

CHARLES NEIL RUDICK, Ph.D.

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Statewide Course Director for Cardiovascular & Hematology

Statewide Course Director for Fundamentals of Health & Disease

Indiana University School of Medicine

Adjunct Lecturer Northwestern University School of Professional Studies

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EDUCATION

Northwestern University, Chicago, IL - Ph.D. Neuroscience - 2005

- Dissertation Advisor: Dr. Charles J. Heckman, Ph.D. in collaboration with Dr. Michela Marinelli, Ph.D.
- Title of Dissertation: *Impulse Activity of Midbrain Dopamine Neurons: Effects of Stress in Drug-Naïve and Drug-Experienced Rats.*

University of Michigan, Ann Arbor, MI - B.S. Biopsychology - 1996

ACADEMIC APPOINTMENTS

Indiana University School of Medicine, Gary, IN 2015 - Present

Assistant Professor of Clinical Pharmacology & Toxicology (2018 - Present)

Statewide Course Director for Fundamentals of Health & Disease (2018 - Present)

Statewide Course Director for Cardiovascular & Hematology (2016 - Present)

Visiting Assistant Professor & Site Director for Pharmacology & Toxicology (2015 - 2017)

My roles at Indiana University School of Medicine are to prepare medical students for board exams, clinical years, and to advance medical education. Currently, I teach Pharmacology and Physiology to first and second year medical students using both didactic and non-didactic sessions to deliver the material. I am also actively involved in advancing medical student education. In the fall of 2016 Dr. Maureen Harrington, the Associate Dean for Medical Education - Foundational Sciences, approached me to lead the development, implementation, and management of the Cardiovascular and Hematology course for the new curriculum at Indiana University School of Medicine. The School of Medicine has nine campuses: Indianapolis is the primary campus with eight regional campuses across the state. One of the primary goals of the course management team is to ensure that the course content is delivered comparably at all nine campuses, which we easily achieved this past year with campus performance means within 3% for all exams and final grades across all nine campuses.

My ongoing research collaboration with Dipika Gupta focuses on the role of the microbiome and immunity in obesity. In the US, more than 35% of adults and 17% of youth are obese, and more than half of all obese individuals develop metabolic abnormalities, which may include hyperglycemia, hyperlipidemia, hepatic steatosis, and/or hypertension. The primary cause of obesity is an excess of caloric intake over

expenditure, and this energy surplus present in obese individuals results in chronic inflammation, which contributes to metabolic dysfunction. In addition, the gut microbiota plays an important role in maintaining energy and immune homeostasis. Both host genetic and environmental factors shape the microbiota, and changes in either factor can alter intestinal bacterial populations. Changes in the microflora may include increased numbers of bacteria that are highly efficient at harvesting energy from the diet and/or are pro-inflammatory, resulting in microbiota-induced obesity and an increased risk for metabolic diseases. However, the genetic and environmental regulation of the microflora is poorly understood and the specific changes in the gut bacteria that contribute to the development of obesity and metabolic disease are not identified.

Northwestern University School of Professional Studies, Chicago, IL

2014 - Present

Adjunct Lecturer (2015 - Present)

Lecturer (2014 - 2015)

I taught Human Physiology I & II in the academic year of 2014-2015. In the summer of 2015 Dr. Peter Kaye, the Assistant Dean for Undergraduate and Post-Baccalaureate Programs, approached me to separate the courses and create what is now Physiology 217 and Advanced Human Physiology 318. Physiology 217 corresponds to the undergraduate Physiology 217 at Northwestern University and Advanced Human Physiology was created to better prepare both undergraduates and post-baccalaureate students for medical, physician assistant, nursing, physical therapy, and other related graduate programs.

Advanced Human Physiology (318): Advanced Human Physiology builds on the concepts covered in Physiology 217 by focusing on the body as an integrated set of systems. The course is designed to construct a global view of the body, its systems, and the many processes that keep the systems working by emphasizing an integrated approach to the study of all major organ systems including neural, autonomic/somatic motor, endocrine, cardiovascular, respiratory, renal, digestive, and reproductive physiology. In addition to discussing the integration of organ systems, each lecture focuses on the clinical relevance of the organ system, including abnormal function, disease states, and medications used to return the system to its normal function.

