

CURRICULUM VITAE

Personal

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Education

<u>Institution and Location</u>	<u>Degree</u>	<u>Dates</u>	<u>Field</u>
St. Ambrose University Davenport, IA	B.S.	1980-1984	Biology/Philosophy
University of Iowa Iowa City, IA	M.S.	1987-1989	Plant Biochemistry
University of Iowa Iowa City, IA	Ph.D.	1991-1994	Anatomy and Cell Biology

Professional Experience

7/2023 –	Provost Fellow for Research
8/2014 -	Distinguished Professor of Cell Biology Missouri State University
8/2008 - 7/2014	Professor of Cell Biology Missouri State University
7/2006 – 5/2023	Director, Center for Biomedical & Life Sciences Missouri State University
6/2005 - 7/2008	Associate Professor of Cell Biology Missouri State University (formerly Southwest Missouri State University)
8/2004 - 6/2006	Executive Director - Center for Applied Science and Engineering Missouri State University
8/2001 - 5/2005	Assistant Professor of Cell Biology Southwest Missouri State University
4/1998 - 7/2001	Assistant Research Scientist, Department of Physiology University of Iowa (Dr. Andrew Russo)
1/1995 - 3/1998	Postdoctoral Fellow, Department of Physiology University of Iowa (Dr. Andrew Russo)
1/1990 - 7/1991	Research Asst. II, Department of Anatomy University of Iowa (Dr. Jeanne Snyder)
6/1985 - 12/1986	Research Asst. II, Speech Pathology and Audiology University of Iowa (Dr. Ingo Titze)
7/1984 - 5/1985	Research Asst. I, Speech Pathology and Audiology University of Iowa (Dr. Adrienne Perlman)

Teaching Experience (Primary Courses from 2015)

6/26 - 7/26	Course Director	ANE 717 Molecular Cell Biology
1/26 – 5/26	Course Director	BIO 503/603 Epigenetics and Human Health
1/26 – 5/26	Course Director	BIO 355/655 Developmental Biology
8/25 – 12/25	Course Director	BIO 543/643 Diabetes Pathology and Treatment
8/25 – 12/25	Course Director	BIO 121 Honor’s Biology (lecture)
6/25 - 7/25	Course Director	ANE 717 Molecular Cell Biology
1/25 – 5/25	Course Director	BIO 503/603 Epigenetics: Beyond Your Genes
1/25 – 5/25	Course Director	BIO 355/655 Developmental Biology
8/24 – 12/24	Course Director	BIO 597/697 Diabetes Pathology and Treatment
8/24 – 12/24	Course Director	BIO 121 Honor’s Biology (lecture)
1/24 – 5/24	Course Director	BIO 597/697 Epigenetics: Beyond Your Genes
1/24 - 5/24	Course Director	BIO 355/655 Developmental Biology
8/23 – 12/23	Course Director	BIO 320 Molecular Cell Biology (lecture)
8/23 – 12/23	Course Director	BIO 121 Honor’s Biology (lecture)
1/23 – 5/23	Course Director	BIO 597/697 Diabetes Pathology and Treatment
1/23 – 5/23	Course Director	BIO 121 General Biology I (lecture)
8/22 – 12/22	Course Director	BIO 320 Molecular Cell Biology (lecture)
8/22 – 12/22	Course Director	BIO 121 Honor’s Biology (lecture)
1/21 – 5/22	Course Director	BIO 597/697/720 Epigenetics and Human Health
1/21 – 5/22	Course Director	BIO 121 General Biology I (lecture)
8/21 – 12/21	Course Director	BIO 320 Molecular Cell Biology (lecture)
8/21 – 12/21	Course Director	BIO 121 Honor’s Biology (lecture)
8/20 – 12/20	Course Director	BIO 320 Molecular Cell Biology (lecture)
8/20 – 12/20	Course Director	BIO 121 General Biology I (lecture)
1/20 – 5/20	Course Director	BIO 597/697 Epigenetics and Human Health
1/20 – 5/20	Course Director	BIO 121 General Biology I (lecture)
8/19 – 12/19	Course Director	BIO 320 Molecular Cell Biology (lecture)
8/19 – 12/19	Course Director	BIO 121 General Biology I (lecture)
1/19 – 5/19	Course Director	BIO 597/697 Diabetes
1/19 – 5/19	Course Director	BIO 121 General Biology I (lecture)
8/18 – 12/18	Course Director	BIO 320 Molecular Cell Biology (lecture)
8/18 – 12/18	Course Director	BIO 121 General Biology I (lecture)
1/18 – 5/18	Course Director	BIO 597/697 Epigenetics and Human Health
1/18 – 5/18	Course Director	BIO 121 General Biology I (lecture)
8/17 – 12/17	Course Director	BIO 320 Molecular Cell Biology (lecture)
8/17 – 12/17	Course Director	BIO 121 General Biology I (lecture)
1/17 – 5/17	Course Director	BIO 597/697 Diabetes – A Global Epidemic
1/17 – 5/17	Course Director	BIO 121 General Biology I (lecture)
8/16 – 12/16	Course Director	BIO 320 Molecular Cell Biology (lecture)
8/16 – 12/16	Course Director	BIO 121 General Biology I (lecture)
1/16 – 5/16	Course Director	BIO 597/697 Epigenetics and Human Health
1/16 – 5/16	Course Director	BIO 121 General Biology I (lecture)
8/15 – 12/15	Course Director	BIO 320 Molecular Cell Biology (lecture)
8/15 – 12/15	Course Director	BIO 121 General Biology I (lecture)
1/15 – 5/15	Course Director	BIO 597/697 Diabetes (lecture)
1/15 – 5/15	Course Director	BIO 121 General Biology (lecture)

Honors and Awards

- Nominated as a member of the National Institute for Dental and Craniofacial Research (NIDCR) Advisory Council Committee, January 2026
- Reviewer of NIH Study Section Special Emphasis Panel ZRG1 MSOS-K(55) meeting, April 2026
- Director's Awards for Outstanding Faculty Research, Missouri State University, May 2025
- Reviewer of NIH Study Section Special Emphasis Panel/Scientific Review Group 2025/10 ZRG1 MBBC-G (50) meeting, April 2025
- Reviewer of NIH Study Section Special Emphasis Panel/Scientific Review Group 2025/01 ZDE1 JC (03) S meeting, October 2024
- Reviewer of NIH Study Section – ZDE1 CC (17) NIDCR Award for Sustaining Outstanding Achievement in Research (SOAR), June 2024
- Award for Contribution and Service to Orofacial Pain Field from the American Academy of Orofacial Pain. Annual Meeting, Phoenix, AZ 2024
- Recipient of Steven Graff-Radford Orofacial Pain Lectureship Award by the American Headache Society, American Headache Society Meeting, Scottsdale, AZ 2023
- Reviewer for NIH Study Section - Neurobiology of Pain and Itch Study Section Meeting, October 2023
- Board of Governors' Faculty Excellence in Public Affairs Award, 2023-2024
- Reviewer for NIH Study Section - Special Emphasis Panel/Scientific Review Group 2022/08 ZRG1 VH-C (10) meeting, July 2022
- Reviewer for NIH Study Section - Special Emphasis Panel/Scientific Review Group 2022/05 ZDE1 AC (14) R Meeting, March 2022
- Reviewer for NIH Study Section – ZNS1 SRB-B (10) Study Section - NINDS Diversity K01 and K22 Review Meeting, June 2021
- Foundation Award in Research Excellence, Missouri State University, May 2020
- Reviewer for NIH Study Section - Special Emphasis Panel/Scientific Review Group 2020/10 ZNS1 SRB-B (79) meeting, June 2020
- Reviewer for NIH Study Section - 2020/01 ZRG1-MOSS-D-10 NIH Review for Orthopedic, Musculoskeletal, Oral, Skin, Rheumatology and Rehab Sciences, November 2019
- Reviewer for NIH Study Section - ZRG1-IFCN-B-02M Pain Mechanisms, November 2019
- Reviewer for NIH Study Section - ZRG1 ETTN-C (50) Special Emphasis Panel, Pain Biomarker Program, June 2019
- Reviewer for NIH Grant Study Section – 2019/05 DSR1 NIDCR Special Grant Review (DSR), February 2019
- Professor Salary Incentive Program Recipient, Missouri State University, July 2019
- Reviewer for NIH Grant Study Section - ZRG1 MOSS-D (82) A - Musculoskeletal, Oral, Skin, Rheumatology and Rehab Sciences AREA (R15) Review, November 2018
- Reviewer for NIH Grant Study Section – Special Emphasis Panel, ZRG1 MOSS-D10 Small Business Review, November 2018
- Foundation Award in Service Excellence, Missouri State University, May 2018
- Reviewer for NIH Grant Study Section - 2018/05 ZRG1 IFCN-B (03) M Pain Mechanisms
- Reviewer for NIH Grant Study Section – 2018/05 ZDE1 MH (15) 1
- NIDCR Clinical Research, Clinical Trials, and Clinical Trials Planning Grants, February 2018
- Recipient of Missouri State University Bronze Bear Award, December 2018
- Invited panel member for Society for Women's Health Research Migraine Roundtable, Washington DC, October 2017
- Reviewer for NIH Grant Study Section - Member conflict: Pain and Chemosensory Mechanisms 2017/10 ZRG1 IFCN-B (03) M, July 2017
- Reviewer for NIH Grant Study Section - RFA-DE-18-002 NIDCR Award for Sustaining Outstanding Achievement in Research (SOAR) (R35) 2017/10 ZDE1 GZ (07) R, June 2017
- Reviewer for NIH Grant Study Section - NIH Special Emphasis Panel/Scientific Review Group

