# Sabhya Rana, Ph.D.

Assistant Professor
Department of Neuroscience
Belford Center for Spinal Cord Injury
Ohio State University

**Email**: sabhya.rana@osumc.edu | **Phone**: (949) 338-4655 | **Research Profile:** ResearchGate , Google Scholar

## RESEARCH INTERESTS

My research group investigates the neural control of breathing in disease and injury states. We study how glutamatergic neurotransmission regulates motor neuron activity within respiratory motor circuits. We are also examining how pharmacological agents and non-invasive neuromodulatory interventions can be used as therapeutic strategies in preclinical models of spinal cord injury. Our lab uses approaches including neuromodulation, microsurgery, electrophysiology, behavioral tests, retrograde viral tracing, anatomical and histopathological analysis, advanced imaging techniques, molecular and cellular assays, and advanced EMG signal analysis to develop and test hypotheses.

## EDUCATION

**Doctor of Philosophy, Biomedical Science**
**Track**: Neuroscience
Mayo Clinic Graduate School of Biomedical Sciences, 7/2014 – 1/2019

**Bachelor of Science in Biological Sciences**
University of California, Irvine, 9/2008 – 9/2011

## POSITIONS

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|---|---|
| **Assistant Professor**<br>(tenure track)<br>8/2025 – Present | **Department of Neuroscience**<br>The Ohio State University<br>Neural control of breathing in disease and injury, with an emphasis on neuromodulation and neuropharmacology to strengthen respiratory motor function. |
| **Principal Investigator**<br>08/2025 – Present | **Belford Center for Spinal Cord Injury Research**<br>Ohio State University Wexner Medical Center |
| **Research Assistant Scientist**<br>8/2024 – 7/2025 | **Department of Physical Therapy**<br>University of Florida |
| **Postdoctoral Research Associate**<br>12/2019 – 7/2024 | **Fuller Lab \| Breathing Research and Therapeutics Center \|**<br>University of Florida<br>Mentor: Dr. David D. Fuller |
| **Postdoctoral Research** Fellow<br>1/2019 – 11/2019 | **Cell and Regenerative Physiology Laboratory** \| Department of Physiology and Biomedical Engineering \| Mayo Clinic<br>Mentors: Dr. Gary C. Sieck and Dr. Carlos B. Mantilla |
| **Doctoral Student**<br>7/2014 – 1/2019 | **Regenerative Physiology Laboratory** \| Department of Physiology and Biomedical Engineering \| Mayo Clinic<br>**Thesis**: Neuroplasticity of Respiratory Motor Control Following Spinal Cord Injury<br>Co-Mentors: Dr. Carlos B. Mantilla and Dr. Gary C. Sieck |
| **Junior Specialist** | **Department of Anesthesiology and Perioperative Care** \| University |

9/2013 - 6/2014 of California, Irvine
Mentor: Dr. Leif Havton

**Lab Assistant II** **Reeve Irvine Research Center** | University of California, Irvine
9/2011 – 9/2013 Mentor: Dr. Oswald Steward

**Lab Assistant IV** **Reeve Irvine Research Center** | University of California, Irvine
8/2010 – 9/2011 Mentors: Dr. Hans Keirstead and Dr. Magdalene Seiler

## RESEARCH GRANTS AND SCHOLARSHIPS

4/2024 – 4/2029
**Career transition award (K99/R00), National Institutes of Health National Institute of Neurological Disease and Stroke**
Title: Spinal Direct Current Stimulation to Enhance Breathing Following Cervical Spinal Cord Injury
Role: Principal Investigator

7/2023 – 4/2024
**Parker B Francis Foundation Fellowship (About)**
Title: Trans-spinal Direct Current Stimulation and Ampakine Therapy to Enhance Breathing
Role: Principal Investigator
$225k for 3 yrs (salary, fringe, travel)
**Relinquished in 2024 to accept K99*

7/2021 – 7/2023
**Spinal Cord Injury Research on the Translational Spectrum Postdoctoral Fellowship: Craig H. Neilsen Foundation (About)**
Title: Ampakine mediated respiratory recovery following cervical spinal cord injury
Role: Principal Investigator
$150,000 for 2 yrs (salary, fringe, travel, science materials)

7/2014 – 1/2019
**Mayo Clinic Graduate School of Biomedical Sciences Fellowship**
100% Support for tuition and stipend for 5 yrs

7/2014 – 7/2016
**Dean's Fellowship - Mayo Clinic Graduate School of Biomedical Sciences**
$6,000 for 2 yrs

## PENDING REVIEW RESEARCH GRANTS

7/2026 – 7/2028
**Translational Spectrum Grants: Craig H. Neilsen Foundation (About)**
Title: A dual TrkB-targeted pharmacologic and neuro-stimulation strategy for respiratory recovery after SCI
Role: Principal Investigator
$400,000 for 2 years
**Recommended for funding, pending board of trustees approval*

12/2026 – 11/2031
**R01: National Institutes of Health**
Title: Mechanisms underlying postoperative cognitive dysfunction in aging
Role: Co-I (5% effort year 4 and 5)
Anticipated Proposal Amount: $3,452,642
*Submitted March 2026, pending study section review*

## FACULTY MENTORING STATUS

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|---|---|
| 02/2026 – Present | **Molecular, Cellular and Developmental Biology Program**<br>The Ohio State University<br>Status: P |
| 01/2026 – Present | **Biomedical Sciences Graduate Program**<br>The Ohio State University<br>Status: P |
| 09/2025 – Present | **Neuroscience Graduate Program**<br>The Ohio State University<br>Status: P |

