

CURRICULUM VITAE

NAME: **Karin N. Westlund High** Date: 5/04/2010
PRESENT POSITION AND ADDRESS: Date 01/02/2007 - present

Professor (Regular Title Series, tenured)
Department of Physiology
MS-609 Chandler Medical Center
University of Kentucky
Lexington, KY 40536-0298
Karin.High@uky.edu
kwhigh2@uky.edu
(859) 323-3668
(859) 323-0672 voicemail
(859) 323-1070 fax
(859) 312-9394 cell

BIOGRAPHICAL:

August 30, 1953; Austin, Texas
U.S. Citizen
4772 Windstar Way
Lexington, KY 40515
(859) 312-9394

EDUCATION:

09/71 - 05/75 B.A. (Zoology), University of Texas at Austin, Austin, Texas
09/75 - 12/76 M.A. (Zoology), University of Texas at Austin, Austin, Texas
09/78 - 12/81 Ph.D. (Physiology & Biophysics), University of Texas Medical Branch,
Galveston, Texas

PROFESSIONAL AND TEACHING EXPERIENCE:

01/07- present Professor, Regular Title Series, tenured, Dept of Physiology, School of
Medicine and adjunct Professor, College of Dentistry, University of Kentucky,
Lexington, KY
01/94-12/06 Professor (tenured), Neuroscience and Cell Biology, University of Texas
Medical Branch, Galveston, Texas (12/04-12/07)

Karin N. Westlund High, Ph.D.

Mary & J. Palmer Saunders Professor for Excellence in Teaching
(2002-2003)

Adjunct Professor, University of Texas M.D. Anderson Cancer Center,
Houston, Texas, Div. of Internal Medicine, Dept. of Symptom Research (03/03-
present)

Professor (tenured), Anatomy & Neurosciences, University of Texas Medical
Branch, Galveston, Texas (09/94-12/04)

Member, Marine Biomedical Institute, University of Texas Medical Branch,
Galveston, Texas (09/94-12/07)

Associate Director, Cell Biology Graduate Program, University of Texas
Medical Branch, Galveston, Texas (1997-2000)

Interim Director, Cell Biology Graduate Program, University of Texas
Medical Branch, Galveston, Texas, (2000-2001)

09/89-09/94 Associate Professor-tenured, Anatomy & Neurosciences, University of Texas
Medical Branch, Galveston, Texas

Associate Member, Marine Biomedical Institute, University of Texas Medical
Branch, Galveston, Texas

09/87-09/89 Assistant Professor, Anatomy & Neurosciences, and Assistant Professor of
Psychiatry & Behavioral Sciences, University of Texas Medical Branch,
Galveston, Texas

Associate Member, Marine Biomedical Institute, University of Texas Medical
Branch, Galveston, Texas

09/85-09/87 Assistant Professor of Psychiatry & Behavioral Sciences and of Anatomy &
Neurosciences, University of Texas Medical Branch, Galveston, Texas
Associate Member, Marine Biomedical Institute, University of Texas Medical
Branch, Galveston, Texas

09/83-08/85 NIH Postdoctoral Fellow, Anatomy, University of Texas Medical Branch,
Galveston, Texas

01/82-08/83 Kempner Postdoctoral Fellow, Anatomy, University of Texas Medical Branch,
Galveston, Texas

Karin N. Westlund High, Ph.D.

- 08/78-12/81 Graduate Teaching and Research Assistant, Physiology & Biophysics,
University of Texas Medical Branch, Galveston, Texas
Teaching Associate, School of Allied Health Sciences, University of Texas
- 12/76-08/78 Research Technician, Marine Biomedical Institute, Graduate School of
Biomedical Sciences, University of Texas Medical Branch, Galveston, Texas
- 09/74-12/76 Course Grader and Laboratory Assistant, Department of Zoology,
University of Texas at Austin, Austin, Texas

RESEARCH ACTIVITIES:

Current studies investigate mechanisms of deep tissue inflammatory pain using animal and tissue culture models of TMJ (temporomandibular joint) disorders, arthritis and pancreatitis. Neurochemical, molecular, pharmacological, electrophysiological, fMRI, behavioral, immunocytochemical and live cell imaging approaches are utilized. Two major findings include (1) discovery of previously unknown visceral pain pathways and (2) elucidation of feed-forward reverberating neurogenic loops formed by peripheral sensory nerves and the spinal cord, amplifying both inflammation and pain. Mechanisms under study driving the vicious cycles include interactions of TRP family receptors and reactive oxygen species (ROS) which increase neurotransmitter receptor membrane expression and inflammatory mediators. As another example, co-activation of NMDA and metabotropic glutamate receptors in cell culture models significantly increases inflammatory mediator production. In translational studies, pharmacological and gene therapy agents are reducing inflammation and pain in affected muscle, joints and pancreas. Focused viral vector transgene delivery of met-enkephalin has been effective in reducing tissue damage, edema, swelling, inflammatory mediators and nociceptive measures. Increased understanding of neuroimmune interactions has significant translational potential for better clinical treatment of pain and protection from tissue damage.

Grant Support

Current

NIH RO1 NS39041-11 (Westlund) “Neurogenic Amplification of Pancreatitis Pain”,
30%, (04/01/00-03/31/11), \$238,607 direct, \$349,443 with indirects. \$1,855,237.00/5 yrs

NIH RO1 NS39041-10S1 (Westlund) “Neurogenic Amplification of Pancreatitis Pain”
(07/20/09 – 10/31/09), \$10,443 for Minority Student Supplement

NIH RO1 NS39041-10S2 (Westlund) “Neurogenic Amplification of Pancreatitis Pain”
(09/01/09-03/31/10), \$56,000 for ROS and Calcium Imaging Microscope

University of Kentucky Research Professorship (Westlund) “Gene Therapy Approach
for Temporomandibular Pain”, (07/01/2009-06/31/2010), \$35,000.

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NIH/NCRR 2P20RR020145-06 COBRE

PI: Ebersole, Jeffrey L. (R Danaher, PI/Trainee; K Westlund-High, Co-I/Mentor Project 5 Gene Therapy for Orofacial Pain) “Center for the Biologic Basis of Oral/Systemic Disease” (CBBOSD) (10/1/2009 – 6/30/2015), \$7,497,684 (Directs) \$11,124,246 (Total) / 5yrs. Project 5 \$130,000 funding for R. Danaher (50%), C Miller (15%) and K Westlund (15%) / yr \$54, 211 (Westlund, Directs) \$23,174 (Westlund, Indirects) / yr

Past Grant Support

Keck Foundation Pharmacoinformatics Program Postdoctoral Fellowship “Pancreatic Tissue Protection by HSV-1 Vector Overexpression and Peripheral Delivery of Met-enkephalin” Pharmacoinformatics Fellowship for Postdoctoral Fellow (Hong Yang, MD, PhD). 7/1/06-6/30/08.

Private Foundation (McNearney) “Targeted HSV-Enk Abrogates Pancreatitis Pain” 7/1/05-06/30/08, 290K (Westlund, Co-I, 0%)

PO1 HD039833 (Perez-Polo) Brain Cell Death Mechanisms alter Perinatal Ischemia. Morphology Core (Westlund, Co-PI 5% (07/01/03-06/30/07)

Dana Foundation (McNearney, Westlund) “Neurogenic Contributions to the Initiation and Persistence of Arthritis” (07/01/02-06/30/05), \$300,000

5 PO1 NS11255-27 (Willis) (08/01/01-07/31/06) Project 2 (Westlund, PI, 15%): Role of Glutamate in Arthritis: Nociception and Inflammation, 30%, \$185,702.

