Nathaniel J. Himmel, PhD

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RESEARCH POSITIONS

Postdoctoral Fellow, University of Lausanne, Lausanne, Switzerland 2022 –
Human Frontier Science Program Fellow
Center for Integrative Genomics, PI: Richard Benton, PhD FRS

Graduate Research Fellow, Georgia State University, Atlanta, GA, USA 2015 – 2022
Ruth L. Kirschstein NRSA Fellow; Honeycutt Fellow; Brains & Behavior Fellow
Neuroscience Institute, PI: Daniel Cox, PhD

Research Technician, Emory University, Atlanta, GA, USA 2013 – 2015
Department of Physiology & Department of Medicine, PI: Mitsi Blount, PhD

EDUCATION

PhD **Neuroscience**, Georgia State University, Atlanta, GA, USA 2015 – 2021
Dissertation: "How the Fly Youth Chill: The Molecular Biology, Ecology, and Evolution of Cold Nociception in *Drosophila* and Subsequent Studies of the Evolution of TRP Channels"

BS **Biology**, University of Florida**,** Gainesville, FL, USA 2011 – 2013

AA **Biological Sciences**, Santa Fe College, Gainesville, FL, USA 2008 – 2011

PUBLICATIONS

These authors contributed equally; * co-corresponding authors; § undergraduate mentees

18. **Himmel NJ***, Moi D, and Benton R*. Remote homolog detection places insect chemosensors in a cryptic protein superfamily spanning the tree of life. *Current Biology.* in press.

17. Benton R* and **Himmel NJ***. Structural screens identify candidate human homologs of insect chemoreceptors and cryptic *Drosophila* gustatory receptor-like proteins. *eLife*. 2023.

16. **Himmel NJ**, Sakurai A, Letcher JM, Patel AA, Bhattacharjee S, Benson MN§, Gray TR§, Cymbalyuk GS, and Cox DN. Chloride-dependent mechanisms of multimodal sensory discrimination and nociceptive sensitization in *Drosophila*. *eLife*. 2023.

15. **Himmel NJ** and Benton R. Sweet sensors support stressed cell survival. *PLoS Biology*. 2022. (commentary to Baumgartner & Mastrogiannopoulos *et al* 2022).

14. **Himmel NJ**, Sakurai A, Donaldson KJ, and Cox DN. Methods for measuring cold-evoked neural activity and cold tolerance in *Drosophila* larvae following fictive cold acclimation. *STAR Protocols*. 2022.

13. Patel AA, Sakurai A, **Himmel NJ**, and Cox DN. Modality specific roles for metabotropic GABAergic signaling and calcium induced calcium release mechanisms in regulating cold nociception. *Frontiers in Molecular Neuroscience*. 2022.

12. **Himmel NJ**, Letcher JM, Sakurai A, Benson MN[§], Gray TR[§], Donaldson KJ, and Cox DN. Identification of a neural basis for cold acclimation in *Drosophila* larvae. *iScience*. 2021.

11. **Himmel NJ**, Rogers RT, Redd SK, Wang Y[§], and Blount MA. Purinergic signaling is enhanced in the absence of UT-A1 and UT-A3. *Physiological Reports*. 2021.

10. **Himmel NJ**, Letcher JM, and Cox DN. Dissecting the molecular and neural circuit bases of behavior as an introduction to discovery-driven research: a report on a Course-Based Undergraduate Research Experience. *Journal of Undergraduate Neuroscience Education*. 2020.

9. **Himmel NJ** and Cox DN. Transient Receptor Potential Channels: Current Perspectives on Evolution, Structure, Function, and Nomenclature. *Proceedings of the Royal Society B*. 2020.

8. **Himmel NJ***, Gray TR[§], and Cox DN*. Phylogenetics identifies two eumetazoan TRPM clades and an eighth TRP family, TRP Soromelastatin (TRPS). *Molecular Biology and Evolution*. 2020.

7. **Himmel NJ***, Letcher JM, Sakurai A, Gray TR[§], Benson MN[§], and Cox DN*. *Drosophila* menthol sensitivity and the Precambrian origins of TRP-dependent chemosensation. *Philosophical Transactions of the Royal Society B*. 2019.

