

Michael C. Saul, Ph.D.

Office: The Jackson Laboratory • 600 Main St • Bar Harbor, ME 04609

Education, Training, and Positions

2019-Present: Research Scientist, The Jackson Laboratory, Bar Harbor, ME.
Faculty Supervisor: Elissa Chesler.

2018-2019: Postdoctoral Associate, The Jackson Laboratory, Bar Harbor, ME.
Faculty Mentor: Elissa Chesler.

2014-2018: Postdoctoral Fellow, University of Illinois at Urbana-Champaign, Urbana, IL.
Faculty Mentor: Lisa Stubbs. Co-Advisors: Alison Bell, Justin Rhodes, Gene Robinson, and Saurabh Sinha.

2010-2014: Ph.D., Zoology (now Integrative Biology), University of Wisconsin-Madison, Madison, WI.
Faculty Mentor: Stephen Gammie.
Thesis: *A Complex Mania Model: The Behavior, Molecules, and Genotype of the Madison Mouse Strain.*

2003-2008: B.S., Biology (with honors), The University of Iowa, Iowa City, IA.
Faculty Mentor: Steven Green.
Thesis: *PKA and Activity-Dependent Synaptogenesis in the Mouse Auditory Cortex.*

Grants, Contracts, and Awards

Awarded

2019-2020: Jacobs Foundation Young Scholar (one of eleven), “Reconciling Genes and Contexts: Exploring the Genomic & Environmental Headwaters of Early Brain Development”. 40,000 Swiss Francs (about \$40,000) awarded for work on genome-by-environment interactions in Madison mice.

2014-2018: UIUC Institute for Genomic Biology Postdoctoral Fellowship. \$205,000 awarded for stipend; \$22,500 awarded for research expenses.

2015: IBANGS Travel Award. \$650 awarded for travel to the annual IBANGS meeting in 2015.

2013: John Jefferson Davis Travel Award. \$400 awarded for travel to Neuroscience 2013.

2013: John T. Emlen Award for Behavioral Research. \$8,100 awarded for research on transcriptomic correlates of mania in the limbic brain of the Madison mouse strain.

2011: John Jefferson Davis Travel Award. \$400 awarded for travel to Neuroscience 2011.

Scholarship

Publications

22 peer-reviewed publications, 9 as first or co-first author. Web of Science H-Index = 12.

ORCID: [0000-0002-4916-8619](https://orcid.org/0000-0002-4916-8619), Web of Science ResearcherID: [N-9303-2019](https://www.researcherid.com/rid/N-9303-2019)

*equal contribution, †undergraduate co-author

Reviews and Position Papers

2019: **Saul MC**, Philip VM, Reinholdt LG, CSNA (consortium author), and Chesler EC. “High-diversity mouse populations for complex traits.” *Trends in Genetics* 35(7): 501-514.
PubMed ID: [31133439](https://pubmed.ncbi.nlm.nih.gov/31133439/)

2018: Lightfoot JT, De Geus EJC, Booth FW, Bray MS, den Hoed M, Kaprio J, Kelly SA, Pomp D, **Saul MC**, Thomis MA, Garland T, and Bouchard C. “Biological/Genetic Regulation of Physical Activity Level: Consensus from GenBioPAC.” *Medicine and Science in Sports and Exercise*, 50(4): 863-873.
PubMed ID: [29166322](https://pubmed.ncbi.nlm.nih.gov/29166322/)

2016: Gammie SC, Driessen TM, Zhao C, **Saul MC**, and Eisinger BE. “Genetic and Neuroendocrine Regulation of the Postpartum Brain.” *Frontiers in Neuroendocrinology* 42: 1-17.

PubMed ID: [27184829](#)

Original Research

2020: Talluri B, Amar K, **Saul MC**, Shireen T, Konjufca V, Ma J, Ha T, 6 and Chowdhury F. “COL2A1 is a novel biomarker of melanoma tumor repopulating cells.” *Biomedicines* (accepted).

PubMed ID: pending

2019: Bukhari SA, **Saul MC**, James N, Bensky M, Stein L, Trapp R, and Bell AM. “Neurogenomic insights into paternal care and its relation to territorial aggression.” *Nature Communications* 10(1):4437.

PubMed ID: [31570726](#)

2019: Shpigler HY, **Saul MC**, Murdoch EE, Corona F[†], Cash-Ahmed AC, Seward CH, Chandrasekaran S, Stubbs LJ, and Robinson GE. “Honey bee neurogenomic responses to affiliative and agonistic social interactions.” *G2B*: e12509.