Human Physiology I (335A): One of the key themes in Human Physiology I is that the body is an integrated set of systems. As such, the course is designed to construct a global view of the body, its systems, and the many processes that keep these systems working. I begin with basic cell processes including molecular interactions, compartmentation, membrane dynamics, and communication and proceed with homeostasis and control by covering the endocrine system, the central and peripheral nervous systems, sensory systems, autonomic, somatic motor control, and cardiovascular physiology. My lectures include key concepts, basic anatomical descriptions, and a discussion of the structure and function of the key components in each system. During each class, students form small discussion groups to summarize what they learn and to discuss a system to present at the end of the term.

Human Physiology II (335B): A continuation of Human Physiology I, this class integrates biological processes to construct a global view of the body, its systems, and the many processes that keep the systems working. This course emphasizes an integrated approach to the study of the cardiovascular, respiratory, urinary, digestive, immune, and reproductive systems. This includes the functional integration of systems that control blood flow and pressure, mechanics of breathing, gas exchange, and fluid and electrolyte balance by the kidneys. I proceed with a discussion of how the digestive system, energy balance, endocrine control of growth and metabolism, the immune system, reproduction, and development play a role in metabolism, growth, and aging. Each lecture includes key concepts, basic anatomical descriptions, and a discussion of the structure and function of the key components in each system. During each class, students form small discussion groups to summarize what they learn and to discuss a system to present at the end of the term.

Northwestern University Feinberg School of Medicine, Chicago, IL
Research Assistant Professor – Department of Urology

2009 - 2014

My research consisted of investigating the mechanisms of viral-, bacterial-, and autoimmune-induced acute and chronic pelvic pain and developing novel therapies to treat pelvic pain. The National Pain Foundation estimates that 12-20% of women have chronic pelvic pain, with up to 61% of women with chronic pelvic pain who remain undiagnosed. I studied the chronic and acute pain conditions of interstitial cystitis/painful bladder syndrome (IC) and urinary tract infection (UTI). IC is a debilitating chronic pain condition of unknown etiology that primarily afflicts women. UTI often causes acute pain with 50% of women having at least one UTI in her lifetime. Both IC and UTI have a significant global impact afflicting approximately 125 million people worldwide. My goal was to gain a better understanding of these conditions through research that will lead to novel therapies to better treat both acute and chronic pelvic pain.

POSTDOCTORAL TRAINING

Northwestern University Feinberg School of Medicine, Chicago, IL
Postdoctoral Research Fellow – Department of Urology

2007 - 2009

- Developed viral-, bacterial-, and autoimmune-induced mouse models of acute and chronic pelvic pain; designed and conducted studies to determine the microbiological, molecular, and electrophysiological determinants of acute and chronic pain; performed implantation of electrodes into the spinal cord to assess electrical changes in dorsal horn neurons; quantified learning and memory and injury-induced pain behaviors in mice; performed molecular biology techniques, including RNA extraction from spinal cord tissue; visualized pain neurons in the bladder using immunofluorescence; quantified trans-epithelial resistance to assess barrier function in the bladder.
- Attended weekly meetings with colleagues to review progress on data analysis and interpretation.
- Collaborated with fellow scientists and physicians in data analysis and interpretation.

Northwestern University Feinberg School of Medicine, Chicago, IL
Postdoctoral Research Fellow – Department of Physiology

2005 - 2007

- Designed and conducted experiments on rats to understand how acute and chronic pain affects brain regions involved in behaviors associated with pain, decision making, and learning and memory; performed stereotaxic surgery on rats for implantation of electrodes to assess electrical changes of hippocampal and amygdala neurons in the brain; quantified learning and memory and injury-induced pain behaviors and in rats; quantified c-Fos, GAD65, and GAD67 expression in the hippocampus; Nistle stained brain slices of the prefrontal cortex, amygdala, and hippocampus to identify electrode placement.
- Attended weekly meetings with colleagues and supervisors to review progress on data analysis and interpretation.
- Collaborated with fellow scientists in data analysis and interpretation.

