

Sally A. Marik, Ph.D.

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Education

- Ph.D. **University of California**, Riverside, Psychology, Systems Neuroscience
- M.A. **University of California**, Riverside, Psychology, Systems Neuroscience
- B.S. **University of Michigan**, Flint, Psychology

Research & Teaching Experience

Pace University, Assistant Professor 2017-present
Department of Biology, 861 Bedford Rd, Pleasantville, NY 10570
My lab focuses on synaptic plasticity and what goes awry in Autism Spectrum Disorders and Neurodegenerative diseases.

Sarah Lawrence College, Guest Faculty 2017
Department of Biology, 1 Mead Way, Bronxville, NY 10708

- Created a new curriculum for a course on Alzheimer's disease
- Developed a creative curriculum to engage learning and promote out-of-the-box and cross-disciplinary thinking
- Mentored students on their independent research projects relating to Alzheimer's disease

Manhattanville College, Adjunct Faculty 2016-2017
Department of Biology, 2900 Purchase St, Purchase, NY 10577

- Developed in-class learning activities that related course material to popular culture and engaged students to help retain complex scientific concepts
- Created class activities that brought about positive classroom learning outcomes based on pre/post testing
- Taught upper level Neuroscience and Biostatistics course

The Rockefeller University, Staff Scientist & Senior Research Associate 2015-present
Advisor: Charles D. Gilbert, M.D., Ph.D
Collaborator: Marc Tessier-Lavigne, Ph.D.

I am investigating how neurotrophins play a role in altering axonal dynamics in the adult following a change in experience (sensory loss, or perceptual learning). I am currently focused on determining how upregulation of neurotrophins in response to experience may promote both axonal growth and axonal pruning within the sensory map depending on the location of the neurons relative to the upregulation of neurotrophins.

The Rockefeller University, Research Associate 2010-2015
Advisor: Charles D. Gilbert, M.D., Ph.D
Collaborator: Marc Tessier-Lavigne, Ph.D.

I examined the molecular pathways that mediate axonal plasticity following experience-dependent plasticity. Previously, I discovered that axons underwent both growth and pruning following a change in experience that caused cortical map plasticity. To further this line of study, I examined the molecular mechanisms that mediate axonal pruning in the adult. I discovered that the Amyloid Precursor Protein

(APP)/Death Receptor 6 (DR6) pathway is crucial for axonal pruning of layer II/III neurons following experience-dependent plasticity. By removing key genes within the DR6/APP pathway with the use of knockout animals, axonal pruning was not observed during cortical map plasticity. This research suggests a physiological role for amyloid precursor protein.

The Rockefeller University, Postdoctoral Associate

2005-2010

Advisor: Charles D. Gilbert, M.D., Ph.D.

Collaborators: Winfried Denk, Ph.D., Gabor Szabo, Ph.D.

I investigated how different neuronal cell-types contribute to functional recovery by modification of their axonal arbors following sensory loss, using a combination of techniques: molecular cloning, genetic engineering adeno-associated viruses, electrophysiology, and two-photon microscopy. Axonal structural plasticity was examined in two model systems: macaque primary visual cortex following retinal lesions and mouse somatosensory cortex following whisker plucking. I found that both excitatory and inhibitory neurons undergo axonal growth and pruning following a change in sensory loss. Specifically, excitatory neurons within the cortical area surrounding the lesion projection zone (LPZ) undergo axonal growth into the LPZ while inhibitory neurons within the LPZ sprout new axons to areas outside the LPZ. This reciprocal growth between the two populations of neurons is thought to be a way to balance excitation and inhibition for the newly reorganized cortical map.

University of California, Riverside Graduate Student

2000-2005

Advisor: Peter Hickmott, Ph.D.

Thesis: "The effects of representational borders on synaptic plasticity in rat Somatosensory Cortex."

I used an *in vivo/in vitro* preparation along with a combination of electrophysiology, immunohistochemistry, and confocal microscopy techniques to address general plasticity and organization principles of adult cortex. Cortical maps are able to undergo reorganization following experience-dependent plasticity, sensory loss, and learning. One proposed mechanism for early phases of this remapping of the cortical map was thought to be mediated by Long-Term Potentiation (LTP) and/or Long-Term Depression (LTD). It was unknown if horizontally projecting axons were capable of undergoing LTP and LTD; furthermore, it was also unknown if the ability to undergo plasticity was affected by the cortical topography e.g., at border regions between two distinct cortical representations within the map. Therefore, I examined the plastic capabilities of horizontal connections in layer II/III by using an *in vivo/in vitro* prep that allowed me to locate and mark the forepaw/lower jaw border in rat somatosensory cortex using standard *in vivo* electrophysiology techniques and then probe layer II/II circuitry in an *in vitro* slice preparation. I discovered that adult horizontal projections are capable of undergoing LTP and LTD, horizontal connections that do not cross a functional border within the cortical map more easily undergo LTP and/or LTD. Furthermore, inhibition plays a role in the ability to induce and the magnitude of plasticity within horizontal connections.

