

SONIA R. MAYORAL, PH.D.

Carney Institute for Brain Science
Department of Neuroscience
Brown University
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EDUCATION

Stanford University School of Medicine, Stanford, CA April 2012
Ph.D. **Neurosciences**

San Jose State University, San Jose, CA December 2002
B.S. **Biological Sciences**, conc. in **Molecular Biology**
Minors: Chemistry, Humanities

PROFESSIONAL POSITIONS

Robert J. and Nancy D. Carney Assistant Professor in Brain Science, 2021-present
Brown University, Providence, RI
Department of Neuroscience

- **Initial appointment – June 1, 2021**
- Investigating CNS neuron-glia and glia-glia interactions in health and disease.
- Collaborating with multiple faculty at Brown University

Postdoctoral Fellow, University of California, San Francisco, CA 2012-2021
Department of Neurology
Advisor: Jonah R. Chan

- Demonstrated that developmental CNS myelination occurs independent of dynamic neuronal signaling. This work was published in Cell Reports.
- Collaborated on six projects within and outside the lab exploring various aspects of myelination in mammalian systems including novel, high-throughput screens of known bioactive compounds for their promotion of oligodendrocyte differentiation and myelination all of which resulted in publications.

Graduate Student, Stanford University School of Medicine, Stanford, CA 2006-2012
Department of Pediatrics
Advisor: Anna A. Penn

- Investigated the involvement of the sex hormone, estrogen, in the production of more severe brain injury in neonatal male mouse pups after undergoing chronic, sublethal hypoxia treatment.
- Established that sex differences exist in a mouse model of preterm brain injury. This work resulted in two publications.

Postbaccalaureate Fellow, Mayo Clinic College of Medicine, Rochester, MN 2003-2005
Department of Neuroimmunology
Advisors: Charles L. Howe and Moses Rodriguez

- Discovered a signaling pathway elicited by human IgM antibodies in glia. This work resulted in a publication.

Summer Research Intern, Harvard Medical School, Boston, MA 2001
Department of Endocrinology
Advisor: Gail K. Adler

- Studied the effects of estrogen on female rats with cardiovascular damage. This work contributed to a publication.

Undergraduate Student, San Jose State University, San Jose, CA

1999-2002

Department of Biological Sciences

Advisor: David J. Matthes

- Cloned the open reading frame of the *Drosophila Sema1b* gene into a vector for subsequent functional analysis. Research culminated in a senior thesis entitled, "Cloning and Constructing *Drosophila Sema1b* cDNA".

RESEARCH AND GRANT SUPPORT

P20GM103645

08/01/2021-07/31/2023

COBRE Center for Nervous System Function Pilot Project Grant

Title: "Investigating the Impacts of oligodendroglia on local axon translation

Oligodendroglia (OLG) interact with neurons in multiple ways including through myelination of axons. However the effects of these interactions on axon function are not completely understood. I hypothesize that OLG impact the abundance of translational machinery and the local translome in axons. I will test this hypothesis by (1) determining the abundance of ribosomes, the translational machinery, along myelinated and unmyelinated optic nerves of the partially myelinated PDGFR α cKO mouse; (2) examining changes in the local axon translome in myelinated vs unmyelinated optic nerve regions of PDGFR α cKOs using AxonTRAP/RNAseq methods. Completion of these aims will uncover whether OLG play a role in local axon translation and possibly lead to groundbreaking discoveries on new regulatory mechanisms for axon function.

Startup Funding

06/01/2021-05/30/2025

Carney Institute for Brain Science, Brown University

Research funding to help set up a lab in the Department of Neuroscience at Brown University.

K22NS104234

09/30/2017-6/30/2024

NINDS Advanced Postdoctoral Career Transition Award to Promote Diversity in Neuroscience Research (K22)

Title: "Uncoupling oligodendrocyte differentiation and myelination: axon signaling not required"

Myelin is important for proper nervous system function, however it is not clear how myelination and the differentiation of oligodendrocytes, the myelin-producing cells of the CNS, are regulated during development. My proposal seeks to 1) uncouple oligodendrocyte differentiation and myelination for the first time and examine the role of dynamic neuronal signaling in regulating both processes, and 2) support a role for astrocytes in regulating oligodendrocyte differentiation. My findings will help to uncover novel, OL differentiation regulators, which could lead to myelin-promoting therapies for the treatment of white matter injury and demyelinating diseases.