PO1 NS 39161-01 A1 (Hulsebosch, PI, Westlund, Co-I) “Chronic Central Pain in Spinal Cord Injury”. Morphology Core C (Westlund) 10%, (12/01/00-11/30/05)

Gift from Mr. Titus Harris, Jr. and The Titus Harris Foundation (01/05)

R21 AR48371 “Glutamate Induced Molecular Events Contributing to Chronic Arthritis” (09/28/01-06/31/03), 30%, \$74,500.

Millennium Supply and Collaboration Agreement, \$119,194

Unrestricted Funds from Parke-Davis, \$6,000.

R. W. Johnson “Gene Expression Profiling of Retrogradely Labeled Spinal Thalamic Neurons and DRG in an Animal Model (rat) for Neuropathic Pain” 07/01/99 –open, unrestricted \$22,727.

Shriner's Grant (Perez-Polo) “Anti-Apoptosis Treatment for Hypoxia/Resuscitation” (01/01/00 - 12/31/01) 5% Salary: \$5,010.00/Fringe: \$1,052.00

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RO1 NS39449 (Englander) (07/01/00 - 06/30/05) NIH-NINDS “Hypoxia-induced DNA Damage and Repair in the Rat Brain” 5% Salary.

IPO1 NS39161-01A2 (Hulsebosch) “Chronic Central Pain in Spinal Cord Injury”, Morphology Core, (01/11/01-12/31/05), 10%, \$155,626.

RO1 NIH/NINDS (Westlund, P.I.) “Neurogenic Contributions to Chronic Arthritis” (2/01/01-1/31/05), 30%, \$250,000 (Awarded not funded due to overlap with PPG PO1 NS11255-27).

John Sealy Memorial Endowment Bridging Grant, (1/22/99-1/21/00) \$40,000.

CA73005, M.D. Anderson Subcontract of NIH Grant (Dr. Charles Cleeland), “Laboratory Studies of Pain Control Methods”, (7/1/99-06/30/00), \$75,002.

TIRR, “SCI Research consortium: Mechanisms of Chronic Pain Induced by Excitotoxicity”, (Hulsebosch) 5%, (04/07/98-04/06/00), \$100,000.

RO1NS32778-01A1, "Central Control of Arthritis and Arthritic Pain", 40%, (4/1/94-1/31/00), \$159,934.

RO1NS09743, “Synaptic Connections of Spinal Cord Neurons” (Willis), 15%, (07/01/96-06/30/98), \$329,348.

Warner-Lambert “Unrestricted Funds for Pain Research”, \$5,000.

SCRF, “Mechanism of chronic pain induced by excitotoxicity”, (01/01/98-12/31/99), \$3,236.

NS11255, Comparative Neurobiology of the Spinal Cord, Project 1A, "Visceral pain", 30%, (8/1/01-7/31/06), \$103,476/yr.

NS11255, Comparative Neurobiology of the Spinal Cord, Project 1A, "Visceral pain", 30%, (8/1/96-7/31/01), \$91,347/yr.

NS11255, Comparative Neurobiology of the Spinal Cord, Project 3, "NA and GLUT/ASP STT cell innervation in normals and after inflammation", 40%, (8/1/91-7/31/96), \$135,631/yr.

NS11255, Comparative Neurobiology of the Spinal Cord, Project 5, “Catecholamine Projections to Primate Spinothalamic Cells and Thalamus”, 50%, (08/01/86-07/31/91) \$195,671/yr.

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NS01445, RCDA, "Inducible Alteration of CGRP in Primary Afferent Neurons", 100% (1/1/90-4/30/95) \$253,000

R01NS28064-01A3, Inducible alteration of CGRP in primary afferent neurons, 40%, (7/18/91-6/30/95) \$315,822.

The Moody Foundation, "The study of a new neuronal cell line for transplantation", Howard Eisenberg, M.D., Project Director, Morphology Core. Co-P.I.'s K.N. Westlund and C.E. Hulsebosch, 10%, (12/10/91-4/27/93) \$799,033.

NIH Small Instrumentation Program, "Small Instrumentation Grant - Reichert Jung Ultramicrotome", K.N. Westlund, P.I. (1/23/91-1/22/92) \$15,488.

Texas Affiliation of the American Heart Association, 90R-663, "Modulation of CGRP in Cardioregulatory Neurons", (7/1/90-6/30/91) \$29,700.

Texas Affiliation of the American Heart Association, "Modulation of CGRP Content in Cardioregulatory Neurons" (7/1/88-6/30/90) \$50,000.

NS 21996 "MAO Localization in Human Brain," C.W. Abell, P.I. (12/1/85-11/30/90) \$132,348/yr. Subcontracted to K.N. Westlund, P.I. (12/1/87-11/29/89) \$34,662/yr.
S10RRO3979 Shared Instrumentation Grant, "Image Processing and Analysis System" (5/1/88-4/30/89) \$113,735 J.D. Bottenstein, P.I., K.N. Westlund, supportive project.

NS07309: Postdoctoral Fellowship, "Neuronal Projections to the Rat Adenohypophysis" (9/1/83-8/31/85) \$19,236/yr.

COMMITTEE RESPONSIBILITIES:

National

Advisory Council for National Institute for Dental and Craniofacial Research, 2008-2012
Associate Editor Board, PAIN (official journal for the International Association for the Study of Pain), 2005 - present

American Pain Society, Nomination Committee, 2007

American Board of Anesthesiology, Pain Management Exam Item Writer, 2001-2005

Academic Success Skills Workshop, Ethics facilitator, Society for Neuroscience, 2004

Mentor Program, Society for Neuroscience, 2003, for Heather S. Hain, Ph.D.

Grant Reviewer for National Institutes of Health, 1991 – 2006

ZRG1 IFCN-E (02) M AED SCS "Member conflict: Pain" May 28, 2008

IFCN-4 Somatosensory and Chemosensory Systems Study Section (Integrated, Functional, and Cognitive Neuroscience), 1999-2006

ZRG1 IFCN K O3 Special Emphasis Panel, 7/15/04

ZRG1 IFCN F O5 Special Emphasis Panel, 10/19/04

ZRG1 IFCN K O2 Special Emphasis Panel, 11/17/04

ZRG1 IFCN F O4 Special Emphasis Panel, 11/24/04

Karin N. Westlund High, Ph.D.

Site Visit Review Team, Natl Inst for Dental and Craniofacial Research, 1991
Ad hoc Review, National Institute for Dental Research, 1993
Ad hoc Reviewer of Program Project Grants, 1996
Ad hoc Grant Reviewer for the National Institute on Drug Abuse, 1991-92
Grant Reviewer for Texas American Heart Association, 1996
NIH, Dental Research Institute Internal Reviewer, April 23-24, 1996

Inter-Institutional

MD Anderson Symptoms Management/Pain Research Group Liaison to UTMB
Pain Group, 2003-2006
Organized UTMB participation in Teleconference sponsored by University of
Texas M.D. Anderson Cancer Center. Speaker: Howard Fields, MD/PhD Chair,
Neurosurgery, University of California, San Diego, 2004.

University of Kentucky

Grad to Med Graduate Curriculum Development, 2007-present
MD-PhD Internal Advisory Committee, 2008-present
Mechanistic Studies Scientific Review Committee (SRC) of the CCTS, 2008-present
Pharmaceutical Medication Samples Management Committee, 2009
Undergraduate Common Reading Experience, Discussion leader, "The Color of Water:
A Black Man's Tribute to His White Mother" by James McBride, Sept 2009
First Generation UK Student Organization, Mentor, 2009

University of Texas Medical Branch

Faculty Senate, Graduate School Senator, September 2005-August 2007
Academic Progress Committee, 2005-2007
Academic Promotion and Tenure Committee, 2003-2006; Vice-Chair -2005-2006
Accreditation External Review Committee for Dept of Surgery at UTMB, May 2003
Fellowship Committee, 2002-2005
Combined Anesthesia/Neuroscience Combined Conference, Co-Organizer 2002-2005
Interim Director, Cell Biology Graduate Program, 2000-2001
Graduate School Basic Biomedical Curriculum, Steering Committee 1999-2001
Graduate School Curriculum Review Committee, 1997-1998
Nominations Committee, 1996- 1999
Academic Planning Committee - 1994-97
Committee on Research, 1992-95, Chair 1994-95
Graduate School Curriculum Committee, 1992-95
Neuroscience Course Committee, 1987 - 2005
Neuroscience Graduate Program Curriculum Committee, Chair 1992-95
Core Facilities Evaluation Committee, 1996-1997
Committee on Management of Scientific Data *ad hoc*, 1995
Anatomy Graduate Program Admissions Committee, 1992-1993
Cell Biology Graduate Program Examination/Advisory Committee, 1993 - 1994
Self-Study Task Force for School of Medicine Accreditation - Academic

Karin N. Westlund High, Ph.D.