- 2017/08 ZRG1 IFCN-T (50) R BRAIN Initiative: Targeted BRAIN Circuits Projects, May 2017
- Missouri Governor's Excellence in Teaching Award, May 2017
 - Foundation Award in Teaching Excellence, Missouri State University, May 2017
 - Elected as a Member of Executive Committee for American Academy of Orofacial Pain, February 2017
 - Foundation Award in Research Excellence, Missouri State University, May 2016
 - Reviewer for NIH Grant Study Section, NIDCR Special Emphasis Panel NZRG1-IFCN-B-03M (IAM), Small Business: Oral, dental and craniofacial sciences, March 2016.
 - Reviewer for NIH Grant Study Section, NIDCR Special Emphasis Panel 2016/01 ZRG1 MOSS-K (11) B Small Business: Oral, dental and craniofacial sciences, November, 2015
 - Reviewer for NIH Grant Study Section, NIDCR Special Emphasis Panel 2016/01 ZDE1 GZ (07) 1, RFA-DE-16-001 Pharmacogenomics of Orofacial Pain Management (R01), September, 2015.
 - Atwood Research and Teaching Award, Missouri State University May 2015
 - Service Award College of Natural and Applied Sciences, Missouri State University May 2015
 - Promotion to Distinguished Professor, Missouri State University, August 2014
 - Invited Co-Chair Headache: Basic Science, American Academy of Neurology, San Diego, March 2014
 - Reviewer for Congressionally Directed Medical Research Programs Peer Reviewed Medical Research Program – Pre-application-Chronic Migraine and Posttraumatic Headache, July 2013
 - Selected as a Council Member of the American Academy of Orofacial Pain Society, April, 2013
 - Invited Co-Chair Headache: Basic Science, American Academy of Neurology, San Diego, March 2013
 - Reviewer for NIH Grant Study Section, Special Emphasis Panel ZDE1 JR (15), January 2013
 - Reviewer for NIH Grant Study Section, Special Emphasis Panel ZDE1 JR (15), March 2012
 - Selected as Program Committee Member, AAOP 2011 Annual Meeting
 - Reviewer for NIH Grant Study Section, NCCAM, RFA-AT-10-002 "Centers of Excellence for Research on CAM (CERC) for Pain (P01), December 2010
 - Invited Chair of 2010 Shanghai International Conference on Traditional Chinese Medicine and Natural Medicine, Hangzhou, China, October 2010
 - Foundation Award in Research, Missouri State University, June 2010
 - Invitation to participate in NIH-sponsored workshop for development of the second phase of a strategic planning effort for headache research, May 2010
 - Chosen as Chair of Scientific Meeting: Fresh Insights into the Pathophysiology of Primary and Secondary Headache Disorders, National Headache Foundation, Chicago, October 2009
 - Chosen as Co-Chair of Teaching Course: Fresh Insights into the Pathophysiology of Primary and Secondary Headache Disorders, 14th Congress of International Headache Society, Philadelphia, September 2009
 - Reviewer for NIH Grant Study Section, Special Emphasis Panel/Scientific Review Group
 - ZRG1 CFS-E(01)S Chronic Fatigue Syndrome, Fibromyalgia Syndrome, and Temporomandibular Disorders, June 2008
 - Reviewer for NIH Grant Study Section, Special Emphasis Panel/Scientific Review Group 2007/10 ZNS1 SRB-R (30) Migraine: Neural Mechanisms and Risk Factors for Progression, July 2007
 - Foundation Award in Research, Missouri State University, June 2007
 - Outstanding Thesis Advisor Award, Missouri State University, May 2007
 - Reviewer for NIH Grant Study Section, Special Emphasis Panel/Scientific Review Group 2007/05 ZDE1 YL (41) meeting, March 2007
 - Reviewer for NIH Grant Study Section, Special Emphasis Panel/Scientific Review Group 2007/05 ZRG1 CFS-E (01) meeting, March 2007
 - Best Poster Presentation at the American Academy of Orofacial Pain Meeting, April 2006
 - Reviewer for NIH Grant Study Section, Special Emphasis Panel/Scientific Review Group 2006/05 ZDE1 MK (63) meeting, April 2006

- Reviewer for NIH Grant Study Section, Special Emphasis Panel/Scientific Review Group 2006/05 ZAR1 MLB-G (M1) (1) meeting, March 2006
- Reviewer for NIH Grant Study Section, Special Emphasis Panel/Scientific Review Group 2006/05 ZDE1 RK (41) meeting, March 2006
- Reviewer for NIH Grant Study Section, Special Emphasis Panel/Scientific Review Group 2006/05 ZRG1 IFCN-F (03) meeting, February 2006
- Excellence In Innovation Award from Allergan, 2005
- Nominated by NIH for Presidential Early Career Award for Science and Engineers, 2005
- Reviewer for NIH Grant Study Section, Special Emphasis Panel/Initial Review Group 2005/01 ZRG1 CFS (01) (S) , December 2004
- University Award for Research, Southwest Missouri State University, 2004
- Invited Presentation at NIH workshop on migraine headache, Boston, 2004
- Invited Perspective Article for *New England Journal of Medicine*, 2004
- Content Review Board member for The Professional Television Network - Neurology, 2004
- Invited Review Article for *Current Opinion in Investigational Drugs*, 2004
- Participant in Sinus Headache-A Multidisciplinary Expert Research Panel Review, Dallas, 2003
- SMSU College of Natural and Applied Sciences Excellence in Research Award, 2003
- Southwest Missouri State University Summer Faculty Fellowship, 2002
- Appointment to Graduate Faculty status at Southwest Missouri State University, 2002
- Southwest Missouri State University Faculty Research/University Grant, 2001
- Iowa Microscopy Society Research Excellence Award, 2000
- Invited Review Article for *Pharmacology and Therapeutics*, 2000
- Invited Review Article for *Expert Opinion on Therapeutic Patents*, 2000
- Endocrine Society Travel Award, 1998
- Postdoctoral Fellow Poster Award Winner, U. of Iowa, College of Medicine, 1997
- University of Iowa Cardiovascular Center Fellowship, 1996-1997
- University of Iowa Cardiovascular Center Fellowship, 1995-1996
- Outstanding Teaching Assistants Award at University of Iowa, 1992
- Tun-Yang Wing Award for Outstanding First Year Anatomy Student, 1990
- University of Iowa Teaching Research Fellowship, 1988
- Graduated Cum Laude from St. Ambrose University, 1984
- Iowa State University Scholastic Achievement Award, 1980
- D.A.R. Award, 1980
- American Legion Award, 1980

Invited Speaker

The Winter Headache Cooperative of the Northeast Headache Conference, Greenwich, CT, March 2026
 American Academy of Orofacial Pain, Presentation, Arlington, VA, May 2025
 International Orofacial Pain Group, Invited Lecture, February 2025
 International Orofacial Pain Group, Keynote Speaker, May 2024
 Texas A&M University, School of Dentistry Health Science Center, Dallas, TX, February 2024
 American Headache Society, Scottsdale, November 2023
 The Jordan Dental Association's Scientific Program, Live Webinar, August 2023
 American Academy of Orofacial Pain, Plenary Talk, Orlando, May 2023
 Fifth Annual Cox Health Research Conference, Keynote Speaker, April 2023
 International Orofacial Pain Group, Keynote Speaker, March 2023
 The Jordan Dental Association's Scientific Program, Live Webinar, August 2022
 American Academy of Orofacial Pain, Three invited presentations, Boston, April 2022
 Cox College, Nutrition Diagnostics Department, Springfield, MO, March 2022
 American Headache Society, Scottsdale, November 2021
 Wichita State University, Department of Biology, Virtual, October 2021.

