Jared M Cregg, PhD

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Research Interests

As a systems neuroscientist, my research aims to understand the functional organization of brainstem motor circuits. Behavior, while complex, coalesces into specific motor instructions transmitted to the spinal cord. The brainstem acts as a critical bottleneck for this process, integrating higher-order circuit information for motor execution. I use mouse behavior, calcium imaging, electrophysiology, optogenetics, and cell-type- and projection-specific targeting to reveal brainstem motor infrastructure in sophisticated detail. My long-term goal is to exploit a functional, neuroanatomical, and molecular map of brainstem motor circuits toward interventions for movement disorders observed clinically.

Education

2018 **PhD, Neuroscience**
Case Western Reserve University
Cleveland, OH

2010 **BSE, Biomedical Engineering**
Michigan Technological University
Houghton, MI

Research Positions

2017 - **Postdoctoral Scholar**
Laboratory of Prof. Ole Kiehn
Department of Neuroscience, University of Copenhagen
Copenhagen, Denmark

2010 - 2017 **Graduate Student**
Laboratories of Drs. Jerry Silver & Lynn T Landmesser
Department of Neuroscience, Case Western Reserve University
Cleveland, OH

2009 - 2010 **Research Assistant**
Laboratory of Dr. John W McDonald, III
Department of Neurology, Johns Hopkins University
Baltimore, MD

2007 - 2009 **Research Assistant**
Laboratory of Asst. Prof. Ryan J Gilbert
Department of Biomedical Engineering, Michigan Technological University
Houghton, MI

Publications & Manuscripts

Postdoc

1. **Cregg JM**[†], Sidhu SK, Leiras R, Kiehn O[†]. (2024) Basal ganglia-spinal cord pathway that commands locomotor gait asymmetries in mice. *Nature Neuroscience*. [†]Co-corresponding authors. (pdf)
2. **Cregg JM**[†], Mirdamadi JL, Fortunato C, Okorokova EV, Kuper C, Nayeem R, Byun AJ, Avraham C, Buonocore A, Winner TS, Mildren RL. (2023) Highlights from the 31st Annual Meeting of the Society for the Neural Control of Movement. *Journal of Neurophysiology* 129:220-234. [†]Corresponding author. (pdf)

3. Leiras R*, **Cregg JM***, Kiehn O. (2022) Brainstem circuits for locomotion. *Annual Review of Neuroscience* 45:63-85. *Co-first authors. (pdf)
4. **Cregg JM**, Leiras R, Montalant A, Wanken P, Wickersham IR, Kiehn O. (2020) Brainstem neurons that command mammalian locomotor asymmetries. *Nature Neuroscience* 23:730-740. (pdf) [Cover Article]

Graduate

5. Vagnozzi AN, Garg K, Dewitz C, Moore MT, **Cregg JM**, Jeannotte L, Zampieri N, Landmesser LT, Philippidou P. (2020) Phrenic-specific transcriptional programs shape respiratory motor output. *eLife* 9:e52859. (pdf)
6. Lager AM, Corradin O, **Cregg JM**, Elitt MS, Shick E, Clayton BL, Allan KC, Olsen HE, Madhavan M, Tesar PJ. (2018) Rapid functional genetics of the oligodendrocyte lineage using pluripotent stem cells. *Nature Communications* 9:3708. (pdf)
7. **Cregg JM**, Chu KA, Dick TE, Landmesser LT†, Silver J†. (2017) Phasic inhibition as a mechanism for generation of rapid respiratory rhythms. *Proceedings of the National Academy of Sciences USA* 114:12815-12820. †Co-corresponding authors. (pdf)
8. **Cregg JM**, Chu KA, Hager LE, Maggard RS, Stoltz DR, Edmond M, Alilain WJ, Philippidou P, Landmesser LT, Silver J. (2017) A latent propriospinal network can restore diaphragm function after high cervical spinal cord injury. *Cell Reports* 21:654-665. (pdf)
9. Niemi JP, DeFrancesco-Lisowitz A, **Cregg JM**, Howarth M, Zigmond RE. (2015) Overexpression of the monocyte chemokine CCL2 in dorsal root ganglion neurons causes a conditioning-like increase in neurite outgrowth and does so via a STAT3 dependent mechanism. *Experimental Neurology* 275:25-37. (pdf)
10. Gardner RT, Wang L, Lang BT, **Cregg JM**, Dunbar CL, Woodward WR, Silver J, Ripplinger CM, Habecker BA. (2015) Targeting protein tyrosine phosphatase sigma after myocardial infarction restores cardiac sympathetic innervation and prevents arrhythmias. *Nature Communications* 6:6235. (pdf)
11. Lang BT, **Cregg JM**, DePaul MA, Tran AP, Xu K, Dyck SM, Madalena KM, Brown BP, Weng YL, Li S, Karimi-Abdolrezaee S, Busch SA, Shen Y, Silver J. (2015) Modulation of the proteoglycan receptor PTPσ promotes recovery after spinal cord injury. *Nature* 518:404-408. (pdf)
12. **Cregg JM**, DePaul MA, Filous AR, Lang BT, Tran A, Silver J. (2014) Functional regeneration beyond the glial scar. *Experimental Neurology* 253:197-207. (pdf)
13. Hilton BJ, Lang BT, **Cregg JM**. (2012) Keratan sulfate proteoglycans in plasticity and recovery after spinal cord injury. *Journal of Neuroscience* 32:4331-4333. (pdf)