RESEARCH POSITIONS

Rosalind Franklin University of Medicine and Science, North Chicago, IL
Research Associate – Department of Cellular and Molecular Pharmacology

2003 - 2005

- Conducted experiments on rats and mice to understand how stress affects brain regions involved in behaviors associated with addiction; performed stereotaxic surgery on rats and mice for implantation of electrodes and performed whole-cell patch clamp experiments in brain slices to assess electrophysiological changes of dopamine neurons in the ventral tegmental area of the brain; quantified self-administration and stereotypical behaviors induced by cocaine and amphetamine treatment in rats; quantified stress induced by the cold water swim test; Nistle stained brain slices in the ventral tegmental area, striatum, and nucleus accumbens to identify electrode placement.

- Independently sought, created, and developed constructive relationships with vendors, inter- and external- department faculty and administration, and contractors within the university.
- Increased productivity by developing standardized processes, routines, forms, and systems; reported to exhibit highest work ethic, level of productivity, and ability to meet deadlines.
- Attended weekly meetings with colleagues and supervisors to review progress on data analysis and interpretation.

University of Michigan, Ann Arbor, MI

1996 - 1998

Research Associate – Department of Biopsychology

- Conducted experiments on rats to understand how reproductive hormones affect brain regions involved in mating behavior, motor behavior, behaviors associated with addiction, and learning and memory; performed stereotaxic surgery on rats for implantation microdialysis probes to assess neurochemical changes in the brain; utilized microdialysis to collect samples of dopamine and its metabolites from the striatum and nucleus accumbens in awake, behaving rats and analyzed the concentrations of these molecules using High Performance Liquid Chromatography; quantified mating behaviors and motor performance in rats with fetal brain graphs in a Parkinson's disease model.
- Independently sought, created, and developed constructive relationships with vendors, inter- and external- department faculty and administration, and contractors within the university.
- Oversaw the administrative tasks required to keep the research projects and collaborations functioning properly; developed policies and procedures for daily operations.
- Increased productivity by developing standardized processes, routines, forms, and systems; reported to exhibit highest work ethic, level of productivity, and ability to meet deadlines.
- Contributed scientific support to graduate students.

TEACHING EXPERIENCE

Northwestern University, Department of Neurobiology and Physiology, Evanston, IL

1999 - 2002

Graduate Student Instructor, Introduction to Excitable Cells Laboratory Session (1999 - 2002)

- Conducted a special course titled *Introduction to Excitable Cells* where I led three groups of four students in discussions of primary scientific papers twice per week for four weeks; graded the students on presentations and papers written on material I chose for the students; performed experiments to give the students hands-on experience and first time exposure to primary research.

Graduate Student Instructor, Introduction to Excitable Cells (1999)

- Taught students the basic principles of neurotransmission; held office hours twice per week and review sessions before exams.

Graduate Student Instructor, Biology 101 (2000)

- Taught students the fundamentals of biology; held four-hour laboratory sessions twice per week where I prepared and helped the students perform various experiments: frog leg dissection and understanding basic principles of muscle contraction, growing various bacteria and learning basic principles of classification, isolating various cellular components, and running gels to isolate specific proteins; graded the student lab books and administered quizzes (written and proctored myself) every week; held office hours twice per week and review sessions before exams.

University of Michigan, Department of Psychology, Ann Arbor, MI

1996 - 1998

Graduate Student Instructor, Biopsychology (1996 - 1998)

- Reviewed material from the lectures and instructed a sheep brain dissection for two discussion sessions where students learned basic neuroanatomy and were tested on the subject; held two-hour discussion

sessions twice per week where quizzes (written and proctored myself) were given once every two weeks; held review sessions before exams and office hours twice per week.

Graduate Student Instructor, Human Neuropsychology (1997)

- Students were taught symptoms and characteristics of several neurological disorders such as Parkinson's disease, Alzheimer's disease, Huntington's disease, Schizophrenia, Aphasia, Ataxic disorders, Multiple personality disorder, and affective disorders; held two-hour discussion sessions twice per week where quizzes (written and proctored myself) were given once every two weeks; held review sessions before exams and office hours twice per week.