6. Lopez-Bellido R, **Himmel NJ**, Gutstein HB, Cox DN, and Galko MJ. An assay for chemical nociception in *Drosophila* larvae. *Philosophical Transactions of the Royal Society B*. 2019.

5. **Himmel NJ**, Rodriguez DA[§], Wang Y[§], Sun MA[§], and Blount MA. Chronic lithium treatment induces novel patterns of pendrin localization and expression. *American Journal of Physiology – Renal Physiology*. 2018.

4. **Himmel NJ** and Cox DN. Sensing the Cold: TRP channels in thermal nociception. *Channels*. 2017. (commentary to Turner & Armengol *et al* 2016).

3. **Himmel NJ**, Patel AA, and Cox DN. Invertebrate Nociception. Originally printed in *The Oxford Research Encyclopedia of Neuroscience*, 2017. Reprinted in *The Oxford Research Encyclopedia of Sensory Systems*, 2022.

2. Turner HN, Armengol K, Patel AA, **Himmel NJ**, Sullivan L, Iyer SC, Battacharya S, Iyer EPR, Landry C, Galko MJ*, and Cox DN*. The TRP channels Pkd2, NompC, and Trpm mediate unique aversive behaviors to noxious cold in *Drosophila*. *Current Biology*. 2016.

1. Sim JH, **Himmel NJ**, Redd SK, Pulous FE, Rogers RT, Black LN, Hong SM, von Bergen TN, and Blount MA. Absence of PKC-alpha attenuates lithium-induced nephrogenic diabetes insipidus. *PLoS One*. 2014.

FUNDING and AWARDS

Grants & Funding:

Human Frontier Science Program Long-Term Fellowship (LT-0003/2022-L) 2022–2025
International Human Frontier Science Program Organization
"Evolutionary, expression, and functional characterization of ancient putative chemosensors"

Ruth L. Kirschstein National Research Service Award (F31NS117087) 2020–2022
National Institute of Neurological Disease and Stroke
"Functional roles of chloride homeostasis and chloride ion channels in thermosensory nociception"

Kenneth W. and Georganne F. Honeycutt Fellowship 2017–2020

Georgia State University, Neuroscience Institute

Brains & Behavior Fellowship 2017–2020
Georgia State University, Brains & Behavior Program
Honorary Fellow, 2020-2021

Other Awards:

Writing Across the Curriculum Pedagogy Award, *Georgia State University* 2021
Neuroscience Institute Outstanding Doctoral Scholar, *Georgia State University* 2020
Neuroscience Institute Outstanding Graduate Student Mentor, *Georgia State University* 2019
Meritorious Research Award, *American Physiological Society* 2016
Meritorious Research Award, *American Physiological Society* 2015

TEACHING EXPERIENCE

Course design/prep:

Course-Based Undergraduate Research Experience (PERS2002)
Co-designers: Daniel N. Cox & Jamin M. Letcher
Course outline and report published in *Journal of Undergraduate Neuroscience Education*

Teaching assistantships:

Biostatistics (BSc2) 2023
Advanced Molecular, Cellular and Developmental Biology (BSc3) 2023
Course-Based Undergraduate Research Experience (PERS2002) 2017
Neuroscience Laboratory (NEUR3010/4000) 2016 & 2018

Other teaching:

Writing Advisor - Writing Across the Curriculum Program 2018–2021
GSU, Center for Excellence in Teaching and Learning

Guest lectures:

GSU's Neuroscience School: *Presenting Data in Different Forms* 2019
GSU's Neuroscience School: *Neurological Diseases* 2016
Atlanta Brain Bee Prep Course: *Senses, Perception, and Movement* 2015
Emory University SUPERR Program: *Techniques in Renal Physiology* 2015

MENTORING, SERVICE, and OUTREACH

Research trainees (date mentored; current affiliation):