Undergraduate

14. Hurtado A*, **Cregg JM***, Wang HB, Wendell DF, Oudega M, Gilbert RJ, McDonald JW. (2011) Robust CNS regeneration after complete spinal cord transection using aligned poly-L-lactic acid microfibers. *Biomaterials* 32:6068-6079. *Co-first authors. (pdf)
15. Wang HB, Mullins ME, **Cregg JM**, McCarthy CM, Gilbert RJ. (2010) Varying the diameter of aligned electrospun fibers alters neurite outgrowth and Schwann cell migration. *Acta Biomaterialia* 6:2970-2978. (pdf)
16. **Cregg JM**, Wiseman SL, Pietrzak-Goetze NM, Smith MR, Jaroch DB, Clupper DL, Gilbert RJ. (2010) A rapid, quantitative method for assessing axonal extension on biomaterial platforms. *Tissue Engineering Part C: Methods* 16:167-172. (pdf) [Cover Article]
17. Wang HB, Mullins ME, **Cregg JM**, Hurtado A, Oudega M, Trombley MT, Gilbert RJ. (2009) Creation of highly aligned electrospun poly-L-lactic acid fiber for nerve regeneration applications. *Journal of Neural Engineering* 6:016001. (pdf) [Cover Article]

Bibliometric Summary

Web of Science: >1800 citations, h-index 12 (link)
Google Scholar: >2700 citations, h-index 15 (link)

Funding

2021 - 2024 Postdoctoral Fellowship
Lundbeck Foundation
$380,000 USD

2018 - 2020 Long-Term Fellowship
European Molecular Biology Organization (EMBO)
$120,000 USD

2016 - 2017 Core Pilot Grant
CTSC Case Western Reserve University
$7,100

2010 - 2013 Graduate Research Fellowship
National Science Foundation (NSF)
$123,500 USD

Invited/Conference Talks

2024 European Molecular Biology Laboratory: DANEMO Symposium
Copenhagen, Denmark
2024 New Horizons in Neuroscience Symposium, California Institute of Technology
Pasadena, CA
2023 Neurology Grand Rounds, Department of Neurology, University of Wisconsin-Madison
Madison, WI
2023 Benzon Symposium: Bringing Circuit for Movement Together
Copenhagen, Denmark
2023 Department of Neuroscience, University of Minnesota
Minneapolis, MN
2023 Motor Control: Spinal Circuits and Beyond
St Andrews, Scotland
2023 XIV Meeting of the International Basal Ganglia Society
Stockholm, Sweden
2023 Department of Neuroscience, Karolinska Institutet
Stockholm, Sweden
2023 School of Psychology and Neuroscience, University of St Andrews
St Andrews, Scotland
2023 Department of Neurobiology and Behavior, Stony Brook University
Stony Brook, NY
2023 Department of Neuroscience, Yale University
New Haven, CT
2022 Department of Neuroscience, Case Western Reserve University
Cleveland, OH
2022 Annual Meeting of the Society for the Neural Control of Movement
Dublin, Ireland
2022 Basal Ganglia Gordon Research Seminar
Ventura, CA
2021 Brain States Meeting, Danish Society for Neuroscience
Copenhagen, Denmark
2020 Emerging Neuroscientists Seminar Series, Sainsbury Wellcome Center
London, UK
2020 International Online Spinal Cord Injury Research Seminars
Virtual seminar
2019 Workshop on Neuronal Circuits in Motor Behavior, Okinawa Institute of Science & Technology
Okinawa, Japan
2016 National Neurotrauma Society Annual Meeting
Lexington, KY
2015 Department of Pulmonary, Critical Care, and Sleep Medicine, Case Western Reserve University
Cleveland, OH

