

Catherine Thorn

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The University of Texas at Dallas
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EDUCATIONAL HISTORY

- 2010 Ph.D., Massachusetts Institute of Technology. Electrical Engineering and Computer Science
Doctoral Thesis: *Simultaneous Activation of Multiple Memory Systems during Learning: Insights from Electrophysiology and Modeling* (PI: Ann Graybiel)
- 2004 S.M., Massachusetts Institute of Technology. Electrical Engineering
Master's Thesis: *Characterization of I-V Medication Changes in MIMIC II* (PI: Roger Mark)
- 2002 B.S., Georgia Institute of Technology. Electrical Engineering

PROFESSIONAL EXPERIENCE

- 2018- **Assistant Professor**, Behavioral and Brain Sciences, University of Texas at Dallas
- 2014-2017 **Postdoctoral Fellow**, Pfizer Inc., Cambridge, MA
- 2011-2014 **Postdoctoral Fellow**, Moore Laboratory, Brown University, Providence, RI
- 2010-2011 **Postdoctoral Associate**, Graybiel Laboratory, MIT, Cambridge, MA

TEACHING EXPERIENCE

- 2018- **Assistant Professor**, Behavioral and Brain Sciences, University of Texas at Dallas
Courses taught: Neurophysiology, Health Disparities in Neuroscience, Seminar in Modern Systems Neuroscience Methods
- 2014 **Faculty**, Marine Biological Laboratory, Neural Systems & Behavior Course, Somatosensory module
- 2004-2005 **Teaching Assistant**, 6.002 – Introduction to Circuits and Electronics, MIT
- 2003 **Instructor**, Women in Technology Program, MIT

RESEARCH INTERESTS

Research in the Thorn Lab at the University of Texas at Dallas aims to understand the neurobiological mechanisms that underlie motor cortical plasticity and motor learning, in healthy subjects and in disease states. Our work combines multiple techniques, including *in vivo* electrophysiology, optogenetics, pharmacology and rodent behavior, to characterize learning-related changes in neural signaling at multiple levels of investigation – from single neurons to behaving animal.

GRANT FUNDING

CURRENT

- 2021-2022 *Vagus nerve stimulation targets fear pathways to enhance extinction of conditioned fear*
NIH/NIMH R56 (co-PIs: CK McIntyre & CA Thorn)
- 2020 *Mechanisms of Vagus Nerve Stimulation-Induced Enhancement of Extinction of Conditioned Fear*
UT Dallas BBS Stimulus Grant (co-PIs: CK McIntyre & CA Thorn)
- 2018-2021 *STARs for the Recruitment of Rising STARs*
Institutional Award to UT Dallas for recruitment of CA Thorn

COMPLETED

- 2018-2019 *Home Cage System for Fine Motor Assessments in Aging Rodent Models*
NIH Subaward 1R43AG059508-P1SUB1 (Subaward PI: CA Thorn)
- 2012-2014 *Parafascicular Nucleus: Its Role in Cortical and Striatal Salience Encoding*
NIH/NINDS Award Number: 1F32 NS082043 (PI: CA Thorn)

AWARDS AND FELLOWSHIPS

2017-2020	Univ. of Texas Board of Regents Rising Science and Technology Retention (STARs) Award
2012-2014	NIH Kirschstein National Research Service Award (NRSA) Postdoctoral Fellowship (F32)
2007-2008	Friends of the McGovern Institute Fellowship
2005	NSF Graduate Research Fellowship Honorable Mention
2002-2003	DuPont-MIT Alliance Fellowship
2002	Georgia Tech ECE Faculty Award
2002	Georgia Tech Most Outstanding Thesis in the School of Engineering
1999	SWE-Weyerhaeuser Scholarship

PUBLICATIONS

RESEARCH ARTICLES

Tseng C.-T.*, Brougher J.*, Gaubling S.J., Hassan B.S., **Thorn C.A.** Vagus nerve stimulation promotes cortical reorganization and reduces task-dependent calorie intake in male and female rats. *Brain Res.* 2020 Dec 1;1748:147099. doi: 10.1016/j.brainres.2020.147099. Epub 2020 Sep 4. *These authors contributed equally to this work.