American Headache Society, Virtual Meeting, June 2021
 American Academy of Orofacial Pain, Plenary presentation, Virtual Conference, May 2021
 American Headache Society, San Diego, June 2020
 American Academy of Orofacial Pain, Two Plenary and Full-Day Workshop, Orlando, FL, May 2020
 MAHAN Conference, Multiple presentations, New Orleans, March 2020
 American Headache Society, multiple presentations, Philadelphia, July 2019
 31st Annual Orofacial Pain Symposium, University of Kentucky, Lexington, KY, April 2019
 American Academy of Craniofacial Pain, Three presentations, Sydney Australia, March 2019
 Leeds School of Dentistry, Leeds, England, June 2018
 British Society for Occlusal Studies Meeting, 6-Lecture Workshop, York, England, June 2018
 Blue Ribbon Seminars Club Educational Series, Montana, May 2018
 American Academy of Craniofacial Pain, All Presentations -Two Day Workshop Epigenetics: Relevance to Orofacial Pain and Management, Los Angeles, May 2018
 American Academy of Oral Medicine 2018 Annual Conference, San Antonio, April 2018
 Mahan Orofacial Pain Alumni Association Annual Meeting, New Orleans, March 2018
 American Pain Society Scientific Summit, Symposium Anaheim, March 2018
 Annual Greater New York Dental Meeting, New York, November 2017
 Orofacial Pain Workshop for US Navy, Bethesda, October 2017
 Southern Headache Society/Southern Pain Society, New Orleans, September 2017
 Physical Therapy Program at the American Academy of Orofacial Pain Meeting, Phoenix, May 2017
 American Academy of Orofacial Pain, Phoenix, May 2017
 Vollum Institute Dental College, Oregon, April 2017
 American Equilibration Society Meeting, Chicago, February 2017
 Trinity College Dublin Ireland, October 2016
 Orofacial Pain Workshop for US Navy, Bethesda, October 2016
 American Headache Society, San Diego, June 2016
 American Academy of Orofacial Pain, Orlando, April 2016
 MOCAN Conference, Springfield, MO, February 2016
 American Academy of Craniofacial Pain Two-day Workshop on Epigenetics, Sydney, April 2015
 American Academy of Craniofacial Pain, August, Denver 2014
 American Headache Society, June, Los Angeles 2014
 MOCAN Conference, Springfield, MO, February 2014
 Upsher-Smith Laboratories, Epilepsy Conference, Minneapolis, October, 2013
 American Academy of Orofacial Pain, Orlando, April 2013
 MAHAN Conference, New Orleans, March 2013
 American Academy of Craniofacial Pain, Sydney, Australia, March 2013
 MOCAN Conference, Springfield, MO, February 2013
 Southern Headache Society, Asheville, NC October 2012
 American Chemical Society, San Diego, March 2012
 Satellite Meeting – From Electrical Synapses to The Clinics, Bochum, Germany, August 2011
 Case Western University, Department of Neurology Grand Rounds, Cleveland, June 2011
 American Academy of Orofacial Pain, Las Vegas, April 2011
 Eli Lilly, Neurology/Pain Group, Indianapolis, IN, December 2010
 University of Kentucky, Chandler Medical Center, May 2010
 American Academy of Orofacial Pain, Orlando, FL, April 2010
 The 23rd Annual Practicing Physician’s Approach to the Difficult Headache Patient, Scottsdale, Feb 2010
 Headache Cooperative of the Pacific, 3rd Annual Winter Conference, Ojah Valley, Jan 2010
 14th International Headache Congress, Satellite Symposium, Philadelphia, September 2009
 The 22nd Annual Practicing Physician’s Approach to the Difficult Headache Patient, Scottsdale, Feb 2009

Wake Forest University, Department of Neurology, January, 2009
Merck & Co., Inc., Medical Grand Rounds, January, 2009
University of Arizona, Pain Center, January 2009
50th Annual Scientific Meeting of American Headache Society, Boston, June 2008
TMJ Association's Fifth Scientific Meeting, Bethesda MD, June 2008
American Association of Dental Research Annual Meeting, Dallas, April 2008
Harvard University, Beth Israel Medical Center, Department of Anesthesia, November 2007
University of Missouri-Columbia, Neuroscience Department, December 2007
University of Kansas Medical Center, Anatomy and Cell Biology Department, September 2007
49th Annual Scientific Meeting of American Headache Society, Chicago, June 2007
4th Annual Headache Research Summit, Rancho Mirage, CA, February 2007
48th Annual Scientific Meeting of American Headache Society, Los Angeles, June 2006
Society for Neuroscience 35th Annual Meeting, Slide Presentation, Washington, DC, Nov, 2005
47th Annual Scientific Meeting of American Headache Society, Philadelphia, June 2005
University of Missouri-Kansas City, Pharmacology Division, Kansas City, MO, April, 2005
Washington University, Department of Anesthesiology, School of Medicine, St. Louis, Nov, 2004
46th Annual Scientific Meeting of American Headache Society, Vancouver, BC, June 2004
Saint Louis University, Microbiology and Immunology, School of Medicine, St. Louis, MO, May 2004
Kansas State University, Division of Biology, Manhattan, KS, March 2004
Sinus Headache-A Multidisciplinary Expert Research Panel Review, Dallas, TX, 2003
45th Annual Scientific Meeting American Headache Society, Chicago, June 2003
Southwest Missouri State University, Biomedical Sciences Department, Springfield, MO, April, 2003
Drury University, Pre-Med Society and Integrated Science Program, Springfield, MO, February, 2003
44th Annual Scientific Meeting American Headache Society, Seattle WA, June 2002
Iowa Microscopy Society Meeting, University of Iowa, Iowa City, IA, October, 2000
Wartburg College, Biology Department, Waverly, IA, February, 2000
International Conference on Migraine (IBC), Philadelphia, April, 1999
Hope College, Biology Department, Holland, MI, March 1999
Neurology Grand Rounds, University of Iowa, Iowa City, IA, October, 1998
International Conference on Migraine (IBC), Philadelphia, April, 1998
Harvard Medical School, Migraine Program Project Lecture Series, Boston, February, 1998
Society of Neuroscience Meeting, Slide Presentation, New Orleans, October, 1997
Coe College, Biology Department, Cedar Rapids, IA, October, 1997
Neurology Grand Rounds, University of Iowa, Iowa City, IA, October, 1996

Professional Activities (typically provide > 15 journal reviews per year)

- Reviewer – *European Journal of Neuroscience* (1999-present)
- Reviewer – *Neuroscience Letters* (2000-present)
- Reviewer – *Brain* (2004-present)
- Reviewer – *Brain Research* (2004-present)
- Reviewer – *Headache* (2005- present)
- Reviewer – *Annals of Neurology* (2005-present)
- Reviewer – *Pain* (2005-present)
- Reviewer – *Cephalalgia* (2005-present)
- Reviewer – *Trends in Neuropharmacology* (2007-present)
- Reviewer – *Journal of Neurochemistry* (2007-present)
- Reviewer – *Neuroscience* (2007- present)
- Reviewer – *Neuropeptides* (2008- present)
- Reviewer – *European Journal of Pain* (2008-present)

- Reviewer – *Journal of Pain* (2008-present)
- Reviewer – *Molecular Pain* (2008-present)
- Reviewer – *Archives of Oral Biology* (2016 to present)
- Reviewer – *Frontiers Neuroscience and Pain Areas* (2016 to present)
- Committee Member – Guidelines Textbook, Education, E-campus for American Academy of Orofacial Pain (current)
- Associate Editor - *Frontiers Musculoskeletal Pain* (current)
- American Headache Society Member - TMD, Cervical Spine and Orofacial Pain and Complementary & Integrative Medicine SIS (current)

Professional Organizations

- American Association for the Advancement of Science
- Society for Neuroscience
- American Headache Society
- American Academy of Orofacial Pain
- Southern Pain Society
- International Association for the Study of Pain

Area of Research Interest

My long-term interest lies in understanding the cellular and molecular mechanisms involved in neuron-glia interactions that promote and sustain chronic peripheral and central sensitization in orofacial pain conditions such as migraine and TMD. Our laboratory utilizes primary cell culture and novel in vivo preclinical models as well as multiple molecular and cell biology techniques including qPCR, western blotting, immunohistochemistry, protein arrays, ELISAs, RIAs, and mechanical and thermal behavior testing. A primary goal of my research is to determine the signaling pathways by which inflammatory and anti-inflammatory agents control gene expression in disorders involving the trigeminal nerve. In addition, I am studying the effects of nutraceutical compounds on neuronal-glia interactions to identify novel biological compounds that inhibit inflammatory pathways and enhance descending inhibitory descending pain pathways. Ongoing research involves investigating the mechanisms by which dietary supplementation of grape seed extract functions to block trigeminal pain signaling in the spinal trigeminal nucleus and trigeminal ganglion in preclinical models of chronic migraine and TMD. Additionally, we are utilizing primary cultures of trigeminal ganglion and spinal cord to better understand the cellular mechanisms by which the neuropeptide CGRP and the nutraceutical grape seed extract regulate the GABAergic system and ion channel activity in glial cells. Most recently we have developed a jaw injury model that is exhibiting sexual dimorphism such that chronic pain signaling is only observed in the females. We are currently investigating the cellular and molecular mechanisms and testing novel treatment strategies. I am also collaborating with a faculty member in the chemistry department to develop and test the efficacy of using caged molecules to selectively target neuronal and glial cells involved in inflammation and pain signaling for future testing in preclinical models of migraine and TMD.

Peer-reviewed Research Publications

1. Finkelhor, B.J., Titze, I.R. and **Durham, P.L.** (1987) The Effect of Viscosity Changes in the Vocal Folds on the Range of Oscillation. *J. Voice* 1: 320-325.
2. Alipour-Haghighi, F., Titze, I.R. and **Durham, P.L.** (1987) Twitch Response in the Canine Vocalis Muscle. *J. Speech Hearing Res.* 30: 290-294.