Maggie N. Benson (2018-2021; MD/PhD candidate, University of Kansas Medical Center); Thomas R. Gray (2017-2020; PhD candidate, Brandeis University); Grace L. Swaim (2014-2015; PhD candidate, Yale University); Matthew R. Borchart (2015; physician); John H. Ward (2014; physician); Michael A. Sun (2014-2015; Project Manager and Analyst, Galaxy Venture Capital); Daniel A. Rodriguez (2014-2015; Equities

Trader, Citadel Securities); Yirong Wang (2014-2015; Assistant Faculty Associate, University of Wisconsin—Madison); Nikki A. Mehran (2013-2015; physician)

Participation in research mentorship programs:

GSU, Initiative for Maximizing Student Development (IMSD)	2017–2020
Emory, Summer Undergrad Program in Emory Renal Research (SUPERR)	2015
Emory/American Physiological Society, Frontiers in Physiology	2014
Emory, Summer Undergraduate Research Experience (SURE)	2013–2015

Peer review & academic publishing:

Preprint Editorial Team Leader (Physio. & Neuro.), *Proceedings of the Royal Society B* 2019–2023

Ad hoc peer review: *The Biological Bulletin*; *Current Opinion in Insect Science*; *eLife*; *Frontiers in Ecology and Evolution*; *Genes, Brain and Behavior*; and *Journal of Economic Entomology*

Ad hoc grant review: Agence Nationale de la Recherche (France)

Media coverage:

Weiner S. "Do insects enjoy sex?" *Gizmodo*. June 2017. Web: https://gizmodo.com/doinsects-enjoy-sex-1796376553.

PRESENTATIONS, POSTERS, and ABSTRACTS

[§]undergraduate co-author; presenter

Invited seminars & symposia:

5. Invited speaker, Georgia State University, Neuroscience Institute, Data Analysis Club. July 2022. *Virtual*.

4. Invited speaker, North Carlina State University, College of Veterinary Medicine, Fungal Systems Biology Laboratory. November 2021. *Raleigh, NC, USA.*

3. Invited speaker, Monthly Maggot Meeting. July 2021. *Virtual.*

2. Invited participant, Theo Murphy International Scientific Meeting on the evolution of mechanisms and behaviour important for pain, hosted by The Royal Society. February 2019. *Chicheley, Buckinghamshire, UK*.

1. Invited panelist, NIDDK/KUH Researcher Panel, Summer Student Symposium. July 2015. *Atlanta, GA, USA.*

Conference talks:

3. **Himmel NJ**, Moi D, Benton R. The enigmatic origins of insect Gustatory and Odorant receptors: a homologous protein superfamily spanning eukaryotes, archaea, and bacteria. June 2023. *Talk at symposium on the emergence of order across biological scales, University of Lausanne, Lausanne, Switzerland.*

2. **Himmel NJ**, Letcher JM, Sakurai A, Gray TR[§], Benson MN[§], Cox DN. Menthol elicits *Trpm*- and *TrpA1*-dependent rolling in *Drosophila* larvae, suggesting Precambrian origins for TRP-dependent menthol sensing. October 2019. *Talk at Neurobiology of Drosophila Meeting, Cold Spring Harbor, NY, USA.*

1. **Himmel NJ,** Rodriguez DA[§], Blount MA. Chronic lithium treatment induces β-intercalated cell expression in the renal inner medulla. March 2015. *Talk at Experimental Biology meeting, Boston, MA, USA.*

Posters (only first-authored) & other published abstracts:

26. **Himmel NJ**, Moi D, and Benton R. The enigmatic origins of *Drosophila* Gustatory and Odorant receptors. June 2023. *Annual Génepode Retreat, Leysin, Switzerland.*

25. **Himmel NJ**, Moi D, and Benton R. The enigmatic origins of *Drosophila* Gustatory and Odorant receptors. June 2023. *Annual Swiss Drosophila Meeting, Fribourg, Switzerland.*

24. **Himmel NJ** and Benton R. Ancient putative chemosensors in the zoosporic fungus *Spizellomyces punctatus*. June 2022. *Annual Génepode Retreat, Les Diablerets, Switzerland.*