PubMed ID: [30094933](#)

2019: **Saul MC**, Blatti C, Yang W, Bukhari SA, Shpigler HY, Troy JM, Seward C, Sloofman L, Chandrasekaran S, Bell AM, Stubbs LJ, Robinson GE, Zhao SD*, and Sinha S*. “Cross-species systems analyses reveal a shared brain transcriptional response to social challenge.” *G2B*: e12502.

PubMed ID: [29968347](#)

2018: Sorokina AM[†], **Saul MC**, Goncalves TM, Gogola JV[†], Majdak P, Rodriguez-Zas SL, and Rhodes JS. “Striatal transcriptome of a mouse model of ADHD reveals a pattern of synaptic remodeling.” *PLoS ONE* 13(8): e0201553.

PubMed ID: [30110355](#)

2018: **Saul MC**, Stevenson SA, Zhao C, Driessen TM, Eisinger BE, and Gammie SC. “Genomic variants in an inbred mouse model predict mania-like behaviors.” *PLoS ONE* 13(5): e0197624.

PubMed ID: [29768498](#)

2017: Shpigler HY*, **Saul MC***, Corona F[†], Block L[†], Cash-Ahmed A, Zhao SD, and Robinson GE. “Deep evolutionary conservation of autism-related genes.” *PNAS* 114(36): 9653-9658 (Featured on the [UIUC Home Page](#) and reported in *Science*, *The Times* of London, and *The New York Post*).

PubMed ID: [28760967](#)

2017: Bukhari SA, **Saul MC**, Seward C, Zhang H, Bensky M, James N, Zhao SD, Chandrasekaran S, Stubbs LS, and Bell AM. “Temporal Dynamics of Neurogenomic Plasticity in Response to Social Interactions in Male Threespined Sticklebacks.” *PLoS Genetics* 13(7): e1006840 (Reported in [EurekAlert!](#)).

PubMed ID: [28704398](#)

2017: Shpigler HY, **Saul MC**, Murdoch EE[†], Cash-Ahmed A, Seward C, Sloofman LG, Chandrasekaran S, Sinha S, Stubbs L, and Robinson GE. “Behavioral, transcriptomic and epigenetic responses to social challenge in honey bees.” *G2B* 16(6): 579-591.

PubMed ID: [28328153](#)

2017: **Saul MC***, Seward C*, Troy J, Zhang H, Sloofman LG, Lu X, Weisner PA, Caetano-Anolles D, Sun H[†], Zhao SD, Chandrasekaran S, Sinha S, and Stubbs L. “Transcriptional regulatory dynamics drive coordinated metabolic and neural response to social challenge in mice.” *Genome Research* 27: 959-972 (Reported in [EurekAlert!](#)).

PubMed ID: [28356321](#)

2017: **Saul MC**, Majdak P, Perez S, Reilly M, Garland T, and Rhodes JS. “High motivation for exercise is associated with altered chromatin regulators of monoamine receptor gene expression in the

striatum of mice from selectively bred lines.” *G2B* 16(3): 328-341 (Reported in the [UIUC’s Storied](#)).
PubMed ID: [27749013](#)

2016: **Saul MC***, Zhao C*, Driessen TM, Eisinger BE, and Gammie SC. “MicroRNA expression is altered in lateral septum across reproductive stages.” *Neuroscience* 312: 130-140.
PubMed ID: [26592715](#)

2014: Mitchell CL, **Saul MC**, Lei L, Wei H, and Werner T. “The Mechanisms Underlying Alpha-Amanitin Resistance in *Drosophila melanogaster*: A Microarray Analysis.” *PLoS ONE* 9(4): e93489.
PubMed ID: [24695618](#)

2014: Driessen TM, Eisinger BE, Zhao C, Stevenson SA, **Saul MC**, and Gammie SC. “Genes Showing Altered Expression in the Medial Preoptic Area in the Highly Social Maternal Phenotype are Related to Autism and Other Disorders with Social Deficits.” *BMC Neuroscience* 15: 11.
PubMed ID: [24423034](#)

2013: Eisinger BE, **Saul MC**, Driessen TM, and Gammie SC. “Development of a Versatile Enrichment Analysis Tool Reveals Associations between the Maternal Brain and Mental Health Disorders, Including Autism.” *BMC Neuroscience* 14: 147.
PubMed ID: [24245670](#)

2013: **Saul MC**, Stevenson SA, and Gammie SC. “Sexually Dimorphic, Developmental, and Chronobiological Behavioral Profiles of a Mouse Model for Mania.” *PLoS ONE* 8(8): e72125.
PubMed ID: [23967278](#)

2013: Eisinger BE, Zhao C, Driessen TM, **Saul MC**, and Gammie SC. “Large Scale Expression Changes of Genes Related to Neuronal Signaling and Developmental Processes Found in Lateral Septum of Postpartum Outbred Mice.” *PLoS ONE* 8(5): e63824.
PubMed ID: [23717492](#)

