

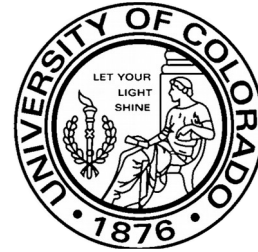
Linda R. Watkins

Department of Psychology & Neuroscience | The Center for Neuroscience | University of Colorado at Boulder | CB345 | Boulder, Colorado 80309-0345

Phone: 303-492-7034 | Fax: 303-492-2967 |

Email: linda.watkins@colorado.edu

Lab website: <http://psych.colorado.edu/~lwatkins>



EDUCATION

Ph.D., Physiology: Medical College of Virginia (1977-1980)

Neuroscience Graduate Program: University of California at Los Angeles (1976-1977)

B.S., Biology & Psychology: Virginia Polytechnic Institute & State University (1973-1976)

Music and Biology: Old Dominion University (1972-1973)

POSTDOCTORAL TRAINING

Dept. of Animal Physiology: University of California Davis (1983-1984)

Dept. of Physiology & Biophysics: Medical College of Virginia (1981-82)

ACADEMIC APPOINTMENTS

2006-present **University of Colorado Distinguished Professor**, Dept. of Psychology & Center for Neuroscience, University of Colorado at Boulder

2006-present **Director, Undergraduate Neuroscience Certificate Program** University of Colorado at Boulder

2002-present **Director, Interdepartmental Neuroscience PhD Program**, U CO Boulder

2002-2003 Executive Advisory Council for the Graduate School, University of Colorado at Boulder

2000-present **Chair, Institutional Animal Care & Use Committee**, CU Boulder

1997-2006 **Professor**, Dept. of Psychology, U. CO Boulder

1993-1997 **Associate Professor**, Dept. of Psychology, U. CO Boulder

1993-1995 **Program Director**, Behavioral Neurosciences Program, Dept. of Psychology, U. CO Boulder

1990-1993 **Assistant Professor**, Dept. of Psychology, U. CO Boulder

1988-1990 **Research Associate**, Dept. of Psychology, U. CO Boulder

1984-1988 **Adjunct Lecturer & Assistant Research Neurophysiologist**, Dept. of Animal Physiology, University of California at Davis

- 2010 **John Liebeskind Pain Management Research Award**, American Academy of Pain Management, 2010
- 2007 **Clinical Science Award & Lectureship**, Karolinska Institute & Karolinska University Hospital, Stockholm, Sweden, 2007
- Multi-Yr **Keynote lectures**: American Academy of Pain Medicine (2012), American Equilibrium Society (2012), Imaging Neuroinflammation and Neuropathic Pain Translational Conference (2011), American Academy of Pain Management (2010), American Academy of Orofacial Pain (2009), Hebrew University Center for Research on Pain (2009), International Meeting on Glial Biology in Medicine (2008), UCLA Basic & Translational Science Symposium (2008); National MD/PhD Conference (2007); 8th International Conference on the Mechanisms and Treatment of Neuropathic Pain (2005)
- 2006 **Selected as a University of Colorado Distinguished Professor**, the highest honor awarded by CU in recognition of research, teaching and service
- 2006 **Gunn-Loke Pain Lectureship**, University of Washington Pain Center, Seattle, WA
- 2005 **Norman Cousins Distinguished Research Award**, Psychoneuroimmunology Research Society
- 2005 **F.W.L. Kerr Distinguished Basic Science Research Award**, American Pain Society
- 2003 **Faculty Research Award**, Department of Psychology, University of Colorado at Boulder
- 2002 **Briggs Memorial Award** for sponsoring and directing undergraduate research at CU-Boulder
- 2001 **Dept. of Psychology Faculty Service Award**, for spearheading the Neuroscience Ph.D. program proposal for the University of Colorado-Boulder
- 1997 **Alumni Star Award for Research**, Medical College of Virginia
- 1997-98 **Faculty Fellowship Award**, University of Colorado-Boulder
- 1997 **President's Teaching Scholar Award for Teaching & Research**, Univ. of Colorado
- 1996 **Teaching Excellence Award**, Univ. CO Boulder, from the Boulder Faculty Assembly
- 1994 **Teaching Excellence Award**, Univ. CO Boulder, presented by the Student Organization for Alumni Relations, Director's Club, and Parents' Association
- 1988-90 **Career Advancement Award**, National Science Foundation
- 1983-6 **Postdoctoral Fellowship**, National Institutes of Health
- 1981 **Finalist, Donald B. Lindsley Award for Behavioral Neuroscience**, Society for Neuroscience
- 1981 **Phi Kappa Phi**
- 1976-80 **Graduate Fellowships**: United Nuclear, 1980; National Science Foundation, 1976, 1978, 1979; A.D. Williams, 1977
- 1979 **Walter Reise Neuroanatomy Award** for Research & Scholarship
- 1976 **Outstanding Biology Graduate**, VA Polytechnic Institute & State University
- 1976 **Graduated with Honors with a dual B.S. in Biology & Psychology**, VPI & SU
- 1975-76 **Undergraduate Research Excellence Awards**: Sigma Xi, 1976; Phi Sigma, 1975
- 1972-76 **Merit Special Scholarship**

1972 **Music Performance Scholarship**, Old Dominion University

INVITED TALKS (accepted invitations)

- 2012:** Keynote lecture, American Equilibrium Society (dental/temporomandibular joint society), Chicago, IL (2/12)
Keynote lecture, American Academy of Pain Medicine, Palm Springs, CA (2/12)
University of Michigan-Ann Arbor, Depression Center Colloquium Series (4/12)
Anesthesiology Grand Rounds and Anesthesiology Journal Club, Department of Anesthesiology, University of Miami, Miami FL (4/12)
American Academy of Orofacial Pain, Pasadena, CA (5/12)
Second Annual Targeted Drug Delivery Conference, San Francisco, CO (5/12)
Neuroimmune targets for treatment of substance and alcohol use disorders symposium, New Clinical Drug Evaluation Unit annual meeting: Identifying common targets across brain diseases - implications for treatment development and delivery, Scottsdale, AZ (5/12)
Zogenix Headache Conference, CA (date to be arranged)
Department of Medicine, University of Hawaii, Honolulu (date to be arranged)
- 2011:** Dept. of Bioengineering, University of Pennsylvania, Philadelphia, PA
Dept. of Pain Medicine, Children's Hospital of Philadelphia, Philadelphia, PA
University of Texas Medical Branch at Galveston, Galveston, TX
Hotchkiss Brain Institute, University of Calgary, Calgary, Alberta, Canada
Biological Sciences Initiative Outreach Program, University of Colorado, Boulder, CO
Chronic Inflammatory and Neuropathic Pain Conference, New York Academy of Sciences, NYC, NY
Zogenix Headache Conference, CA (9/11)
Keynote lecture, Imaging Neuroinflammation and Neuropathic Pain Translational Conference, Albuquerque, NM (10/11)
Department of Pharmacology, Medical College of Virginia/VA Commonwealth Univ., Richmond, VA (11/11)
- 2010:** Eli Lilly Pharmaceutical, Pain & Migraine groups, Indianapolis, IN (12/10)
Pain symposium, associated with the Prince of Asturias Prize for Scientific & Technological Achievement, Oviedo, Spain
Grunenthal GmbH Pharmaceutical, Webinar to Aachen, Germany
Targacept, Webinar to Winston-Salem, NC
Translational Session, Neurotech Investing and Partnering Conference, Boston, MA
GliA: Perspectives on their Clinical Relevance, Chicago, IL
Keynote lecture associated with the awarding of the John Liebeskind Pain Management Research Award, American Academy of Pain Management, Las Vegas, NV
Neurology Grand Rounds, Department of Neurology, Johns Hopkins University, Baltimore, MD
Research Advisory Committee on Gulf War Veterans Illnesses, Washington, DC
5th Annual Pain Consortium Symposium, NIH, Bethesda, MD

National Institute on Drug Abuse, intramural research program, Baltimore, MD
World Congress, International Association for the Study of Pain, Montreal, Canada
University of Colorado Science Sampler, Academy of Live Long Learning, Denver, CO

Biological Sciences Initiative Outreach Program, University of Colorado, Boulder, CO

2009: Keynote lecture, American Academy of Orofacial Pain, Austin, TX
12th International Conference on the Mechanisms and Treatment of Neuropathic Pain, San Francisco, CA
Neuroscience Club, University of Colorado at Boulder, Boulder, CO
Department of Pharmacology, Saint Louis, University, St. Louis, MO
National Headache Foundation 7th Research Summit, Chicago, IL
Butcher symposium, Westminster, CO
Dept. of Physiology & Pharmacology, Oregon Health Sciences University, Portland, OR
Neuroscience Club, University of Colorado-Boulder
SomaLogic, Boulder, CO
Institute for Behavioral Genetics, University of Colorado at Boulder, Boulder, CO
Gulf Coast Consortium for Translational Pain Research, Houston, TX
Headache Cooperative of the Pacific annual conference, Ojai, CA
Keynote lecture, Hebrew University Center for Research on Pain, Jerusalem, Israel
Plenary lecture, International Narcotics Research Conference, Portland, OR