23. **Himmel NJ** and Benton R. Ancient putative chemosensors in the zoosporic fungus *Spizellomyces punctatus*. June 2022. *Symposium on interactions in biology, University of Lausanne, Lausanne, Switzerland.*

22. **Himmel NJ,** Sakurai A, Letcher JM, Patel AA, Benson MN[§], Bhattacharjee S, Gray TR[§], Cymbalyuk GS, and Cox DN. Chloride-dependent mechanisms of multimodal sensory discrimination: roles for *subdued*, *koozie*, and excitatory chloride physiology in *Drosophila* cold nociception. October 2021. *Neurobiology of Drosophila Meeting, Cold Spring Harbor Lab, virtual.*

21. **Himmel NJ**, Letcher JM, Sakurai A, Benson MN[§], Gray TR[§], Donaldson KJ, and Cox DN. How The Fly Youth Chill. March 2021. *Annual GSU Brains & Behavior Retreat, virtual.*

20. **Himmel NJ**, Letcher JM, Sakurai A, Benson MN[§], Gray TR[§], Donaldson KJ, and Cox DN. How The Fly Youth Chill: The evolution of cold nociception in drosophilid larvae and identification of a neural basis for cold acclimation. March 2021. *Animal Behavior Conference*, *hosted by Indiana University—Bloomington, virtual.*

19. **Himmel NJ**, Sakurai A, Letcher JM, Benson MA, Gray TR, and Cox DN. Excitatory chloride physiology discriminately encodes noxious cold in a multimodal sensory neuron. January 2021. *Annual meeting of the Society for Neuroscience, virtual*.

18. Maksymchuk N, Sakurai A, Patel AA, **Himmel NJ**, Cox DN, Cymbalyuk G. Mechanisms of cold temperatures rate coding by *Drosophila* CIII neurons. October 2019. *Annual meeting of the Society for Neuroscience, San Diego, CA, USA*. Abstract online.

17. Letcher JM, **Himmel NJ**, Sakurai A, Holgiun-Lopez M, Cox DN. TrpA1 mediates cold nociception in *Drosophila melanogaster* larvae. October 2019. *Neurobiology of Drosophila Meeting, Cold Spring Harbor Lab, Cold Spring Harbor, NY, USA.*

16. Maksymchuk N, Sakurai A, Patel AA, **Himmel NJ**, Cox DN, Cymbalyuk G. Role of TRP channels in temperature rate coding by *Drosophila* noxious cold sensitive neurons. *Conference abstract in BMC Neuroscience*, 20:56, July 2019. doi: 10.1186/s12868-019-0538-0

15. **Himmel NJ**, Letcher JM, Gray TR[§], Benson MN[§], Cox DN. TRP-dependent chemical sensing: the Precambrian hypothesis. May 2019. *Annual GSU Brains & Behavior Retreat, Atlanta, GA, USA.*

14. **Himmel NJ**, Letcher JM, Gray TR[§], Benson MN[§], Cox DN. Menthol elicits a *Trpm*- and *TrpA1*-dependent nocifensive response in *Drosophila melanogaster* larvae. February 2019. *Theo Murphy International*

Scientific Meeting on the evolution of mechanisms and behaviour important for pain, hosted by The Royal Society, Chicheley, Buckinghamshire, UK.

13. Patel AA, **Himmel NJ**, Cox DN. Calcium induced calcium release mechanisms in cold nociception. February 2019. *Theo Murphy International Scientific Meeting on the evolution of mechanisms and behaviour important for pain, hosted by The Royal Society, Chicheley, Buckinghamshire, UK*.

12. Patel AA, **Himmel NJ**, Yang JJ, Cox DN. Cellular and behavioral requirements for calcium release mechanisms in cold nociception. October 2018. *Annual meeting of the Society for Neuroscience, San Diego, CA, USA.* Abstract online.