Counseling Subcommittee, 1991
Faculty Women's Caucus, Co-Secretary-Treasurer Elect, 1991
Faculty Women's Caucus, Co-Secretary-Treasurer, 1992
Faculty Women's Caucus, President, 1993
Galveston Chapter, Society for Neuroscience, President-Elect 1992
Galveston Chapter, Society for Neuroscience, President, 1993

Departmental

Neuroscience Graduate Program, Advisory Committee, 2002
Admissions Committee, 2005
Curriculum Committee, 2005
Cell Biology Graduate Advisory Committee, 1996-1997, 1999-2000
Long Term Planning Committee Chair, 1998-2000
Curriculum Committee, 2001-2002
Chair, 2005
Admissions Committee, 2002
Academic Promotion and Tenure Committee, 1995-1997
Executive Committee, 1995-1997, 2000
Animal Care Committee, 1988 - 1989
Electron Microscope Committee, 1988 - 1989
Confocal, Light Microscopic/Image Analyses Committee, 1987 - 2006
Faculty Evaluation and Development Committee, 1998-2001

Consultations and Collaborations

Dr. Charles Cleeland, The University of Texas M.D. Anderson Cancer Center, Houston, TX. fMRI Imaging of Clinical Acute and Chronic Pain States.

Drs. Robert F. Gagel and Gilbert J. Cote, The University of Texas M.D. Anderson, Nociceptive hypersensitivity in calcitonin/ alpha calcitonin gene-related peptide knockout mice.

Drs. Bernd Heppelmann, Ulrike Hanesch, and Robert Schmidt at the Physiologisches Institut in Wurzburg, Germany. Study of primary afferents in a model of arthritis.

Drs. Mark Erlander and Sandra Chaplin, R.W. Johnson, San Diego, CA. Single Cell cDNA Micro Chip Technology: Defining Pain

Dr. Mike Salter, University of Toronto, Canada. Tyrosine Kinase Activity Modulation.

Dr. Ada Silos-Santiago, Millenium Corporation, Cambridge, Mass, Single Cell Quantitative RT-PCR using Taq-Man Chemistry for Chronic Arthritis and Pancreatitis in Primate and Rodent Models.

Karin N. Westlund High, Ph.D.

Academic Review Panel for LCME review of the Department of Surgery, UTMB, May 12-15, 2003.

International Workshop consultants meeting to draft a consensus statement “The need for a cross-species approach to the study of pain in animals” held at Warrenton, VA, September 2002, sponsored by the Mayday Fund, published in J. American Veterinary Medical Association Vol 224 (5):692-697, 2004.

TEACHING RESPONSIBILITIES AT UNIVERSITY of KENTUCKY:

Physiology OBI 814, Dental School, 15hr, Feb 2009

TEACHING RESPONSIBILITIES AT UTMB:

Medical School

Medical Neurosciences NEUR 6503

Graduate Assistant, 65 hr, 1977

Teaching Assistant, 75 hr, 1985

Faculty Teaching Assistant, 75hr, 1986

Teaching Faculty, 75hr, 1987-2000, 2004

Backup Teaching Faculty, 2001-2003, 2005-2006

Integrated Functional Laboratory - Graduate Assistant, 40hr, 1981

Senior Medical Student Assessment, 2 hr, 1990 - 2000

Graduate School, SAHS

Advanced Neuroanatomy INTD 6540, 8hr, 1990, 1995

Anatomy and Physiology of Functional Systems in Mammalian Brain NEUX
6024, 1992

Basic Neuroscience NEUR 6603, 2hr, 1989, 1990, 1992

Interdisciplinary Approaches to Problems in Neuroscience NEUR 6405, 4hr, 1986
Course Director, 40hr, 1991 - 1993

Studies in Human Neurosciences INDS 4018

Molecular Cell Biology ANAX 6007, 2hr, 1994, 1995, 1996

Modern Research Techniques CELL 6303, 1hr, 1996-2002

Biochemical and Molecular Neuroscience 2 hr NEUR 6202, 1997- 2006

Fundamentals of Inflammation, “Neurogenic Inflammation”, BBSC 6210, 1hr 2006

Cell Biology of Tissues (formerly Microanatomy) CELL 6502, 3hr, 1999- 2006

Academic Success Skills CELL 6004, Course Director, 15 hr, 2001- 2006

Academic Success Skills BBSC 6101, Course Co-Director, 35 hr, 2003 - 2006

PROFESSIONAL DEVELOPMENT OPPORTUNITIES:

April 9, 1998

Small Group Facilitator Training Workshop and Certification for Medical
School Faculty, University of Texas Medical Branch, Galveston, Michael
Ainsworth, MD, Trainer

Karin N. Westlund High, Ph.D.

- July 11-13, 1998 Professional Development Seminar for Senior Women in Medicine ANA Hotel, Washington, D.C. Systems Redesign/Organizational Transformation; Negotiation Strategies; Setting Priorities; Strategic Career Planning
- Spring, 2002 UTMB Professional Development Course on "Dealing with Difficult People"
- June 3-8, 2002 Eighth Annual "Teaching Survival Skills and Ethics" Workshop; Snowmass Colorado, Beth Fischer and Michael J. Zigmond, Ph.D., Organizers
- August 21, 2003 Professional Development Workshop "Taking Charge of Your Career: Goal-setting, Managing Your Time and Presenting Yourself" by Janet Bickel, President of Janet Bickel and Associates, consultant for professional and leadership development. Sponsored by the UTMB Core Committee on Women and the Office of the President.
- July, 2004 UTMB Office of Equal Opportunity & Diversity Course on "Building Competency to Manage Diversity."
- September 17, 2004 Senior Women Leaders' Breakfast Workshop by Janet Bickel on Friday, September 17th, 8:00-9:30 AM at Open Gates, Room 201, Galveston Texas, sponsored by Linda G. Phillips, M.D., Senior Associate Dean for Academic Affairs.
- October 22, 2004 Eighth Annual "Professional Skills Workshop" held at the Society for Neuroscience meeting in San Diego. Small group facilitator for ethics case luncheon discussion group organized by Michael Zigmond (Neurology, University of Pittsburgh) and Beth Fischer (Department of Instruction and Learning, University of Pittsburgh), funded by the National Institute of Mental Health and National Institute of Neurological Disorders and Stroke. Sponsored by the Society for Neuroscience.
- January 28, 2005 Workshop on "Conflict Management and Negotiation Skills" led by Kevin C. Wooten, Ph.D., Professor of Management and Human Resource Management, University of Houston at Clear Lake.
- June 10, 2005 Workshop on "Transforming your Transformational Leadership for Cultural and Operational Change". Dr. Kevin C. Wooten, Professor of Management and Human Resources at the University of Houston at Clear Lake, TX.

Karin N. Westlund High, Ph.D.

July 13, 2005 Lecture on "Diversity in Biomedical Careers" by Dr. Vivian Pinn, Director of the Office of Research on Women's Health (ORWH) and Associate Director for Research on Women's Health, National Institutes of Health.

