

Robert A. McDougal, Ph.D.

Education:

- 2015 M.S. Computational Biology and Bioinformatics. Yale University. New Haven, Connecticut.
- 2011 Ph.D. Mathematics. The Ohio State University. Columbus, Ohio.
- 2006 M.S. Mathematics. The Ohio State University. Columbus, Ohio.
- 2004 B.S. Mathematics, minor in Computer Science. University of Maryland Baltimore County. Catonsville, Maryland.

Career/Academic Appointments:

- 2016-present Associate Research Scientist, Department of Neuroscience and Yale Center for Medical Informatics, Yale University, New Haven, Connecticut.
- 2013-2016 Postdoctoral Fellow, Department of Neuroscience (previously Neurobiology) and Yale Center for Medical Informatics, Yale University, New Haven, Connecticut.
- 2012-2013 Postdoctoral Associate, Department of Neurobiology, Yale University, New Haven, Connecticut.
- 2011-2012 Postdoctoral Associate, Department of Computer Science, Yale University, New Haven, Connecticut.

Grants and Awards:

- 2016- NIH R01 MH086638: Extension of NEURON simulator for simulation of reaction-diffusion in neurons.
- 2014 Travel Award. SUNY Downstate.
- 2012 Travel Award. SUNY Downstate.
- 2011 Special Graduate Assignment. OSU Math department. No teaching duties for a quarter.
- 2010 Henson Travel Grant. OSU Math department. Funded travel to SfN 2010.
- 2006-2009 VIGRE Fellowship. OSU Math department. Reduced teaching duties.

Publications:

1. Peer-Reviewed Manuscripts

McDougal RA, Morse TM, Carnevale T, Marengo L, Wang R, Migliore M, Miller PL, Shepherd GM, Hines ML. Twenty years of ModelDB and beyond: Building

essential modeling tools for the future of neuroscience. *J Comput Neurosci*. Accepted.

McDougal RA, Bulanova AS, Lytton WW. Reproducibility in computational neuroscience models and simulations. *IEEE Transactions on Biomedical Engineering*. 2016, 63(10), 2021-2035.

Lytton WW, Seidenstein AH, Dura-Bernal S, **McDougal RA**, Schürmann F, Hines ML. Simulation neurotechnologies for advancing brain research: Parallelizing large networks in NEURON. *Neural Computation*. 2016, 28(10), 2063-2090.

Marenco L, Wang R, **McDougal RA**, Olender T, Twik M, Bruford E, Liu X, Zhang J, Lancet D, Shepherd G, Crasto C. ORDB, HORDE, ODORactor and other on-line knowledge resources of olfactory receptor-odorant interactions. *Database*. 2016, baw132.

Neymotin SA, **McDougal RA**, Bulanova AS, Zeki M, Lakatos P, Terman D, Hines ML, Lytton WW. Calcium regulation of HCN channels supports persistent activity in a multiscale model of neocortex. *Neuroscience*. 2016, 316, 344-366.

McDougal RA, Morse TM, Hines ML, Shepherd GM. ModelView for ModelDB: Online Presentation of Model Structure. *Neuroinformatics*. 2015, 13(4), 459-470.

McDougal RA, Shepherd GM. 3D-printer visualization of neuron models. *Frontiers in Neuroinformatics*. 2015, 9.

Neymotin SA, **McDougal RA**, Sherif MA, Fall CP, Hines ML, Lytton WW. Neuronal calcium wave propagation varies with changes in endoplasmic reticulum parameters: a computer model. *Neural Computation*. 2015, 27(4): 898-924.

McDougal RA, Hines ML, Lytton WW. Reaction-diffusion in the NEURON simulator. *Frontiers in Neuroinformatics*. 2013, 7.

McDougal RA, Hines ML, Lytton WW. Water-tight membranes from neuronal morphology files. *J Neuro Meth*. 2013, 220(2): 167-178.

Gu Y, Barry J, **McDougal R (sic)**, Terman D, Gu C. Alternative splicing regulates Kv3.1 polarized targeting to adjust the maximal spiking frequency. *J Biol Chem*. 2012, 287(3):1755-1769.

2. Other Publications

Lin Z, Tropper C, Patoary MNI, **McDougal RA**, Lytton WW, Hines ML. NTW-MT: a multi-threaded simulator for reaction diffusion simulations in NEURON. In *Proceedings of the 3rd ACM SIGSIM Conference on Principles of Advanced*

Discrete Simulation, pp. 157-167. ACM, 2015.