11. Maksymchuk N, Patel AA, **Himmel NJ**, Cox DN, Cymbalyuk G. Modeling of TRP channel mediated noxious cold sensation in *Drosophila* sensory neurons. *Conference abstract in BMC Neuroscience*, 19(Suppl 2):64, July 2018. doi: 10.1186/s12868-018-0452-x

10. **Himmel NJ**, Letcher JM, Gray TR[§], Cox DN. The evolution of cold nociception in drosophilid larvae. May 2018. *Annual GSU Brains & Behavior Retreat, Atlanta, GA, USA.*

9. **Himmel NJ**, Gray TR[§], Cox DN. Anoctamins are required for cold nociception in *Drosophila.* April 2018. A*nnual Georgia Collegiate Neuroscience Symposium*, *Athens, GA, USA.*

8. **Himmel NJ**, Gray TR[§], Cox DN. Calcium-activated chloride channels are required for distinguishing between noxious and innocuous stimuli in multimodal sensory neurons. April 2018. A*nnual meeting of the Genetics Society of America, Philadelphia, PA, USA.* Abstract online.

7. Maksymchuk N, Patel AA, **Himmel NJ**, Cox DN, Cymbalyuk G. Modeling cellular noxious cold sensation in *Drosophila* sensory neurons. October 2017A*annual meeting of the Society for Neuroscience, Washington DC, USA*. Abstract online.

6. Kronk TA, **Himmel NJ**, Mehran NA[§], Blount MA. Lithium administration can attenuate the progression of polycystic kidney disease. *Conference abstract in The FASEB Journal*, 31(Suppl 1):1032.4, April 2017. doi: 10.1096/fasebj.31.1_supplement.1032.4

5. Patel AA, Moon D[§], **Himmel NJ**, Cox DN. Cellular and molecular dissection of noxious cold nociception in *Drosophila*. March 2017. *58th Annual Drosophila Research Conference, San Diego, CA, USA.* Abstract.

4. Patel AA, Turner HN, Armengol K, **Himmel NJ**, Galko MJ, Cox DN. Cellular and molecular dissection of noxious cold nociception in *Drosophila*. July 2016. *The Allied Genetics Conference, Orlando, FL, USA*. Abstract online.

3. **Himmel NJ**, Rodriguez DA[§], Wang Y[§], Sun MA[§], Blount MA. Chronic lithium treatment induces novel patterns of pendrin localization and expression in the kidney. *Conference abstract in The FASEB Journal*, 30(Suppl1):968.14, April 2016. doi: 10.1096/fasebj.30.1_supplement.968.14

2. **Himmel NJ**, Rogers RT**,** Redd SK, Blount MA. Purinergic signaling is enhanced in the absence of UT-A1 and UT-A3. October 2014. *Emory Department of Medicine Research Day, Atlanta, GA, USA.*

1. Rogers RT, **Himmel NJ,** Redd SK, Blount MA. Purinergic signaling is enhanced in the absence of UT-A1 and UT-A3. *Conference abstract in The FASEB Journal*, 38(Suppl 1): 969.17, April 2014. doi: 10.1096/fasebj.28.1_supplement.1137.10

Institutional oral presentations:

6. Chasing cryptic protein homologues through the twilight zone of molecular evolution. March 2023. *Center for Integrative Genomics Seminar*, *Lausanne, Switzerland.*

5. How The Fly Youth Chill: The protective role of cold nociception in *Drosophila* larvae. June 2021. *Neuroscience Institute Breakfast and Lecture Series, Atlanta, GA, USA.*

4. Insects and vertebrates are the odd ones out: unexpected findings in the evolution of TRP channels. September 2019. *Neuroscience Institute Breakfast and Lecture Series, Atlanta, GA, USA.*

3. Multimodality in *Drosophila melanogaster* sensory neurons. February 2018. *Neurogenomics Forum, Atlanta, GA, USA.*

2. Calcium-activated chloride channels play a role in the function of multimodal sensory neurons. August 2017. *Neuroscience Institute Breakfast and Lecture Series, Atlanta, GA, USA.*

1. Chronic lithium treatment induces renal β-intercalated cell expression in the inner medulla. October 2014. *Emory Transport Signaling Workers Union Seminar, Atlanta, GA, USA.*