HONORS/AWARDS/DISTINCTIONS

Advancing Research Careers (ARC) Program Scholar, Carney Institute for Brain Science, Brown University, 2022-2024

COBRE Pilot Project Grant, Brown University/NIH, 2021-2022

Mentoring Institute for Neuroscience Diversity Scholars (MINDS) Fellow, NINDS/Univ. of Florida, 2018

Career Transition Award (K22), NINDS-NIH, 2017-2024

Institutional Research and Academic Career Development Award (IRACDA), NIGMS-NIH/UCSF, 2012-2016

Poster Prize, International Congress of Neuroendocrinology, 2010

Young Investigator Travel Award, International Congress of Neuroendocrinology, 2010

Katherine McCormick Travel Award, Stanford University School of Medicine, 2009

Travel Fellowship, International Conference on Steroids and Nervous System, 2009

Neuroscience Scholars Program (NSP) Scholar, Society for Neuroscience, 2007-2010

Postbaccalaureate Research Education Program (PREP) Fellow, Mayo Clinic College of Medicine, 2003-2005

Ronald E. McNair Scholar, San Jose State University, 2002

Doris A. Howell/California State University Program for Education and Research in Biotechnology (CSUPERB) Award, 2001

Summer Honors Undergraduate Research Program (SHURP) Scholar, Harvard Medical School, 2001
Minority Access to Research Careers (MARC) Program Scholar, San Jose State University, 2000-2001
O. C. Williams Humanities Scholarship, San Jose State University, 1999

PUBLICATIONS

Pan S, **Mayoral SR**, Choi HS, Chan JR, Kheirbek MA. Preservation of a remote fear memory requires active oligodendrogenesis. *Nat Neuro*. 2020. 23:487-499.

Rankin KA, Mei F, Kim K, Shen YA, **Mayoral SR**, Despons C, Lorrain DS, Green AJ, Baranzini SE, Chan JR, Bove R. Selective estrogen receptor modulators enhance CNS remyelination independent of estrogen receptors. *J Neurosci*. 2019. 39:2184-2194.

Mayoral SR, Etxeberria A, Shen, YA, Chan JR. Initiation of CNS myelination in the optic nerve is dependent on axon diameter. *Cell Reports*. 2018. 16:544-550.

Dombrowski Y, O'Hagan T, Dittmer M, Penalva R, **Mayoral SR**, Bankhead P, Fleville S, Eleftheriadis G, Chao Z, Naughton M, Hassan R, Moffat J, Falconer J, Boyd A, Hamilton P, Allen IV, Kissenpfennig A, Moynagh PN, Evergren E, Perbal B, Williams AC, Ingram RJ, Chan JR, Franklin RJM, Fitzgerald DC. Regulatory T cells directly promote myelin regeneration in the Central Nervous System. *Nat Neuro*. 2017. 20:674-680.

Mayoral SR*, Mei F*, Nobuta H, Wang F, Despons C, Lorrain DS, Xiao L, Green AJ, Rowitch D, Whistler J, Chan JR. Identification of the kappa opioid receptor as a therapeutic target for oligodendrocyte remyelination. *J Neurosci*. 2016. 36:7925-35. **co-first authors*.

Etxeberria A, Hokanson K, Dao DQ, **Mayoral SR**, Mei F, Redmond SA, Ullian EM, Chan JR. Dynamic modulation of myelination in response to visual stimuli alters optic nerve conduction velocity. *J Neurosci*. 2016. 36:6937-48.

Mayoral SR, Chan JR. The environment rules: spatiotemporal regulation of oligodendrocyte differentiation. *Current Opin Neurobio*. 2016. 39:47-52.

Hernandez M, Patzig J, **Mayoral SR**, Costa K, Chan JR, Casaccia P. Mechanostimulation promotes nuclear and epigenetic changes in oligodendrocytes. *J Neurosci*. 2016. 36: 806-13.

Shen, YA, Chen Y, Dao DQ, **Mayoral SR**, Wu L, Meijer D, Ullian EM, Chan JR, Lu QR. Phosphorylation of LKB1/Par-4 establishes Schwann cell polarity to initiate and control myelin extent. *Nature Comm*. 2014. 5: 4991.

Mei F, Fancy SP, Shen YA, Niu J, Zhao C, Presley B, Miao E, Lee S, **Mayoral SR**, Redmond SA, Etxeberria A, Xiao L, Franklin RJ, Green A, Hauser SL, Chan JR. Micropillar arrays as a high-throughput screening platform for therapeutics in Multiple Sclerosis. *Nature Med*. 2014. 20: 954-60.

