florida Atlantic University's Undergraduate Research Symposium for "Antidepressant Efficacy of Dextromethorphan in the Forced Swim Test." April 2015

Graduated Cum Laude – Florida Atlantic University, December 2014

Undergraduate Research Grant (April 2014) to assess the effects of an NMDA antagonist, dextromethorphan, on a pre-clinical depression assay, the Porsolt forced swim test.

Phi Kappa Phi

Invited Talks

The Role of Pre-Registrations and Registered Reports in Preclinical Studies. Berlin Institute of Health, January 28th, 2025.

Replicability and Preregistration (panel). Society for Neuroscience, May 8th, 2024.

Oral Presentations

Genomic prediction of alcohol and opioid use disorders using machine learning Ellis, RJ, Zhou, H, Galimberti, M, Kranzler, HR, Gelernter, J, Hurd, YL.

- NIDA Genetics and Epigenetics Cross-Cutting Research Team Meeting, March 2021

Antidepressant Efficacy of Dextromethorphan in the Forced Swim Test Ellis, RJ, Vertes, RP.

- FAU's Fifth Annual Undergraduate Research Symposium, Boca Raton, FL, April 2015

Frequency Coordination in Virtual Partner Interaction Ellis, RJ, Dumas, G, Tognoli, E, Kelso, JA.

- FAU's Third Annual Undergraduate Research Symposium, Boca Raton, FL, April 2013

Posters

Random feature baselines provide distributional performance and feature selection benchmarks for clinical and 'omic machine learning. *ML4H*, Findings track, 2024.
Ellis, RJ, Airaud, A, Patel, CJ

- ML4H, Findings Track, 2024

Machine Learning Identifies SHISA7 as a Translational Target of Heroin Abuse Directly Relevant to Drug-Seeking and Reversal Learning
Ellis, RJ, Ferland, JMN, Landry, JA, Callens, JE, Uzamere, TO, Pandey, G, Hurd, YL.

- Innovators in Neuroscience: From Molecules to Mind, Columbia/Mount Sinai, May 25-26, 2021
- Friedman Brain Institute's 13th Annual Neuroscience Retreat, Mount Sinai, April 30, 2021

Fyn Kinase Linked to Glutamatergic Related Synaptic Alterations and Tau Pathology in the Striatum of Human Heroin Abusers
Ellis, RJ, Akpoyibo, D, Egervari, G, Landry, J, Callens, J, Roussos, P, Hurd, YL.

- Annual Neuroscience Retreat at Mount Sinai, New York, NY, May 2019

High-accuracy decoding of complex visual scenes from neuronal calcium responses
Ellis, RJ, Michaelides, M.

- Society for Neuroscience Annual Meeting, San Diego, CA, November 2018

Prediction of Substance Dependence Status from Electronic Health Records with Machine Learning
Ellis, RJ, Wang, Z, Genes, N, Ma'ayan, A.

- Intelligent Systems in Molecular Biology, Chicago, IL, July 2018
- BD2K-LINCS Data Science Symposium, Miami, FL, February 2018

Visual Decoding of Neuronal Calcium Responses Using Deep Neural Networks Ellis, RJ, Michaelides, M.

- Inaugural Conference on Cognitive Computational Neuroscience, Columbia University, New York, NY, September 2017

Empirical validation of cocaine targets in the striatum identified using big data Ellis, RJ, Gomez, JL, Rodriguez, LA, Michaelides, M.

- Society for Neuroscience Annual Meeting, San Diego, CA, November 2017
- NIH Postbac Poster Day, Bethesda, MD, June 2016, 2017
- NIDA Poster Day, Baltimore, MD, May 2016, 2017

A bioinformatic pipeline for the discovery of translational targets relevant to cocaine abuse Ellis, RJ, Gomez, JL, Rodriguez, LA, Michaelides, M.

- Society for Neuroscience Annual Meeting, San Diego, CA, November 2016

The Cocaine Ignorome: Assessing Differential Gene Expression Predicted via Bioinformatic Analysis Ellis, RJ, Gomez, JL, Rodriguez, LA, Michaelides, M.

- Johns Hopkins Behavioral Pharmacology Research Unit Symposia, July 2016

Antidepressant Efficacy of Dextromethorphan in the Forced Swim Test Ellis, RJ, Vertes, RP.
- Synapse Poster Session at Max Planck Florida Institute, Jupiter, FL, January 2015
- Florida Undergraduate Research Conference, Daytona, FL, February 2015

Effects of Electrolytic Lesions of the Reuniens and Rhomboid Nuclei on Cognitive Behaviors Using the Intradimensional Extradimensional (IED) Task in Rats
Ellis, RJ, Pinedo, P, Linley, SB, Vertes, RP.
- FAU's Fourth Annual Undergraduate Research Symposium, Boca Raton, FL, April 2014

Mentored students

Sydney Weiner – Summer 2021 internship at Mount Sinai. Joined as an undergrad; went on to earn a Masters in Psychology from New York University and is currently a Clinical Research Coordinator at New York Langone Health. Conducted bioinformatics and machine learning analyses.

Danial Bogen – Summer 2022, Mount Sinai. Joined as a high school student; went on to attend Williams College. Conducted co-immunoprecipitation and Western blot experiments.

Audrey Airaud – Spring-Summer 2024, Harvard Medical School. Mentored a Masters thesis on using proteomics data in the UK Biobank to predict dementia diagnosis.

Adithya Madduri – Summer 2024-present, Harvard Medical School. Mentoring on undergraduate research projects using single-cell RNA-seq data to predict Alzheimer's disease.

Helen Qian – Summer 2025-present, Harvard Medical School. Mentoring on what began as a summer research program as part of the Summer Institute in Biomedical Informatics at HMS, continuing the project after the conclusion of the program.