## INSTITUTE MEMBERSHIPS

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|---|---|
| 12/2025 – Present | **Gene Therapy Institute – Ohio State University**<br>Faculty |
| 10/2025 – Present | **Institute of Brain, Behavior, and Immunology – Ohio State University**<br>Faculty |
| 08/2025 – Present | **Chronic Brain Injury Program – Ohio State University**<br>Faculty Affiliate |

## PUBLICATIONS

1. **Rana S*,** Martinez R*, Sieck GC, Mantilla CB. Motor Neuron Size-Dependent Differences in mRNA Expression of Tropomyosin-Related Kinase Receptor B in Adult Rats. J Neurochem. *Accepted for publication Jan 2026. *Authors contributed equally*

2. Mickle AR, **Rana S**, Benevides ES, Byrne BJ, Fuller DD, Dale EA. A respiratory signature of disease progression in the Pompe rat. J Neurophysiol. 2025 Dec 5;. doi: 10.1152/jn.00305.2025. [Epub ahead of print] PubMed PMID: 41348648.

3. Fusco AF, **Rana S**, Macintyre MM, Gonzalez IA, Ribas RA, Sun RC, Fuller DD. Acute Administration of Ampakine CX1739 after Cervical Spinal Cord Injury. J Neurotrauma. 2025 Oct 6;. doi: 10.1177/08977151251382939. [Epub ahead of print] PubMed PMID: 41051937.

4. Fusco AF, **Rana S,** Rayaprolu S, MacIntyre MM, Jorgensen M, Shaw G, Fuller DD. Serum evaluation of NFL correlates with histological identification of degenerating axons. Exp Neurol. 2025 Oct;392:115360. doi: 10.1016/j.expneurol.2025.115360. Epub 2025 Jun 23. PubMed PMID: 40562346.

5. Benevides ES, **Rana S,** Fuller DD. Chemogenetic activation of the diaphragm after spinal cord injury in rats. Respir Physiol Neurobiol. 2025 Aug-Sep;336:104421. doi: 10.1016/j.resp.2025.104421. Epub 2025 Mar 26. PubMed PMID: 40154905.

6. Fuller DD, **Rana S,** Thakre PP, Benevides ES, Pope MK, Todd AG, Jensen VN, Vaught L, Cloutier DA, Ribas RA, Larson RC, Gentry MS, Sun RC, Chandran V, Corti M, Falk DJ, Byrne BJ. Neonatal systemic gene therapy restores cardiorespiratory function in a rat model of Pompe disease. Mol Ther. 2025 Jun 14;. doi: 10.1016/j.ymthe.2025.06.022. [Epub ahead of print] PubMed PMID: 40518673.

7. Benevides ES, Thakre PP, **Rana S,** Sunshine MD, Jensen VN, Oweiss K, Fuller DD. Chemogenetic stimulation of phrenic motor output and diaphragm activity. Elife. 2025 Jun 2;13. doi: 10.7554/eLife.97846. PubMed PMID: 40454577; PubMed Central PMCID: PMC12129449.

8. Radin DP, Lippa A, **Rana S**, Fuller DD, Smith JL, Cerne R, Witkin JM. Amplification of the Therapeutic Potential of AMPAkines from the Nootropic Era to Today. Pharmacol Biochem Behav. 2025 Jan 31:173967. doi: 10.1016/j.pbb.2025.173967. Epub ahead of print. PMID: 39894310.

9. Kondiles BR, **Rana, S.,** Weiner, D, Blesch A, St. John J, Haag-Molkenteller C, Freund P, Guest J, Mikol D, Harkema S, Trumbower R, Fehlings M, Weidner N, Hogge GS, Field-Fote E, Hsieh J*, Jones L*. Lessons Learned and Recommendations from the SCOPE 2023 Spinal Cord Injury Clinical Trials Update. *Accepted at Neurotrauma Reports on 12/27/24*

10. Fusco A, **Rana S**, Jorgenson M, Bindi V, Sunshine MD, Shaw G, Fuller DD. Immunohistochemical labeling of ongoing axonal degeneration 10 days following cervical contusion spinal cord injury in the rat. Spinal Cord (2025). https://doi.org/10.1038/s41393-024-01053-x

11. **Rana S*,** Fusco AF, Witkin JM, Radin DP, Cerne R, Lippa A, Fuller DD. Pharmacological modulation of respiratory control: Ampakines as a therapeutic strategy. Pharmacol Ther. 2025 Jan;265:108744. doi: 10.1016/j.pharmthera.2024.108744. PMID: 39521442; PMCID: PMC11849399. ***corresponding author*

12. Witkin JM, Radin DP, **Rana S**, Fuller DD, Fusco AF, Demers JC, Pradeep Thakre P, Smith JL, Lippa A, Cerne R. AMPA receptors play an important role in the biological consequences of spinal cord injury: Implications for AMPA receptor modulators for therapeutic benefit. Biochem Pharmacol. 2024 May 17:116302. doi: 10.1016/j.bcp.2024.116302. PMID: 38763261.

13. **Rana *S***, Thakre PP, Fuller DD. Ampakines increase diaphragm activation following mid-cervical contusion injury in rats. Exp Neurol. 2024 Apr 4;376:114769. doi: 10.1016/j.expneurol.2024.114769. PMID: 38582278.

14. **Rana S***, Alom F*, Martinez RC, Fuller DD, Mickle AD. Acute ampakines increase voiding function and coordination in a rat model of SCI. Elife. 2024 Mar 7;12:RP89767. doi: 10.7554/eLife.89767. PMID: 38451184. **Authors contributed equally*

15. Fogarty MJ, **Rana S**, Mantilla CB, Sieck GC. Size-dependent differences in mitochondrial volume density in phrenic motor neurons. J Appl Physiol (1985). 2023 Jun 1;134(6):1332-1340. doi: 10.1152/japplphysiol.00021.2023. Epub 2023 Apr 6. PMID: 37022966; PMCID: PMC10190832.

