

Nathaniel J. Himmel, PhD

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APPOINTMENTS and EDUCATION

—	Postdoctoral Fellow , University of Lausanne, Lausanne, Switzerland Human Frontier Science Program Long-Term Fellow Center for Integrative Genomics (PI: Richard Benton, PhD FRS)	2022 –
PhD	Neuroscience , Georgia State University, Atlanta, GA, USA Ruth L. Kirschstein NRSA Fellow; Honeycutt Fellow; Brains & Behavior Fellow Neuroscience Institute (PI: Daniel Cox, PhD)	2015 – 2021
—	Research Technician , Emory University, Atlanta, GA, USA Department of Medicine (PI: Mitsi Blount, PhD)	2013 – 2015
BS	Biology , University of Florida, Gainesville, FL, USA	2011 – 2013
AA	Biological Sciences , Santa Fe College, Gainesville, FL, USA	2011

PUBLICATIONS

* authors contributed equally; § co-corresponding authors; ¹ undergraduate mentee; ² graduate mentee

18. **Himmel NJ**[§], Moi D, and Benton R[§]. Remote homolog detection places insect chemoreceptors in a cryptic protein superfamily spanning the tree of life. *Current Biology*. 2023. [10.1016/j.cub.2023.10.008](https://doi.org/10.1016/j.cub.2023.10.008)
17. Benton R^{*§} and **Himmel NJ**^{*§}. Structural screens identify candidate human homologs of insect chemoreceptors and cryptic *Drosophila* gustatory receptor-like proteins. *eLife*. 2023. [10.7554/eLife.85537](https://doi.org/10.7554/eLife.85537)
16. **Himmel NJ**, Sakurai A, Letcher JM, Patel AA, Bhattacharjee S, Benson MN^{1,2}, Gray TR¹, Cymbalyuk GS, and Cox DN. Chloride-dependent mechanisms of multimodal sensory discrimination and nociceptive sensitization in *Drosophila*. *eLife*. 2023. [10.7554/eLife.76863](https://doi.org/10.7554/eLife.76863)
15. **Himmel NJ** and Benton R. Sweet sensors support stressed cell survival. *PLoS Biology*. 2022. [10.1371/journal.pbio.3001705](https://doi.org/10.1371/journal.pbio.3001705)
14. 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. [10.3389/fnmol.2022.942548](https://doi.org/10.3389/fnmol.2022.942548)
13. **Himmel NJ**^{*}, Sakurai A^{*}, Donaldson KJ^{*}, and Cox DN. Protocols for measuring cold-evoked neural activity and cold tolerance in *Drosophila* larvae following fictive cold acclimation. *STAR Protocols*. 2022. [10.1016/j.xpro.2022.101510](https://doi.org/10.1016/j.xpro.2022.101510)
12. **Himmel NJ**, Letcher JM, Sakurai A, Benson MN^{1,2}, Gray TR¹, Donaldson KJ, and Cox DN. Identification of a neural basis for cold acclimation in *Drosophila* larvae. *iScience*. 2021. [10.1016/j.isci.2021.102657](https://doi.org/10.1016/j.isci.2021.102657)

11. **Himmel NJ**, Rogers RT, Redd SK, Wang Y¹, and Blount MA. Purinergic signaling is enhanced in the absence of UT-A1 and UT-A3. *Physiological Reports*. 2021. [10.14814/phy2.14636](https://doi.org/10.14814/phy2.14636)
10. **Himmel NJ**[§], Gray TR¹, and Cox DN[§]. Phylogenetics identifies two eumetazoan TRPM clades and an eighth TRP family, TRP Soromelastatin (TRPS). *Molecular Biology and Evolution*. 2020. [10.1093/molbev/msaa065](https://doi.org/10.1093/molbev/msaa065)
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. [10.1098/rspb.2020.1309](https://doi.org/10.1098/rspb.2020.1309)
8. **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. [PMC8040840](https://pubmed.ncbi.nlm.nih.gov/38040840/)
7. **Himmel NJ**[§], Letcher JM, Sakurai A, Gray TR¹, Benson MN^{1,2}, and Cox DN[§]. *Drosophila* menthol sensitivity and the Precambrian origins of TRP-dependent chemosensation. *Philosophical Transactions of the Royal Society B*. 2019. [10.1098/rstb.2019.0369](https://doi.org/10.1098/rstb.2019.0369)
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. [10.1098/rstb.2019.0282](https://doi.org/10.1098/rstb.2019.0282)
5. **Himmel NJ**, Rodriguez DA¹, Wang Y¹, Sun MA¹, and Blount MA. Chronic lithium treatment induces novel patterns of pendrin localization and expression. *American Journal of Physiology – Renal Physiology*. 2018. [10.1152/ajprenal.00065.2018](https://doi.org/10.1152/ajprenal.00065.2018)
4. **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. [10.1093/acrefore/9780190264086.013.166](https://doi.org/10.1093/acrefore/9780190264086.013.166)
3. **Himmel NJ** and Cox DN. Sensing the Cold: TRP channels in thermal nociception. *Channels*. 2017. [10.1080/19336950.2017.1336401](https://doi.org/10.1080/19336950.2017.1336401)
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. [10.1016/j.cub.2016.09.038](https://doi.org/10.1016/j.cub.2016.09.038)
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. [10.1371/journal.pone.0101753](https://doi.org/10.1371/journal.pone.0101753)