2008: American Academy of Pain Management, Nashville, TN
Psi Chi, Department of Psychology, University of Colorado-Boulder
Adenosine Therapeutics Group/PGxHealthcare, Charlottesville, VA
Pelvic Pain conference, UNC, Chapel Hill, NC
Array Biopharma, Boulder, CO
Endo Pharmaceuticals, Philadelphia, PA
Abbott Pharmaceuticals, Chicago, IL
Keynote Lecture, International Meeting on Glial Biology in Medicine, University of Alabama at Birmingham, Birmingham, Alabama (12/08)
Keynote Lecture, Basic & Translational Science Symposium, UCLA, Los Angeles, CA
Grand Rounds, Dept of Anesthesia, Stanford University Medical Center, Palo Alto, CA
Pain Seminar Series, Neuroscience, Stanford University, Palo Alto, CA
Plenary lecture, Annual Scientific meeting of the Australian and New Zealand College of Anaesthetists, Sydney, Australia
Continuing Medical Education lecture, Annual Scientific meeting of the Australian and New Zealand College of Anaesthetists, Sydney, Australia
Dept of Psychology, University of Sydney, Sydney, Australia
Plenary lecture, Presidential Symposium, American Headache Society, Boston, MA
TMJ Association 5th Scientific Conference, Bethesda, MD
International Association Study of Pain World Congress, Glasgow, Scotland

2007: University of Colorado-Boulder Fall Convocation research presentation

Clinical Science Lectureship, Karolinska Institute & Karolinska University Hospital,
 Stockholm, Sweden
 Covidien, St. Louis, MO
 NIDA/NIH Miniconvention: Frontiers in Addiction Research, San Diego, CA
 Tenth International Conference on the Mechanisms and Treatment of Neuropathic
 Pain, Salt Lake City, UT
 Columbia University, New York, NY
 Northwestern Center for Drug Discovery and Chemical Biology, Chicago, IL
 Plenary lecture, American Academy of Orofacial Pain, Philadelphia, PA
 Plenary lecture, VIIIth European Meeting on Glial Cells in Health and Disease, Lon-
 don, England
 Keynote lecture, 2007 National MD/PhD Conference, Keystone, CO
 Psychoneuroimmunology symposium, American Association for Immunology annual
 meeting, Miami, FL
 Avigen, Alameda CA
 "Cutting edge" seminar series, National Institute on Drug Abuse, NIH, Bethesda, MD
 Interdepartmental Neurosciences Program, University of Colorado at Boulder, Boul-
 der, CO
 University of Colorado Health Sciences Center, Cells, Development & Cancer semi-
 nar series, Denver, CO
2006: American Headache Society annual meeting, Lake Las Vegas, NV
 GlaxoSmithKline, Research Triangle, NC
 New York Academy of Sciences, Frontiers of Science Program on Neuroimmunolo-
 gy, New York, NY
 Feinstein Institute for Medical Research, North Shore-LIJ Health System, Manhasset,
 NY
 Dept. of Neurobiology & Anatomy, University of Utah Medical Center, Salt Lake
 City, UT
 Program in Neuroscience, University of Maryland Dental School, Baltimore, MD
 Highlights in Pain Research 2006, NIH Pain Consortium, Bethesda, MD
 Norman Cousins Memorial Lecture, PsychoNeuroImmunology Research Society con-
 ference, Miami, FL
 Neuroscience Program, Regis College, Denver, CO
 Cold Spring Harbor Laboratory meeting on Glia in Health and Disease, Cold Spring
 Harbor, NY
 Gunn-Loke Lecture, University of Washington Pain Center, Seattle, WA
 Neurosurgery Grand Rounds, University of Washington Pain Center, Seattle, WA
 European Federation of International Association for the Study of Pain Chapters, Is-
 tanbul, Turkey
 Pain Center, Washington University Medical School, St. Louis, MO
 Psychiatry Grand Rounds, University of Colorado Health Sciences Center, Denver,
 CO
 Johnson & Johnson, La Jolla, CA
 Adolor Corp., Exton, PA

- Neuroscience Club, University of Colorado-Boulder, Boulder, CO
- 2005:** Gordon Conference: Glial Biology: Functional Interactions Among Glia and Neurons, Ventura, CA
- PsiChi Honor Society, Department of Psychology, University of Colorado, Boulder
CU-Boulder University Hospital, Boulder, CO
- Keynote Address, American Psychosomatic Society, Vancouver, Canada
- Colorado State Legislature breakfast forum, Denver, CO
- F.W.L. Kerr Basic Science Research Award plenary lecture, American Pain Society annual meeting, Boston MA
- Keynote Address, 8th International Conference on the Mechanisms and Treatment of Neuropathic Pain, San Francisco, CA
- Pfizer Pharmaceuticals, St. Louis, MO
- McGill University Centre for Research on Pain & the Montreal General Hospital
Clinical Pain Centre, Montreal, Quebec, Canada
- AstraZeneca Pharmaceuticals, Montreal, Quebec, Canada
- Celgene Pharmaceuticals, San Diego, CA
- 2004:** Nobel Conference, “The Inflammatory Reflex”, Stockholm, Sweden
- Avigen, Alameda, CA
- AstraZeneca Pharmaceuticals, Stockholm, Sweden
- Dept. Anesthesiology, University of Florida, Gainesville, FL
- NIH Fibromyalgia Workshop: The Next Advances, Washington, DC
- Grand Rounds, Massachusetts General Hospital, Boston, MA
- Endo Pharmaceuticals, Philadelphia, PA
- Neuroscience Program, University of Virginia, Charlottesville, VA
- Avigen Gene Therapy & CNS Disorders Conference - New Treatment Paradigms Addressing Old Line Illnesses, New York, NY
- Canadian Pain Society-American Pain Society joint meeting, Vancouver, Canada
- Psychoneuroimmunology Research Society annual meeting, Titisee, Germany
- New and Future Directions in Fibromyalgia Pain Management, Portland, OR
- Pain Interest Group, Wake Forest University, Greensboro, NC
- 2003:** New Pain Therapies: From Laboratory to Clinic, GlaxoSmithKline Research Symposium Series; Verona, Italy
- American College of Rheumatology annual meeting, Orlando, FL
- Man, Mind, Matter Conference, Defense Advanced Research Projects Agency, Arlington, VA
- Focus on Pain conference, Orlando, FL
- Psychoneuroimmunology Research Society annual meeting, St. Amelia Island, FL
- Integrative Neural Immune Program Lecture Series at NIH, Bethesda, MA
- Renovis Pharmaceuticals, San Francisco, CA
- Biogen Pharmaceuticals, Cambridge, MA
- Avigen Pharmaceuticals, Alameda, CA
- 2002:** American Academy of Orofacial Pain, San Antonio, TX
- Dept of Anatomy & Neurobiology, Colorado State University, Ft. Collins, CO

Expanding the Frontiers of Pain conference, Wake Forest University School of Medicine, Winston-Salem, NC

National Institute of Neurological Disorders and Stroke and NIH Office of Rare Disease's The Neurobiology of Craniofacial/Deep Tissue Persistent Pain Symposium, Baltimore, MD

American Pain Society, Baltimore, MD

Plenary Lecture, International Association for the Study of Pain World Congress, San Diego, CA

Pain Research Program, University of Iowa, Iowa City, IA

Amgen, Thousand Oaks, CA

Dept. of Kinesiology & Applied Physiology, Univ Colorado-Boulder

Plenary lecture, International Society for NeuroImmunoModulation, Montpellier, France

National Institute of Neurological Disorders and Stroke Workshop on Astrocyte Function in Health and Disease, Rockville, MD

Research lecture, University of Colorado President's Teaching Scholars Retreat, Estes Park, CO

Pueblo Association for Interest in Neuroscience & TMD Study, Pueblo, CO

Pain Interest Group, University of California-San Francisco, San Francisco, CA

Pain and Inflammation Symposium, Univ of North Carolina, Chapel Hill, NC

2001: American Physiological Society symposium, Orlando, FL

Neurocrine Biosciences, San Diego, CA

Plenary Lecture, American Pain Society annual meeting, Phoenix, AZ

Neurosciences Program, Health Sciences Center, University of Colorado, Denver, CO

AstraZeneca Pharmaceuticals, Montreal, Canada

Dept. Pharmacology & Therapeutics, Louisiana State University, Shreveport, LA

Merck Pharmaceuticals, La Jolla, CA

Southern Academic Pain Consortium conference, Greensboro, NC

Grand Rounds, Johns Hopkins University Medical School, Baltimore, MD

Complex Regional Pain Syndrome Conference, Bethesda, MD

Neurological Sciences Institute, Oregon Health Sciences University, Portland, OR

2000: Univ. of Colorado Chancellor's Community Outreach Program, Montrose CO

Univ. of Colorado Chancellor's Community Outreach Program, Delta High School, Delta, CO

Univ. of Colorado Chancellor's Community Outreach Program, Hotchkiss High School, Hotchkiss, CO

Grand Rounds, Dept. of Anesthesiology, Beth Israel Deaconess Hospital, Harvard Medical School, Boston, MA