University of Michigan, Flint, Undergraduate Research Assistant

1998-2000

Advisor: Eric Freedman, Ph.D.

I examined how people formulate and test their hypotheses. We found that people are more likely to generate situations that will confirm their hypothesis rather than disconfirm it.

Teaching Experience

- Neurobiology of Alzheimer's Disease Spring 2017 Sarah Lawrence College (Guest Faculty)
- Biostatistics Spring 2017 Manhattanville College
- Intro to Neuroscience Fall 2016 Manhattanville College
- Intro to Neuroscience Spring 2003 University of California, Riverside

- Intro to Neuroscience Spring 2002 University of California, Riverside
- Intro to Psychology Winter 2002 University of California, Riverside
- Intro to Chemistry lab Fall 1997 University of Michigan
- Intro to Chemistry lab Winter 1998 University of Michigan

Invited Talks

- **Key Note Speaker** at **Westchester Undergraduate Research Conference**. Purchase, NY. 2017
- **Pace University**. Science Seminar. Department of Biology. Pleasantville, NY. 2017
- **Sarah Lawrence College**. Science Seminar. Bronxville, NY. 2017
- **New York Medical College**. Cell Biology and Anatomy Seminar. Valhalla, NY. 2016
- **University of Pittsburgh**. *Neurobiology Seminar*. Pittsburgh, PA. 2015
- **University of California, Riverside**. *Psychology Seminar*. Riverside, CA. 2015
- **Rensselaer Polytechnic Institute**. *Biology Special Seminar*. Troy, NY. 2014
- **Hunter College**. *Neuroscience Special Seminar*. New York, NY. 2014
- **DANDRITE**. *New frontiers in molecular and translational neuroscience*. Aarhus, Denmark. 2014
- **Brooklyn College**. *Undergraduate Neuroscience Group Seminars*. New York, NY. 2014
- **Zentrum fur Molekulare Neurobiologie Hamburg (ZMNH)**. *Advances in Neural Plasticity*. Hamburg, Germany 2014
- **Memorial Sloan Kettering Cancer Center**. *Tri-Institutional Neurodevelopment Group Seminar*. New York, NY. 2014
- **Queens College**. *Behavioral Neuroscience Seminar Series*. New York, NY. 2014
- **Charité**. *Cellular and Molecular Imaging*. Berlin, Germany. 2013
- **HHMI Janelia Farm Research Campus**. *Structural Plasticity in the Mammalian Brain*. Ashburn, VA. 2010

Academic Service and Mentoring Activities

Mentor to Summer Undergraduate Research Fellows (SURF) at The Rockefeller University

- Kanita Chaudhry, SURF student 2012 MD/PhD student at SUNY Buffalo
- Joshua Sturm, SURF student 2010, currently an MD/PhD student at University of Pittsburgh
- Hannah Oh, SURF student 2008, currently a graduate student at Duke University

Mentor to Summer Science Research Program

- Grace Glover, SSRP, 2014, undergraduate at Princeton University

Research Grants

- The Rockefeller University Women & Science Fellowship
- Ruth L Kirschstein National Research Service Award Institutional Training Grant (2006) T32 EY007138
- Graduate Dean's Dissertation Research Grant
- Graduate Student Association Mini Grant

Honors and Awards

- University of California Chancellor's Distinguished Fellowship Award
- University of Michigan Chancellor's Scholarship
- Michigan Competitive Scholarship
- Flint Scholar Award
- Class Honors
- Branstrom Award Winner *Freshman award for University of Michigan students ranked in the upper 5% after Freshman year.*

Leadership Experience

Neuroscience Graduate Student Association (NGSA) Assisted in the creation of NGSA and led the organization as President-elect in 2002-2003, and as President in 2003-2004. I invited leading Neuroscientists to present in our seminar series, organized meetings, and activities that brought in Neuroscience graduate students from multiple departments on campus together.