Shukla T., de la Peña JB, Perish JM, Ploski JE, Stumpf CR, Webster KR, **Thorn CA**, Campbell ZT. A Highly Selective MNK Inhibitor Rescues Deficits Associated with Fragile X Syndrome in Mice. *Neurotherapeutics.* 2020 Oct 1. doi: 10.1007/s13311-020-00932-4. Online ahead of print.

Sanchez CA, Brougher J, Rahebi KC, **Thorn CA.** (2020) Preparation of Peripheral Nerve Stimulation Electrodes for Chronic Implantation in Rats. *J Vis Exp.* 2020 Jul 14;(161). Doi: 10.3791/61128.

Thorn CA, Moon J, Bourbonnais CA, Harms J, Edgerton JR, Stark E, Steyn SJ, Butter CR, Lazzaro JT, O'Connor RE, Popiolek M. (2019) Striatal, Hippocampal, and Cortical Networks Are Differentially Responsive to the M4- and M1-Muscarinic Acetylcholine Receptor Mediated Effects of Xanomeline. *ACS Chem Neurosci.* 2019 Mar 20;10(3):1753-1764. doi: 10.1021/acschemneuro.8b00625. Epub 2018 Dec 11.

Davoren et al. (2017) Design and synthesis of γ - and δ -lactam M1 positive allosteric modulators (PAMs): Convulsion and cholinergic toxicity of an M1-selective PAM with weak agonist activity. *J Med Chem.* 60(15):6649-6663. DOI: 10.1021/acs.jmedchem.7b00597

Thorn C.A., Popiolek M., Stark E., Volfson D., Edgerton, J.E. (2017) Differential effects of M1 and M4 activation on excitatory synaptic transmission in hippocampus CA1. *Hippocampus.* DOI: 10.1002/hipo.22732

Sherman, M, Lee, S, Law, Haegens, S, **Thorn, C**, Hamalainen, M, Moore, CI, Jones, SR. (2016) Neural Mechanisms of Transient Neocortical Beta Rhythms: Converging Evidence from Humans, Computational Modeling, Monkeys and Mice. *Proc Natl Acad Sci USA.* 133(33):E4885-94. PMC4995995.

Thorn C.A., Graybiel, A.M. (2014) Differential Entrainment and Learning-Related Dynamics of Spike and Local Field Potential Activity in the Sensorimotor and Associative Striatum. *J. Neurosci.* 34. 2845-59. PMC3931500

Normand E.A., Crandall, S.R., **Thorn, C.A.**, Murphy, E.M., Voelcker, B., Browning, C., Machan, J.T., Moore, C.I., Connors, B.W., Zervas, M. (2013) Temporal and mosaic Tsc1 deletion in the developing thalamus disrupts thalamocortical circuitry, neural function, and behavior. *Neuron* 78, 895-909. PMC4529124

Thorn, C.A., Atallah, H., Howe M., Graybiel, A.M. (2010) Differential dynamics of activity changes in dorsolateral and dorsomedial striatal loops during learning. *Neuron* 66, 781-795. PMC3108575.

Tort, A.B., Kramer, M.A., **Thorn, C.**, Gibson, D.J., Kubota, Y., Graybiel, A.M., Kopell, N.J. (2008) Dynamic cross-frequency couplings of local field potential oscillations in rat striatum and hippocampus during performance of a T-maze task. *Proc Natl Acad Sci USA* 105, 20517-20522. PMC2629291.

Thorn, C.*, DeCoteau, W.E.*, Gibson, D.J., Courtemanche, R., Mitra, P., Kubota, Y., Graybiel, A.M. (2007) Learning-related coordination of striatal and hippocampal theta rhythms during acquisition of a procedural maze task. *Proc Natl Acad Sci USA* 104, 5644-5649. PMC1838454. *These authors contributed equally to this work.