Graduate Student Instructor, Introduction to Psychology (1996)

- Reviewed material from the lectures twice per week in two-hour discussion sessions with the students; reviewed quizzes (written and proctored myself) once every two weeks; held review sessions before exams and office hours twice per week.

TUTORING EXPERIENCE

Northwestern University Institute for Neuroscience, Chicago, IL 2005 - 2006

- Helped graduate students learn the fundamentals of neuroscience.

Professional Chemistry Fraternity (AXΣ), Ann Arbor, MI 1996 - 1998

- Helped undergraduate and high school students learn the principles of organic and inorganic chemistry.

Blue Book Tutoring, Ann Arbor, MI 1996 - 1997

- Helped undergraduate students learn various aspects of human neuropsychology.

PROFESSIONAL AFFILIATIONS

- Society for Neuroscience – 2000 - 2014
- Professional Chemistry Fraternity (AXΣ) – 1996 - 1998

HONORS/AWARDS

- Trustee Teaching Award, Indiana University School of Medicine (2018)
- Exemplar of Professionalism Award, Indiana University School of Medicine (2018)
- NIH National Service Award in the Northwestern University Department of Urology (2006 - 2008)
- Cellular and Molecular Basis of Disease NIH Training Grant appointment (1999 - 2002)
- NIH Predoctoral Training Award from Northwestern University Institute for Neuroscience (1998 - 1999)

COMMITTEES

- CCSC Elective Subcommittee, Indiana University School of Medicine (2017 - Present)
 - I review, revise, and approve elective proposals for third and fourth year medical students.
- Urology Retreat committee, Northwestern University (2012 - 2013)
 - I organized and hosted the Department of Urology Retreat, a day long conference of seminars and breakout groups.

REVIEW OF MANUSCRIPTS AND GRANTS

- Reviewed a primary research manuscript for PLoS ONE (2014)
- Reviewed a primary research manuscript for PLoS ONE (2013)
- Reviewed a clinical research manuscript for PLoS ONE (2013)
- Reviewed a grant proposal for the Veni Program (2012)
- Reviewed a review manuscript for the Journal of Urology (2012)
- Reviewed a primary research manuscript for the Journal of Obstetrics and Gynaecology Research (2011)

PRESENTATIONS

- 1) Taylor AK, Klumpp DJ, Schaeffer AJ, **Rudick CN**. Rapid Attenuation of Acute Urinary Tract Infection Pain and Colonization using an Asymptomatic Bacteriuria Strain. American Urological Association annual meeting May 2011. Journal of Urology (abstract # 1367).
- 2) Thumbikat P, **Rudick CN**, Klumpp DJ, Schaeffer AJ. Chronic Pelvic Pain is Associated with Mast Cell Activation and is Amenable to Mast Cell Directed Therapies. American Urological Association annual meeting April 2010. Journal of Urology (abstract # 802).
- 3) **Rudick CN**. Host-Pathogen Interactions Mediating Pain of Urinary Tract Infection. International Pelvic Pain Society annual meeting October 2009.
- 4) **Rudick CN**, Billips BK, Yaggie RE, Schaeffer AJ, Klumpp DJ. UTI Pelvic Pain is Independent of Bacterial Colonization, Inflammation and Type 1 Pili. American Urological Association annual meeting April 2009. Journal of Urology (Vol. 181, Issue 4, Page 237).
- 5) Thumbikat P, **Rudick CN**, Schaeffer AJ. Characterization of Pain Mechanisms in a Model of Chronic Prostatitis/Chronic Pelvic Pain Syndrome. American Urological Association annual meeting April 2008. Journal of Urology (Vol. 179, Issue 4, Page 34).
- 6) **Rudick CN**, Bryce PJ, Guichelaar LA, Klumpp DJ. Mast Cell-Derived Histamine Mediates Cystitis Pain. American Urological Association annual meeting April 2008. Journal of Urology (Vol. 179, Issue 4, Page 62).
- 7) **Rudick CN**, Centeno MV, Chialvo D, Apkarian AV. Pain Hurts the Emotional Brain: Impairment of mPFC Neurons to Signal Memory of Extinction in Rats with Neuropathic Pain. National Instruments Symposium at the annual Society for Neuroscience meeting 2006.
- 8) **Rudick CN**, Woolley CS. Estrogen Regulates Functional Inhibition of Hippocampal CA1 Pyramidal Cells in the Adult Female Rat. Center for Reproductive Science annual minisymposium on reproductive science October 2001.
- 9) **Rudick CN**, Woolley CS. Estradiol Induces a Phasic Fos Response in the Hippocampal CA1 and CA3 Regions of Adult Female Rats. Northwestern University Institute for Neuroscience annual retreat March 2000.