3. **Durham, P.L.** and Poulton, J.E. (1989) Effect of Castanospermine and Related Polyhydroxalkaloids on Purified Myrosinase from *Lepidium sativum* Seedlings. *Plant Physiol.* 90: 48-52.
4. **Durham, P.L.** and Poulton, J.E. (1990) Enzymatic Properties of Purified Myrosinase from *Lepidium sativum* Seedlings. *Z. Naturforsch.* 45c: 173-178.
5. Snyder, J.M., Rodgers, H.F., O'Brien, J.A., Mahli, N., Magliato, S.A. and **Durham, P.L.** (1992) Glucocorticoid Effects on Rabbit Fetal Lung Maturation in vivo: An Ultrastructural Morphometric Study. *Anat. Rec.* 232: 133-140.
6. **Durham, P.L.**, Davis-Nanthakumar, E.K. and Snyder, J.M. (1992) Developmental Regulation of Surfactant-associated Proteins in Rabbit Fetal Lung in vitro. *Exp. Lung Res.* 18: 775-793.
7. Wohlford-Lenane, C.L., **Durham, P.L.** and Snyder, J.M. (1992) Localization of Surfactant-associated Protein C (SP-C) in Fetal Rabbit Tissue by in situ Hybridization. *Am. J. Respir. Cell Mol. Biol.* 6: 225-234.
8. **Durham, P.L.**, Wohlford-Lenane, C.L. and Snyder, J.M. (1993) Glucocorticoid Regulation of Surfactant-Associated Proteins in Rabbit Fetal Lung in vivo. *Anat. Rec.* 237: 365-377.
9. **Durham, P.L.** and Snyder, J.M. (1995) Characterization of $\alpha 1$, $\beta 1$, and $\gamma 1$ Laminin Subunits during Rabbit Fetal Lung Development. *Dev. Dynamics* 203: 408-421.
10. **Durham, P.L.** and Snyder, J.M. (1996) Regulation of Laminin $\beta 2$ Subunit Chain during Rabbit Fetal Lung Development. *Differentiation* 60: 229-243.
11. Russo, A.F., Clark, M.S., and **Durham, P.L.** (1996) Thyroid Parafollicular Cells: An Accessible Model for the Study of Serotonergic Neurons. *Mol. Neurobiol.* 13: 257-276.
12. **Durham, P.L.**, Sharma, R.V., and Russo, A.F. (1997) Repression of the Calcitonin Gene-Related Peptide Promoter by 5HT₁ Receptor Activation. *J. Neurosci.* 17: 9545-9553.
13. **Durham, P.L.** and Russo, A.F. (1998) Serotonergic Repression of Mitogen-Activated Protein Kinase Control of the Calcitonin Gene-Related Peptide Enhancer. *Mol. Endocrinol.* 12:1002-1009.
14. **Durham, P.L.** and Russo, A.F. (1999) Regulation of Calcitonin Gene-Related Peptide Secretion by a Serotonergic Antimigraine Drug. *J. Neurosci.* 19: 3423-3429.
15. **Durham, P.L.** and Russo, A.F. (2000) Differential Regulation of Mitogen-Activated Protein Kinase-Responsive Genes by the Duration of a Calcium Signal. *Mol. Endocrinology.* 14: 1570-1582.
16. **Durham, P.L.** and Russo, A.F. (2002) New Insights into the Molecular Actions of Serotonergic anti-migraine Drugs. *Pharmacology & Therapeutics*, 94:77-92.
17. Mora, S., **Durham, P.L.**, Smith, J.R., Russo, A.F., Jeromin, A., and Pessin, J.E. (2002) NCS-1 Inhibits Insulin-stimulated GLUT4 Translocation in 3T3L1 Adipocytes through a Phosphatidylinositol 4-kinase-dependent Pathway. *J. Biol. Chem.* 277:27494-27500.
18. **Durham, P.L.** and Russo, A.F. (2003) Stimulation of the Calcitonin Gene-Related Peptide Enhancer by Mitogen-Activated Protein Kinases and Repression by an Antimigraine Drug in Trigeminal Ganglia Neurons. *J. Neuroscience*, 23:807-815.

19. **Durham, P.L.**, Cady, R, and Cady, R. (2004) Regulation of Calcitonin Gene-Related Peptide Secretion from Trigeminal Nerve Cells by Botulinum Toxin Type A: Implications for Migraine Therapy. *Headache*, 44:35-43.
20. **Durham, P.L.**, Dong, P.X., Belasco, K.T., Kasperski, J., Gierasch, W.W., Edvinsson, L., Heistad, D., Faraci, F.M., and Russo, A.F. (2004) Neuronal expression and regulation of CGRP promoter activity following viral gene transfer into cultured trigeminal ganglia neurons. *Brain Research*, 997:103-110.
21. **Durham, P.L.** (2004) CGRP Receptor Antagonists – A Fresh Approach to Migraine Therapy? *New Engl. J. Med.*, 350:1073-1075.
22. Eddings, D., Barnes, C., Gerasimchuk, N., **Durham, P.**, Domasevich, K. (2004) First Bivalent Palladium and Platinum Cyanoximates: Synthesis, Characterization and Biological Activity. *Inorganic Chemistry*, 43:3894-3909.
23. **Durham P.L.** (2004) CGRP receptor antagonists: A new choice for acute treatment of migraine. *IDrugs? Curr Opin Invest Drugs*. 5:731-735.
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53. Garrett, F., Thalakoti, S., Langford, L., Patil, V., **Durham, P.L.** (2008) Identification of Connexins Involved in Facilitating Neuron-Satellite Glial Cell Signaling in Trigeminal Ganglion. 5th Annual Headache Research Summit, Scottsdale, AZ.
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Ganglion Neurons and Glia. 32nd Scientific Meeting of the American Academy of Orofacial Pain, Los Angeles, CA.

55. Garrett, F., Thalakoti, S., Patil, V., **Durham, P.L.** (2008) Identification of Connexins Involved in Facilitating Neuron-Satellite Glia Cell Signaling in Trigeminal Ganglion. 32nd Scientific Meeting of the American Academy of Orofacial Pain, Los Angeles, CA.
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57. **Durham, P.L.**, Kankipati, S. M. (2008) Effect of Intranasal Delivery of Carbon Dioxide on Trigeminal Ganglion Neurons: Inhibition of Neuron-Glia Gap Junction Communication and SNAP-25 Expression. 60th Annual Meeting of the American Academy of Neurology, Chicago, IL.
58. Bolay, H., **Durham, P.L.** (2008) Biological Sciences for Headache: Pharmacology in Handbook of Clinical Neurology, 3rd Series: Headache. Edited by Nappi, G., Moskowitz, M., chapter accepted for publication.
59. **Durham, P.L.** Kankipati, S.M., Thalakoti, S, Damodaram, S., Garrett, Filip, G. (2008) Effect of Intranasal Delivery of Carbon Dioxide on Trigeminal Ganglion Neurons: Inhibition of Neuron-Glia Gap Junction Communication and SNAP-25 Expression. TMJ Association's Fifth Scientific Meeting, Bethesda MD.
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62. Garrett, F.G., Freeman, S.E., Durham, P.L. (2008) DHE Regulation of Trigeminal Ganglion Neurons: Inhibition of Neuropeptide Release and Increased Phosphatase Gene Expression. European Headache and Migraine Trust International Congress (EHMTIC), London.
63. Damodaram, S., Thalakoti, S., Freeman, S.E., Garrett, F.G., Durham, P.L. (2008) Tonabersat represses trigeminal ganglion neuronal-satellite glial cell communication: implications for understanding migraine pathology and treatment. European Headache and Migraine Trust International Congress (EHMTIC), London.
64. Garrett, F. G., **Durham, P.L.** (2008) Stimulation of Trigeminal Nerves Leads to Increased Connexin Expression and Gap Junction Signaling Between Neurons and Satellite Glial Cells: Inhibition by Tonabersat. Society for Neuroscience, Washington, D.C.
65. Thalakoti, S., **Durham, P.L.** (2008) Differential Expression of MAP Kinases and MAP Kinase Phosphatases in Ipsilateral and Contralateral Trigeminal Ganglion in Response to Capsaicin Injection in the Temporomandibular Joint Capsule. Society for Neuroscience, Washington, D.C.

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67. **Durham, P.L.**, Strider, J., Valluri, A. (2009) Carbon Dioxide Inhibits Mast Cell Degranulation and Histamine Release. American Academy of Allergy, Asthma & Immunology Annual Meeting, Washington, D.C.
68. Garrett, F., **Durham, P.L.** (2009) Repression of Cellular Events Involved in Peripheral and Central Sensitization In an Adjuvant-Induced Model of TMJ Pathology by Tonabersat. 33rd Scientific Meeting of the American Academy of Orofacial Pain, Austin, TX.
69. Overmyer, A., **Durham, P.L.** (2009) Calcitonin Gene-Related Peptide Injection into the TMJ Capsule Differentially Regulates Expression of Signaling Molecules in Trigeminal Ganglion Neurons and Satellite Glial Cells. 33rd Scientific Meeting of the American Academy of Orofacial Pain, Austin, TX.
70. Strider, J., Valluri, A., **Durham, P.L.** (2009) Carbon Dioxide Inhibits Mast Cell Degranulation And Histamine Release. American Academy of Allergy, Asthma, and Immunology Annual Meeting, Washington, D.C.
71. Cady, R.K., Vause, C. V., Ho, T.W., Bigal, M.E., **Durham, P.L.** (2009) Elevated Saliva Calcitonin Gene-Related Peptide (CGRP) Levels During Acute Migraine Predicts Therapeutic Response to Rizatriptan, 14th International Headache Congress, Philadelphia, PA.
72. Glenn, J.R., Overmyer, A.E., **Durham, P.L.** (2009) Calcitonin Gene-Related Peptide Differentially Regulates Expression of Signaling Molecules in Trigeminal Ganglion Neurons and Satellite Glial Cells, 14th International Headache Congress, Philadelphia PA.
73. Masterson, C.G., **Durham, P.L.** (2009) DHE Repression of ATP-Mediated Sensitization of Trigeminal Ganglion Nociceptive Neurons Involves Activation of Alpha2 Adrenergic Receptors, 14th International Headache Congress, Philadelphia PA.
74. Cady, R.J., **Durham, P.L.** (2009) Repression of Acute and Chronic Inflammatory Changes in Trigeminal Ganglion Neurons and Glia in Response to Cocoa Enriched Diets, 14th International Headache Congress, Philadelphia PA.
75. Masterson, C.G., Garrett F.G., **Durham, P.L.** (2009) Rizatriptan Represses Stimulatory Effects of Capsaicin in Trigeminal Ganglion and Trigeminal Nucleus Caudalis: Inhibition of Peripheral and Central Sensitization, 14th International Headache Congress, Philadelphia PA.
76. Garrett F.G., **Durham, P.L.** (2009) Tonabersat Repression of Proteins Involved in Peripheral and Central Sensitization In Response to Acute or Chronic Inflammation, 14th International Headache Congress, Philadelphia PA.
77. Durham, Z.L., **Durham, P.L.** (2009) Interleukins IL-1 β and IL-6 Cause Sensitization of Trigeminal Ganglion Neurons Leading to Changes in the Ganglion and Trigeminal Nucleus Caudalis: Implications for Understanding Their Role in Migraine Pathology, 14th International Headache Congress, Philadelphia PA.