Patoary MNI, Tropper C, Lin Z, **McDougal R**, Lytton WW. Neuron time warp. *Proceedings of the 2014 Winter Simulation Conference*. IEEE Press. 2014.

Shepherd G, Morse T, Marengo L, Cheung K, Carnevale T, Migliore M, **McDougal R**, Hines M, Miller P. SenseLab: Integration of Multidisciplinary Neuroscience Data. In: Jaeger D, Jung R. (Ed.) *Encyclopedia of Computational Neuroscience*: SpringerReference (www.springerreference.com). Springer-Verlag Berlin Heidelberg, 2014.

Lytton W, **McDougal R**. Deterministic Reaction-Diffusion Simulators. In: Jaeger D, Jung R. (Ed.) *Encyclopedia of Computational Neuroscience*: SpringerReference (www.springerreference.com). Springer-Verlag Berlin Heidelberg, 2014.

McDougal R, Wang R, Morse T, Migliore M, Marengo L, Carnevale T, Hines M, Shepherd G. ModelDB. In: Jaeger D, Jung R. (Ed.) *Encyclopedia of Computational Neuroscience*: SpringerReference (www.springerreference.com). Springer-Verlag Berlin Heidelberg, 2014.

3. Submitted Manuscripts

Patoary MNI, Tropper C, **McDougal RA**, Lin Z, Lytton WW. Parallel stochastic discrete event simulation of calcium dynamics in NEURON.

Invited Talks:

- 2016 The ModelDB repository as a tool for model development. Collaborative Development of Data-Driven Models of Neural Systems conference. Janelia Research Campus. September 19, 2016.
- 2016 NEURON strategies for the simulation and visualization of spatial mathematical neuroscience models. NJIT Mathematical Biology Seminar. February 23, 2016.
- 2014 ModelView: extracting model structure and presenting it on the web with NEURON. Open Source Brain Conference. Alghero, Italy. May 14, 2014.

Additional Talks:

- 2014 ModelView: An HTML5 Graphical Tool for Exploring Model Structures. NLM Informatics Training Conference. Pittsburgh, PA. June 17, 2014.

- 2014 Toward a study of Calcium dynamics: a computational journey. Neurobiology Postdoc Network. Yale University. February 19, 2014.
- 2012 Modeling calcium waves and electrical dynamics in neurons: extending NEURON's support for reaction-diffusion. Sackler Discussion Group. Yale University. December 14, 2012.
- 2011 Novel patterns and dopamine modulation in a model of working memory. Workshop for Young Researchers in Mathematical Biology. Mathematical Biosciences Institute. The Ohio State University. August 30, 2011.

Teaching:

- SU 2016 Tutor, Web Development summer course at New Haven Reads.
 June 2016 Lecturer, NEURON course at Janelia Research Center.
 Oct 2015 Lecturer, NEURON course at Society for Neuroscience conference.
 SU 2015 Tutor, Web Development summer course at New Haven Reads.
 Nov 2014 Lecturer, NEURON course at Society for Neuroscience conference.
 July 2014 Lecturer, NEURON tutorial at Organization for Computational Neuroscience conference.
 SU 2014 Tutor, Web Development summer course at New Haven Reads.

The Ohio State University:

- AU 2010 TA, Accelerated Calculus I.
 SP 2010 TA, Accelerated Calculus III for Engineering Honors.
 WI 2010 TA, Accelerated Calculus II for Engineering Honors.
 AU 2009 Lecturer, Calculus and Analytic Geometry II.
 AU 2008 Grader, Linear Algebra for Applications.
 WI 2008 TA, Ordinary and Partial Differential Equations.
 AU 2007 TA, Ordinary and Partial Differential Equations.
 SU 2007 Mentor, Mathematical Biosciences Institute Undergraduate Summer Program in Mathematical Biology.
 AU 2005 TA, Calculus and Analytic Geometry II.
 SU 2005 Lecturer, Calculus and Analytic Geometry I.
 SP 2005 TA, Calculus and Analytic Geometry I.
 WI 2005 TA, Mathematical Analysis for Business III.
 AU 2004 TA, Mathematical Analysis for Business II.

University of Maryland Baltimore County:

- SP 2004 TA, Calculus and Analytic Geometry II.
 AU 2003 TA, Precalculus Mathematics.
 SP 2003 Grader, Complex Analysis.

Conference Posters:

Ikeno H, Yamazaki T, Kannon T, Okumura Y, Kamiyama Y, Ishihara A, Inagaki K, Hirata Y, Satoh S, Wagatsuma H, Asai Y, Yamaguchi Y, **McDougal R**, Wang R, Marengo L, Morse T, Shepherd G, Usui S. Development of an on-line simulation environment for computational neuroscience. Wakō, Saitama, Japan: Advances in Neuroinformatics, 2016.