PUBLICATIONS IN PREPARATION

- 1) **Rudick CN**, Yaggie RE, Pavlova S, Fischer D, Schaeffer AJ, Tao L, Klumpp DJ. (2016). *Streptococcus milleri* Strains Possess Distinct TLR-Dependent Pain Phenotypes. (in process for submission).

- 2) **Rudick CN**, Jaing MC, Yaggie RE, Heckman CJ, Klumpp DJ. (2016). Asymptomatic Bacteriuria *E. coli* Attenuate Spinal Cord Hyperexcitability and Biomarkers Associated with Chronic Pelvic Pain (in preparation).

PUBLICATIONS

- 1) Yang W, Yaggie RE, Jiang M, **Rudick CN**, Done J, Heckman CJ, Rosen JM, Schaeffer AJ, Klumpp DJ. (2018). Acyloxyacyl Hydrolase Modulates Pelvic Pain Severity. *American Journal of Physiology, Integrative and Comparative Physiology*. 314(3): R353-365.
- 2) Rodriguez-Nunez I, Caluag T, Kirby K, **Rudick CN**, Dziarski R, Gupta D. (2017). Nod2 and Nod2-regulated microflora protect from diet-induced obesity and metabolic dysfunction. *Scientific Reports*. 3;7(1):548.
- 3) Lai H, Gereau RW 4th, Luo Y, O'Donnell M, **Rudick CN**, Pontari M, Mullins C, Klumpp DJ. (2015). Animal Models of Urologic Chronic Pelvic Pain Syndromes: Findings from the Multidisciplinary Approach to the Study of Chronic Pelvic Pain Research Network. *Urology*. 85(6):1454-65
- 4) **Rudick CN**, Taylor AK, Yaggie RE, Schaeffer AJ, Klumpp DJ. (2014). Asymptomatic Bacteriuria *E.coli* are Live Biotherapeutics for UTI. *PLoS One*. 9(11):e109321
- 5) Block M, Stern DB, Raman K, Lee S, Carey J, Humphreys AA, Mulhern FJ, Calder B, Schultz DE, **Rudick CN**, Blood AJ, Breiter HC. (2014). The Relationship Between Self-Report of Depression and Media Usage. *Frontiers in Human Neuroscience*. 8:712
- 6) **Rudick CN**, Jaing MC, Yaggie RE, Pavlov VI, Done JD, Whitfield C, Schaeffer AJ, Heckman CJ, Klumpp DJ. (2012). O-Antigen Modulates Infection-Induced Pain States. *PLoS One*. 7(8):e41273.
- 7) Yang W, **Rudick CN**, Hoxha E, Allsop SA, Dimitrakov JD, Klumpp DJ. (2012). Ca²⁺/Calmodulin-Dependent Protein Kinase II is Associated with Pelvic Pain of Neurogenic Cystitis. *American Journal of Physiology-Renal Physiology*. 303(3):350-6.
- 8) Quick ML, Mukherjee S, **Rudick CN**, Done JD, Schaeffer AJ, Thumbikat P. (2012). CCL2 and CCL3 are Essential Mediators of Pelvic Pain in Experimental Autoimmune Prostatitis. *American Journal of Physiology-Regulatory Integrative Comparative Physiology*. 303(6):580-9.
- 9) Done JD, **Rudick CN**, Quick MJ, Schaeffer AJ, Thumbikat P. (2012). Role of Mast Cells in Male Chronic Pelvic Pain. *Journal of Urology*. 187:1473-1482.
- 10) **Rudick CN**, Pavlov VI, Chen MC, Klumpp DJ. (2012). Gender-Specific Pelvic Pain Severity in Neurogenic Cystitis. *Journal of Urology*. 187:715-724.
- 11) **Rudick CN**, Berry RE, Johnson JR, Johnston B, Klumpp DJ, Schaeffer AJ, Thumbikat P. (2011). Uropathogenic *Escherichia coli* Induces Chronic Pelvic Pain. *Infection and Immunity*. 79(2):628-635.
- 12) **Rudick CN**, Billips BK, Pavlov VI, Yaggie RE, Schaeffer AJ, Klumpp DJ. (2010). Host-Pathogen Interactions Mediating Pain of Urinary Tract Infection. *Journal of Infectious Disease*. 201(8):1240-9.
- 13) **Rudick CN**, Schaeffer AJ, Klumpp DJ. (2009). Pharmacologic Attenuation of Pelvic Pain in a Murine Model of Interstitial Cystitis. *BMC Urology*. 9(16):1-8.