2012: Zhao C, **Saul MC**, Driessen TM, and Gammie SC. “Gene Expression Changes in the Septum: Possible Implications for MicroRNAs in Sculpting the Maternal Brain.” *PLoS ONE* 7(6): e38602.
PubMed ID: [22701680](#)

2012: **Saul MC**, Gessay GM, and Gammie SC. “A New Mouse Model for Mania Shares Genetic Correlates with Human Bipolar Disorder.” *PLoS ONE* 7(6): e38128.
PubMed ID: [22675514](#)

Preprints

2020: **Saul MC**, Bagley JR, Bailey LS, Datta U, Dickson PE, Dodd R, Gagnon LH, Huggett SB, Kimble VM, Leonardo M, Kim S-M, Olson A, Roy T, Schoenrock SA, Wilcox T, Jentsch JD, Logan RW, McClung CA, Palmer RHC, Philip VM, Reinholdt LG, Sukoff Rizzo SJ, Tarantino LM, and Chesler EJ. “Consideration of genetic and sex effects in mice enhances consilience with human addiction studies.” bioRxiv, posted 2020-07-28 (in peer review).
doi: <https://doi.org/10.1101/2020.02.14.949784>

Presentations

Invited Talks

2018: “Mathematics of whole genome and neural circuitry analysis.” CIFAR/Jacobs Foundation Joint Conference on Reconciling Genes and Context, Marbach Castle, Germany.

2017: “The neural transcriptome of mice born to run supports a link between chromatin structure and motivation for exercise.” International Roundtable on the Genetic Regulation of Physical Activity, College Station, TX, USA.

Contributed Talks

2019: “Reference traits bridge drug use phenotypes and drug-naïve brain gene expression in Diversity Outbred mice.” Complex Traits Consortium annual meeting, San Diego, CA, USA.

2019: “Individual differences govern cocaine-related neurobehavioral phenotypes.” IBANGS annual meeting, Edinburgh, Scotland, UK.

2016: “Transcriptional dynamics and the neural response to social challenge in mice.” IBANGS annual meeting, Bar Harbor, ME, USA.

2016: “Transcriptional regulatory dynamics set the stage for metabolic and neural response to social threat-induced emotional learning in mice.” IGB Fellows Symposium, Urbana, IL, USA.

General Audience Lectures

2015: “This is your brain on exercise: how your brain’s genes influence your motivation to work out.” Chambana Science Café, Urbana, IL, USA.

Posters

2019: “Correlation among striatum coexpression networks and drug-related sensation-seeking behaviors in Diversity Outbred mice.” Society for Neuroscience annual meeting. Chicago, IL, USA.

2019: “Genetics and sex govern the striatum transcriptional response to cocaine.” NIDA Genetics Consortium. Bethesda, MD, USA.

2016: “Cross-species network analyses reveal conserved genomic toolkits involved in response to social challenge.” RSG with DREAM meeting of the ISCB. Phoenix, AZ, USA.

2015: “Born to run: The neural transcriptomic signature of mice selectively bred for high voluntary wheel running.” IBANGS annual meeting. Uppsala, Sweden.

2013: “Exome resequencing of the Madison mania model reveals variants associated with chromatin structure, glutamate metabolism, and cannabinoid signaling.” Society for Neuroscience annual meeting. San Diego, CA, USA.

2011: “Dysregulation of multiple genes linked to bipolar disorder in a potential new mouse model for mania.” Society for Neuroscience annual meeting. Washington, DC, USA.

Code

msaul (personal R package, github.com/msaul/msaul, includes Orthooverlap), released under the GPL v3.

MSET (Modular Single-set Enrichment Test, sourceforge.net/projects/mset2013), written with Brian Eisinger, released under the Apache License v2.

Research Experiences

2019-Present: Research Scientist, The Jackson Laboratory. PI: Elissa Chesler.

2018-2019: Postdoctoral Associate, The Jackson Laboratory. PI: Elissa Chesler.

2014-2018: GNDP Postdoctoral Fellow, Institute for Genomic Biology, UIUC. PI: Lisa Stubbs

2010-2013: Graduate Research Assistant: (3 semesters, 3 summers), Department of Zoology, University of Wisconsin-Madison. PI: Stephen Gammie.

2009-2010: Field Assistant, Lomas Barbudal Monkey Project, UCLA. PI: Susan Perry.

2008-2009: Research Assistant, Department of Neurology, UIHC. PI: Daniel Tranel.

2007-2008: Honors Research Assistant, Department of Biology, University of Iowa. PI: Steven Green.