78. Strider, J.W., Garrett, F.G., **Durham, P.L.** (2009) Non-Inhaled Administration of 100% Carbon Dioxide Represses Capsaicin Mediated Activation of Neurons and Glia In the Trigeminal Nucleus Caudalis, 14th International Headache Congress, Philadelphia PA.
79. Strider, J.W., Garrett, F.G., **Durham, P.L.** (2009) Non-Inhaled Administration of 100% Carbon Dioxide Represses Capsaicin Mediated Activation of Neurons and Glia In the Trigeminal Nucleus Caudalis, 14th International Headache Congress, Philadelphia PA.
80. Vause, C.W., **Durham, P.L.** (2009) Calcitonin Gene-Related Peptide Acts as a Neuronal-Glial Modulator within the Trigeminal Ganglion, 14th International Headache Congress, Philadelphia PA.
81. Garrett, F.G., Hawkins, J., Scanlon, T., **Durham, P.L.** (2009) Temporal Expression of Connexin 26 Correlates with Development of Calcitonin Gene-Related Peptide-Containing Trigeminal Ganglion Neurons, Society for Neuroscience, Chicago, IL.
82. **Durham, P.L.** (2010) Predicting Treatment Response, Headache Cooperative of the Pacific, 3rd Annual Winter Conference, Ojai, CA.
83. **Durham, P.L.** (2010) Pathophysiology of Migraine, Diamond Headache Meeting, Scottsdale, Az.
84. **Durham, P.L.** (2010) Neuron-Glial Interactions in Trigeminal Mediated Disease. American Academy of Orofacial Pain, Orlando, FL.
85. **Durham, P.L.** (2010) Effects of REM Sleep Deprivation on Trigeminal Nerve Function. American Academy of Orofacial Pain, Orlando, FL.
86. Masterson, C., **Durham, P.L.** (2010) Dihydroergotamine Repression of Nociceptive Changes in the Trigeminal Ganglion and Trigeminal Nucleus Caudalis Involves Activation of Alpha2-Adrenergic Receptors, 52nd American Headache Society Meeting, Los Angeles, CA.
87. Cady, R.J., **Durham, P.L.** (2010) Inclusion of Grape Seed Extract as a Dietary Supplement Represses Neuron and Glia Activation in Trigeminal Nucleus Caudalis in Response to Chronic Trigeminal Nerve Stimulation, 52nd American Headache Society Meeting, Los Angeles, CA.
88. Strider, J.W., Smith, K.M., **Durham, P.L.** (2010) Calcitonin Gene Related Peptide Receptor Antagonist MK8825 Represses Nociceptive Signaling in the Trigeminal Ganglion and Trigeminal Nucleus Caudalis in Response to Capsaicin, 52nd American Headache Society Meeting, Los Angeles, CA.
89. Garrett, F.G., Hawkins, J., **Durham, P.L.** (2010) Effect of REM Sleep Deprivation on Trigeminal Ganglia and Trigeminal Nucleus Neurons and Glia: Towards a Better Understanding of Sleep and Migraine, 52nd American Headache Society Meeting, Los Angeles, CA
90. Garrett, F.G., Overmyer, A.E., Vause, C.V., Hawkins, J.L., Hayden, J.B., **Durham, P.L.** (2010) Development of a novel device for measuring withdrawal latency by thermal stimulation in animal facial pain models using the Hargreaves plantar apparatus. Society for Neuroscience, San Diego.

91. Strider, J., Vause, C.V., **Durham, P.L.** (2010) Expression of signaling molecules and receptors implicated in central sensitization is increased by calcitonin gene-related peptide in cultured astrocytes and microglia. Society for Neuroscience, San Diego, CA.
92. Durham, P.L., Masterson, C. (2010) Proton stimulation of CGRP secretion from trigeminal ganglia neurons occurs via an amiloride sensitive, calcium-independent mechanism and is not blocked by rizatripan or botulinum neurotoxin type A. Society for Neuroscience, San Diego, CA.
93. Garrett, F.G., Hawkins, J.L., Hayden, J.B., Campos, J.R., **Durham, P.L.** (2011) REM Sleep Deprivation Promotes Sustained Levels of Proteins Implicated in Peripheral and Central Sensitization of Trigeminal Nerves: Role in Pain Chronification. American Pain Society's 30th Annual Scientific Meeting, Austin, TX.
94. Garrett, F.G., Hawkins, J.L., Hayden, J.B., **Durham, P.L.** (2011) Differential Behavioral Response to Thermal Stimuli Following Unilateral or Bilateral Temporomandibular Joint Inflammation. American Pain Society's 30th Annual Scientific Meeting, Austin, TX.
95. An, T., Hirst, J., Cady, R., **Paul Durham** (2011) β -Sitosterol Isolated from Cocoa Powder Functions to Increase Expression of Anti-Inflammatory Proteins in Trigeminal Neurons: Implications for Treatment of Migraine and TMJ Disorders. 10th Annual Oxford International Conference on the Science of Botanicals (ICSB), Oxford, MS.
96. Strider, J.W., Glenn, J.R., and **Durham, P.L.** (2011) Calcitonin Gene-Related Peptide Stimulates Prolonged Expression of Proteins in Spinal Trigeminal Nucleus Neurons and Glia that Promote Central Sensitization. 35th Scientific Meeting of the American Academy of Orofacial Pain, Las Vegas, NV.
97. Cady, R.J., Hawkins, J.L., **Durham, P.L.** (2011) Inclusion of Cocoa as a Dietary Supplement Represses Neuron and Glia Activation in Trigeminal Nucleus Caudalis in Response to Chronic Trigeminal Nerve Stimulation, 53rd American Headache Society Meeting, Washington, DC.
98. Overmyer, A.E., Garrett, F.G., Hawkins, J.L., Hayden, J.B., **Durham, P.L.** (2011) REM Sleep Deprivation Evokes Facial Hyperalgesia in Response to Thermal Stimulation. 53rd American Headache Society Meeting, Washington, DC.
99. Strider, J.W., Vause, C.V., **Durham, P.L.** (2011) Calcitonin Gene-Related Peptide Stimulates Expression of Proteins In Spinal Trigeminal Nuclei Astrocytes and Microglia Known to Promote Central Sensitization. 53rd American Headache Society Meeting, Washington, DC.
100. **Durham, P.L.** (2012) Regulation of inflammatory proteins in trigeminal ganglion and trigeminal nucleus caudalis in response to cocoa enriched diets: Implications for migraine and TMJ disorder. American Chemical Society, Division of Agricultural and Food Chemistry, San Diego, CA.

101. Dieckhoff, D.T., Cady, R.J., **Durham, P.L.** (2012) Calcitonin Gene-Related Peptide Promotes Healing of Cutaneous Thermal Wounds, 22nd Annual Meeting of the Wound Healing Society, Atlanta, GA. Wound Rep Reg (2012) 20 A21
102. Hawkins, J.L., Garrett, F.G., and **Durham, P.L.** (2012) Prolonged Jaw Opening Promotes Sensitization of Trigeminal Nociceptive Neurons. 36th Scientific Meeting of the American Academy of Orofacial Pain, Pasadena, CA.
103. Cady, R.J., Hawkins, J.L., and **Durham, P.L.** (2012) Sensitization of Trigeminal Nociceptive Neurons In Response to Prolonged Neck Muscle Pain: Implications for TMD Pathology, 36th Scientific Meeting of the American Academy of Orofacial Pain, Pasadena, CA.
104. Hawkins, J.L., Denson, J.E., Miley, D.R., and **Durham, P.L.** (2012) Chronic Nicotine Promotes Expression of Proteins Implicated in Development of Peripheral and Central Sensitization of Trigeminal Neurons. 54th American Headache Society Meeting, Los Angeles, CA.
105. Durham, P.L., Cady, R.J., and Hawkins, J.L. (2012) Sensitization of Trigeminal Nociceptive Neurons in Response to Prolonged Neck Muscle Pain: Implications for Migraine Pathology 54th American Headache Society Meeting, Los Angeles, CA.
106. Cady, R.J., Hawkins, J.L., and **Durham, P.L.** (2012) Elevated Levels of CGRP in the Upper Spinal Cord Promotes Cellular Changes in Trigeminal Ganglia Associated with Peripheral Sensitization of Trigeminal Nociceptors. 54th American Headache Society Meeting, Los Angeles, CA.
107. Cady, R.J., Denson, J.E., and **Durham, P.L.** (2012) Inclusion of Cocoa as a Dietary Supplement Represses Cytokine Expression in Spinal Trigeminal Nucleus in Response to Chronic Trigeminal Nerve Stimulation. 54th American Headache Society Meeting, Los Angeles, CA.
108. Siqiang Zhu, Joseph Mbugua, Mark Chase, Theodore R. Nicholson III, June-Ho Jung, Jeffrey Maskrod, Carrie V. Vause, Eve Fabrizio, Gusphyl Justin, **Paul L. Durham**, Ramil Marcelo L. Mercado (2012) Nanotech 2012 Electronically-Controlled Drug Release System to Assist Wound Healing.
109. T. R. Nicholson III¹, S. Zhu¹, J. Maskrod¹, M. Chase¹, J. Mbugua¹, J-H. Jung, C. V. Vause, G. Justin¹, **P. L. Durham**, and R. M. Mercado (2012) An Electroactive Polymer-based Drug Delivery System for the On-demand Loading and Release of Ibuprofen Sodium Salt and Doxycycline Hyclate. Fall BMES Meeting.
110. White, S. H. and **Durham, P.L.** (2012) Tonabersat. Eleventh Eilat Conference on New Antiepileptic Drugs (Eilat XI), Eilat, Israel, May 2012.