- 14) Klumpp DJ and **Rudick CN**. (2009). Dietary Sensitivity of Interstitial Cystitis: Bane and Opportunity. *European Urological Review*. 4(1):54-56.
- 15) Klumpp DJ and **Rudick CN**. (2008). Summation Model of Pelvic Pain in Interstitial Cystitis. *Nature Clinical Practice Urology*. 5(9):494-500.
- 16) **Rudick CN**, Bryce PJ, Guichelaar LA, Berry RE, Klumpp DJ. (2008). Mast Cell-Derived Histamine Mediates Cystitis Pain. *PLoS One*. 3(5):e2096.
- 17) **Rudick CN**, Schaeffer AJ, Thumbikat P. (2008). Experimental Autoimmune Prostatitis Induces Chronic Pelvic Pain. *American Journal of Physiology-Regulatory Integrative Comparative Physiology*. 294(4):R1268-75.
- 18) **Rudick CN**, Chen MC, Mongiu AK, Klumpp DJ. (2007). Organ Cross Talk Modulates Pelvic Pain. *American Journal of Physiology-Regulatory Integrative Comparative Physiology*. 293(3):1191-1198.
- 19) Mellecamps M, Centeno MV, Berra HH, **Rudick CN**, Lavarello S, Tkatch T, Apkarian AV. (2007). d-Cycloserine Reduces Neuropathic Pain Behavior Through Limbic NMDA-Mediated Circuitry. *Pain*. 132(1-2):108-23.
- 20) Marinelli M, **Rudick CN**, Hu XT, White FJ. (2006). Excitability of Dopamine Neurons: Modulation and Physiological Consequences. *CNS Neurological Disorders and Drug Targets*. 5(1):79-97.
- 21) **Rudick CN**, Gibbs RB, Woolley CS. (2003). A Role for the Basal Forebrain Cholinergic System in Estrogen-Induced Disinhibition of Hippocampal Pyramidal Cells. *Journal of Neuroscience*. 23(11):4479-90.
- 22) **Rudick CN**, Woolley CS. (2003). Selective Estrogen Receptor Modulators Regulate Phasic Activation of Hippocampal CA1 Pyramidal Cells by Estrogen. *Endocrinology*. 144(1):179-87.
- 23) **Rudick CN**, Woolley CS (2001). Estrogen Regulates Functional Inhibition of Hippocampal CA1 Pyramidal Cells in the Adult Female Rat. *Journal of Neuroscience*. 21(17):6532-43.
- 24) Becker JB, **Rudick CN**, Jenkins WJ. (2001). The Role of Dopamine in the Nucleus Accumbens and Striatum During Sexual Behavior in the Female Rat. *Journal of Neuroscience*. 21(9):3236-41.
- 25) Gupta RR, Sen S, Diepenhorst LL, **Rudick CN**, Maren S. (2001). Estrogen Modulates Sexually Dimorphic Contextual Fear Conditioning and Hippocampal Long-Term Potentiation (LTP) in Rats. *Brain Research*. 888(2):356-365.
- 26) **Rudick CN**, Woolley CS. (2000). Estradiol Induces a Phasic Fos Response in the Hippocampal CA1 and CA3 Regions of Adult Female Rats. *Hippocampus* 10(3):274-83.
- 27) Becker JB, **Rudick CN**. (1999). Rapid Effects of Estrogen or Progesterone on the Amphetamine-Induced Increase in Striatal Dopamine are Enhanced by Estrogen Priming: a Microdialysis Study. *Pharmacology Biochemistry Behavior*. 64(1):53-7.