Exhibits of research and public education

Neurodome: Made a significant data contribution to interdisciplinary project that incorporates the latest Neuroscience imaging technology, digital effects, with astrophysics to create a planetarium show to educate and provide a glimpse of the brain's intricate architecture to the general public.

www.neurodome.org, Hayden Planetarium, New York, NY

Westchester Science and Engineering Fair. Sleepy Hollow, NY - Judge 2015

Simon Baruch Middle School MS 104 Science Fair. New York, NY – Judge 2015

Courses

Zebrafish Development and Genetics Course, A two-week intensive course on the model organism zebrafish and cutting-edge techniques. **Marine Biological Laboratory,** Woods Hole, MA, 2017

From Scientist to Chief Scientific Officer, 40-hour 'mini-MBA' course for Ph.D. Scientists, New York Academy of Sciences, 2015

Introduction to R, Verified Certificate of Completion, Microsoft: DAT204x, edX, 2015

Skills

Two-photon microscopy, light sheet microscopy, confocal microscopy, electron microscopy, genetically engineering AAVs, molecular biology, cloning, PCR, AAV production, immunohistochemistry, i3DISCO, electrophysiology, *in vivo* and *in vitro* preparations.

Professional Memberships

- Society for Developmental Biology, Member, (2017- present)
- Mid-Atlantic Regional Zebrafish - Principal Investigator, Member, (2017-present)
- Faculty for Undergraduate Neuroscience, Member (2016-present)
- New York Academy of Science, Member (2006-present)
- Society for Neuroscience, Member (2000-present)
- Dyson Vision Research Institute at Cornell, affiliate
- Barrels, member (2004-2005)
- Neuroscience Graduate Student Association (2002-2005)
- University of Michigan Freshman-sophomore Honors Program (1996-1998)
- Psi Chi (1998-present)
- Honor Scholar Program at the University of Michigan, Flint

Conference Presentations

- **Marik, S.A.,** Gilbert, C.D. (2016) Brain-derived neurotrophic factor and caspase activity in mouse barrel cortex following whisker plucking. *46th Annual Meeting of the Society for Neuroscience.* Poster. San Diego, CA.
- Meyer zum alten Borgloh, S., Morelli, D., Hernandez-Solis R., **Marik, S.A.,** & Gilbert, C.D. (2015) The role of V2 in shaping V1 neuronal activity during complex visual tasks in mice. *45th Annual Meeting of the Society for Neuroscience.* Poster. Chicago, IL.
- **Marik, S.A.** & Gilbert, C.D. (2014) Alterations in neurotrophin expression associated with adult experience-dependent plasticity. *44th Annual Meeting of the Society for Neuroscience.* Poster. Washington D.C.

- **Marik, S.A.,** Olsen, O., Tessier-Lavigne, M., & Gilbert, C.D. (2013) Physiological role for amyloid precursor protein in the adult brain. *43rd Annual Meeting of the Society for Neuroscience*. Poster. San Diego, CA.
- **Marik, S.A.,** Olsen, O., Tessier-Lavigne, M., & Gilbert, C.D. (2012) Cortical plasticity mediated by apoptotic pathways. Presentation. *Axon Guidance, Synapse Formation and Regeneration*. Presentation. Cold Spring Harbor, NY.
- **Marik, S.A.,** Nikolaev, A., Tessier-Lavigne, M., & Gilbert, C.D. (2011) Cortical plasticity mediated by apoptotic pathways. *41st Annual Meeting of the Society for Neuroscience*. Poster. Washington, D.C.
- **Marik, S.A.,** Nikolaev, A., Tessier-Lavigne, M., & Gilbert, C.D. (2011) Apoptotic pathways and cortical plasticity. *Barrels Conference*. Poster. Baltimore, M.D.
- **Marik, S.A.,** Yamahachi, H., & Gilbert C.D. (2010) Plasticity of inhibitory axonal arbors in visual cortex following retinal lesions. *40th Annual Meeting of the Society for Neuroscience*. Presentation. San Diego, CA.
- **Marik, S.A.** & Gilbert C.D. (2010) Plasticity of excitatory and inhibitory neurons. *The Rockefeller University Postdoctoral Retreat*. Presentation. Skytop, PA.
- **Marik, S.A.,** Yamahachi, H., Denk, D. Szabo, G. & Gilbert C.D. (2009) Whisker plucking in the adult induces a massive restructuring of inhibitory interneurons. *39th Annual Meeting of the Society for Neuroscience*. Poster. Chicago, IL.
- **Marik, S.A.,** Yamahachi, H., Denk, D. & Gilbert C.D. (2008) Axonal sprouting of horizontal connections in adult mouse somatosensory cortex follows whisker trimming. *38th Annual Meeting of the Society for Neuroscience*. Poster. Washington, D.C.
- Yamahachi, H., **Marik, S. A.,** McManus, J.N., Denk, W., & Gilbert, C. D. (2008) Axonal sprouting and pruning accompanies functional recovery in primary visual. *38th Annual Meeting of the Society for Neuroscience*. Presentation. Washington, D.C.
- Pena, J.T.G., Yamahachi, H., **Marik, S.A.,** Tuschl, T., and Gilbert, C.D. (2008) RNAi suppression of BDNF expression inhibits cortical plasticity. *38th Annual Meeting of the Society for Neuroscience*. Poster. Washington, D.C.
- **Marik, S.A.** & Hickmott, P.W. (2005). Repetitive depolarization of layer II/III cells results in enhancement in the amplitude of the postsynaptic potential (PSP) evoked by stimulation of horizontal connections. *Neural Circuits and Plasticity. Gordon Conference*. Poster. Newport, RI
- Steen, P.A., Pham, L., Mason, M., **Marik, S.,** Ma, C., Lefebvre, Y., & Hickmott, P.W. (2005) Microarray analysis of the adult rat S1 forepaw/lower jaw border during cortical reorganization. *35th Annual Meeting of the Society for Neuroscience*. Poster. Washington, D.C.
- **Burns (Marik), S.A.** & Hickmott, P.W. (2004). Long-term depression of horizontal connections at representational borders in adult rat somatosensory cortex (S1). *Barrels XVII Conference*. Presentation. Carlsbad, CA
- **Burns (Marik), S.A.** & Hickmott, P.W. (2004). Long-term potentiation and long-term depression of horizontal connections at representational borders in adult rat somatosensory cortex (S1). *34th Annual Meeting of the Society for Neuroscience*. Poster. San Diego, CA
- **Burns (Marik), S.A.** & Hickmott, P.W. (2004). The Effects of a representational border on synaptic plasticity in supragranular layers of adult rat somatosensory cortex (S1). *Channels, Receptors and Synapses Meeting*. Poster. Cold Spring Harbor, NY
- Hickmott, P.W. & **Burns (Marik), S.A.** (2003). Reorganization of the adult somatotopic map: dendritic and synaptic mechanisms. *Latsis Symposium on Neural Coding & Modeling, EPFL*. Presentation. Lausanne, Switzerland
- **Burns (Marik), S.A.** & Hickmott, P.W. (2003). Effects of a Representational Border on Long-Term Potentiation (LTP) in Rat Primary Somatosensory Cortex (S1). *33rd Annual Meeting of the Society for Neuroscience*. Poster. New Orleans, LA