Orofacial Pain & Headache group, UCLA, Los Angeles, CA

Univ. of Colorado Chancellor's Community Lecture Series, Boulder, CO

Texas A&M, College Station, TX

Univ. of Colorado "Smart Lunch" program, Colorado State Legislature, Denver, CO

NIMH Workshop on Neuroimmunology, Bethesda, MD

Rocky Mountain Neurosciences meeting, Denver, CO

- American Pain Society annual meeting, Atlanta, GA
- 1999:** School of Medicine, Loyola Univ, Chicago, IL
 Dept. of Psychology, Ohio State Univ., Columbus, OH
 School of Medicine, Ohio Sate Univ., Columbus, OH
 Denver Academy for Dental Education Study Group for Head, Neck & Cran-
 iomandibular Disorders, Denver, CO
 CRTC, Legacy Holladay Park Medical Center, Portland, OR
 Picower Medical Research Institute, Manhasset, NY
 University of Maryland, Baltimore, MD
 Barrows Neurological Institute, Phoenix, AZ
 Neuroscience group, Univ Colorado at Boulder, Boulder, CO
 DuPont Pharmaceuticals, Wilmington, DE
- 1998:** Taniguchi Symposium "Brain and Bio-defense System", Kyoto, Japan
 School of Medicine, UCLA, Los Angeles, CA
 Dept. of Psychology, UCLA, Los Angeles, CA
 Dept. of Molecular, Cellular & Developmental Biology, Univ. Colorado at Boulder,
 Boulder, CO
 Cytokines, Stress & Depression Conference, Roscoff, France
 Psychoneuroimmunology Symposium, Kansas City, MO
 EuroPain, Geneva, Switzerland
 Neurobiology of Pain conference, National Academy of Sciences, Irvine, CA
- 1997:** Dept. of Physiology, Medical College of Virginia, Richmond, VA
 Dept. of Medicine, University of California, Irvine, CA
 3M Pharmaceuticals, St. Paul, MN
 Zeneca Pharmaceuticals, Wilmington, DE
 Psychoneuroimmunology Research Society International Meeting, Boulder, CO
 Developmental Psychobiology Research Group, Denver, CO
 National Institutes of Health Consortium on Pain, "New Frontiers in Pain Research"
 workshop, Washington, DC
 Cytokines and the Brain Conference, New Orleans, LA
- 1996:** Amgen, Boulder, CO
 Dept. of Psychology, Univ. Colorado at Boulder, Boulder, CO
 Winter Brain Conference, CO
 Institute for Basic & Applied Medical Research, Lovelace Institute, Albuquerque,
 NM
 New Frontiers in Stress Research, OHOLO Conference, Zichron, Ya'akov, Israel
 Hebrew University, Tel Aviv, Israel
 Grand Rounds, Dept. of Psychiatry, Univ. CO Health Sciences Center, Denver, CO
 American Pain Society national meeting, Washington, D.C.
 International Association for the Study of Pain, Vancouver, Canada
- 1995:** Symposium on cytokines as communication factors, Arcachon, France
 American Pain Society national meeting, San Diego, CA
 Behavioral Neuroscience Seminar, Univ. CO Boulder, Boulder, CO
 Amgen, Boulder, CO

- 1994:** American Pain Society national meeting, Miami, FL
Interdepartmental Neuroscience, Florida State Univ., Tallahassee, FL
- 1993:** International Association for the Study of Pain, Paris, France
Synergen, Boulder, CO
Behavioral Immunology Research Group, Univ. of Colorado at Denver, Denver, CO
Dept. of Psychology, Univ. Colorado at Boulder, Boulder, CO
- 1992:** American Pain Society national meeting, San Diego, CA
Behavioral Neuroscience Seminar, Univ. CO Boulder, Boulder, CO
- 1990:** Synergen, Boulder, CO
Dept. of Psychology, Univ. Colorado at Boulder, Boulder, CO
Mapleton Hospital, Boulder, CO
- 1988:** Behavioral Immunology Research Group, Univ. of Colorado at Denver, Denver, CO
NIH Pain Measurement Workshop, Univ. of Washington Pain Center, Seattle, WA
Neuropeptides in Pain and Analgesia Workshop, Winter Neuropeptide Conference,
Breckenridge, CO
- 1986:** Dept. of Psychology, Hunter College, New York, NY
Chronic Pain Course, Baylor College of Medicine, Houston, TX
- 1985:** Werner Lambert/Parke Davis, Ann Arbor, MI
Chronic Pain Course, Baylor College of Medicine, Houston, TX
Anaquest Pharmaceuticals, New Providence, NJ
International Conference on Stress-Induced Analgesia, NY Academy of Sciences,
New York City, NY
Sutter Community Hospital, Sacramento, CA
- 1984:** Dept. Animal Physiology, UC Davis, Davis, CA
Fourth World Congress on Pain, Seattle, WA
Pain Interest Group, UCSF, San Francisco, CA
- 1983:** A.H. Robbins Pharmaceutical Comp., Richmond, VA
Chronic Pain Course, Baylor College of Medicine, Houston, TX
Dept. of Pharmacology, Georgetown Univ., Washington, D.C.
- 1982:** American Pain Society National Meeting, Miami, FL
Dept. of Psychology, Princeton Univ., Princeton, NJ
Neurobiology Branch, National Institutes of Health, Washington, D.C.

MEMBERSHIPS

International Society for NeuroImmunoModulation
International Association for the Study of Pain
Rocky Mountain Region Neuroscience Group
Faculty for Undergraduate Neurosciences
Psychoneuroimmunology Society
International Pain Foundation
Society for Neuroscience

GRANT SUPPORT

Principal Investigator

- Non-neuronal contributions to drug reinforcement, R01 proposal, \$1,580,000 total direct costs requested, competitive renewal, submitted 11/2011, in review
- Removal of discrete spinal cord tissues cures human chronic SCI pain: are glial products involved? Department of Defense, \$500,000 total direct costs requested, 11/2011 invited proposal in review
- Exploration of non-neuronal cells (glia and meningeal immune cells) as novel targets for preventing and treating chronic migraine and post-traumatic headache, Dept of Defense, total direct costs requested \$750,000 for 3 years, 7/2011 invited proposal in review.
- DREZ removal cures human chronic SCI pain: are glial products implicated? , Craig Neilsen Foundation, total direct costs requested \$300,000 for 2 years, 11/2011 invited proposal in review.
- Preventing transition of acute-to-chronic neuropathic pain: models, mechanisms & mediators, NIDCR, Total direct costs \$1,250,000 for 5 years, 9/01/11-8/31/16
- Rethinking the causes of drug abuse: targeting a key receptor on brain immune-like cells, Peter F. McManus Charitable Trust, Total direct costs \$46,000 funded 12/2011-6/2013
- Systemic alpha7 agonists for treating neuropathic pain, Targacept Pharm., total direct costs \$33,970, 12/10-12/11.
- Exploration of a novel persistent reversal of pathological pain: mechanisms and mediators, Department of Defense, Total direct costs: \$997,000; 1/15/11-1/14/14.
- Human spinal cord injury: do glia define when chronic pain occurs?, Craig Hospital Spinal Cord Injury Rehabilitation & Research Center, Total direct costs: \$635,000; 10/07-open ended.
- Exploration of a novel microparticle-based gene therapy approach for treating diseases of the central nervous system, Colorado CoPilot Grant Program, total direct costs: \$50,000 4/2010-4/2011.

- A unique approach for treating chronic pain & increasing the clinical efficacy of opioid analgesics, State of Colorado and University of Colorado Technology Transfer Office Bioscience Discovery Evaluation Grant Program, total direct costs: \$185,000, 7/30/2009-2/28/2011.
- Spinal adenosine modulator: enduring anti-inflammatory action in neuropathic pain, NINDS RC1 Challenge Grant, total direct costs: \$500,000; 9/30/09-8/31/12
- Models and mechanisms for the transition of acute-to-chronic orofacial pain, NIDCR RC1 Challenge Grant, total direct costs: \$500,000; 9/22/09-8/31/12.
- Sustained delivery of IL10 pDNA for the treatment of neuropathic pain, 2009 CO Clinical and translational sciences CO-Pilot grant proposal, \$100,000 2009-2011.
- Role of toll-like receptors in opioid-induced spinal cord microglia activation and development of opioid tolerance/dependence, 2009 International Association for the Study of Pain Collaborative Research Grant proposal, total direct costs: \$15,000, 2009-2011.
- Defining pharmacological manipulations that block pain behavior in meningeal inflammation, GSK, Total direct costs: \$184,286; 5/08-4/10
- Immune & glial regulation of pain & analgesic actions; NIDA K05 Career Award; 7/2008-6/2013
- Exploration of ATL313, an A2a agonist, on neuropathic pain, Adenosine Therapeutics, Total direct costs: \$93,150, 9/07-open ended.
- Exploring the potential of glia for regulating clinically relevant opioid actions, NIDA R01 proposal, Total direct costs: \$1,250,000, 2/08-1/2013;
Supplement for minority summer student access to research, summer 2008
2009-10 supplement: ARRA Summer Undergraduate Research supplement funded
2010 supplement: three "Summer with NIDA" undergraduates funded for the summer
2011 supplement: two "Summer with NIDA" undergraduates funded for the summer
- Exploration of glial regulation of a rat model of multiple sclerosis, Avigen. Total direct costs: \$15,000; 10/07-open ended.
- Glial modulatory effects of AV411 and derivatives, Avigen. Total support \$110,000; 1/07-12/09.
- Development of rat models to assess glial involvement in migraine, GlaxoSmithKline Sponsored Research Project, Total direct costs: \$220,000; 9/06-8/08.