Teaching Activity

Teaching Experiences

8 full semesters of teaching including 2 semesters as instructor. Badged Carpentries instructor.

2020: **Instructor** (1 semester), School of Biology and Ecology, University of Maine.
Course: Introduction to Neuroscience.

2019: Trained as badged Carpentries instructor.

2015-2018: Guest Lecturer, Department of Statistics, UIUC. Lecture: “A brief introduction to RNA-Seq analysis.”

Course: Bioinformatics

2014: Guest Lecturer, School of Molecular and Cellular Biology, UIUC. Lecture: “Analyzing complex designs in RNA-Seq experiments.”

Course: Special Topics in Cell and Developmental Biology – Genomic Biology Workshop.

2014: **Instructor** (1 semester) Department of Zoology, University of Wisconsin-Madison.

Course: Comparative and Evolutionary Physiology Lab.

2011-2013: Teaching Assistant (4 semesters) Department of Zoology, University of Wisconsin-Madison.

Courses: Comparative and Evolutionary Physiology Lab, Introductory Zoology Lab.

2007-2008: Teaching Assistant (2 semesters) Department of Biology, University of Iowa.

Courses: Introduction to Neurobiology, Biology of the Brain.

Mentorship

Graduate Students

2019: Ahmed Almaghasilah. Primary mentor for Ahmed as part of his graduate rotation with Elissa Chesler in new computational approaches to analyzing behavior.

2014-2018: Abbas Bukhari. Assisted in mentoring Abbas with a specific emphasis on the computational aspects of his Ph.D. project.

2014-2015: Kavya Kannan. Co-mentored Kavya on her master’s project on alternative splicing in the brain.

Undergraduate Students

2019: Violet Kimble. Violet worked on computational genomics in the JAX Summer Student program.

2016-2018: Navroop Gill. Trained Navroop in neuropathology and routine PCR applications.

2017: Elliot Ping. Worked as an undergraduate funded through an NSF REU program. Trained on R programming and on CLARITY for brain clearing.

2015-2016: Hao Sun. Co-mentored Hao Sun with Chris Seward of the Stubbs Lab. Hao worked on pathology experiments, contributing sufficiently to become a co-author on a paper.

2015-2016: Yujun Wu. Yujun assisted on mouse behavioral and molecular work.

2011-2013: Anna Whitlinger. Worked with Anna during her undergraduate effort in the Gammie Lab.

2010-2012: Tyler Wied. Tyler’s research project examined somatostatin receptor expression in the maternal brain.

2010-2011: Katie Engh. Oversaw Katie’s biology major requirement for lab work.

Workshops Attended

2018: Carpentries workshop in Python for reproducible statistical analysis (The Jackson Laboratory)

2018: Addiction Short Course (High Seas Conference Center at The Jackson Laboratory)

2015: IGB at BGI Workshop in Genomics (held at BGI in Shenzhen, China)

Skills and Proficiencies

Computational biology experience includes: core competency in UNIX command line work, programming (R, Python 3), statistical graphics (ggplot2, lattice), sequencing analysis software (alignment, read counting, EM calculations), bioinformatics analysis (edgeR, DEXSeq, WGCNA), reproducible research (Jupyter, RStudio), and genetics (DOQTL, qtI2).

Molecular biology laboratory experience includes: nucleic acid extraction, sequencing library preparation and QC, cloning, real-time PCR, confocal and conventional microscopy, Western blotting, and immunoassays.

Laboratory behavior experience includes: high-throughput computer vision analysis, observation of honeybees and mice, analysis of aggression and nurturance.

Field behavior experience includes: ethological data collection, GPS mapping, field site maintenance.

Basic computer literacy includes: graphics (Adobe CS), office tools (MS Office, OpenOffice), and web management and CMS (WordPress, HTML and CSS).

Service and Outreach

2019: Co-Chair, JAX Computational Sciences Workgroup on Reproducibility.

2016-2017: World of Genomics station member, "Understanding Behavior: From Honey Bees to Humans."

2014-2017: Genome Day participant and activity coordinator. "Your Genome and Your Senses" and "Understanding Behavior".

2014-2015: Co-Chair, IGB Fellows Symposium. Jointly organized a day-long symposium with multiple speakers including a keynote from Bonnie Bassler.

2013-2014: Student Member, University of Wisconsin-Madison Department of Zoology Faculty Search.

Peer Reviewer: *Genome Biology and Evolution*, *Neuropharmacology*, *PLoS ONE*, *BMC Biology*, *BMC Systems Biology*, *BMC Evolutionary Biology*, *Psychoneuroendocrinology*, *Behavioral Ecology and Sociobiology*.