Morse TM, Marengo L, **McDougal RA**, Wang R, Hines ML, Carnevale NT, Cavarretta F, Migliore M, Crasto C, Miller P, Shepherd GM. Advances in SenseLab's interoperable neuroinformatics databases: FunctionalMicroconnectomeDB and ModelDB. Bonita Springs, FL: AChemS XXXVIII, 2016.

McDougal RA, Neymotin SA, Morse TM, Hines ML, Lytton WW, Shepherd GM. Developing models with NEURON and ModelDB. Columbus, OH: Mathematical Biosciences Institute, Modeling and Computation of Transmembrane Transport Workshop, 2015.

McDougal RA, Hines ML, Lytton WW. Coupling 1D and 3D domains in neuroscience simulations. Bethesda, MD: Multiscale Modeling. National Institutes of Health, 2015.

McDougal RA, Bulanova AS, Hines ML, Lytton WW. Hybrid 1d/3d reaction-diffusion in the NEURON simulator. Chicago IL: Society for Neuroscience, 2015.

Morse TM, **McDougal RA**. Unified real-time searching of keywords and attributes in ModelDB. Chicago IL: Society for Neuroscience, 2015.

Marengo L, Wang R, **McDougal RA**, Morse TM, Carnevale NT, Miller P, Shepherd GM. Exploring data-driven techniques for visual representation of neuronal micro-connectomes. Chicago IL: Society for Neuroscience, 2015.

Tropper C, Lin Z, **McDougal RA**, Hines M, Lytton W. Parallel reaction-diffusion simulation in NEURON. Chicago IL: Society for Neuroscience, 2015.

Seidenstein A, Neymotin SA, Fesharaki A, Hines ML, **McDougal RA**, Bulanova AS, Lytton WW. Neuronal network bump attractors augmented by calcium up-regulation of Ih in a multiscale computer model of prefrontal cortex. Chicago IL: Society for Neuroscience, 2015.

McDougal RA, Hines ML, Lytton WW. Calcium 'impedance mismatch' – the role of geometry on diffusion dynamics. Washington DC: Society for Neuroscience, 2014.

Morse TM, **McDougal RA**, Wang R, Marengo L, Hines M, Carnevale NT, Miller P, Shepherd GM. Advances in Senselab: ModelView, synaptic connectivity, and structured data submission. Washington DC: Society for Neuroscience, 2014.

Shepherd GM, **McDougal RA**, Wang R, Morse TM, Carnevale NT, Marengo LN, Migliore M, Miller PL. 3D printouts of neurons and microcircuits. Washington DC: Society for Neuroscience, 2014.

Neymotin SA, **McDougal RA**, Hines ML, Lytton WW. Calcium regulation of HCN supports persistent activity associated with working memory: A multiscale model of prefrontal cortex. Washington DC: Society for Neuroscience, 2014.

Bulanova AS, **McDougal RA**, Neymotin SA, Mutai VK, Lytton WW, Hines ML. Integrating Systems Biology Markup Language (SBML) with NEURON. Washington DC: Society for Neuroscience, 2014.

Tropper C, Pataory M, **McDougal RA**, Hines ML, Lytton WW. Stochastic diffusion simulation in NEURON. Washington DC: Society for Neuroscience, 2014.

McDougal RA, Bulanova A, Patoary MNI, Tropper C, Hines ML, Lytton WW. NEURON for multiscale simulations: reaction-diffusion meets electrophysiology. Bethesda, MD: Multiscale Modeling. National Institutes of Health, 2014.

Neymotin SA, **McDougal RA**, Hines ML, Lytton WW. Calcium regulation of HCN supports persistent activity associated with working memory: A multiscale model of prefrontal cortex. Bethesda, MD: Multiscale Modeling. National Institutes of Health, 2014.

McDougal RA, Hines M, Lytton WW. A method for multi-simulator reaction-diffusion with NEURON. Quebec, QC: Organization for Computational Neurosciences, 2014.

Neymotin SA, **McDougal RA**, Hines M, Lytton WW. Calcium regulation of HCN supports persistent activity associated with working memory: a multiscale model of prefrontal cortex. Quebec, QC: Organization for Computational Neurosciences, 2014.

Bulanova A, **McDougal RA**, Neymotin S, Mutai V, Lytton WW, Hines M. Integrating Systems Biology Markup Language (SBML) with NEURON. Quebec, QC: Organization for Computational Neurosciences, 2014.