- Opioid analgesics: modulation of trigeminal & spinal glial activation, NIDCR R01 grant, Total direct costs: \$1,205,775; 7/01/06 – 4/30/11. Supplement: \$150,000 across 3 years 2008-2011.
2009-10 ARRA Supplement for summer undergraduate research, \$21,210
- Glial modulation of opioid tolerance and withdrawal, Avigen Sponsored Research Project, Total direct costs: \$198,600; 10/05-9/07
- Interleukin-10 gene therapy: Part III. development of clinically relevant methodologies; Avigen Sponsored Research Project 3/06-2/07; Total direct cost \$50,000.
- The role of spinal glial activation by opioid analgesics in opioid induced hyperalgesia, International Association for the Study of Pain 2005 Collaborative Research Grant, Total direct costs: \$10,000; 7/8/05-7/06.
- Investigations of novel anti-inflammatory drugs for pathological pain; Avigen Sponsored Research Project; 4/05-12/05 Total direct costs: \$62,000
- Spinal glial activation in human chronic pain; NINDS R03 Small grant; Total direct costs \$100,000; 9/05-5/07.
- Pain facilitation via neuron-to-glia signaling; NIDA R01; Total direct costs: \$1,125,000; 03/05-12/09
2007-2009 Minority postdoctoral trainee supplement
2007-10 - Supplement applied for (at the request of NIDA) and awarded to explore glial regulation of cocaine, THC and methamphetamine induced drug reward
2009-10 supplement: ARRA Summer Undergraduate Research supplement funded \$42,820
- Methods development for studying dorsal spinal cord glia; NIDA R03 Small Grant; Total direct costs: \$100,000, 9/04-8/06.
- Proteomic and gene array analyses of fractalkine effects in spinal cord; AstraZeneca Sponsored Research Project, 2/04-1/06; Total direct cost \$4,500.
- Cannabinoid regulation of dorsal spinal cord glial function; GlaxoSmithKline Sponsored Research Project, 9/04-8/05; Total direct cost \$9,573.
- Translation from rats to humans: are chronic pain states in humans associated with glial activation in spinal cord and/or brain? American Fibromyalgia Syndrome Association, 2/04-1/08; Total direct costs \$50,000

- Interleukin-10 gene therapy: Part I. development of clinically relevant methodologies; Avigen Sponsored Research Project 6/03-9/04; Total direct cost \$191,121.
- Interleukin-10 gene therapy: Part II. development of clinically relevant methodologies; Avigen Sponsored Research Project 9/04-8/05; Total direct cost \$159,459.
- Involvement of spinal cord glia in hyperalgesia induced by phospholipases A2 (Lys49 and Asp49) isolated from *Bothrops asper* snake venom, International Collaborative Research Grant, International Association for the Study of Pain, 9/02-4/03, Total direct costs: \$9,980
- Involvement of spinal cord glia in hyperalgesia induced by phospholipases A2 (Lys49 and Asp49) isolated from *Bothrops asper* snake venom; Brazil CAPES Foundation, \$4,000. 9/02-4/03
- Gene array analysis of glially driven exaggerated pain states; Johnson & Johnson Sponsored Research Project; Total direct costs: \$22,000; 7/02-6/04
- Pain control via spinal interleukin-10 gene therapy; NIDA R21/CEBRA Phase I; 8/02-7/04; Total direct costs: \$200,000
- Immune/glial mediation of exaggerated pain states; NIDA K02 Career Award; Total direct costs: \$600,050; 6/01/03-5/31/08
- Allodynic effects of sciatic inflammatory neuritis; NINDS R01; 6/01-5/05; \$922,200
- Hyperalgesia induced by gp120, an HIV coat protein; NINDS RO1 7/99-6/05 Total direct costs: \$1,243,822
(Minority Graduate Student Supplement; 1/00-12/02)
(Minority Postdoctoral Student Supplement; 1/00-12/01)
- Hyperalgesia induced by gp120, an HIV coat protein; Univ. of CO Grants-in-Aid; 1998-1999; \$7,000
- Cytokine-to-brain communication: role of the vagus; NIMH K02 Career Award; 6/98-5/03
- Cytokine-to-brain communication: role of the vagus; Univ. of CO Grants-in-Aid; 1997-1998; \$4,000
- Cytokine-to-brain communication: role of the vagus; NIMH 4/96-3/02
(Minority Graduate Student Supplement, NIH, awarded 5/1/96 for 4 years)
Total direct cost: \$1,214,388

- Endogenous anti-opiate analgesia systems, NINDS, 9/93-9/97 (Minority Graduate Student Supplement, NINDS, 9/95-9/97)
Total direct cost: \$528,257
- Studies of interleukin-1 and interleukin-1 receptor antagonist; Syngergn, Inc., 1/93-8/93; small grant
- Endogenous anti-analgesia systems, Univ. CO Grants-in-Aid; 1/93-12/93; small grant
- Stressor controllability and immunocompetence, NSF Career Advancement Award; 1988-1990; \$50,000
- Immunoenzymatic identification of HLA and RBC antibodies; Small Business Innovative Research Grant, NIH, 1987; \$50,000
- Studies of the effects of cholecystinin antagonists on opiate analgesia and tolerance, A.H. Robbins Pharmaceuticals, 1983-1988
- Studies of the effects of neuropeptides on pain sensitivity and analgesia, Univ. CA Davis Faculty Research Grant, 1984-1985
- Studies of the effects of thiorphan, an enkephalinase inhibitor, on opiate and non-opiate footshock-induced analgesia, Eli Lilly, 1982-1983

Co-Principal Investigator

- Glial-neuronal interactions in peripheral and central neuropathic pain (Wieseler, PI), NIH R01, direct costs: 1,250,000 requested; in revision.
- DREZ removal cures human chronic SCI pain: are glial products involved? (Wieseler, PI), Craig Neilsen Foundation, 11/11 in review.
- Comparison of effect between ACTh, melanocortin peptides and prednisolone on a model of multiple sclerosis in rats (Loram, PI), Questcor Pharmaceuticals, direct costs: \$138,095, in review.
- Role of non-neuronal cells in chronic migraine & post-traumatic headache, NIDCR R01 proposal, total direct costs requested \$1,250,000 for 5 yr, 10/2011, in review.
- Glial-neuronal interactions in central neuropathic pain, Dept of Defense, total direct costs requested \$500,000 for 3 years, 12/2011. Invited proposal in response to LOI, in

review.

- Development of a novel rat model of post-traumatic brain injury (TBI) headache and treatment with anti-CGRP or glial inhibition: optimization & characterization (Wieseler, PI), Merck Pharm., small grant proposal, funded direct costs \$66,600, 12/10-11/12.
- Targeting microglia to prevent post-traumatic epilepsy (Barth, PI), Total direct costs \$850,000; 1/11-12/14.
- The role of neuroinflammation in Autism Spectrum Disorder related behaviors, hyper-excitability and epilepsy (Barth, PI), Autism Speaks, Total direct costs \$120,000; 1/2011-12/13.
- The Role of Glucocorticoids and Neuroinflammation in Mediating the Effects of Stress on Drug Abuse (Maier, PI), Department of Defense, Total direct costs \$800,000; 1/2011-12/14.
- Why opioids enhance migraine pain: the puzzle points to glia (Wiesler, PI), Migraine Research Foundation, \$50,000 11/09-10/10.
- Alternatively activated macrophages of EAE rats: a novel target for treating MS (Loram, PI), National MS Society, Pilot grant proposal, \$40,000, 7/10 in review
- Autism spectrum disorder, epilepsy & neuroimmunity (Barth, PI), Dept. of Defense, Autism Research Program, \$450,000 2011-2013, in review.
- Post-traumatic brain injury as a priming event for migraine pain (Wieseler, PI), Merck small grant proposal, \$60,000, 7/10 in review.
- The insular cortex and neuropathic pain (Barth, PI), NIH R21 proposal, in revision.
- Developing novel drug candidates suppressing opiate addiction and abuse (Yin, PI) R01, total amount requested \$1,859,778, 2009 in review.
- Behavioral control, the medial prefrontal cortex, and resilience in the face of chronic stress (Maier, PI), NIMH RC1 Challenge grant, direct costs \$500,000, 9/30/09-8/31/11.
- Probing opioid-induced glial activation with peptide antagonists (Yin, PI) R03 Support Opportunity for Addiction Research for New Investigators, NIDA, \$100,000, 9/2009-8/2011.
- Pharmacophore optimization for targeted therapeutics (Ahn, PI), State of Colorado and University of Colorado Technology Transfer Office Bioscience Discovery Evaluation

Grant Program, total direct costs: \$243,000, 7/30/2009-10/31/2010.

- Developing small molecule probes for opioid-induced glial activation (Yin, PI), NIH R21 proposal, 9/2009-8/2011.
- Does opioid administration block the efficacy/function of the migraine therapy, Anti-CGRP? (Wieseler, PI) Merck & Co., Inc. 9/1/2008-8/31-2010, \$60,000
- Transforming clinical pain control by targeting a novel non-neuronal receptor, Butcher CU seed grant proposal (Sammakia, PI), \$100,000; 2008-2010.
- Optimizing the clinical efficacy of opioids by TLR4 blockade, NIH/NIDA CEBRA R21 (Yin, PI); \$205,000 in direct costs, 7/01/09-6/30/2011.
- Transforming clinical pain control by targeting a novel non-neuronal receptor; NIH R03 (Yin, PI); DA25740 5/15/09-4/30/2011; \$125,000 direct costs.
- Biochemical characterization of proinflammatory and apoptotic markers in human spinal cord injury patients compared to rat spinal cord injury models; Christopher and Dana Reeve Foundation (Wieseler, PI); \$150,000 project proposed for 2009-2011; Revision in review.
- Human spinal cord glial cytokines and chronic pain; NIAMSD (R01; Lorton, PI); \$800,000; 7/31/07-5/30/12
- Stressor controllability: the role of the medial prefrontal cortex in producing resiliency; NIMH (R01; Maier, PI); \$1,250,000; 04/01/07-03/31/12
- Stressor controllability, drugs of abuse, and serotonin; NIDA (R01; Maier, PI); \$1,325,000; 07/01/06 - 6/30/11
- Neuroinflammation, inflammatory challenge and memory; NIA (R01; Maier, PI); Total direct costs: \$1,750,000; 07/06-6/11.
- Pain control via spinal interleukin-10 gene therapy; NIDA CEBRA Phase II (R01; Milligan PI); Total direct costs requested: \$1,245,000; 09/20/04- 09/19/09
- Immune activation, hippocampal IL-1beta and memory, NIMH (R01; Rudy PI), 06/01/02 - 05/30/07; Total direct costs: \$1,050,000
- Stressor controllability as a key modulator of drug reward, NIDA (R01; Maier, PI), 1/15/01-1/14/06; Total direct costs: \$1,250,000