16. Shaw G, Madorsky I, Li Y, Wang Y, Jorgensen M, **Rana S**, Fuller DD. Uman-type neurofilament light antibodies are effective reagents for the imaging of neurodegeneration. Brain Commun. 2023 Mar 16;5(2):fcad067. doi: 10.1093/braincomms/fcad067. PMID: 37091583; PMCID: PMC10120172.

17. Thakre PP, **Rana S**, Benevides ES, Fuller DD. Targeted drug or gene delivery to the phrenic motoneuron pool. J Neurophysiol. 2022 Nov 23;. doi: 10.1152/jn.00432.2022. Review. PubMed PMID: 36416447.

18. Singer M, Benevides E, **Rana S**, Martinez R, Barral B, Byrne BJ, Fuller DD. Optogenetic activation of the tongue in spontaneously breathing mice. Respir Physiol Neurobiol. 2022 Nov 21; 103998. doi: 10.1016/j.resp.2022.103998. [Epub ahead of print] PubMed PMID: 36423822.

19. **Rana S,** Sunshine MD, Gaire J, Simmons CS, Fuller DD. Breathing patterns and $CO_2$ production in adult spiny mice (Acomys cahirinus). Respir Physiol Neurobiol. 2023 Jan;307:103975. doi: 10.1016/j.resp.2022.103975. Epub 2022 Oct 4. PubMed PMID: 36206972.

20. Fuller DD, **Rana S**, Smuder AJ, Dale EA. The phrenic neuromuscular system. Handb Clin Neurol. 2022;188:393-408. doi: 10.1016/B978-0-323-91534-2.00012-6. PMID: 35965035.

21. Singer ML, **Rana S**, Benevides ES, Barral BE, Byrne BJ, Fuller DD. Chemogenetic activation of hypoglossal motoneurons in a mouse model of Pompe disease. J Neurophysiol. 2022 Aug 17. doi: 10.1152/jn.00026.2022. PMID: 35976060.

22. Benevides ES, Sunshine MD, **Rana S**, Fuller DD. Optogenetic activation of the diaphragm. Sci Rep. 2022 Apr 20;12(1):6503. doi: 10.1038/s41598-022-10240-w. PMID: 35444167; PMCID: PMC9021282.

23. **Rana S**, Zhan WZ, Sieck GC, Mantilla CB. Cervical spinal hemisection alters phrenic motor neuron glutamatergic mRNA receptor expression. Exp Neurol. 2022 Jul;353:114030. doi: 10.1016/j.expneurol.2022.114030. Epub 2022 Mar 2. PMID: 35247372; PMCID: PMC9090312.

24. **Rana S**, Sunshine MD, Greer JJ, Fuller DD. Ampakines Stimulate Diaphragm Activity after Spinal Cord Injury. J Neurotrauma. 2021 Dec;38(24):3467-3482. doi: 10.1089/neu.2021.0301. PMID: 34806433; PMCID: PMC8713281.

25. Fuller DD, Trejo-Lopez JA, Yachnis AT, Sunshine MD, **Rana S,** Bindi VE, Byrne BJ, Smith BK. Case Studies in Neuroscience: Neuropathology and diaphragm dysfunction in ventilatory failure from late-onset Pompe disease. J Neurophysiol. 2021 Aug 1;126(2):351-360. doi: 10.1152/jn.00190.2021. Epub 2021 Jun 30. PubMed PMID: 34191636; PubMed Central PMCID: PMC8409957.

26. Doyle BM, Singer ML, Fleury-Curado T, **Rana S,** Benevides ES, Byrne BJ, Polotsky VY, Fuller DD. Gene delivery to the hypoglossal motor system: preclinical studies and translational potential. Gene Ther. 2021 Aug;28(7-8):402-412. doi: 10.1038/s41434-021-00225-1. Epub 2021 Feb 11. Review. PubMed PMID: 33574581; PubMed Central PMCID: PMC8355248.

27. **Rana S***, Fogarty MJ*, Mantilla CB, Sieck GC. Quantifying mitochondrial volume density in phrenic motor neurons. J Neurosci Methods. 2021 Apr 1;353:109093. doi: 10.1016/j.jneumeth.2021.109093. Epub 2021 Feb 4. PubMed PMID: 33549636; PubMed Central PMCID: PMC7990712. **Authors contributed equally*

28. Gaire J, Varholick JA, **Rana S**, Sunshine MD, Doré S, Barbazuk WB, Fuller DD, Maden M, Simmons CS. Spiny mouse (Acomys): an emerging research organism for regenerative medicine with applications beyond the skin. NPJ Regen Med. 2021 Jan 4;6(1):1. doi: 10.1038/s41536-020-00111-1. PMID: 33397999; PMCID: PMC7782534.

29. Pareja-Cajiao M, Gransee HM, Stowe JM, **Rana S,** Sieck GC, Mantilla CB. Age-related impairment of autophagy in cervical motor neurons. Exp Gerontol. 2021 Feb;144:111193. doi: 10.1016/j.exger.2020.111193. Epub 2020 Dec 5. PubMed PMID: 33290859; PubMed Central PMCID: PMC7968728.

30. **Rana S,** Zhan WZ, Mantilla CB, Sieck GC. Disproportionate loss of excitatory inputs to smaller phrenic motor neurons following cervical spinal hemisection. J Physiol. 2020 Oct;598(20):4693-4711. doi: 10.1113/JP280130. Epub 2020 Aug 19. PubMed PMID: 32735344; PubMed Central PMCID: PMC7869015.

