

# Michael C. Saul

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## Education and Training

2014-Present: University of Illinois at Urbana-Champaign, Urbana, IL USA. Postdoctoral Fellow.

Primary Mentor: Lisa Stubbs. Co-Advisors: Alison Bell, Justin Rhodes, Gene Robinson, and Saurabh Sinha.

2010-2014: University of Wisconsin-Madison, Madison, WI USA. PhD, Integrative Biology (formerly Zoology).

Faculty Advisor: Stephen Gammie

Thesis: *A Complex Mania Model: The Behavior, Molecules, and Genotype of the Madison Mouse Strain.*

2003-2008: The University of Iowa, Iowa City, IA USA. BS, Biology (with honors).

Thesis: *PKA and Activity-Dependent Synaptogenesis in the Mouse Auditory Cortex.*

## Grants and Awards

### Awarded

2017: CIFAR/Jacobs Foundation Young Scholar (one of eleven), “Reconciling Genes and Contexts: Exploring the Genomic & Environmental Headwaters of Early Brain Development”. After attending a conference in April 2018, I am eligible for up to 40,000 Swiss Francs (~\$41,000) in funding for collaborative interdisciplinary research.

2014-Present: 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.

### Submitted

2017: US NIH R21. “Molecular transducers of motivation for exercise.” Submitted in June 2017 as co-investigator, resubmitted in November 2017.

### Not Awarded

2017: Simons Foundation SFARI Bridge to Independence. “Studying a Deeply Conserved ASD Candidate Gene *NR2F1*.” Submitted in August 2017 as primary investigator.

## Scholarship

### Publications

\* equal contribution, † undergraduate author

### Peer-Reviewed

2017: Lightfoot JT, De Geus EJC, Booth FW, Bray MS, den Hoed M, Kaprio J, Kelly SA, Daniel 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*, in press.

PubMed ID: [29166322](https://pubmed.ncbi.nlm.nih.gov/29166322/). Short URL: [mcs.fyi/2017pub5](https://mcs.fyi/2017pub5)

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, Scotland’s The Herald, IFLScience, and EurekAlert!*).

PubMed ID: [28760967](https://pubmed.ncbi.nlm.nih.gov/28760967/). Short URL: [mcs.fyi/2017pub4](https://mcs.fyi/2017pub4)

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](#). Short URL: [mcs.fyi/2017pub3](#)

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](#). Short URL: [mcs.fyi/2017pub2](#)

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](#). Short URL: [mcs.fyi/2017pub1](#)

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 Website](#)).  
PubMed ID: [27749013](#). Short URL: [mcs.fyi/2016pub3](#)

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](#). Short URL: [mcs.fyi/2016pub2](#)

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](#). Short URL: [mcs.fyi/2016pub1](#)

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](#). Short URL: [mcs.fyi/2014pub2](#)

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](#). Short URL: [mcs.fyi/2014pub1](#)

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](#). Short URL: [mcs.fyi/2013pub3](#)

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](#). Short URL: [mcs.fyi/2013pub2](#)

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](#). Short URL: [mcs.fyi/2013pub1](#)

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](#). Short URL: [mcs.fyi/2012pub2](#)

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](https://pubmed.ncbi.nlm.nih.gov/22675514/). Short URL: [mcs.fyi/2012pub1](https://mcs.fyi/2012pub1)

### In Preparation or Submission

In Submission: **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.”

bioRxiv Preprint Short URL: [mcs.fyi/2017pre1](https://mcs.fyi/2017pre1)

In Submission: **Saul MC**, Stevenson SA, Zhao C, Driessen TM, Eisinger BE, and Gammie SC. “Genomic variants in an inbred mouse model predict mania-like behaviors.”

In Submission: Sorokina AM, **Saul MC**, Goncalves TM, Gogola JM, Majdak P, Rodriguez-Zas SL, and Rhodes JS. “Striatal transcriptome of a mouse model of ADHD reveals a pattern of synaptic remodeling.”

## Presentations

### Invited Talks

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

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.

### Posters

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](https://github.com/msaul/msaul)), released under the GPL v3.

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

## Research Experiences

2014-Present: Theme Postdoctoral Fellow, Carl R. Woese Institute for Genomic Biology, UIUC. PI: Lisa Stubbs  
Members of the GNDP Theme are concerned with the genes underlying neural and developmental plasticity.

As a theme postdoctoral fellow, I am responsible for working on a project comparing the genomics of social challenge and social opportunity between mice, honey bees, and three-spined sticklebacks.

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

The Gammie lab is interested in manic behavior and in maternal behavior. As a research assistant, I worked on projects aiming to elucidate the role of beta-adrenergic receptors and miRNAs in the transition to motherhood.

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

The Lomas Barbudal Monkey Project records behavior in the field to study social interaction and social intelligence in wild white-faced capuchin monkeys. As a field assistant, I recorded animal behavior, collected biological samples, and performed GPS mapping.

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

The Tranel lab studies the neural correlates of human social behavior using the lesion method. As a research assistant, I worked on voice recognition in temporal lobectomy patients, gender-based lateralization of social decision-making in ventral medial prefrontal cortex patients, and the fundamental attribution error in prefrontal patients.

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

The Green lab investigates the neural processes behind audition from the cochlea to the brain. As an honors research assistant, I studied the roles of PKA and activity in the formation of synapses in *ex vivo* slices of mouse auditory cortex.

## Teaching Activity

### Teaching Experiences

7 full semesters of teaching including 1 semester as sole instructor.

2015-2017: Guest Lecturer – 2015-2017 (3 Lectures in 3 Semesters) Department of Statistics, UIUC. Lecture: “A brief introduction to RNA-Seq analysis.”

Instructor: Sihai Dave Zhao

Course: Bioinformatics

2014: Guest Lecturer (1 Half-Day Workshop) School of Molecular and Cellular Biology, UIUC. Lecture: “Analyzing complex designs in RNA-Seq experiments.”

Instructor: Lisa Stubbs

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

2014: **Sole 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.

Course Supervisors: Stephen Gammie, Carol Lee, Gale Oakes, and Sarah Jane Alger

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

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

Course Supervisor: Jeffrey Denburg

Courses: Introduction to Neurobiology, Biology of the Brain.

## Mentorship

### Graduate Students

2014-Present: Abbas Bukhari. I assist in mentoring Abbas with a specific emphasis on the computational aspects of his PhD project. Meetings occur on a biweekly basis.

2014-2015: Kavya Kannan. I co-mentored Kavya on her master's project looking at alternative splicing in the social brain. Meetings occurred on a weekly basis, and I pushed Kavya to acquire significantly more skills in R.

### Undergraduate Students

2017: Elliot Ping. Elliot worked with me as an undergraduate funded through an NSF REU program. I trained her on R programming and on CLARITY protocols for brain clearing.

2016-Present: Navroop Gill. I am working to train Navroop to work on CLARITY and other pathology experiments as well as some routine PCR applications.

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

2015-2016: Yujun Wu. Yujun worked with me on mouse behavioral work, nucleic acid extraction, and various PCR-based assays.

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

2010-2012: Tyler Wied. I oversaw Tyler's research project looking at somatostatin receptor expression in the maternal brain.

2010-2011: Katie Engh. I oversaw Katie's biology major requirement for lab work.

### Workshops Attended

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, statistical programming (R), statistical graphics (ggplot2, lattice), sequencing analysis software (tuxedo suite, htseq, STAR), bioinformatics analysis (edgeR, DEXSeq, WGCNA), programming languages (R, Python).

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

### Service and Outreach

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*, *Behavioral Ecology and Sociobiology*.