- Stressor controllability, anxiety & serotonin, NIMH, 4/97-3/07 (R01; Maier, PI; Merit award) Total direct costs: \$1,250,000 each five years (Minority graduate student supplement, NIMH)
- Stress and immunity: immunological and physiological mechanisms, NIH (R01; Maier, PI), 7/96-6/01 Total direct costs: \$1,270,400 (Minority graduate student supplement, NIMH)
- Stressor controllability, anxiety & serotonin, NIMH (R01; Maier, PI), 4/93-3/97 Total direct costs: \$432,034
- Stress and immunity: immunological and physiological mechanisms, NIH (R01; Maier, PI), 5/91-7/96 Total direct costs: \$1,080,963

PUBLICATIONS

Books

DeLeo, J.A., Sorkin, L. & **Watkins, L.R.** (Eds.), Immune and Glial Regulation of Pain, Seattle: International Association for the Study of Pain Press, (2007).

Watkins, L.R. & Maier, S.F. (Ed.), Cytokines and Pain, Basel: Birkhauser, (1999).

Book Chapters

Grace, P., **Watkins, L.R.** & Hutchinson, M.R., The role of the immune system in chronic pain comorbidities, Pain Comorbidities, Giamberardino, M.A. & Jensen, T.S. (Eds). IASP Press, (2011) in press.

Grace, P., **Watkins, L.R.** & Hutchinson, M.R., Immune to brain communication in pain: historical perspectives, new directions, Psychoneuroimmunology, Wiley-Blackwell, (2011) in press.

Wieseler-Frank, J., Milligan, E.D., Maier, S.F. & **Watkins, L.R.**, Cord glial activation, Encyclopedic Reference of Pain, Schmidt, R. & Willis, W.D. (Ed.) Springer-Verlag, (2011) CD-Rom, invited update in preparation.

Hutchinson, M.R. & **Watkins, L.R.**, Glial dysregulation of opioids, Encyclopedic Reference of Pain, Schmidt, R. & Willis, W.D. (Ed.) Springer-Verlag, (2011) CD-Rom, invited review in preparation.

- Wieseler, J., Ellis, A., Maier, S.F. & **Watkins, L.R.**, & Falci, S., Unilateral T13 and L1 Avulsion: methods for a novel model of central neuropathic pain. Pain Research: Methods and Protocols: "Methods of Molecular Medicine", 2nd Edition, D. Luo (Ed.) Humana Press, (2011) invited chapter in press.
- Wieseler, J., Maier, S.F. & **Watkins, L.R.**, An awake behaving rat model for the study of dural inflammation-induced facial allodynia: a rat model relevant to migraine. Pain Research: Methods and Protocols: "Methods of Molecular Medicine", 2nd Edition, D. Luo (Ed.) Humana Press, (2011) invited chapter in press.
- Milligan, E.D., Maier, S.F., **Watkins, L.R.**, Gene therapy in the central nervous system: chronic pain, Encyclopedia of Pain, 2009.
- Maier, S. F., Amat, J., Baratta, M. V., Bland, S. T., Christianson, J. C., Thompson, B., Rozeske, R. R., & Watkins, L. R. The role of the medial prefrontal cortex in mediating resistance and vulnerability to the impact of adverse events. In C. M. Pariante, R. M. Nesse, D. Nutt, & L. Wolpert (Eds.), Understanding depression: a translational approach, Oxford University Press, 2009, 157-171.
- Hutchinson, M.R., Johnson, K.W. & **Watkins, L.R.**, Glial dysregulation of pain and opioid actions: past, present and future, Pain 2008 – An Updated Review, Castro-Lopes, J.M., Raja, S., and Schmelz, M. (Eds), IASP Press, Seattle, 2008.
- Milligan, E.D., Ledeboer, A., Sloane, E.M., Busha, D.A. Maier, S.F. & **Watkins, L.R.**, Glially driven enhancement of pain and its control by anti-inflammatory cytokines. In: DeLeo, J.A., Sorkin, L.S. & Watkins, L.R. (Eds), Immune and Glial Regulation of Pain, Seattle: IASP Press, 2007, pp. 319-340.
- Shavit, Y., Wolf, G., Johnston, I.N., Westbrook, R.F., **Watkins, L.R.** & Yirmiya, R., Proinflammatory cytokines modulate neuropathic pain, opioid analgesia, and opioid tolerance. In: DeLeo, J.A., Sorkin, L.S. & Watkins, L.R. (Eds), Immune and Glial Regulation of Pain, Seattle: IASP Press, 2007, 361-384.
- Ledeboer A, Sloane EM, Milligan ED, Langer SJ, Maier SF, Johnson KW, Leinwand LA, Chavez RA, **Watkins LR**. Paclitaxel-induced mechanical allodynia in rats is inhibited by spinal delivery of plasmid DNA encoding interleukin-10. In: Flor H, Kalso E, Dostrovsky JO (Eds), Proceedings of the 11th World Congress on Pain, Progress in Pain Research and Management, Seattle: IASP Press, 2007, pp. 187-194.
- Watkins, L.R.**, Milligan E.D. & Maier, S.F., Mechanisms of glial activation after nerve injury, Handbook of the Senses, Bushnell, C & Basbaum, A. (Eds)., Elsevier Press (2007) CD Rom.

- Wieseler-Frank, J., Milligan, E.D., Maier, S.F. & **Watkins, L.R.**, Cord glial activation, Encyclopedic Reference of Pain, Schmidt, R. & Willis, W.D. (Ed.) Springer-Verlag, (2007) CD-Rom.
- Watkins, L.R.** & Maier, S.F. Proinflammatory cytokines, Encyclopedic Reference of Pain, Schmidt, R. & Willis, W.D. (Ed.) Springer-Verlag, (2007) CD-Rom.
- Milligan, E.D., Maier, S.F. & **Watkins, L.R.**, Inflammatory neuropathy, Encyclopedic Reference of Pain, Schmidt, R. & Willis, W.D. (Ed.) Springer-Verlag, (2007) CD-Rom.
- Watkins, L.R.**, Wieseler-Frank, J., Hutchinson, M. Ledeboer, A., Spataro, L., Milligan, E.D., Sloane, E., & Maier, S.F., Neuroimmune interactions and pain: the role of immune and glial cells, Psychoneuroimmunology, Ader, R. (Ed.), Academic Press (2006) 393-414.
- Watkins, L.R.**, Wieseler-Frank, J., Milligan, E.D., Johnston, I., & Maier, S.F., Contribution of glia to pain processing in health and disease, Handbook of Clinical Neurology - Pain, Cervero, F & Jensen, T.S. (Eds), Edinburgh: Elsevier Press (2006) 309-324.
- Watkins, L.R.** & Maier, S.F., Glia and pain: Past, present and future, The Paths of Pain 1975-2005, Merskey, H., Loeser, J.D. & Dubner, R. (Eds.), IASP Press, (2005) 165-176.
- Milligan, E.D., Maier, S.F. & **Watkins, L.R.**, Sciatic inflammatory neuropathy: a new model for studying neuropathic pain of inflammatory origin. Pain Research: Methods and Protocols; "Methods of Molecular Medicine", Vol. 99, D. Luo (Ed.) Humana Press, (2004) pp. 67-89.
- Watkins, L.R.**, Milligan, E.D. & Maier, S.F., Immune and glial involvement in physiological and pathological exaggerated pain states. Advances in Pain Research and Therapy, Dostrovsky, J.O., Carr, D.B. & Koltzenberg, M. (Eds), IASP Press, Seattle (2003) 369-385.
- Maier, S. F., **Watkins, L. R.**, and Nance, D. M., Multiple routes of action of interleukin-1 on the nervous system. In R. Ader, D. L. Felten, and N. Cohen (Eds.), Psychoneuroimmunology, Third Edition. New York, Academic Press, (2001) 563-583.
- Watkins, L.R.** & Maier, S.F., Illness-induced hyperalgesia: mediators, mechanisms and implications, In: Cytokines & Pain, Birkhauser Pub., Watkins, L.R. & Maier, S.F. (Eds.), (1999) pp. 39-58.
- Maier, S.F. & **Watkins, L.R.**, The neurobiology of stressor controllability, In: Learned Helplessness & Optimism, Templeton Fdn. Press, (1999).