McDougal RA, Morse TM, Marengo L, Wang R, Hines ML, Carnevale NT, Shepherd GM. ModelView for ModelDB: Exploring model properties in a web browser. San Diego, CA: Society for Neuroscience, 2013.

Morse TM, **McDougal RA**, Wang R, Hines ML, Marengo L, Carnevale NT, Shepherd GM. Using full text, context, and attributes to mine neuroscience models. San Diego, CA: Society for Neuroscience, 2013.

Hines ML, **McDougal RA**, Neymotin SA, Tropper C, Lytton WW. Interfaces in multiscale reaction-diffusion models in the NEURON simulator. San Diego, CA: Society for Neuroscience, 2013.

Sherif MA, **McDougal R**, Neymotin S, Hines M, Lytton WW. Calcium wave propagation varies with changes in endoplasmic reticulum parameters: a computer model. San Diego, CA: Society for Neuroscience, 2013.

Tropper C, Patoary MNI, **McDougal RA**, Hines ML, Lytton WW. Parallel stochastic simulation of neuronal reaction-diffusion equations. San Diego, CA: Society for Neuroscience, 2013.

Neymotin SA, Skolnick Y, Hilscher MM, Moulin T, **McDougal RA**, Hines ML, Lytton WW. Ih tunes theta/gamma oscillations and cross-frequency coupling in an in silico CA3 model. Rhythmic Dynamics and Cognition Conference, MIT, Boston MA. 2013.

McDougal RA, Neymotin S, Hines M, Lytton W. Computational study of neuronal calcium waves. Brooklyn, NY: SUNY Downstate Research Day, 2013.

McDougal RA, Hines ML, Lytton WW. Reaction-diffusion modeling in the NEURON simulator. Bethesda, MD: Multiscale Modeling. National Institutes of Health, 2012.

Neymotin S, Skolnick Y, **McDougal RA**, Hilscher M, Moulin T, Lytton W. Simulated relations of molecular, cellular, and neuronal network dynamics in a hippocampal network. Bethesda, MD: Multiscale Modeling. National Institutes of Health, 2012.

McDougal RA, Lytton WW, Hines ML. Calcium-electrical interactions: an example of reaction-diffusion in the NEURON simulator. New Orleans, LA: Society for Neuroscience, 2012.

McDougal RA, Lytton WW, Hines ML. Modeling calcium waves and electrical dynamics in neurons. Columbus, OH: Mathematical Biosciences Institute, Workshop for Young Researchers in Mathematical Biology, 2012.

McDougal RA, Skolnick Y, Schaff JC, Lytton WW, Hines ML. Reaction-diffusion modeling in the NEURON simulator. Decatur, GA: Organization for Computational Neurosciences, 2012.

McDougal RA, Skolnick Y, Schaff JC, Lytton WW, Hines ML. Reaction-diffusion modeling in the NEURON simulator. Brooklyn, NY: SUNY Downstate Research Day, 2012.

McDougal RA, Lytton WW, Hines ML. Object-oriented reaction-diffusion modeling in the NEURON simulator. Washington DC: Society for Neuroscience, 2011.

McDougal RA, Zeki M, Lyman K, Terman DT. A working memory model based on excitatory-inhibitory interactions and calcium dynamics. San Antonio, TX: Organization for Computational Neurosciences, 2010.

McDougal RA, Best J. A mathematical model for intracellular PER protein dynamics. Sandestin, FL: Society for Research on Biological Rhythms, 2008.

Technical Volunteering:

New Haven Reads: Tutored for summer Web Development course. Summers 2014-2016.

Friends of East Rock Park: Developed an interactive web page to enable voting for their annual photo contest. 2013, 2014, 2016.
<http://ramcdougal.com/photocontest2016/>

City Alderman Doug Hausladen: Developed a web app to visualize police incidents over time for New Haven, CT. 2013.
<http://ramcdougal.com/nhvcrime2012/>

Activities:

2016-	NeuroML Editorial Board
2013-2016	Judge, Connecticut STEM Fair (formerly Southern Connecticut Invitational Science & Engineering Fair)
2015-2016	Presenter, Yale Brain Education Day
2016	Presenter, Neuroscience Demos with the Talented and Gifted Program
2013	Judge, New Haven Public School Science Fair

Memberships:

2007-present	Member, American Mathematical Society.
2007-present	Member, Society for Industrial and Applied Mathematics.
2011-present	Member, Society for Neuroscience.
2012-present	Member, Organization for Computational Neurosciences.
2007-2011	Member, Mathematical Association of America.