2010 Society for Biomaterials Annual Meeting
Seattle, WA
2008 Biomedical Engineering Society Annual Meeting
St. Louis, MO

Awards

2022 Scholarship Award, Society for the Neural Control of Movement

2021 Trainee Professional Development Award, Society for Neuroscience

2018 Best Poster Award, The Brain Prize Meeting, Middlefart, Denmark

2018 Doctoral Excellence Award in Neurosciences, Case Western Reserve University

2015 Travel Award, International Symposium on Neural Regeneration

2008 Summer Undergraduate Research Fellowship, NASA / Michigan Space Grant Consortium

2008 Summer Undergraduate Research Fellowship, Michigan Technological University

2008 Barry M. Goldwater Scholarship

2008 Grand Prize Winner, Graduate Research Forum Poster Competition, Michigan Technological University

Mentoring

2020 - 2023 Simrandeep K Sidhu
Advisor: MS Thesis in Neuroscience, University of Copenhagen
Current PhD student in Neuroscience Academy Denmark

2018 - 2020 Paulina Wanken
Advisor: MS Thesis in Human Biology, University of Copenhagen
Current PhD student at Max Planck Institute

2015 - 2017 Kevin A Chu
Advisor: BS Thesis in Biology, Case Western Reserve University
Medical Graduate of NYIT College of Osteopathic Medicine

Teaching

2024 PhD Course: Translational Neuroscience
Lecture: 'Animal Models of Locomotor Control in Health and Disease'
Neuroscience Academy Denmark

2023 - 2024 PhD Course: Open Neurophysiology – Analysis Tools & Datasets (link)
Lecture: 'Tracking Locomotion using DeepLabCut'
Practicum: 'Kinematic Analysis using OpenAI'
Faculty of Health and Medical Sciences, University of Copenhagen

2022 PhD Course: Animal Models of Disease and Behavior
Lecture: 'In Vivo Calcium Recording' (slides)
Department of Neuroscience, University of Copenhagen

2021 Workshop on Animal Models
Lecture: 'Measuring Mouse Behavior: Dissection of Circuits for Motor Control'
Graduate Program in In Vivo Pharmacology, University of Copenhagen

2018 - 2022 MS Course: Neuronal Signaling/Neuroscience
Lecture: 'In Vivo Optogenetics & Chemogenetics' (slides)
Department of Neuroscience, University of Copenhagen

2017 PHOL519: Cardiorespiratory Physiology
Cardiovascular Control in Disease: Cardiac Arrhythmia (syllabus) (slides)
Department of Physiology & Biophysics, Case Western Reserve University

2017 PHOL466: Cell Signaling
Neurotransmitter-Gated Ion Channels (syllabus)
Department of Physiology & Biophysics, Case Western Reserve University

Patents

1. Hurtado A, Gilbert RJ, Wang HB, **Cregg JM**, Mullins ME, Oudega M. Three-dimensional scaffolds, methods for fabricating the same, and methods of treating a peripheral nerve or spinal cord injury. US Patent 10,413,391.
2. Silver J, Lang BT, **Cregg JM**, Weng YL, Li H, Wu W. Compositions and methods of treating root avulsion injury. US Patent 10,258,672.
3. Lang BT, **Cregg JM**, Weng YL, Silver J. Compositions and methods for inhibiting the activity of lar family phosphatases. US Patent 9,937,242.
    - Licensed to NervGen Pharma as NVG-291 (link)
    - Completed Phase Ia safety study (NCT05308953) (link)
    - Enrolling Phase Ib/IIa (NCT05965700) (link)