111. Cady, R.J., Hawkins, J.L., and **Durham, P.L.** (2012) Inflammatory Neck Muscle Pain Mediates Cellular and Behavioral Changes that Promote Prolonged Sensitization of Trigeminal Nociceptive Neurons. Society for Neuroscience Meeting, New Orleans.
112. Hawkins, J.L., Denson, J.E., and **Durham, P.L.** (2012) Prolonged Jaw Opening Promotes Sensitization of Trigeminal Nociceptive Neurons: Repression of Behavioral Response by Dietary Grape Seed Extract. Society for Neuroscience Meeting, New Orleans.
113. Hawkins, J.L., Denson, J.E., Miley, D.R., and **Durham, P.L.** (2012) Chronic Nicotine Promotes Cellular Changes in the Trigeminal System that Block the Effect of the Anti-Migraine Drug Sumatriptan. Society for Neuroscience Meeting, New Orleans.
114. Turner, I., Cady, R., **Durham, P.L.**, Dexter, J.K., Cady, R.J., and Browning, R. (2013) An Exploratory Study of Calcitonin Gene-Related Peptide in Chronic Migraineurs Receiving OnabotulinumtoxinA: Implications to Pathophysiology and Treatment Responses. 55th American Headache Society Meeting, Boston, MA.
115. **Durham, P.L.** (2013) Epigenetics: Exploring the Impact of Nutrition on the Regulation of Our Genes that Promote Human Health and Disease. Missouri Council for Activity & Nutrition (MOCAN), Springfield, MO.
116. **Durham, P.L.** (2013) What Rats Can Teach Us About Migraine. Oral Presentation at the Southern Headache Society Meeting. Ashville, N.C.
117. **Durham, P.L.**, Sullivan, L. and Cady, R. (2013) Dual Orexin Receptor Antagonist 12 Represses Expression of Proteins in Neurons and Glia Implicated in Peripheral and Central Sensitization. The 65th Annual American Academy of Neurology Meeting. San Diego, CA.
118. **Durham, P.L.** (2013) Regulation of Orofacial Pain: Emerging Importance of Epigenetics. Oral Presentation at the American Academy of Craniofacial Pain. Sydney, Australia.
119. **Durham, P.L.** (2013) Neuron-Glia Interactions in Migraine, TMD, and Other Orofacial Pain Disorders. Oral Presentation at the American Academy of Craniofacial Pain. Sydney, Australia.
120. **Durham, P.L.** (2013) Muscle Pathology Leads to Peripheral Sensitization: Evidence of Bidirectional Signaling in the Trigeminal System. Oral Presentation at the American Academy of Orofacial Pain. Orlando, FL.
121. Turner, I., Cady, R., **Durham, P.**, Dexter, K., Cady, R., Browning, R. (2013) An Exploratory Study of Calcitonin Gene-Related Peptide in Chronic Migraineurs Receiving OnabotulinumtoxinA: Implications to Pathophysiology and Treatment Responsiveness. International Headache Congress, Boston, MA.
122. Hawkins, J.L., Denson, J.E., Thurman, B.N., **Durham, P.L.** (2013) Prolonged Sensitization of Trigeminal Nociceptive Neurons Caused by Neck Muscle Inflammation and REM Sleep

Deprivation: Implications for Migraine and TMD Pathology. Society for Neuroscience, San Diego, CA.

123. Finley, P.J., Norton, R., Austin, C., Mitchell, A., Zank, S., **Durham, P.** (2013) Isolation and Characterization of Highly Silver-Resistant Clinical Bacteria. Clinical Symposium on Advanced Wound Care. Lake Buena Vista, FL.
124. **Durham, P.L.** (2014) Epigenetics: Exploring the Impact of Nutrition on the Regulation of our Genes. Missouri Council for Activity & Nutrition (MOCAN), Springfield, MO.
125. **Durham, P.L.**, Hawkins, J.L. (2014) Neck Muscle Inflammation Leads to Prolonged Sensitization of Trigeminal Neurons and Increased Nociceptive Behavioral Responses to a Pungent Odor. ICOT 2014 & AAOP 38th Scientific Meeting. Las Vegas.
126. Cady, R., Cady, R., Martin, V., **Durham, P.L.** (2014) Salivary Biomarkers and their Relationship to Menstrual Migraine Before and After Treatment with Sumatriptan-Naproxen or Placebo. American Headache Society 2014 Annual Scientific Meeting. Los Angeles, CA.
127. **Durham, P.L.**, Hawkins, J.L. (2014) Trigeminal Sensitization in Migraine: Creation of the Perfect Storm. American Headache Society 2014 Annual Scientific Meeting. Los Angeles, CA.
128. Masterson, C., **Durham, P.L.** (2014) Human Parafollicular Cancer Cells: A Neuronal Model for Novel Drug Identification to Treat Neuropathic Pain to the American Academy of Otolaryngology—Head and Neck Surgery Foundation, Orlando, FL.
129. **Durham, P.L.** (2014) Why A Patient’s Environment Matters: Role of Epigenetics in Disease Progression and Treatment Response. American Academy of Orofacial Pain Summer Symposium. Denver, CO.
130. O’Reily, A. and **Durham, P.L.** (2014) Study of Proteins Associated with Epileptic Seizures in Primary Hippocampal Cultures Under Basal and Stimulated Conditions. 16th International Neuroscience Winter Conference, Solden, Austria, April 2014.
131. Durham, Z.L. and **Durham, P.L.** (2014) Elevated TNF-Alpha Levels in the TMJ Promotes Transient Peripheral Sensitization of Trigeminal Nociceptive Neurons. Society for Neuroscience, Washington D.C.
132. **Durham, P.L.**, Miley, D., Moore, N., Hawkins, J. (2015) Secondary Traumatic Stress Increases Trigeminal Nerves: Potential Role in Migraine Pathogenesis. Annual American Academy of Neurology Meeting, Washington DC.
133. Hawkins, J.L., Norton, R., **Durham, P.L.** (2015) Prolonged Trigeminal Sensitization Induces Gut Dysbiosis: Implications for Migraine Pathology. Annual American Academy of Neurology Meeting, Washington DC.

134. Moore, N., Miley, D., **Durham, P.L.** (2015) Prenatal or Postnatal Secondary Traumatic Stress Increases Expression of Proteins Implicated in Peripheral and Central Sensitization of Trigeminal Nerves, American Academy of Orofacial Pain Scientific Meeting, Denver, CO.
135. Denson, J.E., **Durham, P.L.** (2015) Investigation of the Nocifensive Behavioral and Cellular Effects of Dihydroergotamine and Sumatriptan in a Model of Sustained Trigeminal Activation. American Headache Society Meeting, Washington DC.
136. **Durham, P.L.**, Smith, K. (2015) Cannabis Extract from Cultivars Expressing Low Levels of THC Increases MAP Kinase Phosphatase Levels in Trigeminal Ganglion Neurons and Glia. American Headache Society Meeting, Washington DC. AHS
137. Miley, D., Moore, N., **Durham, P.L.** (2015) Prenatal and Postnatal Secondary Traumatic Stress: Implication for Migraine Pathogenesis by Promoting Peripheral and Central Sensitization of Trigeminal Nerves. American Headache Society Meeting, Washington DC. AHS
138. Cornelison, L., Hawkins, J., **Durham, P.L.** (2015) Elevated Intrathecal CGRP Levels Promote Trigeminal Nociception: Evidence of Bidirectional Signaling. American Headache Society Meeting, Washington DC. AHS
139. Norton, R., Hawkins, J., **Durham, P.L.** (2015) Prolonged Trigeminal Sensitization Induces Gut Dysbiosis, American Society for Microbiology, New Orleans, LA.
140. Hawkins, J., **Durham, P.L.** (2015) Chicken Broth AAC1 as a Dietary Supplement Represses Nocifensive Behaviors and PKA Expression Caused by Prolonged Jaw Opening. Society for Neuroscience, Chicago, IL.
141. Hawkins, J., Norton, R., **Durham, P.L.** (2015) Persistent Sensitization of Trigeminal Neurons Promotes Gut Dysbiosis. Society for Neuroscience, Chicago, IL.
142. Cornelison, L., Hawkins, J., **Durham, P.L.** (2015) Central Role of Calcitonin Gene-Related Peptide in Promoting Peripheral Sensitization of Trigeminal Nociceptive Neurons. Society for Neuroscience, Chicago, IL
143. Hawkins, J.L., **Durham, P.L.** (2016) Biochemical Comparison of AAC1 Enriched Chicken Broth to Homemade Chicken Broth: Potential Benefits to Joint Health. American Society for Nutrition, San Diego, CA.
144. Norton, R., Hawkins, J.L., **Durham, P.L.** (2016) Inclusion of Chicken Broth AAC1 as a Dietary Supplement Modulates the Gut Microbiome: Results of Next-Generation DNA Sequencing. American Society for Nutrition, San Diego, CA.
145. Hawkins, J.L., Cornelison, L.E., **Durham, P.L.** (2016) Chicken Broth AAC1 as a Dietary Supplement Inhibits Pain Transmission and Decreases Serum C-Reactive Protein Levels In a Model of TMJ Disorder. American Society for Nutrition, San Diego, CA.