- Watkins, L.R.** & Maier, S.F., Vagal afferent nerve mediates immune signals to the brain, 21st International Symposium on Brain Sciences: Brain & Biodefense, Y. Oomura and T. Hori (Eds.), Karger, Basel, 1998, pp 171-184.
- Maier, S.F., Goehler, L.E., Fleshner, M. & **Watkins, L.R.**, The role of the vagus nerve in cytokine-to-brain communication, In: Annals of the New York Academy of Sciences, Neuroimmunomodulation, NYAS Press, New York, 1998, Vol. 840, pp 289-300.
- Watkins, L.R.** & Maier, S.F., Stress and cytokine-brain interactions, In: New Frontiers in Stress Research, Modulation of Brain Function, A. Levy, E. Grauer, D. Ben-Nathan & R. DeKloet, (Eds), Harwood Academic Pub., Amsterdam, 1998, pp. 187-194.
- Maier, S.F., Fleshner, M. & **Watkins, L.R.**, Neural, endocrine, and immune mechanisms of stress-induced immunomodulation, In: New Frontiers in Stress Research, Modulation of Brain Function, A. Levy, E. Grauer, D. Ben-Nathan & R. DeKloet, (Eds), Harwood Academic Pub., Amsterdam, 1998, pp. 175-186.
- Watkins, L.R.**, Algesiometry in laboratory animals and man: current concepts and future directions, Advances in Pain Research and Therapy: Issues in Pain Measurement, C.R. Chapman and J.D. Loeser (eds.), Raven Press, New York, 1989, pp. 249-266.
- Suberg, S.N. & **Watkins, L.R.**, Interaction of cholecystokinin and opioids in pain modulation. In: Pain and Headache - Neurotransmitters and Pain, H. Akil & J. Lewis (eds.), Karger, 1987, pp. 247-265.
- Watkins, L.R.** & Mayer, D.J., Multiple endogenous opiate and non-opiate analgesia systems: evidence for their existence and clinical implications, In: Annals of the New York Academy of Sciences, First International Conference on Stress Induced Analgesia, Vol. 467, D.D. Kelly (ed.), NYAS Press, New York, 1986, pp. 273-299.
- Suberg, S.N., Culhane, E.S., Carstens, E. & **Watkins, L.R.**, Behavioral and electrophysiological investigations of opiate/cholecystokinin interactions. In: Advances in Pain Research and Therapy, Vol. 9, H.L. Fields, R. Dubner & F. Cervero (eds.), Raven Press, New York, 1985, pp. 541-554.
- Watkins, L.R.** & Mayer, D.J., Organization of endogenous opiate and non-opiate pain control systems. In: Neuroscience, P.H. Abelson, E. Butz & S.H. Snyder (eds.), American Association for the Advancement of Science, Washington, D.C., 1985, pp. 355-371.
- Frenk, H., **Watkins, L.R.** & Mayer, D.J., Localization of the CNS sites mediating epileptiform activity elicited by morphine and endogenous opioids. In: Neurotransmitters, Seizures, and Epilepsy, Vol. 2, R.G. Fariello et al. (eds.) , Raven Press, New York, 1984, pp. 327-336.

Mayer, D.J. & **Watkins, L.R.**, Neural mechanisms of endogenous opiate and non-opiate analgesia systems. In: Analgesia and Enkephalinases, R. Boigegrain (ed.), Sanofi, Montpellier, 1984, pp. 121-152.

Mayer, D.J. & **Watkins, L.R.**, Multiple endogenous opiate and non-opiate analgesia systems. In: Advances in Pain Research and Therapy, Vol. 6, L. Kruger & J.C. Liebeskind (eds.), Raven Press, New York, 1984, pp. 253-276.

Mayer, D.J. & **Watkins, L.R.**, The role of endorphins in endogenous pain control systems. In: Modern Problems of Pharmacopsychiatry: The Role of Endorphins in Neuropsychiatry, H.M. Emrich (ed.), Karger, AG, Basel, Vol. 17, 1981, pp. 68-96.

Encyclopedia Entry

Maier, S. F. & **Watkins, L. R.** (2000). Learned helplessness. In A. E. Kazdin (Ed.), Encyclopedia of Psychology. New York, NY: Oxford University Press.

Society Newsletter Articles; Journal Editorials

Watkins, L.R., Glia as the “bad guys” in regulating pain and opioid dysfunction, Feature article, American Academy of Pain Management “The Pain Practitioner”, (2010).

Bartley, J. & **Watkins, L.R.**, Comment on: Excessive opioid use and the development of chronic migraine, Pain 142 (2009) 179-182.

Watkins, L.R., “Listening” and “talking” to neurons: clinical implications of immune and glial dysregulation of pain and opioid actions, Feature article, American Academy of Pain Management “The Pain Practitioner” Vol. 18 (2008) pp. 58-61

Banks, W.A. & **Watkins, L.R.**, Mediation of chronic pain: not by neurons alone, Pain 124 (2006) 1-2.

Watkins, L.R., Curing chronic pain – hope on the horizon? Reflex Sympathetic Dystrophy Syndrome Association Review, (2005).

Journal Special Issues

Watkins, L.R. (Guest Editor) Immune & Glial Regulation of Pain, Brain, Behavior & Immunity, (2007) volume 21.

Refereed Review Articles

- Nicotra, L, Loram, L., **Watkins, L.R.** & Hutchinson, M.R., Toll like receptors in chronic pain, Experimental Neurology Special Issue on Microglia and Chronic Pain, (2011) in press.
- Hutchinson, M.R., Shavit, Y., Grace, P.M., Rice, K.C., Maier, S.F. & **Watkins, L.R.**, Exploring the neuroimmunopharmacology of opioids: an integrative review of mechanisms of central immune signaling and their implications for opioid analgesia, Pharmacological Reviews 63 (2011) 722-810.
- Frank, M.G., **Watkins, L.R.** and Maier, S.F. Stress- and glucocorticoid-induced priming of neuroinflammatory responses: potential mechanisms of stress-induced vulnerability to drugs of abuse, Brain, Behavior & Immunity Special Issue, 25 Suppl. 1 (2011) S21-28.
- Maier, S.F. & **Watkins, L.R.**, Role of the medial prefrontal cortex in coping and resilience, Brain Research 1355 (2010) 52-60. PMID: PMC2967290
- Barrientos, R.M., Frank, M.G., **Watkins, L.R.** & Maier, S.F., Memory impairments in healthy aging: role of aging-induced microglial sensitization. Special Issue on Neuroimmunomodulation and Aging, Aging and Disease, (2010) 212-231. PMID: PMC2995216
- Buchanan, M., Hutchinson, M.R., **Watkins, L.R.** & Yin, H., The role of toll-like receptor 4 in pathologies of the CNS, Journal of Neurochemistry 114 (2010) 13-27.
- Watkins, L.R.**, Hutchinson, M.R., Rice, K., & Maier, S.F., The “toll” of opioid-induced glial activation: improving the clinical efficacy of opioids by targeting glia, Trends in Pharmacological Sciences, 30 (2009) 581-591. PMID: PMC2783351
- Sloane, E., Soderquist, R., Maier, S.F., Mahoney, M., Chavez, R., **Watkins, L.R.** & Milligan, E.D., Long term control of neuropathic pain in a non-viral gene therapy paradigm, Gene Therapy special issue 16 (2009) 470-5. PMID: PMC2756299
- Milligan, E.D. and **Watkins, L.R.**, Pathological and protective roles of glia in chronic pain, Nature Neuroscience Reviews, 10 (2009) 23-36. PMID: PMC2752436
- Milligan, E.D., Sloane, E. and **Watkins, L.R.**, A role for the chemokine, fractalkine, in pathological pain states, Journal of NeuroImmunology, 198 (2008) 113-120.

- Hutchinson, M.R., Bland, S.T., Johnson, K.W., Rice, K.C., Maier, S.F. & **Watkins, L.R.**, Opioid-induced glial activation: mechanisms of activation and implications for opioid analgesia, dependence, and reward, TheScientificWorldJOURNAL 7 (2007) 98-111.
- Ledeboer, A., Hutchinson, M.R., **Watkins, L.R.** & Johnson, K.W., Ibudilast (AV41): a new class therapeutic candidate for neuropathic pain and opioid withdrawal syndromes, Expert Opinion on Investigational Drugs, 16 (2007) 935-950.
- Watkins, L.R.**, Hutchinson, M.R., Milligan, E.D. & Maier, S.F., “Listening” and “talking” to neurons: implications of immune activation for clinical pain control and increasing the efficacy of opioids, Brain Research Reviews, 56 (2007) 148-169. PMC2245863
- Watkins, L.R.**, Hutchinson, M.R., Ledebor, A., Wieseler-Frank, J., Milligan, E.D. & Maier, S.F., Glia as the “bad guys”: implications for improving clinical pain control and the clinical utility of opioids, Brain, Behavior & Immunity, 21 (2007) 131-146. PMC1857294
- Maier, S. F., Amat, J., Baratta, M. V., & **Watkins, L. R.** Behavioral control, the medial prefrontal cortex, and resilience. Discourses in Clinical Neuroscience, 8 (2006) 397-407.
- Watkins, L.R.**, Hutchinson, M.R. Johnston, I. & Maier, S.F., Glia: Novel counter-regulators of opioid analgesia, Trends in Neuroscience 28 (2005) 661-669.
- Watkins, L.R.** & Maier, S.F., Immune regulation of central nervous system functions: from sickness responses to pathological pain, Journal of Internal Medicine special volume for the Nobel Conference “The Inflammatory Reflex”, 257 (2005) 139-155.
- Wieseler-Frank, J., Maier, S.F. & **Watkins, L.R.**, Central proinflammatory cytokines and pain enhancement, NeuroSignals 14 (2005) 166-174.
- Wieseler-Frank, J., Maier, S.F. & **Watkins, L.R.**, Immune-to-brain communication dynamically modulates pain: physiological and pathological consequences, Brain, Behavior & Immunity, 19 (2005) 104-111.
- Maier, S. F. & **Watkins, L. R.** Stressor controllability and learned helplessness: The roles of the dorsal raphe nucleus, serotonin, and corticotropin releasing hormone. Neuroscience and Biobehavioral Reviews, 29 (2005) 829-841.
- Watkins, L.R.** & Maier, S.F., Targeting glia to control clinical pain: An idea whose time has come, Drug Discovery Today: Therapeutic Strategies, 1 (2004) 83-88.
- Watkins, L.R.** & Maier, S.F., Neuropathic pain: the immune connection, Clinical Updates, 12 (2004) 1-4.