May 05, 2006 "Current Advances in the Management of Opioid-related Gastrointestinal Adverse Events", Thompson American Health Consultants, American Pain Society, San Antonio, TX

September 2007- August 2008 Circles of Power Women's Leadership Training, University of Kentucky Leadership Retreat September 17-18, 2007 Dress for Success October 21, 2007

October 18, 2007 Bench to Bedside: Using Lean Techniques to Get From the Clinical Research Bench to the Bedside, Paul DePriest and Jeff Norton, University of Kentucky

December 17, 2007 "Using Emotional Intelligence to Gain Personal Mastery", Dr. Andrew Weiner, University of Kentucky, Lexington, KY

January 18, 2008 "Negotiating Skills Workshop" by Dr. Joe Labianca, Martin School of Business, University of Kentucky, Lexington, KY

March 3, 2008 "Engaging a Multi-Generational Workforce" by Robert Jewell, Omega Leadership Group, Circles of Power Women's Leadership Training, University of Kentucky

MEMBERSHIP IN SCIENTIFIC SOCIETIES:

International Association for the Study of Pain, 1988-present
Associate Editor Board 2005
American Pain Society*, 1987-present
Society for Neuroscience, Local and National* Chapters, 1987-present
Sigma Xi*
Texas Society for Electron Microscopy, 1983-1987
(* denotes elected membership)
New York Academy of Science, 2001-2004

BOARD CERTIFICATION: None
LICENSURE INFORMATION: None

HONORS:

Robert A. Welch Foundation Predoctoral Fellowship	1976
Roche Laboratories Award for Neuroscience, National Student Research Forum	1979
Jeanne B. Kempner Postdoctoral Fellowship	1982
Vector Laboratories Young Investigator Award	1983
The Endocrine Society, Travel Award; 7th International Endocrine Congress	1985
International Association for the Study of Pain Travel Award; 6th World Congress	1988
Research Career Development Award (K08)	1990-1995
Teaching Survival Skills and Ethics Workshop Travel Award	2002

Karin N. Westlund High, Ph.D.

American Board of Anesthesiology, Pain Management Exam Item Writer	2001-2003
Mary & J. Palmer Saunders Professor for Excellence in Teaching	2002-2003
Frederick W.L. Kerr Basic Science Career Research Award	2008
University of Kentucky Research Professorship	2009-2010

ADDITIONAL INFORMATION:

Patent Information

US Patent Application Serial No. 61/235,534 Authorized by Eric Ostertag and K Westlund High. Filed August 20, 2009, TRP Inhibitors and their use.

US Patent Application Serial No. 12/399,392, Cannabinoid-Containing Compositions and Methods for Their Use, University of Kentucky Research Foundation, filed March 6, 2009.

US Provisional Patent Application Serial No. 61/068,328 Authorized by Audra L. Stinchcomb, Performed by Dana C. Hammell, Stan L. Banks, Liping Zhang, Fei Ma, and Sarah Abshire, Karin Westlund High. Evaluation of cannabidiol in the CFA-induced monoarthritis rat model. Published March 6, 2008.

US Patent No. 6,329,429 Schier et al. Use of Gaba Analogs Such as Gabapentin in the Manufacture of a Medicament for Treating Inflammatory Diseases, Warner Lambert (Park Davis Corp)(Pfizer), U.S. Serial No. 60/050736, Awarded 12/01/01. Foreign Serial No. PD-5660-L-01-CA, 06/25/97. Full rights sold to Pfizer Sept, 2007.

US Patent No. 6,887,902 Schier et al. Anti-Inflammatory Method Using Gamma-aminobutyric Acid (GABA) Analogs, Warner Lambert (Park Davis Corp)(Pfizer), U.S. Serial No. 60/050736, Awarded 05/03/05.

US Patent No. 20020032235 Schier et al. Anti-Inflammatory Method, Warner Lambert (Park Davis Corp)(Pfizer), Provisional U.S. Application Serial No. 924656, Filed 03/14/02.

US Patent No. 7,022,484 B2 Karin Westlund High and Giulio Tagliatela, Methods for Treating Neuropathological States and Neurogenic Inflammatory States and Methods for Identifying Compounds Useful Therein, The University of Texas System (Board of Regents), U.S. Serial No. 09/877,220, Issued April 4, 2006.

US Provisional Patent Application Serial No. 11/352,829 Karin Westlund High and Giulio Tagliatela, Methods for Treating Neuropathological States and Neurogenic Inflammatory States and Methods for Identifying Compounds Useful Therein, The University of Texas System (Board of Regents), Published June 29, 2006.

Glutamate Receptor Subunit NR1 Signal Transduction and Method of Use.
Provisional U.S. Application 60/210,413, 06/08/00.

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NMDA Receptor NR1 Subunit and Methods of Use, Karin Westlund High et al.

U.S. Utility Application # 60/225,702, Filed 06/08/01.

Awarded as U.S. Patent # 6,887,902, December 2005.

Invited Presentations

International Symposium on Endocoids (endogenous drugs), "Distribution of non-opioid peptides in the mammalian CNS: relationship to monoamine neurotransmitter systems", Fort Worth, Texas, Presented talk, May 23-26, 1984.

Peptide and Biogenic Amine Interactions Symposium, "Differential distribution of MAO A and B determined by immunocytochemical localization of monoclonal antibodies", Pullman, Washington, Presented talk, August, 1986.

VA Medical Center Research and Development, "Immunocytochemical localization of monoamine oxidases A and B in monkey and human brain", Houston, Texas, Presented talk, March 30, 1987.

Texas Women's University seminar, "Catecholamine neurons and their contacts with spinothalamic pain systems", Denton, Texas, Presented talk, October 29, 1987.

Descending Brainstem Controls of Nociceptive Transmission Symposium, "Catecholamine terminals and synapses on spinothalamic tract somata in the monkey", Beaune, France, Presented poster, July 26-28, 1987.

University of Texas Medical Branch seminar, Marine Biomedical Institute and Department of Anatomy & Neurosciences, "The microenvironment of a spinothalamic tract neuron", Galveston, Texas, Presented talk, December 18, 1989.

International Conference, Neurobiology of the Locus Coeruleus, "Anatomy of the Locus Coeruleus", Post Falls, Idaho, Presented introduction and served as session chairman, May 11-15, 1990.

International Conference, What Do Nociceptors Tell the Brain, Madrid, Spain, Poster presentation, February 24-26, 1992.

International Conference, Toward the Use of Noradrenergic Agonists for the Treatment of Pain, "Anatomy of the noradrenergic descending system", Versailles, France, Presented talk, March 20-21, 1992.

International Conference, XVth Congress of the International Association of Gerontology symposium, "The distribution of MAO A and B in normal brain", Budapest, Hungary, Presented talk, July 3-5, 1993.

Karin N. Westlund High, Ph.D.

Baylor College of Dentistry seminar, Department of Biomedical Sciences, "Central control of knee joint inflammation and pain", Dallas, Texas, Presented talk, April 18, 1995.

Galveston Chapter, Society for Neuroscience, "Pain: mechanisms associated with central sensitization", Galveston, Texas, Presented talk, November 8, 1995.

International Conference, International Symposium of the Sonderforschungsbereich 353, Academy of Sciences, "Central and peripheral mechanisms of knee joint pain", Mainz, Germany, Presented talk, October 14, 1996.

International Conference, XXXIII International Congress of Physiological Sciences, "Dorsal root reflex and central and peripheral receptor contributions to inflammation", St. Petersburg, Russia, July 3, 1997.

University of Minnesota seminar, "Central and peripheral neurogenic mechanisms of inflammatory pain", Minneapolis, MN, Presented talk, December 2, 1997.