** Featured as Journal Cover: Volume 598, Issue 20, 15 October 2020*
*** Highlighted in a perspective article by Bolser. DOI: 10.1113/JP280588.*
**** Selected as editor's choice article for issue*

31. **Rana S,** Sieck GC, Mantilla CB. Heterogeneous glutamatergic receptor mRNA expression across phrenic motor neurons in rats. J Neurochem. 2020 Jun;153(5):586-598. doi: 10.1111/jnc.14881. Epub 2019 Oct 17. PubMed PMID: 31563147; PubMed Central PMCID: PMC7101263.

** Featured as Journal Issue Cover (June 2020). J. Neurochem., 153:. doi:10.1111/jnc.14747*

32. **Rana S,** Mantilla CB, Sieck GC. Glutamatergic input varies with phrenic motor neuron size. J Neurophysiol. 2019 Oct 1;122(4):1518-1529. doi: 10.1152/jn.00430.2019. Epub 2019 Aug 7. PubMed PMID: 31389739; PubMed Central PMCID: PMC6843086.

33. Khurram OU, Fogarty MJ, **Rana S,** Vang P, Sieck GC, Mantilla CB. Diaphragm muscle function following midcervical contusion injury in rats. J Appl Physiol (1985). 2019 Jan 1;126(1):221-230. doi: 10.1152/japplphysiol.00481.2018. Epub 2018 Sep 20. PubMed PMID: 30236045; PubMed Central PMCID: PMC6383644.

34. **Rana S,** Sieck GC, Mantilla CB. Diaphragm electromyographic activity following unilateral midcervical contusion injury in rats. J Neurophysiol. 2017 Feb 1;117(2):545-555. doi: 10.1152/jn.00727.2016. Epub 2016 Nov 9. PubMed PMID: 27832610; PubMed Central PMCID: PMC5288488.

35. **Rana S**, Gonzalez Porras MA, Mantilla CB, Sieck GC. The Burden of Proof of Nanotechnology. J Neuroscience. EPub Apr 17, 2016; *Letter to the Editor*

*A full list of publications can be found at:*
*https://www.ncbi.nlm.nih.gov/myncbi/sabhya.rana.1/bibliography/public/*

## PUBLICATIONS UNDER REVIEW

1. Thakre PT, **Rana S**, Mitchell GS, Fuller DD. Pairing ampakine with brief hypoxia evokes phrenic neuroplasticity via a spinal NMDA receptor mediated mechanisms. *Under review at Function. *minor revision being addressed at the moment*

## INVITED PRESENTATIONS

National:

1. American Physiological Society Summit. Session: Animal Models in Respiratory Science: Past, Present and Future. *Modeling to medicine: Leveraging preclinical animal models to advance respiratory recovery after spinal cord injury.* Minneapolis, MN. 25th April, 2026

2. National Neurotrauma Society Meeting. Session: Spinal Cord Injury Beyond Locomotor and Sensory Dysfunction: The Whole Body Problem. *Non-invasive spinal stimulation improves respiratory function following SCI.* Philadelphia, PA. 17th June, 2025.

3. American Physiological Society Summit. Session: Hot Topics in Respiratory Control. *Powering Up the Breath: A Non-invasive Approach to Mitigate Respiratory Insufficiency Following Spinal Cord Injury*. Baltimore, MD. 24th April, 2025.

4. George Washington University, Department of Pharmacology and Physiology*. Re-learning to breathe: Therapeutic strategies to alleviate respiratory depression following spinal cord injury.* Washington DC.19th Sept, 2024.
5. International Symposium on Neural Regeneration. Stevenson, WA. *Ampakine therapy improves respiratory muscle activation following cervical spinal cord injury*, 26th April, 2023.
6. Therapeutic Intermittent Hypoxia Virtual Workshop. *Ampakines Amplify Phrenic LTF.* Jan 7th 2022.
7. Unite 2 Fight Paralysis 2021 Symposium. *Facilitating Meaningful Connections between SCI Researchers and the Community.* Oct 21st 2021. Hosted online due to COVID-19.
8. Motor Unit Group Seminar Series (MUGSS). Online. *Ampakines Enhance Diaphragm Motor Unit Activity and Ventilation in Awake Rats following Cervical Spinal Cord Injury*. Feb 22nd, 2021.
9. 2020 ACD Neuro Summit. *Motor Neuron Size Dependent Mechanisms of Neuroplasticity Following Spinal Cord Injury*. Nov 20, 2020. https://acdbio.com/2020-nov-12-acd-neuro-summit
10. Nature Webcast. *Motor Neuron Size Dependent Mechanisms of Neuroplasticity Following Spinal Cord Injury*. May 14, 2019. https://www.nature.com/webcasts/event/motor-neuron-size-dependent-mechanisms-of-neuroplasticity-following-spinal-cord-injury/
11. Experimental Biology Meeting, Orlando, FL. Hot Topics in Respiratory Control. *Cervical Spinal Hemisection Induced Changes in Glutamatergic Receptor Expression that Depend on Phrenic Motor Neuron Size*. Organizer: Peter MacFarlane. Apr 6, 2019.

Local:

1. Pulmonary Research Conference. The Ohio State University. Columbus, OH. *Powering up the breath: Therapeutic strategies to improve respiratory function following cervical spinal cord injuries.* 17th March, 2026.

2. Chronic Brain Injury Program. The Ohio State University. Columbus, OH. *Powering up the breath: Therapeutic strategies to improve respiratory function following cervical spinal cord injuries.* 13th February, 2026.

3. DHLRI Research in Progress Seminar. The Ohio State University. Columbus, OH. *Powering up the breath: Therapeutic strategies to improve respiratory function following cervical spinal cord injuries.* 6th February, 2026.

4. SCI-SHARP Science Seminar. *Transcutaneous spinal cord stimulation to enhance hand function following SCI.* Hosted online. 30th July, 2024.