- Wieseler-Frank, J., Milligan, E.D., Maier, S.F. & **Watkins, L.R.**, Glial activation and pathological pain, Neurochemistry International, 45 (2004) 389-395.
- Watkins, L.R.**, Milligan, E.D. & Maier, S.F., Glial proinflammatory cytokines mediate exaggerated pain states: implications for clinical pain, Adv. Exp. Med. Biol.: Immune Mechanisms of Pain & Analgesia, 532 (2003) 1-21.
- Milligan, E.D., Maier, S.F. & **Watkins, L.R.**, Neuronal-glia interactions in central sensitization, Seminars in Pain Medicine: Central Sensitization, 3 (2003) 171-183.
- Watkins, L.R.** & Maier, S.F., Glia: a novel drug discovery target for clinical pain, Nature Reviews-Drug Discovery, 2 (2003) 973-985.
- Watkins, L.R.** & Maier, S.F., When good pain turns bad, Current Directions in Psychological Sciences, 12 (2003) 232-236.
- Dworkin, R.H., Backonja, M., Rowbotham, M.C., Allen, R.R., Argoff, C.R., Bennett, G.J., Bushnell, C., Farrar, J.T., Galer, B.S., Haythornthwaite, J.A., Dewitt, D.J., Loeser, J.D., Max, M.B., Saltarelli, M., Schmader, K.E., Stein, C., Thompson, D., Turk, D.C., Wallace, M.S., **Watkins, L.R.**, & Weinstein, S.M., Advances in neuropathic pain: diagnosis, mechanisms, and treatment recommendations, Archives of Neurology, 60 (2003) 1524-1534.
- Maier, S. F. & **Watkins, L. R.** Immune-to-central nervous system communication and its role in modulating pain and cognition: Implications for cancer and cancer treatment. Brain, Behavior, and Immunity, 17 (2003) S125-S132.
- Watkins, L.R.** & Maier, S.F., Beyond neurons: Evidence that immune and glial cells contribute to pathological pain states, Physiological Reviews, 82 (2002) 981-1011.
- Watkins, L.R.**, Milligan, E.D., & Maier, S.F., Spinal cord glia: new players in pain, Pain, 93 (2001) 201-205.
- Watkins, L.R.**, Milligan, E.D. & Maier, S.F., Glial activation: a driving force for pathological pain, Trends in Neuroscience, 24 (2001) 450-455.
- Maier, S. F. & **Watkins, L.R.**, Immune-to-brain communication: Possible implications for cancer related fatigue. Anemia and Quality of Life in Oncology, 4 (2001) 2-7.
- Pugh, C. R., Fleshner, M., **Watkins L. R.**, Maier, S. F. & Rudy, J. W., The immune system and memory consolidation: a role for the cytokine IL-1, Neuroscience and Biobehavioral Reviews, 25 (2001) 21-24.

- Goehler, L.E., Gaykema, R.P.A., Hansen, M.K., Andreson, K., Maier, S.F., **Watkins, L.R.** Vagal immune-to-brain communication: A visceral chemosensory pathway, Autonomic Neuroscience, 85 (2000) 49-59.
- Watkins, L.R.** & Maier, S.F., The pain of being sick: Implications of immune-to-brain communication for understanding pain, Ann. Rev. Psych., 51 (2000) 29-57.
- Maier, S. F., & **Watkins, L. R.** The immune system as a sensory system: Implications for psychology, Current Directions in Psychological Sciences, 9 (2000) 98-102.
- Watkins, L.R.** & Maier, S.F., Implications of immune-to-brain communication for sickness and pain, Proc. Natl. Acad. Sci., 96 (1999) 7710-7713.
- Watkins, L.R.**, Hansen, M.K., Nguyen, K.T. , Lee, J.E. & Maier, S.F., Dynamic regulation of the proinflammatory cytokine, interleukin-1beta: molecular biology for non-molecular biologists, Life Sci., 65 (1999) 449-481.
- Maier, S.F. & **Watkins, L.R.**, Bidirectional communication between the brain and the immune system: implications for behavior, Animal Behaviour, 57 (1999) 57741-760.
- Watkins, L.R.**, Nguyen, K.T., Lee, J., & Maier, S.F., Dynamic regulation of proinflammatory cytokines, Adv. Exp. Med. Biol., 461 (1999) 153-178.
- Maier, S.F., Nguyen, K.T., Deak, T., Milligan, E.D. & **Watkins, L.R.**, Stress, learned helplessness and brain interleukin-1beta, Adv. Exp. Med. Biol., 461 (1999) 235-250.
- Maier, S.F. & **Watkins, L.R.**, Stressor controllability, anxiety, and serotonin, Cognitive Therapy & Research, 22 (1998) 595-613.
- Maier, S.F. & **Watkins, L.R.**, Cytokines for psychologists: implications of bi-directional immune-to-brain communication for understanding behavior, mood, and cognition, Psych. Review, 105 (1998) 83-107.
- Watkins, L.R.** & Maier, S.F., The case of the missing brain: arguments for a role of brain-to-spinal cord pathways in pain facilitation, Behav. Brain Sci., 20 (1997) 469.
- Watkins, L.R.**, Maier, S.F. & Goehler, L.E., Basic science review: Immune activation: the role of proinflammatory cytokines in inflammation, illness responses, and pathological pain states, Pain, 63 (1995) 289-302.
- Watkins, L.R.**, Maier, S.F. & Goehler, L.E., Minireview: Cytokine-to-brain communication: a review & analysis of alternative mechanisms, Life Sci. 57 (1995)1011-1026.

Maier, S.F., **Watkins, L.R.** & Fleshner, M., Psychoneuroimmunology: the interface between behavior, brain and immunity, Amer. Psychologist, 49_(1994) 1004-1018.

Refereed Original Research Articles

Loram, L.C., Hutchinson, M.R., Taylor, F.R., Zhang, Y., Konrad, B., Babb, J.A., Day, H.E.W., Rice, K., Maier, S.F. and Watkins, L.R., Estradiol potentiates (+)-morphine induced thermal hyperalgesia in female rats, (2011) in preparation.

Northcutt, A.L., Hutchinson, M.R., Hiranita, T., Wang, X., Lewis, S., Kopajtic, T.A., Loram, L., Sfregola, C., Galer, E., Miles, N.E., Bland, S.T., Amat, J., Rozeske, R.R., Maslanik, T., Chapman, T., Strand, K., Fleshner, M., Bachtell, R.K., Yin, H., Katz, J.L., Rice, K.C., Maier, S.F. and **Watkins, L.R.**, Blockade of opioid reinforcement by (+)-naloxone, a toll-like receptor 4 antagonist, (2011) in review.

Bastos, L.F.S., da Silva, J.G., Gouveia, L.F., Vierira, R.P., Guidine, P.A.M., dos Santos, S.G., Santos, D.A., Watkins, L.R. Beraldo, H.O., Coelho, M.M., and MOraes, M.F.D., A novel non-antibacterial pyrazoline minocycline derivative inhibits experimental pain in mechanistically distinct models, Neuropharmacology (2011), in preparation.

Frank, M.G., Thompson, B.M., **Watkins, L.R.** & Maier, S.F., Glucocorticoids mediate stress-induced priming of microglial pro-inflammatory responses, Brain, Behavior & Immunity, (2011) in press.

Johnston, I.N., Maier, S.F., Rudy, J.W. and **Watkins, L.R.**, Post-conditioning experience with acute or chronic inflammatory pain reduces contextual fear conditioning in the rat, Behavioral Brain Research, 226 (2011) 361-618.

Rozeske, R.R., Evans, A.K., Frank, M.G., **Watkins, L.R.**, Lowry, C.A. & Maier, S.F., Uncontrollable, but not controllable, stress desensitizes 5-HT1A receptors in the dorsal raphe nucleus, Journal of Neuroscience, 31 (2011) 14107-15.

Rozeske, R.R., Der-Avakian, A., **Watkins, L.R.** & Maier, S.F. , Activation of the medial prefrontal cortex by escapable stress is necessary for protection against subsequent inescapable stress-induced potentiation of morphine conditioned place preference, Eur. J. Neuroscience (2011) in press.

Wang, X., Loram, L.C., Cheng, K., Wang, H., Hutchinson, M.R. **Watkins, L.R.** & Ying, H., TLR4/MD2 complex as a target for regulating morphine-induced glial activation, (2011) in review.