BOOK CHAPTERS

- 1) **Rudick CN** Treatment of Obesity and Eating Disorders. In: Brody's Human Pharmacology, Elsevier, Chapter 33, 2018.

ABSTRACTS

Selected abstracts that have not been published in a peer reviewed journals.

- 1) **Rudick CN**, Centeno MV, Chialvo D, Apkarian AV. (2006). Pain Hurts the Emotional Brain: Impairment of mPFC Neurons to Signal Memory of Extinction in Rats with Neuropathic Pain. *Society for Neuroscience Abstract*.
- 2) **Rudick CN**, Marinelli M. (2004). Prior Exposure to Cocaine Enhances the Effects of Stress on Dopamine Neurons in the Ventral Tegmental Area. *Society for Neuroscience Abstract*.
- 3) Marinelli M, **Rudick CN**, Cotterly LM, Beales M, Conrad KL. (2006). Persistent Increases in Cocaine-Seeking Behavior and in Dopamine Neuronal Activity after Acute Exposure to Cold Swim Stress. *Society for Neuroscience Abstract*.
- 4) Apkarian AV, **Rudick CN**, Centeno MV, Chialvo D. (2006). Emotional Learning and Memory Deficits in a Neuropathic Pain Rat Model. *Society for Neuroscience Abstract*.
- 5) Whitlon D, **Rudick CN**, Greiner M, Ketels K. (2000). Distributions of Intergrin Alpha 6 and Laminin in the Developing Mouse Cochlea. *Association for Research in Otolaryngology Abstract*, vol 23: 872

GRANTS AND FUNDING

- 1) Co-Investigator: Richard Gershon; David J Klumpp; Anthony J Schaeffer; Charles J Heckman; Laurie Keefer; Todd Parrish; **Charles N Rudick**; Interactive Mechanisms of Pelvic Pain (9/15/2008 - 6/30/2014). Document ID: 5U01DK082342-05. Sponsor: National Institute of Diabetes, Digestive and Kidney Diseases.
- 2) Co-Investigator: Praveen Thumbikat; **Charles N Rudick**; Anthony J Schaeffer; Chemokine Mechanisms in Chronic Pelvic Pain (9/15/2010 - 6/30/2014). Document ID: R01 DK083609-01A2. Sponsor: National Institute of Diabetes, Digestive and Kidney Diseases.

PATENTS

- 1) **Charles N Rudick**; Praveen Thumbikat; Anthony J Schaeffer; Joseph Done; David J Klumpp; Treatment of Chronic Pelvic Pain Syndrome. Northwestern University US20128586044 Issued 11/19/2013. The present invention provides compositions and methods for detection, diagnosis, treatment and/or prevention of chronic pelvic pain syndrome. In particular, the present invention provides biomarkers of chronic pelvic pain syndrome (e.g., mast cell markers (e.g., tryptase)), and/or inhibition of mast cell function (e.g., inhibition of MCP-1 and/or MIP-1) to treat or prevent chronic pelvic pain syndrome.
- 2) **Charles N Rudick**; David J Klumpp; Anthony J Schaeffer; Compositions and Methods for Treatment of Pain. Northwestern University US20120230957 Issued 03/09/2012. The present invention provides compositions and methods for treatment or prevention of pain resulting from infection, infection related pain, and non-infectious pain as well as treatment or prevention of infections or adverse health consequences associated with infections.