University of Toronto Dental School, "Central and peripheral mechanisms contributing to the amplification of pain", Toronto, Ontario, Canada, Presented talk, April 7, 1998.

American Pain Society, "Dynamic Peripheral Receptors in Inflammatory Pain: Chemical Exchange for Pain or Gain", San Diego, CA. Workshop Organizer, 1999.

International Conference, International Association for the Study of Pain, 9th World Congress on pain, 1)"Introduction into the Basic Science of Pain and Headache for the Clinician", August 22, 1999. 2)"Antidromic Firing in Primary Afferents and Neurogenic Inflammation", August 25, 1999.

Merck Research Laboratories, "Inflammatory Pain is Blocked in a Calcitonin/Calcitonin Gene-related Peptide Gene Knockout Mouse", West Point PA, February, 2000.

University of Florida, Gainesville, "Novel Actions and Signal Transduction Events Mediated by Excitatory Amino Acid Receptors", May, 2000.

National Institute of Neurological Disorders and Stroke (NINDS) and the NIH Office on Rare Diseases. "The Neurobiology of Craniofacial/Deep Tissue Persistent Pain," an official satellite meeting of the Annual Meeting of the American Pain Society (APS), Baltimore, Maryland, March 13-14, 2001.

Janssen Research Foundation, New Brunswick, NJ, Visceral Sensation and Hyperalgesia Conference, "Physiology of Primary Afferent Neurons & Organization/Function of Spinal Visceral Tracts", May 17-18, 2001

4th International Conference on the Calcitonin Gene-Related Family of Peptides, Copenhagen, Denmark, "CGRP Knock-out mice: New Findings", September 28-30, 2001.

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National Institute of Neurological Disorders and Stroke (NINDS) and the NIH Office on Rare Diseases Symposium entitled "The Neurobiology of Craniofacial/Deep Tissue Persistent Pain," Satellite meeting to the American Pain Association meeting Baltimore, Maryland. "Glutamate-Induced Amplification of Inflammatory Pain", March 12-13, 2002.

MayDay Foundation Workshop on "A Cross-Species Approach to Pain and Analgesia", Airlie Conference Center, Warrenton, Virginia, "Neurotransmitter Glutamate is a Novel Neurotransmitter Initiator in Arthritis Inflammation", September 20, 2002.

The Center for Interdisciplinary Research in Women's Health, UTMB. "A Novel Neuroimmune Initiator of Osteoarthritis and Osteoarthritis Pain", November 14, 2002.

Winter Conference on Brain Research, "Persistent Pancreatitis: Behavioral, Pharmacological and fMRI Studies", Snowbird, Utah, January 25-31, 2003.

University of Arkansas, Little Rock, Arkansas, "Visceral Pain: Novel Pathways and Processes", April 25, 2003.

Spring Pain Research Conference, "fMRI imaging of rat pancreatitis pain", Grand Cayman, BWI, April 26, 2004.

Joint American and Canadian Pain Association Meeting, Workshop Organizer and Speaker, Westlund, K.N., "Visceral and Nociceptive Sensory Information Processing in the Central Nervous System: Human and rat fMRI, Electrophysiology, and Tract Tracing", Other speakers: Cechetto, D.F., Mayer, E., Vancouver, Canada, May 9, 2004.

Mechanisms and Treatment of Cancer-Related Symptoms Conference, The University of Texas M.D. Anderson Cancer Center, Houston, Texas, September 10-12, 2005.

Physiology and Pathology of Chloride Transporters and Channels, Junta de Castilla y Leon and Universidad de Valladolid, Soria, Spain, September 19-22, 2005.

Physiology Seminar, University of Kentucky, Arthritis and Pancreatitis Pain - Connections, Mechanisms, and Translational Strategies, Lexington, KY, July 6, 2006.

Spring Pain Research Conference, Grand Cayman, BWI, April 24, 2006.

American Society of Regional Anesthesia and Pain Medicine Annual Pain Medicine Meeting and Workshops, Refresher Course Instructor, "Visceral Pain- Basic Science", San Francisco, CA, November 16, 2006.

American Pain Society 26th Annual Meeting, "HSV Viral Vector Translational Approaches to Pain Relief", Session Chair and Speaker, Washington, DC, May 3, 2007.

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4th World Congress World Institute of Pain, “Visceral and Emerging Therapies: Enkephalin Over-expression as Transgene Therapy for Pancreatitis Pain”, Session Chair and Speaker, Budapest, Hungary, September 28, 2007.

Czech National Academy of Sciences, Physiological Institute, “Neurotransmitter receptors on human synoviocytes mediate neurogenic inflammation”, Prague, Czech Republic, September 30, 2007.

Symposium on Neurobiology of Pain and Analgesia, “Neurotransmitter receptors on human synoviocytes mediate neurogenic inflammation”, University of Minnesota School of Medicine Graduate Program, Minneapolis, MN, October 15, 2007.

Frederick W.L. Kerr Basic Science Research Award, 27th American Pain Society Meeting, “Stopping Pain in Its Tracks”, Tampa, Florida, May 10, 2008.

12th World Congress on Pain, Annual International Association for the Study of Pain Meeting, Mechanisms of Pain Induced by Cancer and Cancer Therapy, Glasgow, Scotland, August 22, 2008.

University of Louisville Health Science Center, “Enkephalin Gene Therapy”, Louisville, KY, September 18, 2008.

University of Oklahoma Health Science Center, Department of Physiology Distinguished Speaker, November 14, 2008.

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Advisor and Mentor Responsibilities

UK Medical School Student Trainees:

Summer Laboratory Rotation of Nick Jones, 2008

UTMB Medical School Student Trainees:

Honors Thesis Committee of Joel Patterson, 1991

MD - PhD Supervisory Committee of Cabe Owens, 1991

MD - PhD Supervisory Committee of James Patterson, 1994

MD - PhD Supervisory Committee of Ted Zompa, 1993-95

Laboratory Supervision of medical student Joe Valdez, 1996-2000

Laboratory Supervision of medical student Matt Smiley, 2000-2003

Laboratory Supervision of medical student Angelica Motta, 2003-2004

Laboratory Supervision of Latash Rabatt, 2004-2005

Summer Medical Student Rotations:

Sabrina Harris - 1988

Craig Kemper – 1986

Electra Papadopoulos - 1991

Alan Wong - 1987

Kelly Carmichael - 1991, 1993

Ted Zompa - 1993

Heidi Jordan - 1992, 1993

Steve Ladner - 1994

Mark Milton – 1994

Research Fellows:

Supervision of Elena Hewitt, M.D. - 1995-96

Supervision of Ain-Shams (Amr) Zidan, M.D. – 2000-2001

Research Scientists:

Ying Lu, MD 1990-2007

Mikhail Kochukov, MD, PhD 2004-2007

Larissa Ponomareva, PhD 2007-2008

Liping Zhang, PhD 2007-present at University of Kentucky

Fei Ma, PhD 2008-present at University of Kentucky

Postdoctoral Fellows:

Andrea Houghton, PhD 1995-1998

Liping Zhang, PhD 1998-2004

Hong Yang, PhD 2005-2007

Keck Fellow 2006, 2007

Yong Ren, MMS, MD 2005-2007

Fei Ma, PhD 2007-2008 at University of Kentucky

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Sabrina McIlwrath, PhD

2010-present at University of Kentucky

Graduate School Students University of Texas Medical Branch Galveston

PhD Mentor of Kathleen Sluka, 1990-1993
PhD Mentor of David Rosenstein, 1993-1998
PhD Mentor of Zaiming Ye, 1993-1999
PhD Mentor of Chia-Chuan (Allan) Wang, 1993-1999
PhD Mentor of Nada Lawand, 1995-2000
PhD Mentor of Louis Vera-Portocarrero, 1999-2003
MA Mentor of Elyse Rubenstein, 1994-95
MA Thesis Committee of Iqbal Khan, 1992
MA Thesis Committee of Shailaja Dholakia, 1995
PhD Thesis Committee of Don Pizzo, 1995
PhD Thesis Committee of Juan Yu, 1994
PhD Thesis Committee of Elie Al-Chaer, 1995
PhD Thesis Committee of David Rosenstein, 1998
PhD Thesis Committee of Zezong Gu, 1999
PhD Thesis Committee of Jing Wu, 2000
PhD Thesis Committee of Kevin Chen, 2000
PhD Thesis Committee of Passara Lanlua, 2001
PhD Thesis Committee of Andrea Witlin, 2001
PhD Thesis Committee of Xuan Zhang, 2005
PhD Thesis Committee of Xiaoming Hu, 2005
PhD Thesis Committee of Danny Rafati, 2005
PhD Thesis Committee of Jeong Han, 2005
PhD Thesis Committee of Edna Tirado, 2006
PhD Thesis Committee of Tori Strong, Keck Fellow
PhD Thesis Committee of Misti Caudle White

University of Kentucky Lexington

PhD Thesis Committee of Chen Zhang
PhD Thesis Committee of Courtney Swadley
PhD Thesis Committee of Jordan Clark, 2009

Graduate Student Rotation Supervisor:

John Allensworth - 1988
Theresa Hensler - 1992
Kathleen Sluka - 1990
Zaiming Ye - 1992
Iqbal Khan - 1990
David Rosenstein - 1993
Nada Lawand - 1995
Chia-Chuan Wang - 1995
Louis Vera-Portocarrero - 1999

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Shuxiang Gao – 2001
Xuan Zhang – 2001
Bridget Hawkins – 2003

College Student Rotations University of Kentucky:

Ryan Nesemeier – Sept 2007- May 2008
Nick Mancuso – October 2008- present 2 semesters BIO 395, 1 semester ABT 395
NIH student supplement July-August 2009; June 2010
David Thompson – December 2009-present 2 semesters BIO 395

Summer College Student Rotations:

UTMB Julie Seigen - 1992
Amanda Hunt - 1991
Joe Valdez - 1995
Erin Mussumara - 1996
Alokananda Ghosh – 1997
Rima Patel – 2001
Paivi Roozen – 2002
Krista Handyside – 2003
Chris Berry – 2003, 2004
Li Li - 2010

Summer High School Student Rotations:

Erin Denney - 1995, 1996
Nicole Klekowski – 1998
Paige Oberholtzer – 2001
Allison Winger (UK) – 2008
Zain Hassan (UK) - 2010

COMMUNITY SERVICE:

First Generation UK Student Planning Committee (2009-present)

UK AMSTEMM Program funded by NSF is program for underserved Appalachian and minority students to expose them to scientific research (Nick Mancuso, 2008-2010)

The Translating Research to Youth through Information Technology (TRY-IT!) project, Science Education Partnership Award (SEPA) project supported by the NIH National Center for Research Resources awarded to the UK Department of Behavioral Science, Mentor, 2009-2010

Brain Awareness Exhibit (explained human brain and spinal cord anatomy; demonstrated thinking games and reflexes to children and parents), Explorium, Lexington, KY (Children's museum), March 2008.

Maxwell Street Presbyterian choir fund raising events such as Red Cross after 9/11, Mission Lexington, and Faith Pharmacy

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ADA Women's Center, Advisory Board Consultant (residential substance abuse treatment for indigent women), Galveston, TX, 2005

National Women's Health Week Mini Medical School Poster Session Judge, Galveston, TX, May 2004, 2005

Council of Elders, Webster Presbyterian Church, 1996-1998, 2006

Clear Creek ISD Districtwide, Lead Science Fair Judge, League City, TX 1996-2002, 2006

American Heart, Neighborhood Campaign Block Volunteer, League City, TX 2003, 2004, 2005

Trustee, Webster Presbyterian Church, Webster, TX, 2004-2005

Clear Creek ISD Districtwide Educational Improvement Council, League City, TX, 1998-2000

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PUBLICATIONS:

A. ARTICLES IN PEER-REVIEWED JOURNALS (published as Westlund, KN):

1. Perez-Polo, J.R., Hall, K., Livingston, K. and Westlund, K. Steroid induction of nerve growth factor synthesis in cell culture. *Life Sciences* 21:1535-1543, 1977.
2. Westlund, K.N. and Coulter, J.D. Descending projections of the locus coeruleus and subcoeruleus/medial parabrachial nuclei in monkey: Axonal transport studies and dopamine- β -hydroxylase immunocytochemistry. *Brain Res. Rev.* 2:235-264, 1980.
3. Westlund, K.N., Bowker, R.M., Ziegler, M.G. and Coulter, J.D. Origins of spinal noradrenergic pathways demonstrated by retrograde transport of antibody to dopamine- β -hydroxylase. *Neurosci. Lett.* 25:243-249, 1981.
4. Bowker, R.M., Westlund, K.N. and Coulter, J.D. Serotonergic projections to spinal cord from the midbrain in the rat: An immunocytochemical and retrograde transport study. *Neurosci. Lett.* 24:221-226, 1981.
5. Bowker, R.M., Westlund, K.N. and Coulter, J.D. Origins of serotonergic projections to the spinal cord in rat: An immunocytochemical-retrograde transport study. *Brain Res.* 226:187-199, 1981.
6. Correia, M.J., Eden, A.R., Westlund, K.N. and Coulter, J.D. Organization of ascending auditory pathways in the pigeon (*Columba livia*) as determined by autoradiographic methods. *Brain Res.* 234:205-212, 1982.
7. Yeziarski, R.P., Bowker, R.M., Kevetter, G.A., Westlund, K.N., Coulter, J.D. and Willis, W.D. Serotonergic projections to the caudal brain stem: a double label study using horseradish peroxidase and serotonin immunocytochemistry. *Brain Res.* 239:258-264, 1982.
8. Bowker, R.M., Westlund, K.N., Sullivan, M.C., Wilber, J.F and Coulter, J.D. Transmitters of the raphe-spinal complex: Immunocytochemical studies. *Peptides* 3:291-298, 1982.
9. Ritchie, T.C., Westlund, K.N., Bowker, R.M., Coulter, J.D. and Leonard, R.B. The relationship of the medullary catecholamine containing neurons to the vagal motor nuclei. *Neuroscience* 7:1471-1482, 1982.
10. Bowker, R.M., Westlund, K.N., Sullivan, M.C. and Coulter, J.D. A combined retrograde transport and immunocytochemical staining method for demonstrating the origins of serotonergic projections. *J. Histochem. Cytochem.* 30:805-810, 1982.