146. Hawkins, J.L., **Durham, P.L.** (2016) Nocifensive Response and PKA Expression Caused by Prolonged Jaw Opening Are Suppressed by Inclusion of Chicken Broth AAC1 as a Dietary Supplement. American Academy of Orofacial Pain, Orlando, FL.
147. Hawkins, J.L., Cornelison, L.E., **Durham, P.L.** (2016) Vagal Nerve Stimulation Inhibits Activation of Trigeminal Nociceptive Neurons in a Model of Trigeminal Sensitization. American Academy of Orofacial Pain, Orlando, FL.
148. Hawkins, J.L., **Durham, P.L.** (2016) Dietary Inclusion of Chicken Broth AAC1 Inhibits Mechanical Hyperalgesia and Increased PKA Expression: Evidence Blocking Peripheral and Central Sensitization in the Trigeminal System. American Headache Society, San Diego, CA.
149. Hawkins, J.L., Hyde, C., **Durham, P.L.** (2016) Administration of a Cannabinoid Enriched Extract Expressing Low Levels of THC Stimulates Increased Expression of MAP Kinase Phosphatases in Trigeminal Ganglion Neurons and Glia: Implications for Migraine Therapy. American Headache Society, San Diego, CA.
150. Koop, L., Hawkins, J.L., Cornelison, L.E., **Durham, P.L.** (2016) Temporomandibular Joint Inflammation Induces Changes in Protein Expression in V1 and V2 Trigeminal Neurons Implicated in Peripheral Sensitization and Migraine Pathology: Central Role of CGRP. American Headache Society, San Diego, CA.
151. Hawkins, J.L., Cornelison, L.E., **Durham, P.L.** (2016) Vagal Nerve Stimulation Suppresses Activation of Trigeminal Nociceptive Neurons in an Animal Model of Migraine Involving Trigeminal Sensitization. American Headache Society, San Diego, CA.
152. Hawkins, J.L., Cornelison, L.E., **Durham, P.L.** (2016) Vagal Nerve Stimulation Inhibits Activation of Trigeminal Nociceptive Neurons in a Model of Trigeminal Sensitization. European Headache and Migraine Trust International Congress, Glasgow, UK.
153. Hawkins, J.L., Cornelison, L.E., **Durham, P.L.** (2016) Vagal Nerve Stimulation Inhibits Expression of Proteins Implicated in Sensitization and Excitation of Trigeminal Nociceptive Neurons: Relevance to Migraine Therapy. European Headache and Migraine Trust International Congress, Glasgow, UK.
154. Chelliboina, N., Hawkins, J.L., and **Durham, P.L.** (2017) Neck Muscle Inflammation Promotes Sensitization of Trigeminal Neurons: Risk Factor for Chronic Nociception In Response to Prolonged Jaw Opening. American Academy of Orofacial Pain, Phoenix, AZ.
155. Hawkins, J.L., Blankenship, B.A., Cornelison, L.E., **Durham, P.L.** (2017) Vagal Nerve Stimulation Suppresses Trigeminal Sensitization Induced by Neck Muscle Inflammation: Treating a Risk Factor of Migraine. American Academy of Orofacial Pain, Phoenix, AZ.

156. Hawkins, J.L., Blankenship, B.A, Cornelison, L.E., and **Durham, P.L.** (2017) The Use of an Odorant Trigger to Induce Nociception in Animals with Trigeminal Sensitization Elicited by Neck Muscle Inflammation: A Novel Model of Migraine Pathology. American Headache Society, Boston.
157. Hawkins, J.L., Blankenship, B.A., Cornelison, L.E., **Durham, P.L.** (2017) Non-invasive Vagal Nerve Stimulation Suppresses Trigeminal Sensitization Induced by Neck Muscle Inflammation: Treating a Risk Factor of Migraine. American Headache Society, Boston.
158. Cornelison, L.E., Hawkins, J.L., Mohite, S., Allen, J., Chelliboina, N., **Durham, P.L.** (2017) Inhibition of Trigeminal Nociception by Cannabidiol In a Model of Migraine Pathology American Headache Society, Boston.
159. Peterson, O., Hawkins, J.L., Cornelison, L.E., **Durham, P.L.** (2017) Early-Life Stress Causes a Heightened State of Trigeminal Nociception and Gut Dysbiosis: Evidence of Risk Factor for Development of Chronic Orofacial Pain Conditions. Society for Neuroscience, Washington, D.C.
160. Hawkins, J.L., Blankenship, B.A., **Durham, P.L.** (2017) Neck Muscle Inflammation Induces Trigeminal Central Sensitization: A Risk Factor for Episodic Migraine. Society for Neuroscience, Washington, D.C.
161. Hawkins, J.L., Blankenship, B.A., Cornelison, L.E., and **Durham, P.L.** (2018) Evidence that Trapezius Inflammation Is a Risk Factor of Episodic Migraine by Promoting Trigeminal Central Sensitization. American Academy of Orofacial Pain, Chicago, IL.
162. Peterson, O., Hawkins, J.L., Cornelison, L.E., and **Durham, P.L.** (2018) Early Life Stress is a Risk Factor for Development of Chronic Trigeminal Pain: Correlation with Dysbiosis of Gut Microbiota. American Academy of Orofacial Pain, Chicago, IL.
163. Sara E. Woodman, Jordan L. Hawkins, Lauren E. Cornelison, Hannah G. Childs, and **Paul L. Durham.** (2018) Novel Model for Development of a Persistent Sensitized State of Trigeminal Nociceptors: Implications for Understanding Chronic Migraine. Society for Neuroscience, San Diego, CA.
164. Lauren E. Cornelison, Sara E. Woodman, and Jordan L. Hawkins and **Paul L. Durham** (2018) Vagus Nerve Stimulation Attenuates Trigeminal Nociception Similarly to Sumatriptan in Two Rat Models of Episodic Migraine. Society for Neuroscience, San Diego, CA.
165. Cornelison, L.E., Woodman, S.E., Hawkins, J.L., Simon, B.J. and **Durham, P.L.** (2019) Trigeminal Nociception is Similarly Attenuated by Vagus Nerve Stimulation and Sumatriptan in Episodic Migraine Models. North American Neuromodulation Society, Las Vegas, NV.
166. **Durham, P.L.** The Sympathetic Versus Parasympathetic Activity: Getting the Balance Right. (2019) Invited symposium talk. 8th International Symposium, Sydney, Australia.

167. **Durham, P.L.** Improving Gut Brain Health: Key to Management of Chronic Pain. (2019) Invited symposium talk. 8th International Symposium, Sydney, Australia.
168. **Durham, P.L.** Novel Treatments to Manage Orofacial Pain: Quieting the Trigeminal System. (2019). Invited symposium talk. 8th International Symposium, Sydney, Australia.
169. Cornelison, LE, Woodman, SE, Keyes, C., Cox, J. **Durham, PL** (2019) Dietary Supplementation with Grapeseed Extract Prevents Development of Trigeminal Sensitization and Inhibits Pain Signaling in a Preclinical Chronic TMD Model. American Academy of Orofacial Pain, San Diego, CA.
170. Cornelison, LE, Woodman, SE, Keyes, C., Cox, J., **Durham, PL** (2019) Trigeminal Pain Signaling Is Attenuated by Noninvasive Vagus Nerve Stimulation and Sumatriptan in Preclinical Episodic Migraine Models via Different Mechanisms. American Academy of Orofacial Pain, San Diego, CA.
171. Peterson, O., Cornelison, L.E., and **Durham, P.L.** (2019) Early Life Stress Promotes Development of a Sensitized Trigeminal System and Gut Dysbiosis that is More Severe in Females. American Headache Society Meeting, Philadelphia, PA.
171. Cornelison, LE, Woodman, SE, **Durham, P.L.** (2019) Noninvasive Vagus Nerve Stimulation and Morphine Transiently Inhibit Trigeminal Pain Signaling in a Chronic Migraine Model. American Headache Society Meeting, Philadelphia, PA.
172. Cornelison, LE, Woodman, SE, **Durham, PL.** (2019) Noninvasive Vagus Nerve Stimulation Inhibits Trigeminal Nociception in Two Episodic Migraine Models by Enhancing Descending Pain Modulation. American Headache Society Meeting, Philadelphia, PA.
173. Cornelison, LE, Woodman, SE, Keyes, C., Cox, J., **Durham, PL.** (2019) Dietary supplementation with grape seed extract prevents development of trigeminal sensitization and inhibits pain signaling in a preclinical chronic TMD model. Society for Neuroscience, Chicago, IL.
174. Peterson, O, Cornelison, LE, **Durham, PL.** (2019) Trigeminal sensitization caused by early life stress is inhibited by dietary supplementation with enriched chicken bone broth in a model of episodic migraine. Society for Neuroscience, Chicago, IL.
175. Woodman, SE, Cornelison, LE, **Durham, PL.** (2019) Noninvasive vagus nerve stimulation inhibits trigeminal nociception by enhancing descending pain modulation: similar effect as observed with morphine in chronic migraine model. Society for Neuroscience, Chicago, IL.
176. **Durham, PL.** (2020) Invited lecture: Update on Orofacial Pain Pathology and Treatment. MAHAN Conference, New Orleans.
177. **Durham, PL.** (2021) Invited presentation: Modulation of Inhibitory Descending Pain Pathway: Insights into Migraine Pathology and Treatment, American Headache Society, virtual meeting.