DeCoteau, W.E.*, **Thorn, C.***, Gibson, D.J., Courtemanche, R., Mitra, P., Kubota, Y., Graybiel, A.M. (2007) Oscillations of local field potentials in the rat dorsal striatum during spontaneous and instructed behaviors. *J Neurophysiol* 97, 3800-3805. *These authors contributed equally to this work.

REVIEWS & COMMENTARY

Lebois, E.P., **Thorn, C.A.**, Edgerton, J.R., Popiolek, M., Xi, S. (2018) Muscarinic receptor subtypes and distribution in the CNS. *Neuropharm.* Jul 1;136(Pt C):362-373. doi: 10.1016/j.neuropharm.2017.11.018. Epub 2017 Nov 11. Review

Thorn, C.A., Graybiel, A.M. (2010) Pausing to regroup: thalamic gating of cortico-basal ganglia networks. *Neuron* 67, 175-178.

PAPERS IN PREPARATION

Tseng C.-T., Gauldin S.G., **Thorn C.A.** Local activation of $\alpha 2$ noradrenergic receptors is required for vagus nerve stimulation induced motor cortical map plasticity. *Under review.*

Brougher J., Sanchez C.A., Aziz U.S., Gove K.F., **Thorn C.A.** Vagus nerve stimulation induced cortical plasticity is not dopamine dependent. *Under review.*

Sanchez C.A., Thorn C.A. DJ-1 knockout rats exhibit motor impairments on a skilled reaching task. *In preparation.*

SELECTED ABSTRACTS AND CONFERENCE ACTIVITY

Poster. J. Brougher, C.A. Thorn. Differential activation of dopaminergic signaling pathways following right and left vagus nerve stimulation. Program No. P291.16 2020 Society for Neuroscience Global Connectome. Jan. 11-13, 2021. Online.

Poster. C.A. Sanchez, J. Brougher, D. Krishnan, C.A. Thorn. Longitudinal Assessment of Skilled Motor Function and Levodopa Treatment Efficacy in DJ-1 Knockout Rats. Program No. P110.03 2020 Society for Neuroscience Global Connectome. Jan. 11-13, 2021. Online.

Poster. J. BROUGHER, C. A. THORN. Exploring the necessity of dopamine in vagus nerve stimulation induced motor map expansion. Program No. 582.09. 2019 Neuroscience Meeting Planner. Chicago, IL: Society for Neuroscience, 2019. Online.

Poster. C.-T. TSENG, S. J. GAULDING, C. A. THORN; Noradrenergic alpha-2 receptor antagonism inhibits vagus nerve stimulation dependent enhancement of motor cortical plasticity. Program No. 582.10. 2019 Neuroscience Meeting Planner. Chicago, IL: Society for Neuroscience, 2019. Online.

Poster. C. A. SANCHEZ, C. A. THORN; Skilled motor assessment of the DJ-1 knockout rat. Program No. 379.11. 2019 Neuroscience Meeting Planner. Chicago, IL: Society for Neuroscience, 2019. Online.

Poster. A. M. SLOAN, C. A. SANCHEZ, D. K. BORN, C. A. THORN; A wireless operant behavior system for fine motor assessments in standard rack-mounted home cages. Program No. 582.07. 2019 Neuroscience Meeting Planner. Chicago, IL: Society for Neuroscience, 2019. Online.

Poster. Tseng, C.T., Thorn, C.A. The effect of noradrenergic alpha-2 receptor antagonism on vagus nerve stimulation dependent enhancement of neuroplasticity. *17th Annual Molecular and Cellular Cognition Society Poster Session 2018*

Poster. Thorn, C.A., Butler, C.R., Edgerton, J.R., Garst-Orozco, J., Harms, J.F., Stark, E., Popiolek, M. Striatal and hippocampal memory systems are differentially responsive to the M4- and M1-mediated effects of xanomeline. *Gordon Research Conference on the Basal Ganglia 2018.*

Poster. Thorn, C.A., Stark, E., Volfson, D., Edgerton, J.R. Activation of M1 and M4 muscarinic acetylcholine receptors biases synaptic transmission in hippocampus CA1. *International Symposium on Cholinergic Mechanisms.* 2016.