- **Burns (Marik), S.A.** & Hickmott, P.W. (2001). Horizontal field potentials are affected by a representational border in rat S1. *31st Annual Meeting of the Society for Neuroscience*. Poster. San Diego, CA

Publications

- **Marik, S.A.**, Olsen, O., Tessier-Lavigne, M. & Gilbert, C. D. (2016) Physiological role for amyloid precursor protein in adult experience-dependent plasticity. *Proceedings of the National Academy of Science*. 113(28):7912-7.
- Abe, H., McManus, J.N.J., Ramalingam, N., Li, W., **Marik, S.A.**, Meyer zum Alten Borgloh S., and Gilbert, C.D. (2015) Adult cortical plasticity studied with chronically implanted electrode arrays. *The Journal of Neuroscience*. 35(6): 2766-2777.
- **Marik, S.A.**, Yamahachi H., Meyer zum Alten Borgloh S., & Gilbert C.D. (2014) Large scale axonal reorganization of inhibitory neurons following retinal lesions. *The Journal of Neuroscience*. 34(5):1625-1632.
- **Marik, S. A.**, Olsen, O., Tessier-Lavigne, M. & Gilbert, C. D. (2013) Death Receptor 6 Regulates Adult Experience-Dependent Cortical Plasticity. *The Journal of Neuroscience*. 33(38), 14998-15003.
 - *Featured Article.*
- **Marik, S.A.**, Yamahachi H., McManus, J.N.J., Szabo, G., & Gilbert C.D. (2010) Axonal dynamics of excitatory and inhibitory neurons in somatosensory cortex. *PLoS Biology*. 8(6):e1000395.
- Yamahachi H., **Marik, S.A.**, McManus, J.N.J., Denk, W., & Gilbert C.D. (2009) Rapid axonal sprouting and pruning accompany functional reorganization in primary visual cortex. *Neuron*. 64 (5):719-729.
 - *Highlighted in Featured Topic of Neuron, May 2010.*
- **Marik, S. A.** & Hickmott, P.W. (2009) Plasticity of Horizontal Connections at a Functional Border in Adult Rat Somatosensory Cortex. *Neural Plasticity*. vol. 2009, Article ID 294192.
- **Burns (Marik), S.A.** & Hickmott, P.W. (2003). Effect of Representational Borders on Responses of Supragranular Neurons in Rat Somatosensory Cortex. *Brain Research*. 985(1): 108-111.