5. Neuroplasticity NeuroNines Seminar. Gainesville, FL. *Pharmacological Restoration of Motor Function after Spinal Cord Injury,* 8th June, 2023.

6. Brains and Brews Seminar. University of California, Irvine. *Drug Therapies to Restore Breathing after Spinal Cord Injury*. 4th Oct, 2021

7. Neuromedicine Seminar. Gainesville, FL. *Re-learning to Breathe after a Spinal Cord Injury.* Jun 28th, 2021.

8. Neuroplasticity NeuroNines Seminar. *Ampakine therapy to restore breathing after cervical spinal cord injury*. Jun 3rd, 2021. Hosted online due to COVID-19.

9. Department of Physiology and Biomedical Engineering Seminar. Rochester MN. *Mechanisms of Neuroplasticity Following Spinal Cord Injury in the Respiratory System*. June 21, 2019.

## SESSIONS

1. **Co-Host:** APS Physiolo-GIST Competition, APS Summit, Baltimore, MD 25th April 2025

2. **Session Moderator:** Intermittent Hypoxia Workshop 2024, Basic Science Session; Shirley Ryan Ability Lab, 5th October 2024, Chicago, IL

3. **Co-Host:** Spinal Cord Outcomes Partnership Endeavors (SCOPE) clinical trials update (CTU) pre-course at the 2023 International Spinal Research Trust Meeting, 14th September 2023, London, UK

4. **Co-Chair:** DEIJA workshop: Promoting Diversity in SCI Research; 25th April, 2023, Stevenson, WA

5. **Chair:** APS Workshop: How to Develop Your Research Program and Lead Your Lab Team to Success!; 23rd April, 2023. Long Beach, CA

## MEETING ABSTRACTS (SELECT)

1. **Rana S**, Benevides E, Maldonado G, Fuller DD. Non-invasive transcutaneous spinal direct current stimulation enhances diaphragm activation during acute hypoxia in rats with high-cervical spinal cord injury (SCI). APS Physiology Summit. 24-27th April 2025, Baltimore MD.

2. **Rana S**, Pope M, Sun R, Gentry M, Corti M, Byrne B, Fuller DD. Comparing two adeno-associated virus (AAV) strategies for preventing respiratory decline in Pompe disease. APS Physiology Summit. 24-27th April 2025, Baltimore MD. APS Physiology Summit. 24-27th April 2025, Baltimore MD.

3. **Rana S**, Benevides EB, Gonzalez I, Martin JH, Fuller DD. Non-invasive transcutaneous spinal direct current stimulation enhances diaphragm activity following high-cervical spinal cord injury. Society for Neuroscience Meeting; 2024 Oct 4-9, Chicago, IL.

4. **Rana S**, Fuller DD. Ampakine therapy improves respiratory muscle activation following cervical spinal cord injury. International Spinal Research Trust Meeting; 2023 Sept 14-16, London, UK.

5. **Rana S**, Pope MK, Corti M, Byrne BJ, Fuller DD. Neonatal AAV gene therapy prevents ventilatory decline in a rat model of Pompe disease. Congenital Central Hypoventilation Syndrome Annual Network Meeting, 2023 Sept 6-9, Orlando, FL.