Lan WC, Priestley M, **Mayoral SR**, Tian L, Shamloo M, Penn AA. Sex-specific cognitive deficits and regional brain volume loss in mice exposed to chronic, sublethal hypoxia. *Pediatr Res*. 2011. 70: 15-20.

Mayoral SR, Omar G, Penn AA. Sex differences in a hypoxia model of preterm brain damage. *Pediatr Res*. 2009. 66: 248-53.

Mayoral SR*, Howe CL*, Rodriguez M. Activated microglia stimulate transcriptional changes in primary oligodendrocytes via IL-1b. *Neurobiol. Dis.* 2006. 23: 731-9. *co-first authors.

Oestreicher EM, Guo C, Seely EW, Kikuchi T, Martinez-Vasquez D, Jonasson L, Yao T, Burr D, **Mayoral S**, Roubasanthisuk W, Ricchiuti V, Adler, GK. Estradiol increases proteinuria and angiotensin II type 1 receptor in kidneys of rats receiving L-NAME, angiotensin II and high salt diet. *Kidney Int.* 2006. 70: 1759-68.

INVITED TALKS/SEMINARS

“Unwrapped: my journey through academia and discovering a passion for glia”, SACNAS/Center for Science and Engineering Partnerships (CSEP), University of California, Santa Barbara. Santa Barbara, CA. November 17, 2022.

“Bench to Bedside: Multiple Sclerosis”, Neuroscience Graduate Program Seminar Bench to Bedside Series. Brown University, Providence, RI. October 14, 2021.

“The oligodendrocyte-axon unit: myelination and neuroprotection”, Neuroscience Seminar Series. Santa Clara University, Santa Clara, CA. February 8, 2021.

“Is dynamic neuronal signaling necessary for developmental CNS myelination?”, Minisymposium, Society for Neuroscience Meeting. Chicago, IL. October 20, 2019.

“Is dynamic neuronal signaling necessary for developmental CNS myelination?”, Dr. Samuel M. Nabrit Conference for Early Career Scholars. Brown University, Providence RI. June 7, 2019.

“Is dynamic neuronal signaling necessary for developmental CNS myelination?”, Neuroscience Seminar Series. Santa Clara University, Santa Clara, CA. May 29, 2019.

“Developmental CNS myelination is dependent on axon caliber, not dynamic neuronal signaling”, Myelin Gordon Research Conference, Ventura, CA. March 19, 2018.

“Identification of the kappa opioid receptor as a therapeutic target for oligodendrocyte remyelination”, Myelin Gordon Research Seminar, Lucca, IT. May 14. 2016.

“Myelin: Making neurons faster since the birth of the shark”, Biology Department Seminar Series, Skyline College, San Bruno, CA. October 6, 2014.

“Sex differences in a mouse model of preterm brain injury”, Biology Department Seminar Series, Macalester College, St. Paul, MN. October 12, 2009.

PRESENTATIONS (Posters)

Mayoral SR, Etxeberria A, Shen YA, Chan JR. Developmental CNS myelination is dependent on axon caliber, not dynamic neuronal signaling. Gordon Research Conference on Myelin. Ventura, CA. March 2018.

Mayoral SR, Etxeberria A, Chin JS, Chew SY, Chan JR. Oligodendrocyte myelination: Axon size may be all that matters. Society for Neuroscience. Washington, DC. November 2017.

Mayoral SR, Etxeberria A, Chan JR. Oligodendrocyte differentiation and myelination during development: Is dynamic neuronal signaling required? European Meeting on Glial Cells in Health and Disease. Edinburgh, UK. June 2017.

Mei F, **Mayoral SR**, Nobuto H, Rowitch D, Whistler J, Chan JR. Identification of the kappa opioid receptor as a therapeutic target for oligodendrocyte remyelination. Gordon Research Conference on Myelin, Lucca, IT. May 2016.

Mayoral SR, Etxeberria A, Tufford A, Cayouette M, Chan JR. Oligodendrogenesis occurs in the absence of neuronal signaling in mouse optic nerve. IRACDA Conference, San Diego, CA. June 2015.

Mayoral SR, Llarena NC, Omar G, and Penn AA. Sex differences in a chronic, sub-lethal hypoxia (CSH) mouse model of preterm brain injury. Society for Neuroscience Meeting, San Diego, CA. November 2010.