Poster. Thorn, C.A., Edgerton, J. Dissecting the roles of M1 and M4 receptors in CA1 excitatory transmission. *Society for Neuroscience Abstracts.* 2015.

Poster. Thorn, C.A., McDonnell, E., Moore, C.I. Dynamics of cortical and striatal activity during vibrissa-CS trace eyeblink conditioning. *Society for Neuroscience Abstracts.* 2014.

Poster. Thorn, C.A., Graybiel, A.M. Differential theta-band entrainment dynamics in sensorimotor and associative striatum. *Gordon Research Conference on the Basal Ganglia.* 2014.

Poster. Thorn, C.A., Moore, C.I. The role of the parafascicular nucleus in sensory perception. *Society for Neuroscience Abstracts.* 2013.

Workshop. "How Do Multiple Cortico-Basal Ganglia Loops Support Learning Across a Wide Range of Functional Domains?" Computational and Systems Neuroscience (Cosyne), 2011. Organized by M. Frank and C.A. Thorn.

Poster. Thorn, C.A., Atallah, H., Howe, M., Graybiel, A.M. Simultaneous activation of dorsolateral and dorsomedial striatal loops during T-maze learning. *International Basal Ganglia Society.* 2010.

Poster. Thorn C and Graybiel A (2009). Projection Neurons in Medial and Lateral Striatum Show Different Ensemble Patterns during Learning. *Frontiers in Systems Neuroscience. Conference Abstract: Computational and systems neuroscience.* doi: 10.3389

Poster. Thorn C, Atallah H, Howe M, Graybiel A. Ensemble unit activity differs between lateral and medial striatal regions during T-maze task learning. *Society for Neuroscience Abstracts*, 2008.

Poster. Thorn, C.A., Gibson, D.J., DeCoteau, W.E., Kubota, Y., Mitra, P., Graybiel, A.M., Striatal and hippocampal theta rhythms exhibit task-specific coherence relationships that are modulated by learning in a T-maze task. *Society for Neuroscience Abstracts*, 2007.

INVITED AND DEPARTMENTAL TALKS

2019 “Rewards, Habits and Decision-Making: Why Do People Behave the Way They Do?” Mary K. Craig Class, Dallas, TX. Invited Talk.

2019 “Neuromodulatory signaling in motor cortical plasticity” Frontiers Lunch Lectures at the Center for BrainHealth, UT Dallas. Departmental Talk.

2019 “Neuromodulatory signaling in motor cortical plasticity” Center for Vital Longevity Science Luncheon Series, UT Dallas. Departmental Talk.

PROFESSIONAL SERVICE AND ACTIVITIES

NATIONAL/EXTERNAL SERVICE

2021 NINDS NST-2 Study Section, ad hoc review

2020 Session Judge, Black in Neuro Conference

Ad hoc reviewer: *Journal of Advanced Research; Psychology and Neuroscience*

UNIVERSITY/INTERNAL SERVICE

2020- UTD Institutional Animal Care and Use Committee (IACUC)

2020- BBS Equity Justice and Inclusion Committee

2020- BBS Colloquium Series Committee

2020- Chair, Cognitive and Systems Neuroscience Graduate Admissions Committee (SN track)

2019-2020 Faculty Search Committee, Department of Neuroscience

2019 Reviewer, UTD Office of Research MEGA Grant

2019 Graduate Admissions Committee, Cognitive and Systems Neuroscience PhD Program (SN track)

2018 Reviewer, BBS Small and Tucker Scholarships

PROFESSIONAL MEMBERSHIPS

2006-present Society for Neuroscience

2015-2017 Postdoc Advisory Committee, Pfizer Worldwide Research and Development

2014 Founding member, Postdocs in Brain Science, Brown University

2010-2013 International Basal Ganglia Society

1998-2012 Institute of Electrical and Electronics Engineers

1998-2002 Society of Women Engineers

PROFESSIONAL DEVELOPMENT

2019, 2020 UT Dallas Office of Research R.O.A.D. to DC

The goal of this Program is to build and strengthen relationships between program managers and UTD faculty, to increase knowledge about and success in obtaining extramural funding.