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11. Bowker, R.M., Westlund, K.N. and Coulter, J.D. Origins of serotonergic projections to the lumbar spinal cord in the monkey using a combined retrograde transport and immunocytochemical technique. *Brain Res. Bull.* 9:271-278, 1982.
12. Westlund, K.N. and Childs, G.V. Localization of serotonin fibers in the rat adenohypophysis. *Endocrinol.* 111:1761-1763, 1982.
13. Westlund, K.N., Bowker, R.M., Ziegler, M.G. and Coulter, J.D. Noradrenergic projections to the spinal cord of the rat. *Brain Res.* 263:15-31, 1983.
14. Correia, M.J., Eden, A.R., Westlund, K.N. and Coulter, J.D. A study of some of the ascending and descending vestibular pathways in the pigeon (*Columba livia*) as demonstrated by anterograde trans-synaptic autoradiography. *Brain Res.* 278:53-61, 1983.
15. Childs, G.V., Naor, Z., Hazum, E., Tibolt, R., Westlund, K. and Hancock, M.B. Cytochemical characterization of pituitary target cells for biotinylated gonadotropin releasing hormone. *Peptides* 4:549-555, 1983.
16. Childs, G.V., Naor, Z., Hazum, E., Tibolt, R., Westlund, K.N. and Hancock, M.B. Localization of biotinylated gonadotropin releasing hormone on pituitary monolayer cells with avidin-biotin-peroxidase complexes. *J. Histochem. Cytochem.* 31:1422-1425, 1983.
17. Westlund, K.N., Chmielowiec, S. and Childs, G.V. Somatostatin fibers and their relationship to specific cell types (GH and TSH) in the rat anterior pituitary. *Peptides* 4:557-562, 1983.
18. Bowker, R.M., Westlund, K.N., Sullivan, M.C., Wilber, J.F. and Coulter, J.D. Descending serotonergic, peptidergic, and cholinergic pathways from the raphe nuclei: a multiple transmitter complex. *Brain Res.* 288:33-48, 1983.
19. Westlund, K.N., Bowker, R.M., Ziegler, M.G. and Coulter, J.D. Origins and terminations of descending noradrenergic projections to the spinal cord of monkey. *Brain Res.* 292:1-16, 1984.
20. Westlund, K.N., Wynn, P.C., Chmielowiec, S., Collins, T.J. and Childs, G.V. Characterization of a potent biotin-conjugated CRF analog and the response of anterior pituitary corticotropes. *Peptides* 5:627-634, 1984.
21. Westlund, K.N., Aguilera, G. and Childs, G.V. Quantitation of morphological changes in pituitary corticotropes produced by in vivo corticotropin-releasing factor stimulation and adrenalectomy. *Endocrinol.* 116:439-445, 1985.
22. Westlund, K.N., Denney, R.M., Kochersperger, L.M., Rose, R.M. and Abell, C.W. Distinct monoamine oxidase A and B populations in primate brain. *Science* 230:181-183, 1985.

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23. Thorpe, L.W., Westlund, K.N., Kochersperger, L.M., Abell, C.W. and Denney, R.M. Immunocytochemical localization of monoamine oxidases A and B in human peripheral tissues and brain. *J. Histochem. Cytochem.* 35:23-32, 1987.
24. Kemper, C.M., O'Connor, D.T. and Westlund, K.N. Immunocytochemical localization of dopamine- β -hydroxylase in neurons of the human brainstem. *Neuroscience* 23:981-989, 1987.
25. Harmann, P.A., Chung, K., Briner, R.P., Westlund, K.N. and Carlton, S.M. Calcitonin gene-related peptide (CGRP) in the human spinal cord: a light and electron microscopic analysis. *J. Comp. Neurol.* 269:371-380, 1988.
26. Westlund, K.N., Denney, R.M., Rose, R.M. and Abell, C.W. Localization of distinct monoamine oxidase A and monoamine oxidase B cell populations in human brainstem. *Neurosci.* 25:439-456, 1988.
27. DiPette, D.J., Westlund, K.N. and Holland, O.B. Dietary calcium modulates spinal cord content of calcitonin gene-related peptide. *Neurosci. Lett.* 95:335-340, 1988.
28. Westlund, K.N., McNeill, D.L. and Coggeshall, R.E. Glutamate immunoreactivity in rat dorsal root axons. *Neurosci. Lett.* 96:13-17, 1989.
29. Chung, K., Briner, R.P., Carlton, S.M. and Westlund, K.N. Immunohistochemical localization of seven different peptides in the human spinal cord. *J. Comp. Neurol.* 280:158-170, 1989.
30. Westlund, K.N., McNeill, D.L. and Coggeshall, R.E. Aspartate immunoreactive axons in normal rat L4 dorsal roots. *Brain Res.* 489:347-351, 1989.
31. Kwan, S.W., Patel, N.T., Vuilliet, P.R., Hall, F.L., Denney, R.M., Shen, R.S., Westlund, K.N. and Abell, C.W. Isolation, characterization and application of monoclonal antibodies to rat tyrosine hydroxylase. *J. Neurosci. Res.* 23:316-325, 1989.
32. Childs, G.V., Westlund, K.N. and Unabia, G. Characterization of anterior pituitary target cells for arginine vasopressin: Including cells that store adrenocorticotropin, thyrotropin- β , and both hormones. *Endocrinol.* 125:554-559, 1989.
33. McNeill, D.L., Westlund, K.N. and Coggeshall, R.E. Peptide immunoreactivity of unmyelinated primary afferent axons in rat lumbar dorsal roots. *J. Histochem. Cytochem.* 37:1047-1052, 1989.
34. Chung, K., Lee, W.T. and Westlund, K.N. Adrenergic fibers in the spinal cord of the monkey: light and electron microscopic study. *J. Autonomic Nerv. Syst.*, 28:203-210, 1989.

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35. Carlton, S.M., Westlund, K.N., Zhang, D., Sorkin, L.S. and Willis, W.D. Calcitonin gene-related peptide containing primary afferent fibers synapse on primate spinothalamic tract cells. *Neurosci. Lett.*, 109:76-81, 1990.
36. Westlund, K.N., Sorkin, L.S., Ferrington, D.G., Carlton, S.M., Willcockson, H.H. and Willis, W.D. Serotonergic and noradrenergic projections to the ventral posterolateral nucleus of monkey thalamus. *J. Comp. Neurol.*, 295:197-207, 1990.
37. Klein, C.M., Westlund, K.N. and Coggeshall, R.E. Percentages of dorsal root axons immunoreactive for galanin are higher than those immunoreactive for calcitonin gene-related peptide in the rat. *Brain Res.*, 519:97-101, 1990.
38. Klein, C.M., Coggeshall, R.E., Carlton, S.M., Westlund, K.N. and Sorkin, L.S. Changes in calcitonin gene-related peptide immunoreactivity in the rat dorsal horn following electrical stimulation of the sciatic nerve. *Neurosci. Letts.*, 115:149-154, 1990.
39. Westlund, K.N., Carlton, S.M., Zhang, D. and Willis, W.D. Direct catecholaminergic innervation of primate spinothalamic tract neurons. *J. Comp. Neurol.*, 299:178-186, 1990.
40. Childs, G.V., Westlund, K.N., Tibolt, R.E. and Lloyd, J.M. Hypothalamic regulatory peptides and their receptors: cytochemical studies of their role in regulation at the adenohipophyseal level. *J. Electron Microsc. Tech.*, 19:21-41, 1991.
41. Westlund, K.N., DiPette, D.J., Carson, J. and Holland, O.B. Decreased spinal cord content of calcitonin gene-related peptide in the spontaneously hypertensive rat. *Neurosci. Lett.* 131:183-186, 1991.
42. Dougherty, P.M., Sluka, K.A., Sorkin, L.S., Westlund, K.N. and Willis, W.D. Neural changes in acute arthritis in monkeys. I. Parallel enhancement of responses of spinothalamic tract neurons to mechanical stimulation and excitatory amino acids. *Brain Res. Rev.*, 17:1-13, 1992.
43. Westlund, K.N., Sun, Y.C., Sluka, K.A., Dougherty, P.M., Sorkin, L.S. and Willis, W.D. Neural changes in acute arthritis in monkeys. II. Increased glutamate immunoreactivity in the medial articular nerve. *Brain Res. Rev.*, 17:15-27, 1992.
44. Sluka, K.A., Dougherty, P.M., Sorkin, L.S., Willis, W.D. and Westlund K.N. Neural changes in acute arthritis in monkeys. III Changes in substance P, calcitonin gene-related peptide and glutamate in the dorsal horn of the spinal cord. *Brain Res. Rev.*, 17:29-38, 1992.
45. Sorkin, L.S., Westlund, K.N., Sluka, K.A., Dougherty, P.M. and Willis, W.D. Neural changes in acute arthritis in monkeys. IV. Time course of amino acid release into the lumbar dorsal horn. *Brain Res. Rev.*, 17:39-50, 1992.