6. **Rana S**, Fuller DD. Ampakine therapy improves respiratory muscle activation following cervical spinal cord injury. International Symposium on Neural Regeneration; 2023 Apr 23-27, Stevenson, WA.
7. **Rana S**, Byrne BJ, Fuller DD. Low-dose ampakine CX717 increases ventilation in a rat model of Pompe Disease. Physiology Meeting; 2023 Apr 19-23, Long Beach, CA. https://journals.physiology.org/doi/abs/10.1152/physiol.2023.38.S1.5732994
8. **Rana S**, Fuller DD. Daily low-dose ampakine treatment causes a sustained increase in diaphragm activation following chronic cervical spinal cord injury. Physiology Meeting; 2023 Apr 19-23, Long Beach, CA. https://journals.physiology.org/doi/abs/10.1152/physiol.2023.38.S1.5732568
9. Shaw G, Madorsky I, Li Y, Wang YS, **Rana S,** Fuller DD. Novel, interesting, surprising and useful properties of a panel of NF-L monoclonal antibodies. International Neurotrauma Symposium; 17–20 July 2022 • Berlin, Germany
10. **Rana S,** Thakre PT Barral BB, Fuller DD. Ampakine CX717 Stimulates Diaphragm Activity following Mid-cervical Spinal Contusion Injury. Experimental Biology Meeting; 2022 Apr 2-5, Philadelphia, PA.
11. **Rana S,** Sunshine MD, Fuller DD. Low Dose Ampakine Stimulates Diaphragm Activity and Increases Tidal Volume following Cervical Spinal Cord Injury in Non-Anesthetized Freely Behaving Rats. Experimental Biology Meeting; 2021 Apr 27-30, virtual.
12. **Rana S,** Sunshine MD, Fuller DD. Ipsilateral Diaphragm EMG Recorded from Unanesthetized Freely Behaving Rats is Persistently Reduced following High Cervical Spinal Hemilesion. Experimental Biology Meeting; 2021 Apr 27-30, virtual.
13. **Rana S,** Sunshine MD, Fuller DD. Impact of Ampakine CX-717 on Diaphragm EMG Activity and Breathing in Non-anesthetized Freely Behaving Rats. Experimental Biology Meeting; 2020 Apr 04-07; *Meeting cancelled due to COVID-19.*
14. **Rana S,** Zhan WZ, Sieck GC, Mantilla CB. Disruption of BDNF/TrkB Signaling Alters Glutamatergic mRNA Expression at Phrenic Motor Neurons. Experimental Biology Meeting; 2020 Apr 04-07; *Meeting cancelled due to COVID-19.*
15. **Rana S,** Zhan WZ, Sieck GC, Mantilla CB. Distribution of Ipsilateral and Contralateral Glutamatergic Synaptic Inputs to Phrenic Motor Neurons. Experimental Biology Meeting; 2019 Apr 06-09; Orlando, FL.
16. CE Fain, **S Rana,** MA Huggins, GC Sieck, AJ Johnson. Upregulation of Neuronal VEGF in Experimental Cerebral Malaria Coincides with Disease Severity Biomarkers in Humans: A Novel Mechanism of Pathophysiology. Immunology Meeting; 2019 May 09-13; San Diego, CA.
17. **Rana S,** Zhan WZ, Sieck GC, Mantilla CB. Distribution of Ipsilateral and Contralateral Glutamatergic Synaptic Inputs to Phrenic Motor Neurons. Experimental Biology Meeting; 2019 Apr 06-09; Orlando, FL.
18. **Rana S,** Fogarty MJ Mantilla CB, Sieck GC. Mitochondrial density and morphology in phrenic motor neurons is size-dependent. Society For Neuroscience Annual Meeting; 2018 Nov 03-07; San Diego, CA.
19. Mantilla CB, **Rana S,** Zhan WZ, Sieck GC. Cervical spinal hemisection induced changes in phrenic motor neuron TrkB mRNA expression depend on motor neuron size. Society for Neuroscience Annual Meeting; 2018 Nov 03-07; San Diego, CA.
20. Sieck GC, **Rana S,** Zhan WZ, Mantilla CB. Glutamatergic synaptic input to phrenic motor neurons depends on motor neuron size. Society For Neuroscience Annual Meeting; 2018 Nov 03-07; San Diego, CA.
21. **Rana S,** Mantilla CB, Sieck GC. Phrenic Motor Neuron Size Dependent Neuroplasticity of Glutamatergic Neurotransmission Following Cervical Spinal Cord Injury. Motoneuron Meeting; 2018 June 11-14; Boulder, CO.
22. **Rana S**, Mantilla CB, Gransee HM, Zhan WZ, Sieck GC. Neuroplasticity of Glutamatergic Neurotransmission at Phrenic Motor Neurons following Cervical Spinal Cord Injury. Dynamic Poster. Society For Neuroscience Annual Meeting; 2017 Nov 11- 15; Washington, D.C.
23. **Rana S**, Sieck GC, Mantilla, CB. Phrenic Motoneuron Loss and Compensatory Increase in Diaphragm Muscle Activity Following a Unilateral Mid-Cervical Contusion Injury in Rats. Young Investigator Research Symposium; 2016 March 19; Rochester, MN

24. **Rana S**, Sieck GC, Mantilla, CB. Assessment of Diaphragm EMG Activity and Neural Drive Following a Mid-Cervical Contusion Injury in Rats. International Symposium on Neural Regeneration; 2015 Nov 30-Dec 1; Pacific Grove, CA
25. **Rana S**, Gransee HM, Correa S, Cajiao MP, Zhan WZ, Sieck GC, Mantilla, CB. Histological and Functional Characterization of a Mid-Cervical Contusion Injury in Rats. Society for Neuroscience Annual Meeting; 2015 Oct 17-Oct 21; Chicago, IL
26. **Rana S**, Seiler MJ, Keirstead HS. Optimization of Stem Cell Differentiation into Retina. Undergraduate Research Symposium, University of California, Irvine; 2011 May 14; Irvine, CA

## AWARDS AND HONORS

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|---|---|
| 2024 | AJP-Lung Cellular and Molecular Physiology Editorial Board Fellow |
| 2023 | International Spinal Research Trust Meeting Travel Award, London, UK<br>Spinal Research Trust, United Kingdom |
| 2023 | Congenital Central Hypoventilation Syndrome Postdoctoral Scholarship, Orlando, FL, CCHS Annual Network Meeting |
| 2023 | Respiration Section Outstanding Trainee Award<br>Annual Experimental Biology Meeting 2023, American Physiological Society, Long Beach, CA |
| 2023 | Respiration Section Abstract of Distinction (two abstracts selected)<br>Annual Experimental Biology Meeting 2023, American Physiological Society, Long Beach, CA |
| 2023 | Women in Physiology Committee award<br>Annual Experimental Biology Meeting 2023, American Physiological Society, Long Beach, CA |
| 2023 | Physiologists in Industry Committee Postdoctoral Translational Research Award (*relinquished*)<br>Annual Experimental Biology Meeting 2023, American Physiological Society, Long Beach, CA |
| 2023 | Postdoctoral Poster Award<br>13th Annual NCF SfN Regional Conference, University of Florida, Gainesville, FL |
| 2021 | McKnight Brain Institute Rising Star<br>University of Florida, Gainesville, FL |
| 2021 | Outstanding Scholars in Neuroscience Award Program (OSNAP) awardee<br>National Institute of Health (NIH), Bethesda, MD |
| 2021 | Respiration Section Trainee Poster Presentation Award<br>Annual Experimental Biology Meeting 2021, American Physiological Society |
| 2021 | Research Recognition Award<br>Annual Experimental Biology Meeting 2021, American Physiological Society |
| 2021 | Inaugural Physiological Reports Award<br>Annual Experimental Biology Meeting 2021, American Physiological Society |
| 2021, 2022 | Postdoctoral Poster Award<br>16th Annual Neuromuscular Plasticity Symposium, University of Florida, Gainesville FL |
| 2019 | Mayo Clinic Graduate School of Biomedical Sciences Commencement Speaker |
| 2019 | Respiration Section Trainee Poster Presentation Award<br>Annual Experimental Biology Meeting 2019, American Physiological Society, Orlando, FL |
| 2019 | Neuromuscular Plasticity Scholar<br>14th Annual Neuromuscular Plasticity Symposium, University of Florida, Gainesville, FL |
| 2017 | Duane K. Rorie, MD, PhD Excellence in Research Award<br>Department of Anesthesiology, Mayo School of Graduate Medical Education |
| 2016 | Young Investigator Poster Award<br>Mayo Clinic Research Fellows Symposium, Rochester, MN |