Conference Abstracts

2022 Cregg JM, Sidhu SK, Leiras R, Kiehn O. Basal ganglia-spinal cord pathway that commands locomotor gait asymmetries. Society for Neuroscience Annual Meeting
San Diego, CA

2022 Cregg JM, Sidhu SK, Leiras R, Kiehn O. Basal ganglia-spinal cord pathway that commands locomotor asymmetries. Federation of European Neuroscience Societies Forum
Paris, France

2022 Cregg JM, Leiras R, Kiehn O. Basal ganglia-spinal cord pathway that commands locomotor asymmetries. Basal Ganglia Gordon Research Conference
Ventura, CA

2021 Cregg JM, Leiras R, Kiehn O. Basal ganglia-spinal cord pathway that mediates locomotor asymmetries. Society for Neuroscience Annual Meeting
Virtual meeting

2019 Cregg JM, Leiras R, Kiehn O. Brainstem command neurons that specify locomotor direction. Society for Neuroscience Annual Meeting
Chicago, IL

2018 Cregg JM, Leiras R, Kiehn O. Spinal projection neurons that control direction orientation during mammalian locomotion. The Brain Prize Meeting
Middelfart, Denmark

2016 Cregg JM, Chu K, Dick T, Landmesser LT, Silver J. Optogenetic dissection reveals principles underlying respiratory frequency control. Society for Neuroscience Annual Meeting
San Diego, CA

2016 Cregg JM, Chu K, Dick T, Landmesser LT, Silver J. Optogenetic dissection reveals principles underlying respiratory frequency control. Cell Symposium: Big Questions in Neuroscience
San Diego, CA

2015 Cregg JM, Landmesser LT, Silver J. Control of diaphragm activity in the absence of supraspinal input: the contribution of interneurons. International Symposium on Neural Regeneration
Pacific Grove, CA

2015 Cregg JM, Landmesser LT, Silver J. Control of diaphragm activity in the absence of supraspinal input: the contribution of interneurons. Society for Neuroscience Annual Meeting
Chicago, IL

2009 Cregg JM, Wang HB, Gilbert RJ. The role of fiber density in axon motility on aligned topography. Biomedical Engineering Society Annual Meeting
Pittsburgh, PA

2009 Cregg JM, Wang HB, Gilbert RJ. The role of aligned fiber density in axon motility. Midwest Biomedical Engineering Conference
Ann Arbor, MI

2008 Cregg JM, Wang HB, Mullins ME, Gilbert RJ. Development of polymeric nerve guidance conduits that contain anisotropic cues including aligned microfibers and gradients of adsorbed laminin-1. Design of Medical Devices Conference
Minneapolis, MN

2007 Cregg JM, Wang HB, Trombley MT, Gilbert RJ. Anisotropic micro-fibrous scaffolds for nerve regeneration applications. Biomedical Engineering Society Annual Meeting
Los Angeles, CA

Short Courses/Workshops (Attendee)

2022 EMBO Course on Laboratory Leadership
Virtual course

2020 EMBO Course on Negotiation for Scientists
Heidelberg, Germany

2016 Brain Function: Development, Aging and Disease
Lexington, KY

2010 Practical Training Course in Confocal Microscopy and Stereology
Chicago, IL

2009 Tissue Engineering of the Nervous System
Pittsburgh, PA

2008 Peripheral Nerve Regeneration, Georgia Institute of Technology
Atlanta, GA

Service

Leadership and Committees

Nominations Committee – Student Invited Speaker, Department of Neuroscience, Case Western Reserve University (2015)
President – Michigan Technological University Chapter of the Biomedical Engineering Society (2008 - 2009)
President – Research Scholars Program, Michigan Technological University (2008 - 2009)
Social Committee Chairperson – Honors Institute, Michigan Technological University (2007 - 2008)

Peer Review

Reviewer for *Nature*, *Science*, *Experimental Neurology*, *Scientific Reports*
Co-reviewer for *Cell*, *Nature Neuroscience*, *Neuron*, *Nature Communications*, *Frontiers in Neuroscience*

Society Membership

Society for Neuroscience (2015 - present)
American Association for the Advancement of Science (2010 - present)