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46. Sluka, K.A. and Westlund, K.N. Spinal projections of the locus coeruleus and the nucleus subcoeruleus in the Harlan and the Sasco Sprague-Dawley rat. *Brain Res.*, 579:67-73, 1992.
47. Westlund, K.N., Carlton, S.M., Zhang, D. and Willis, W.D. Glutamate-immunoreactive terminals synapse on primate spinothalamic tract cells. *J. Comp. Neuro.*, 322:519-527, 1992.
48. Carlton, S.M., Westlund, K.N., Zhang, D. and Willis, W.D. GABA-immunoreactive terminals synapse on primate spinothalamic tract cells. *J. Comp. Neurol.*, 322:528-537, 1992.
49. Westlund, K.N., Lu, Y., Coggeshall, R.E. and Willis, W.D. Serotonin is found in myelinated axons of the dorsolateral funiculus in monkeys. *Neurosci. Lett.*, 141:35-38, 1992.
50. Sluka, K.A. and Westlund, K.N. An experimental arthritis in rat: Dorsal horn aspartate and glutamate increases. *Neurosci. Lett.*, 145:141-144, 1992.
51. Westlund, K.N., Lu, Y., Werrbach-Perez, K., Hulsebosch, C.E., Morgan, B., Pizzo, D., Eisenberg, H.M. and Perez-Polo, J.R. Effects of nerve growth factor and acetyl-l-carnitine arginyl amide on the human neuronal line HN-1A. *Intl. J. Dev. Neurosci.*, 10:1-10, 1992.
52. Sluka, K.A. and Westlund, K.N. An experimental arthritis model in rats: the effects of NMDA and non-NMDA antagonists on aspartate and glutamate release in the dorsal horn. *Neurosci. Lett.*, 149:99-102, 1993.
53. Westlund, K.N., Krakower, T.J., Kwan, S.-W. and Abell, C.W. Intracellular distribution of monoamine oxidase A in selected regions of rat and monkey brain and spinal cord. *Brain Res.*, 612:221-230, 1993.
54. Supowit, S.C., Ramona, C.V., Westlund, K.N. and DiPette, D.J. Calcitonin gene-related peptide gene expression in the spontaneously hypertensive rat. *Hypertension*, 21:1010-1014, 1993.
55. Sluka, K.A. and Westlund, K.N. Centrally administered non-NMDA but not NMDA receptor antagonists block peripheral knee joint inflammation. *Pain*, 55:217-225, 1993.
56. Sluka, K.A. and Westlund, K.N. Spinal cord amino acid release and content in an arthritis model: the effects of pretreatment with non-NMDA, NMDA, and NK1 receptor antagonists. *Brain Res.*, 627:89-103, 1993.
57. Sluka, K.A. and Westlund, K.N. Behavioral and immunohistochemical changes in an experimental arthritis model in rats. *Pain*, 55:367-377, 1993.
58. Sluka, K.A., Willis, W.D. and Westlund, K.N. Joint inflammation and hyperalgesia are reduced by spinal bicuculline. *NeuroReport*, 5:109-112, 1993.

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59. Rees, H., Sluka, K.A., Westlund, K.N. and Willis, W.D. Do dorsal root reflexes augment peripheral inflammation? *NeuroReport*, 5:821-824, 1994.
60. Sluka, K.A., Lawand, N.B. and Westlund, K.N. Joint inflammation is reduced by dorsal rhizotomy and not by sympathectomy or spinal cord transection. *Annals of Rheum. Dis.*, 53:309-314, 1994.
61. Sluka, K.A., Jordan, H.H. and Westlund, K.N. Reduction in joint swelling and hyperalgesia following post-treatment with a non-NMDA glutamate receptor antagonist. *Pain*, 59:95-100, 1994.
62. Sluka, K.A., Jordan, H.H., Willis, W.D. and Westlund, K.N. Differential effects of NMDA and non-NMDA receptor antagonists on spinal release of amino acids after development of acute arthritis. *Brain Res.* 664:77-84, 1994.
63. Sluka, K.A., Willis, W.D. and Westlund, K.N. Arthritis induced release of excitatory amino acids is prevented by spinal administration of a GABA_A and not by a GABA_B receptor antagonist in rats, *J. Pharm. Exp. Therap.* 271:76-82, 1994.
64. Cameron, A.A., Khan, I.A., Westlund, K.N., Cliffer, K.D. and Willis, W.D. The efferent projections of the periaqueductal gray in the rat: a Phaseolus vulgaris leucoagglutinin (PHA-L) study. I. Ascending projections. *J. Comp. Neurol.* 351:568-584, 1995.
65. Cameron, A.A., Khan, I.A., Westlund, K.N. and Willis, W.D. The efferent projections of the periaqueductal gray in the rat: a Phaseolus vulgaris leucoagglutinin (PHA-L) study. II. Descending projections. *J. Comp. Neurol.*, 351:585-601, 1995.
66. Rees, H., Sluka, K.A., Westlund, K.N. and Willis, W.D. The role of glutamate and GABA receptors in the generation of dorsal root reflexes by acute arthritis in the anaesthetized rat. *J. Physiol.*, 484:437-445, 1995.
67. Supowit, S.C., Gururaj, A., Ramana, C.V., Westlund, K.N. and DiPette, D.J. Enhanced neuronal expression of calcitonin gene-related peptide in mineralocorticoid-salt hypertension. *Hypertension*, 25:1333-1338, 1995.
68. Westlund, K.N., Lu, Y., Kadekaro, M., Harmann, P., Terrell, M.L., Pizzo, D., Hulsebosch, C.E., Eisenberg, H.M. and Perez-Polo, J.R. NGF-producing transfected 3T3 cells: behavioral and histological assessment of transplants in nigral lesioned rats. *J. Neurosci. Res.*, 41:367-373, 1995.
69. Supowit, S.C., Christensen, M.D., Westlund, K.N., Hallman, D.M. and DiPette, D.J. Dexamethasone and activators of the protein kinase A and C signal transduction pathways regulate neuronal calcitonin gene-related peptide expression and release. *Brain Res.*, 686:77-86, 1995.

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70. Sluka, K.A., Rees, H., Westlund, K.N. and Willis, W.D. Fiber types contributing to dorsal root reflexes induced by joint inflammation in cats and monkeys. *J. Neurophysiol.*, 74:981-989, 1995.
71. Westlund, K.N. and Craig, A.D. Association of spinal lamina I projections with brainstem catecholamine neurons in the monkey. *Exp. Brain Res.*, 110(2):151-162, 1996.
72. Hirshberg, R.M., Al-Chaer, E.D., Lawand, N.B., Westlund, K.N. and Willis, W.D. Is there a pathway in the posterior funiculus that signals visceral pain? *Pain*, 67:291-305, 1996.
73. Houghton, A. and Westlund, K.N. An I₂ imidazoline ligand, RS 45041, potentiates hyperalgesia in acute arthritis. *NeuroReport*, 7:1497-1501, 1996.
74. Al-Chaer, E.D., Westlund, K.N. and Willis, W.D. Potentiation of thalamic responses to colorectal distension by visceral inflammation. *NeuroReport*, 7:1635-1639, 1996.
75. Al-Chaer, E.D., Lawand, N.B., Westlund, K.N. and Willis, W.D. Visceral nociceptive input into the ventral posterolateral nucleus of the thalamus: a new function for the dorsal column pathway. *J. Neurophysiol.*, 76:2661-2674, 1996.
76. Al-Chaer, E.D., Lawand, N.B., Westlund, K.N. and Willis, W.D. Pelvic visceral input into the nucleus gracilis is largely mediated by the postsynaptic dorsal column pathway. *J. Neurophysiol.*, 76:2675-2690, 1996.
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B. OTHER SCHOLARLY WORK:

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