2015-2017 MCGSBS-sponsored Annual Meeting travel award
Society for Neuroscience, Chicago, IL, Washington, DC, San Diego, CA

2013 Backbone Research Award
Reeve Irvine Research Center, Irvine, CA

2011 Excellence in Research – University of California Irvine
Title: Optimization of Stem Cell Differentiation into Retina

## TRAINING WORKSHOPS

2026 Master Mentorship Program
Center for Faculty Advancement, Mentoring and Engagement, Ohio State University

2025 New Faculty Boot Camp, American Thoracic Society, San Francisco, May 2025

2025 COMPASS Scholar, Washington University in St. Louis (About)

2015 OSU Spinal Cord Injury Training Program, Columbus OH
Funded by Craig H. Neilsen Foundation and Ohio State University

2014 Write Winning Grant Proposals Workshop, Rochester MN
Conducted by Dr. David C. Morrison

2011 2011 CDRF/RIRC BMS Training, Irvine CA

## SERVICE – Editorial service and peer review

2026 – Present Associate Editor: Journal of Neurophysiology

2026 – Present Editorial board: ODC-SCI

AJP-Lung Cellular and Molecular Physiology Editorial Board Fellow (2024 – 2025)

*Adhoc* Reviewer for Scientific Journals

- PLOS One
- Aging Cell
- Brain Research Bulletin
- Neural Regeneration Research
- Journal of Neurophysiology
- Brain Research
- Journal of Neurotrauma
- FASEB Bioadvances
- eLife
- IBRO Neuroscience Reports
- Experimental Neurology
- JOVE
- Journal of Physiology
- Neurobiology of Disease
- Experimental Neurology
- Journal of Neurochemistry
- Acta Physiologica
- Expert Opinion On Investigational Drugs

## RELEVANT LEADERSHIP AND SERVICE

***National:***

2025 – Present American Physiological Society, Respiration section Mixer programming committee

| | |
|---|---|
| 2026 | American Physiological Society, Porter Fellowship Reviewer |
| 2025 – Present | National Neurotrauma Society, Membership Committee |
| 2025 | American Physiological Society, Porter Fellowship Program Speaker |
| 2019 – Present | American Physiological Society, Respiration Section – Awards Sub-Committee |
| 2025 – Present | Respiration Section Programming Committee, American Physiological Society |
| 2024 – 2025 | SHARP – SCI Health and Research Partnership Steering Leadership Team |
| 2022 – Present | International Online SCI Seminar (I-OSCIRS) – Co-Chair |
| 2022 – 2025 | American Physiological Society, Committee on Committees member |
| 2022 – 2025 | American Physiological Society, Trainee Advisory Committee – GSA Subcommittee |
| 2021 – 2025 | American Physiological Society, Trainee Advisory Committee Chair (Respiration Section) |
| 2020 – 2021 | American Physiological Society, Respiration Section – Newsletter Co-Editor |
| 2019 – 2025 | American Physiological Society, Respiration Section – Training Sub-Committee |

***Local:***

| | |
|---|---|
| 2026 – | *Poster Judge:* Department of Neuroscience Research Day |
| 2026 - | Reviewer, Department of Neuroscience, Internal Grant Review Program (IGRP) |
| 2026 – | *Poster Judge:* Center for Brain Injury Recovery & Discovery (CBIRD) Research Day |
| 2026 – | OSU MSTP Roundtable chat host, February 26, 2026 |
| 2026 – | *Reviewer*: Application Reviewer for the 2026 Explorations in Neuroscience Internship |
| 2026 – | Programming and Engagement in Neuroscience Committee, OSU |
| 2025 – | *Poster Judge:* Neuroscience Research Day Retreat |
| 2025 – | Awards Committee, Widening Impact in Medicine & Science (WIMS), OSU |
| 2025 – | Search Committee, Department of Neuroscience, OSU |
| 2025 – | *Ad hoc* reviewer: Neuroscience Graduate Program (NGP) PhD program applications |
| 2023 – 2025 | NeuroPD^2 – Leadership team, McKnight Brain Institute, University of Florida |
| 2021 – 2025 | Summer Neuroscience Internship Program (SNIP) – Admissions Committee<br>University of Florida, Department of Neuroscience. |
| 2020 – 2025 | Diversity & Inclusion Committee BREATHE Center - Member |
| 2016 – 2017 | Graduate Student Association Co-President |
| 2015 – 2016 | Graduate Student Association Executive Education Committee Representative |
| 2015 – 2016 | Brainwaves Director, Mayo Clinic |
| 2014 – 2015 | Graduate Student Association First-Year Representative, Mayo Clinic |
| 2014 – 2015 | Brainwaves Outreach Coordinator, Mayo Clinic |