FUNDING and AWARDS

Grants & Funding:

Human Frontier Science Program Long-Term Fellowship (LT-0003/2022-L) <i>International Human Frontier Science Program Organization</i> “Evolutionary, expression, and functional characterization of ancient putative chemosensors”	2022–2025
Ruth L. Kirschstein National Research Service Award (F31NS117087) <i>National Institute of Neurological Disease and Stroke</i> “Functional roles of chloride homeostasis and chloride ion channels in thermosensory nociception”	2020–2022

Kenneth W. and Georganne F. Honeycutt Fellowship <i>Georgia State University, Neuroscience Institute</i>	2017–2020
Brains & Behavior Fellowship <i>Georgia State University, Brains & Behavior Program</i> Honorary Fellow, 2020-2021	2017–2020

Other Awards:

Best Poster Prize , <i>University of Lausanne, Génopode Conference</i>	2024
Writing Across the Curriculum Pedagogy Award , <i>Georgia State University</i>	2021
Neuroscience Institute Outstanding Doctoral Scholar , <i>Georgia State University</i>	2020
Neuroscience Institute Outstanding Graduate Student Mentor , <i>Georgia State University</i>	2019
Meritorious Research Award , <i>American Physiological Society</i>	2016
Meritorious Research Award , <i>American Physiological Society</i>	2015

TEACHING EXPERIENCE

Course design/prep:

Course-Based Undergraduate Research Experience (PERS2002)
Co-designers: Daniel N. Cox & Jamin M. Letcher

Teaching assistantships:

Biostatistics (BSc2)	2023
Advanced Molecular, Cellular and Developmental Biology (BSc3)	2023 & 2024
Course-Based Undergraduate Research Experience (PERS2002)	2017
Neuroscience Laboratory (NEUR3010/4000)	2016 & 2018

Other teaching:

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

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

MENTORING, SERVICE, and OUTREACH

date	name	location	career stage	current affiliation
2024	Leana Keel	UNIL	Masters	Masters, UNIL/Cambridge
2018-2021	Maggie Benson	GSU	Undergrad/Masters	MD/PhD candidate, U Kansas
2017-2020	Thomas Gray	GSU	Undergrad	PhD candidate, Brandeis
2015	Matthew Borchart	Emory U	Undergrad	Physician, U Arizona
2014-2015	Michael Sun	Emory U	Undergrad	Project Manager, GVC
2014-2015	Daniel Rodriguez	Emory U	Undergrad	Equities Trader, Citadel Securities

2014-2015	Yirong Wang	Emory U	Undergrad	Scientific Designer, Promega
2014	John Ward	Emory U	Postbacc	Physician
2013-2015	Nikki A. Mehran	Emory U	Undergrad	Physician, Icahn SOM
2013-2015	Grace Swaim	Emory U	Undergrad	PhD candidate, Yale

Participation in organized research mentorship:

University of Lausanne, First-step Research Project	2024
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 & editorial experience:

Preprint Editorial Team Leader (Physio. & Neuro.), <i>Proceedings of the Royal Society B</i>	2019–2023
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Ad hoc peer review: *Science*; *The Biological Bulletin*; *Current Opinion in Insect Science*; *eLife*; *Frontiers in Ecology and Evolution*; *Genes, Brain and Behavior*; *Journal of Economic Entomology*; *Biochemical and Biophysical Research Communications*; *American Journal of Physiology- Regulatory, Integrative and Comparative Physiology*; and *Genome Biology and Evolution*

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

Invited seminars & symposia:

- University of Fribourg, Department of Biology. Invited seminar. Fribourg, Switzerland. 2024.
- Georgia State University, Neuroscience Institute. Invited seminar. Virtual. 2022.
- North Carolina State University, College of Veterinary Medicine, Fungal Systems Biology Laboratory. Invited seminar. Raleigh, NC, USA. 2021.
- Monthly Maggot Meeting. Invited seminar. Virtual. 2021.
- Theo Murphy International Scientific Meeting on the evolution of mechanisms and behaviour important for pain, hosted by The Royal Society. Invited participant. Chicheley, Buckinghamshire, UK. 2019
- NIDDK/KUH Researcher Panel, Summer Student Symposium. Invited panelist. Atlanta, GA, USA. 2015.

Conference talks:

- Himmel NJ**, Keel L, Fournes F, Collier J, and Benton R. Twilight zone homologs of insect Odorant receptors are evolutionarily constrained, sperm-expressed proteins conserved in humans, flies, and beyond. July 2024. *3rd Joint Congress on Evolutionary Biology, Montreal, QC, Canada*.

4. **Himmel NJ** and Benton R. Evolutionary, expression, and functional analyses of a cryptic Or/Gr homolog conserved in flies, humans, and beyond. June 2024. *19th International Symposium on Olfaction and Taste, Reykjavík, Iceland*.
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. *Symposium on the emergence of order across biological scales, Lausanne, Switzerland*.
2. **Himmel NJ**, Letcher JM, Sakurai A, Gray TR, Benson MN, Cox DN. Menthhol elicits *Trpm*- and *TrpA1*-dependent rolling in *Drosophila* larvae, suggesting Precambrian origins for TRP-dependent menthol sensing. October 2019. *Neurobiology of Drosophila, 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. *Experimental Biology, Boston, MA, USA*.

Posters (only first-authored) & published abstracts:

31. **Himmel NJ**, Keel L, Fournes F, Collier J, and Benton R. A testis-expressed homolog of insect Gustatory and Odorant receptors. September 2024. *Annual Génepode Retreat, Leysin, Switzerland*.
30. **Himmel NJ**, Keel L, Fournes F, Collier J, and Benton R. A testis-expressed homolog of insect Gustatory and Odorant receptors, July 2024. *Swiss Scientific Advisory Committee meeting, Lausanne, Switzerland*.
29. **Himmel NJ**, Keel L, Fournes F, Collier J, and Benton R. A testis-expressed homolog of insect Gustatory and Odorant receptors. June 2024. *Annual Swiss Drosophila Meeting, Lausanne, Switzerland*.
28. **Himmel NJ** and Benton R. Evolutionary, expression, and functional analyses of a cryptic Or/Gr homolog conserved in flies, humans, and beyond. in press, *Chemical Senses*, June 2024.
27. **Himmel NJ**, Moi D, and Benton R. The mysterious origins of insect Odorant receptors; a case study for remote homolog detection in the protein folding age. December 2023. *22nd Annual Human Frontier Science Program Awardees Meeting, Cape Town, South Africa*.
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. *BMC Neuroscience*, 20:56, July 2019. doi: [10.1186/s12868-019-0538-0](https://doi.org/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. *BMC Neuroscience*, 19(Suppl 2):64, July 2018. doi: [10.1186/s12868-018-0452-x](https://doi.org/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. *Annual 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. *Annual 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 2017 *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. *The FASEB Journal*, 31(Suppl 1):1032.4, April 2017. doi: [10.1096/fasebj.31.1_supplement.1032.4](https://doi.org/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. *The FASEB Journal*, 30(Suppl1):968.14, April 2016. doi: [10.1096/fasebj.30.1_supplement.968.14](https://doi.org/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. *The FASEB Journal*, 38(Suppl 1): 969.17, April 2014. doi: [10.1096/fasebj.28.1_supplement.1137.10](https://doi.org/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 Progress Report 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*.