178. Woodman, S.E., **Durham, P.L.** (2021) Inhibition of Trigeminal Nociception in a Preclinical Migraine Model by Dietary Grape Seed Extract Involves Activation of Endocannabinoid Receptors. International Association for the Study of Pain. Virtual meeting.
179. **Durham, P.L.** (2021) Invited presentation: Alternative Strategies for Migraine and TMD by Enhancing Descending Pain Modulation Pathway: Role of nVNS and Nutraceuticals. Wichita State University, Department of Biology, Wichita, KS.
180. **Durham, P.L.** (2021) Invited presentation: Non-invasive Vagus Nerve Stimulation in Animal Models of Trigeminal Sensitization. American Headache Society, Scottsdale, AZ.
181. **Durham, P.L.** (2021) Invited presentation: Complementary and alternative approaches in orofacial pain and sleep management. American Academy of Orofacial Pain, Boston, MA.
182. **Durham, P.L.** (2021) Invited presentation: The importance of the nervous system-digestive system connection in OFP. American Academy of Orofacial Pain, Boston, MA.
183. **Durham, P.L.** (2021) Invited presentation: Nutrition guidelines for the patient with a TMD/OFP. American Academy of Orofacial Pain, Boston, MA.
184. Huelsing, M. Woodman, S.E., Kaf, W., **Durham, P.L.** (2022) Novel Investigation of the Effects on Hearing Thresholds in a Preclinical Chronic Migraine Model Using Tone Burst Auditory Brainstem Response. American Academy of Audiology, St Louis, MO.
185. Woodman, S.E., Pedersen, J., **Durham, P.L.** (2022) Changes in Fecal and Cecal Microbiota in Male and Female Offspring Exposed Prenatally and Postnatally to Silver and Palladium Nanoparticles. Society of Toxicology, San Diego, CA.
186. Satterfield, C., Pedersen, J., **Durham, P.L.** (2022) Prenatal and Postnatal Dietary Exposure to Silver or Palladium Nanoparticles Causes an Increase in Iba1 Positive Macrophages in Pubescent Rat Colon. Society of Toxicology, San Diego, CA.
187. Antonopoulos, S., Pedersen, J. **Durham, P.L.** (2022) Prenatal and Postnatal Dietary Exposure to Tin Dioxide and Copper Oxide Nanoparticles Did Not Lead to Morphological Abnormalities or Changes in Allograft Inflammatory Factor-1 Expression in Pubescent Rat Kidney. Society of Toxicology, San Diego, CA.
188. Keyes, C., Pederson, J., **Durham, P.L.** (2022) Effects of Silver Nanoparticle Exposure on Cell Viability and NFkB Gene Expression in a Neuronal-like Cell Line: Inhibition of Basal and Stimulated NFkB Promoter Activity. Society of Toxicology, San Diego, CA.
189. Huelsing, M.W., Woodman, S.A., Kaf, W., **Durham, P.L.** (2022) Changes in Hearing Threshold and Auditory Brainstem Pathway Correlate with Trigeminal Nociception in a Preclinical Chronic Migraine Model. American Academy of Orofacial Pain, Boston, MA.

190. Huelsing, M.W., Woodman, S.E., Kaf, W., **Durham, P.L.** (2022) Trigeminal Nociception is Associated with Changes in Hearing Threshold and Auditory Brainstem Pathway in a Preclinical Chronic Migraine Model. American Headache Society, Denver, CO.
191. **Durham, P.L.** (2022) The Importance of The Nervous System-Digestive System in Orofacial Pain. Jordan Commission of Orofacial Pain and Dysfunction, Scientific Meeting, Live Webinar Event.
192. Donaldson, A.L., Woodman, S.E., Kaf, W., **Durham, P.L.** (2023) Changes in Auditory Brainstem Response in Model of Chronic Migraine. American Auditory Society Annual Meeting, Scottsdale, AZ.
193. Masten, A.S., Woodman, S.E., Kaf, W., **Durham, P.L.** (2023) Auditory Brainstem Changes in Preclinical Chronic Temporomandibular Joint Disorder Model. American Auditory Society Annual Meeting, Scottsdale, AZ.
194. **Durham, P.L.** (2023) Invited presentation: Role of Glial Cells in Orofacial Pain Pathology. American Academy of Orofacial Pain, Orlando, FL.
195. Garten, D.A., Antonopoulos, S.R., **Durham, P.L.** (2023) Daily Supplementation with Grape Seed Extract Inhibits Nociception in a Preclinical Chronic TMD Model by Increasing Neuronal Expression of GABAergic Proteins in the Trigeminal Ganglion. American Academy of Orofacial Pain, Orlando, FL.
196. Masten, A.S., Woodman, S.E., Kaf, W., **Durham, P.L.** (2023) Changes in Hearing Threshold and Auditory Brainstem Pathway Correlate with Trigeminal Nociception in a Preclinical Chronic TMD Model. American Academy of Orofacial Pain, Orlando, FL.
197. **Durham, P.L.** (2023) Towards A Better Understanding of Orofacial Pain Pathology and Treatments. American Headache Society, Scottsdale, AZ.
198. Loder, EA, Antonopoulos, SR, **Durham, PL** (2024) A Dietary Supplementation of Grape Seed Extract in Pregnant/Nursing Females Inhibits Gut Microbiome Dysbiosis in Offspring and Increases Levels of Commensal *Bacterioides Acidifaciens*. American Academy of Orofacial Pain, Scottsdale, AZ.
199. Sonia Sharma, Gary Slade, Hanna Grol-Prokopczyk, D. Brad Rindal, **Paul Durham**, Werner Ceusters, Barry Smith, Richard Ohrbach (2025) Rates Of Injury Across The Disease Course Of A Chronic Overlapping Pain Condition, United State Association for Study of Pain Scientific Meeting, Chicago, April 2025.
200. Nalley, N. **Durham, P.L.** (2025) Calcitonin Gene-Related Peptide Modulates the Excitability State of Trigeminal Ganglion A δ and C Fiber Neurons to Depolarizing Stimuli: Implications for TMD and Migraine Pathology. American Academy of Orofacial Pain, Arlington, VA.

201. Scharnhorst, M. **Durham, P.L.** (2025) Transient Maximum Jaw Opening Causes Sustained Nociception and Changes in Proteins Implicated in Pain Signaling in Female but Not Male Sprague Dawley Rats: Evidence of Sexual Dimorphism in a Novel Preclinical TMD Model. American Academy of Orofacial Pain, Arlington, VA.
202. Durham, P.L. (2026) Invited presentation: Differential Regulation of Trigeminal Nociceptive Pathway by CGRP and GABA: Implications for Migraine Pathology and Treatment. Headache Cooperative of New England Winter Meeting, Greenwich, CT.

Grants Awarded

I have been the Principal Investigator or Co-Investigator on grants totaling ~18 million dollars. I have received funding from the National Institutes of Health, pharmaceutical companies, private foundations, and other universities to provide our students opportunities to cutting-edge biomedical research.

Summary of Other Activities

Patents and Inventions:

I am an author on 17 patents (8 since 2011). I designed a novel device for behavior testing in rats this is sold by Ugo Basile (http://www.ugobasile.com/catalogue/product/37100_durham_animal HOLDERS.html).

Student Mentoring (since 2002):

Provided research opportunities for >120 undergraduate students. Primary thesis advisor for >50 graduate students (completed). In addition, I have served on the thesis committee for >50 additional graduate students from the Departments of Biology, Chemistry, and Biomedical Sciences.

Service:

I have served as faculty advisor for Tri-Beta Honor Society (2002 to present), Ice Hockey team (2003-2018), Roller Hockey team (2010- 2018), Member of Public Affairs Committee (multiple years), Vision Committee (2014-2015), Steering Committee (2015-2016), Hearing Committee (2015-2016), Chair of CNAS Scholarship Committee (>10 yrs; now serving as member), Sustainability Academic Subcommittee (currently), University Sustainability Advisory Committee (currently), Strategic Planning Committee (2020), Strategic Research Planning committee (currently), Chair of Faculty Research Grant committee (currently), Chair of Summer Faculty Fellowship committee (currently), Advisory board for Doctor of Nurse Anesthesia Practice program (currently), church choir member (currently), and teacher for children liturgy at our church (currently).

Scholarship of Teaching:

My average mean evaluation for all courses taught at MSU is >4.5 (5 = outstanding, 5 pt. scale). I have consistently taught two full courses each semester (average of 6 contact hours per week). I am currently teaching the General Biology I course for the Honors College and teach the following courses for upper-level undergraduate students and graduate students when required: Cell and Molecular Biology; Diabetes: Pathology and Treatment; Epigenetics and Human Health; Developmental Biology, and Human Nature. I was responsible for developing the content for Developmental Biology, Diabetes, and Epigenetics since those courses were not being taught in the Biology department. In addition, I am teaching a cell biology course in the summer to students in the accredited Doctor of Nurse Anesthesia Practice (DNAP) program at MSU after an invitation from the director of that program.