## TEACHING EXPERIENCE

| | |
|---|---|
| Spring 2026 | **Course Director:** Seminar Topics in Neuroscience (NEUROGS 7887)<br>Ohio State University (79 enrolled students) |
| Fall Qtr 2024 | **Guest Lecture:** Neuroplasticity: A Foundation for Rehabilitation (RSD 6718)<br>University of Florida, Rehabilitation Sciences Graduate Program<br>Lectures: DCS and neuroplasticity |

| | |
|---|---|
| Fall Qtr 2024 | **Guest Lecture:** Neurophysiology (GMS 6022)<br>University of Florida, Neuroscience PhD Program<br>Lectures: Neurophysiology of Breathing |
| Fall Qtr 2022 | **Guest Lecture:** Neuroplasticity: A Foundation for Rehabilitation (RSD 6718)<br>University of Florida, Rehabilitation Sciences Graduate Program (class of 22 students)<br>Lectures: Neuroinflammation, Neuromodulation Techniques |
| Spr Qtr 2022 | **Guest Lecture:** Control of Breathing and Airway Defense: Implications for Rehabilitation (RSD6930), University of Florida, Rehabilitation Sciences Graduate Program (class of 20 students), Lectures: Neural Control of Breathing: In-lab Demonstrations of EMG Data Acquisition and Plethysmography |
| Spr Qtr 2021 | **Guest Lecture:** Neuroscience for physical therapists (PHT6168C)<br>University of Florida, Physical Therapy Program (class of +70 students)<br>Spinal Cord (Part I, II), Cranial Nerves (Part I, II)<br>*Student evaluations available on request |
| Fall Qtr 2020 | **Guest Lecture:** Neuroplasticity: A Foundation for Rehabilitation (RSD 6718)<br>University of Florida, Rehabilitation Sciences Graduate Program (class of 12 students)<br>Lectures: Homeostatic Plasticity, Crossed Phrenic Phenomenon |
| Spr Qtr 2016-18 | **Teaching Assistant:** Grant Writing and Critical Thinking (CORE 6050)<br>Mayo Clinic Graduate School of Biomedical Sciences (class of +35 students)<br>Lead discussion sessions for 1st and 2nd-year pre-doctoral students<br>Assist students with the structure and content of F31 grant writing assignment |
| Fall Qtr 2015 | **Teaching Assistant:** Practical Neuroanatomy (NBD 6410)<br>Mayo Clinic Graduate School of Biomedical Sciences (class of 8 students)<br>Lead lecture and lab sections for 1st year pre-doctoral students |

## MENTORING

### Mentoring since faculty appointment (Ohio State University)

*Graduate Mentoring*

| Mentee | Years | Outcomes | Project |
|---|---|---|---|
| Natalie Stover (Neuroscience Graduate Program) | 2026 - | | Targetting Trk-mediated respiratory motor plasticity in neural disease and injury |

*Undergraduate Mentoring*

| Mentee | Level | Years | Outcome | Project |
|---|---|---|---|---|
| Kailash Shastry | Senior | 2025 - | 2026 Barbara A. Horwitz and John M. Horowitz Undergraduate award and APS Excellence in undergraduate research award (national); CBIRD Research Day Poster award | Machine learning approaches for processing of respiratory biosignals |
| Dhruva Venakari | Senior | 2025 - | CBIRD Research Day Poster award, DNS research Day award | Non-invasive spinal stimulation to enhance hypoxia induced respiratory facilitation following SCI |
| Isabel Oliveira | Freshman | 2026 - | | |
| Shritha Velaga | Freshman | 2026 - | | |

*Postbaccalaureate Mentoring*

| Mentee | Level | Years | Outcome | Project |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Matthew Rease | Research Technician | 2025 - | Abstract submission 2026 APS meeting, trainee talk at CBIRD research day, APS Merilyn Merker Trainee talk (2026) | Non-invasive spinal stimulation to enhance respiratory output following SCI |

**Thesis committees**

OSU student committees:

Sarayu Ali – Jacy Wagnon Lab (NGP, Year 2)

**Mentoring prior to faculty appointment**

*Graduate and Professional Student Mentoring*

| Mentee | Program | Institution | Years | Current Position | Thesis or Project |
|---|---|---|---|---|---|
| Alyssa Brown | MD PhD, Biomedical Engineering | Mayo Clinic GSBS | 2017–2019 | PGY3 Surgery, Northwestern University | Mitochondrial dynamics in diaphragm |
| Michele Singer | PhD, Rehabilitation Science | University of Florida | 2020–2022 | Postdoctoral Fellow, Johns Hopkins University | Hypoglossal motor system, AAV therapy |
| Ethan Benevides | PhD Candidate | University of Florida | 2020–2024 | PhD Candidate | Genetic manipulation of diaphragm afferents |
| Kyle Deegan | MS, Neuroscience | University of Florida | 2022–2024 | MS Student | Normobaric hyperoxia for SCI |
| Anna M. Fusco | MD PhD, Neuroscience | University of Florida | 2022–2025 | MD PhD Student | Axonal degeneration after cervical SCI |

*Undergraduate Mentoring*

| Mentee | Level | Institution | Years | Current position | Project |
|---|---|---|---|---|---|
| Zachary Sloan | Junior | UCI BioSci Mentor Program | 2022–2023 | Undergraduate | N/A |
| Jane Yap | Undergraduate | Mayo Clinic | 2017–2019 | Research Technician, Mayo Clinic | Mitochondrial assays in phrenic MNs |
| LiAna Patterson | BS | University of Florida | 2021–2022 | MS3, FSU College of Medicine | Daily ampakine after thoracic SCI |
| Katelyn H. Cabral | Sophomore | University of Florida | 2022–2025 | Undergraduate | TrkB signaling and respiratory recovery |

*Postbaccalaureate Mentoring*

| Mentee | Degree | Program | Years | Current Position |
|---|---|---|---|---|
| Victoria Bindi | BS | Postbaccalaureate Research Training | 2020–2022 | MS4, University of Florida COM |
| Brian Barral | BS | Postbaccalaureate Research Training | 2021–2022 | MS3, Northeast Ohio Medical University |
| Robert Martinez | BS | Mayo Clinic PREP | 2021–2023 | PREP Scholar, Mayo Clinic |