Mayoral SR, Llarena NC, Omar G, and Penn AA. Sex steroid effects on chronic, hypoxic brain injury in neonatal mice. International Congress of Neuroendocrinology, Rouen, FR. July 2010.

Mayoral SR, Lan W-C, Llarena NC, Omar G, and Penn AA. Sex steroids modulate damage due to chronic hypoxia brain injury in neonatal mice. Society for Neuroscience Meeting, Chicago, IL. October 2009.

Mayoral SR, Omar G, and Penn AA. Sex and estrogen effects in a Mouse Model of Chronic Neonatal Hypoxia. International Conference on Steroids and the Nervous System, Torino, IT. February 2009.

Mayoral SR, Omar G, and Penn AA. Gender and estrogen effects in neonatal hypoxic brain injury. Society for Neuroscience Meeting, Washington, DC. November 2008.

Mayoral SR and Penn AA. Gender Differences in a Mouse Model of Preterm Birth. Pediatric Academic Societies Meeting, Honolulu, HI. May 2008.

Mayoral SR and Howe CL. Signaling Events Initiated by Remyelination-Promoting Antibodies in vitro: Activation of NFkB. Annual Biomedical Research Conference for Minority Students (ABRCMS), Dallas, TX. November 2004.

Mayoral SR and Matthes DJ. Construction and Cloning of Sema1b cDNA. Annual Biomedical Research Conference for Minority Students (ABRCMS), New Orleans, LA. November 2002.

Mayoral SR, Oestreicher EM, Burr D, Roubanthisuk W, Martinez-Vasquez D, Adler GK. The Influence of Estrogen (E2) on Cardiovascular Damage Induced by L-NAME, Angiotensin II, and a High Salt Diet. Annual Biomedical Research Conference for Minority Students (ABRCMS), Orlando, FL. November 2001.

Mayoral SR and Matthes DJ. Isolating and Cloning Sema1b cDNA. National Minority Research Symposium (NMRS), Washington D.C. November 2000.

TEACHING AND MENTORSHIP EXPERIENCE

Guest Lecturer, Course: Principles of Neurobiology, Brown University 2022
Developed and taught a lecture on oligodendrocytes to a class of ~60 undergraduate students.

Research Mentor, Sonia Mayoral Lab, Brown University 2021-present
Supervising multiple graduate and undergraduate students as well as research assistants in research projects in the lab, including Ph.D. thesis studies and honors thesis work.

Guest Lecturer, Course: Basic Concepts in Neural Cell and Developmental Biology, UCSF 2018
Independently developed and taught a lecture on oligodendrocyte biology to a class of 18 Neuroscience PhD graduate program students. Created and graded exam questions.

Co-teacher, Course: Cell Biology, San Francisco State University 2014

Developed and taught four upper-division lectures on topics in cell biology to a class of 85 undergraduates under the mentorship of Assistant Professor, Dr. Blake Riggs. Implemented active learning techniques and used cutting edge technologies. Created and graded problem sets and exams.

Research Mentor, Anna Penn Lab, Stanford University 2008-2011
Supervised a Stanford undergraduate student in the execution and completion of an honors thesis research project. Supervised a Stanford undergraduate in the execution and completion of a summer research project. Supervised a high school student assistant during the summer.

Journal Club Organizer, Neurosciences PhD Program, Stanford University 2007-2008
Organized weekly graduate student seminars and designed the curriculum for professional career development sessions.

Teaching Assistant, Course: Mammalian Physiology Lab, San Jose State University 2001
Assisted Professor, Dr. Dan Holley in preparing lab exercises, assisting undergraduate students in lab exercises, and grading assignments and exams.

ADDITIONAL TRAINING

Building Knowledge and Making Changes/ DEI STEMM Faculty Seminar 2021
Workshop, Dr. Bruce Birren and Dr. AZA Allsop, MIT, Zoom

Scholars of Color Research Leadership Development Program 2021
Workshop, ATKisson Training Group, Zoom

SFSU Teaching Workshop 2014
Workshop, SFSU/IRACDA, San Francisco State University, San Francisco, CA

Optogenetics Workshop 2011
Lab course, Karl Deisseroth Lab, Stanford University, Stanford, CA

Introduction to Stereology for Neuroscientists 2009
Lab course, Mark West, Organizer. Chicago, IL.

Advanced Techniques in Molecular Neuroscience 2007
Lab course, Cold Spring Harbor Laboratories. Cold Spring Harbor, NY.