Hains, L.E., Loram, L.C., Taylor, F., Strand, K., Wieseler, J.L., Barrientos, R., Young, J.C.,

- Frank, M.G., Sobesky, J., Martin, T.J., Eisenach, J.C., Maier, S.F., Johnson, J.D., Fleshner, M.R., & **Watkins, L.R.**, Prior laparotomy or corticosterone potentiates lipopolysaccharide-induced fever and sickness behaviors, Journal of Neuroimmunology, 239 (2011) 53-60.
- Barrientos, R., Frank, M., Crysdale, N., Chapman, T., Ahrendsen, J., Day, H., Campeau, S., **Watkins, L.R.**, Patterson, S. and Maier, S.F., Little exercise, big effects: reversing aging and infection-induced memory deficits and underlying processes, Journal of Neuroscience, 31(2011) 11578-11586.
- Liu, L., Ghosh, N., Slivka, P.F., Fiorini, Z., Hutchinson, M.R., **Watkins, L.R.**, & Yin, H., An MD2 hot-spot mimicking peptide that suppresses TLR4-mediated inflammatory response in vitro and in vivo, Chemibiochem, 12 (2011) 1827-31.
- Wu, Y., Lousberg, E.L., Moldenhauer, L.M., Hayball, J.D., Robertson, S.A., Collier, J.K., Rice, K.C., **Watkins, L.R.**, Somogyi, A.A. & Hutchinson, M.R., Inhibiting the TLR4-MyD88 signalling cascade by genetic or pharmacologic strategies reduces acute alcohol dose-induced sedation and motor impairment in mice, Brit. J. Pharmacol. (2011) in press.
- Lewis, S.S., Loram, L.C., Hutchinson, M.R., Zhang, Y., Maier, S.F., Rice, K.C. & **Watkins, L.R.**, The opioid-inactive toll-like receptor 4 (TLR4) antagonist (+)-naloxone reverses multiple models of chronic neuropathic pain in rats, (2011) MS in preparation.
- Lewis, S.S., Zhang, Y., Hutchinson, M.R., Hund, D.K., Maier, S.F., Rice, K.C. & **Watkins, L.R.**, Glucuronic acid and ethanol metabolite ethyl-glucuronide cause toll-like receptor 4 (TL4) activation and enhanced pain, (2011) MS in preparation.
- Lewis, S.S., Zhang, Y., Hutchinson, M.R., Hund, D.K., Maier, S.F., Rice, K.C., & **Watkins, L.R.**, Select steroid hormone glucuronide metabolites can cause toll-like receptor 4 (TLR4) activation and enhanced pain, (2011) MS in preparation.
- Loram, L.C., Taylor, F.R., Strand, K.A., Frank, M.S. Sholar, P., Harrison, J.A., Maier, S.F. & **Watkins, L.R.**, Prior exposure to glucocorticoids potentiates lipopolysaccharide induced mechanical allodynia and spinal neuroinflammation, Brain, Behavior & Immunity, 25 (2011) 1408-15.
- Christianson, J., Jenings, J.H., Ragole, T., Flyer, J., Benison, A., Barth, D. **Watkins, L.R.** & Maier, S.F., Safety signals mitigate the consequences of uncontrollable stress via a circuit involving the sensory insular cortex and bed nucleus of the stria terminalis, Biological Psychiatry 70 (2011) 458-64.

- Liu, L., Coller, J.K., **Watkins, L.R.**, Somogyi, A.A. & Hutchinson, M.R., The association of naloxone-precipitated morphine withdrawal jumping with brain IL-1beta expression: comparison of different mouse strains, Brain, Behavior & Immunity, 25 (2011) 1223-1232.
- Barrientos, R.M., Frank, M.G., Crysdale, N.Y., Chapman, T.R., Ahrendsen, J., Day, H.E.W., Campeau, S., **Watkins, L.R.** & Maier, S.F., Little exercise, big effects: reversing aging and infection-induced memory deficits, and underlying processes, Journal of Neuroscience, 31 (2011) 11578-86.
- Rozeske, R.R., Greenwood, B.N., Fleshner, M., **Watkins, L.R.**, Maier, S.F., Voluntary wheel running produces resistance to inescapable stress-induced potentiation of morphine conditioned place reference, Behavioral Brain Research, 219 (2011) 378-81.
- Benison, A.M., Chumachenko, S., Northcutt, A., Harrison, J.A., Falci, S.P., Maier, S.F., **Watkins, L.R.** & Barth, D.S., Caudal granular insular cortex is sufficient and necessary for the long-term maintenance of allodynic behavior in the rat due to mononeuropathy, Journal of Neuroscience 31 (2011) 6317-28.
- Wu, Y., Lousberg, E., Moldenhauer, L.M., Hayball, J.D., Robertson, S.A., Coller, J.K., **Watkins, L.R.**, Somogyi A.A. & Hutchinson, M.R., Attenuating microglial and IL-1 signaling protects mice from acute alcohol-induced sedation and/or motor impairment, Brain, Behavior & Immunity Special Issue, 25 Suppl. 1 (2011) S155-64.
- Muscoli, C., Doyle, T., Dagostino, C., Bryant, L., Chen, Z., **Watkins, L.** Ryerse, J., Bieberich, E., Neuman, W., Salvemini, D., Counter-regulation of opioid analgesia by glial-derived bioactive sphingolipids, Journal of Neuroscience, 30 (2010) 15400-15408. PMID: PMC3000610
- Thompson, B. M., Baratta, M. V., Biedenkapp, J. C., Rudy, J. W., **Watkins, L. R.**, & Maier, S. F. Activation of the infralimbic cortex in a fear context enhances extinction learning, Learning And Memory, 17 (2010) 591-599. PMID: PMC2981413
- Frank, M.G., Miguel, Z.D., **Watkins, L.R.**, & Maier, S.F., Prior exposure to glucocorticoids sensitizes the neuroinflammatory and peripheral inflammatory responses to E. coli lipopolysaccharide, Brain, Behavior & Immunity, 24 (2010) 19-30.
- Frank, M.G., Barrientos, R.M., **Watkins, L.R.** & Maier, S.F., Aging sensitizes rapidly isolated hippocampal microglia to LPS ex vivo, J. Neuroimmunol. 226 (2010) 181-184.
- Ramos, K.M., Lewis, M.T., Morgan, K.N., Crysdale, N.Y., Kroll, J.L., Taylor, F.R., Harrison, J.A., Sloane, E.M., Maier, S.F., & **Watkins, L.R.**, Spinal Upregulation of Glutamate Transporter GLT-1 by Ceftriaxone: Therapeutic Efficacy in a Range of Experimental Nervous System Disorders, Neuroscience 169 (2010) 1888-1900. PMID: PM-

C2918694

- Bevan, D.E., Martinko, A.J., Loram, L.C., Stahl, J.A., Taylor, F.R., Joshee, S., **Watkins, L.R.**, Yin, H., Selection, preparation, and evaluation of small-molecule inhibitors of toll-like receptor 4, ACS Med. Chem. Letters, 1 (2010) 194-198. PMCID: PMC2930797
- Bland, S.T., Beckley, J.T., Young, S., Tsang, V., **Watkins, L.R.**, Maier, S.F. & Bilbo, S.D., Enduring consequences of early-life infection on glial and neural genesis within cognitive regions of the brain, Brain, Behavior & Immunity, 24 (2010) 329-338. PMCID: PMC2826544
- Bland, S.T., Beckley, J.T., **Watkins, L.R.**, Bilbo, S.D. & Maier, S.F., Neonatal E. coli infection alters glial, cytokine, and neuronal gene expression in response to acute amphetamine in adolescent rats, Neuroscience Letters, 474 (2010) 52-57. PMCID: PMC2865898
- Wieseler, J., Ellis, A.L., McFadden, A., Brown, K., Starnes, C., Maier, S.F., **Watkins, L.R.** & Falci, S., Below level central pain induced by discrete dorsal spinal cord injury, Journal of Neurotrauma 27 (2010) 1697-707.
- Amat, J., Alekseyev, R., **Watkins, L.R.** & Maier, S.F., Behavioral control over shock blocks behavioral and neurochemical effects of later social defeat, Neuroscience, 165 (2010) 1013-1038. PMCID: PMC2847505
- Hutchinson, M.R., Lewis, S.S., Coats, B.D., Rezvani, N., Xhang, Y., Wieseler, J.L., Somogyi, A.A., Yin, H., Maier, S.F., Rice, K.C. & **Watkin, L.R.**, Possible involvement of toll-like receptor 4/myeloid differentiation factor-2 activity of opioid inactive isomers causes spinal proinflammation and related behavioral consequences, Neuroscience 167 (2010) 880-93. PMCID: PMC2854318
- Hains, L.E., Loram, L.C., Wieseler, J.L., Frank, M.G., Bloss, E.B., Sholar, P., Taylor, F.R., Harrison, J.C., Martin, T.J., Esenach, J.C. Maier, S.F. & **Watkins, L.R.**, Pain intensity and duration can be enhanced by prior challenge: initial evidence suggestive of a role of microglial priming, Journal of Pain, 11 (2010) 1004-1014. PMCID: PMC2916950
- Loram, L.C., Harrison, J.A., Chao, L., Taylor, F.R., Reddy, A., Travis, C., Giffard, R., Al-Abed, Y., Tracey, K., Maier, S.F. & **Watkins, L.R.**, Intrathecal injection of an alpha 7 nicotinic acetylcholine receptor agonist attenuates gp120-induced mechanical allodynia and spinal pro-inflammatory cytokine release in rats, Brain Behavior & Immunity 24 (2010) 959-967. PMCID: PMC2902784
- Christianson, J.P., Ragole, T., Amat, J., Greenwood, B.N., Strong, P.V., Paul, E.D., Fleshner, M., **Watkins, L.R.** & Maier, S.F., 5-hydroxytryptamine 2C receptors in the basolat-

eral amygdala are involved in the expression of anxiety after uncontrollable traumatic stress, Biological Psychiatry, 67 (2010) 339-345.

Soderquist, R.G., Sloane, E.M., Loram, L.C., Harrison, J.A., Dengler, E.C., Johnson, S.M., Amer, L.D., Young, C.S., Lewis, M.T., Poole, S., **Watkins, L.R.**, Milligan, E.D., and Mahoney, M.J., Release of plasmid DNA encoding IL-10 from PLGA microparticles facilitates long-term reversal of neuropathic pain following a single intrathecal administration, Pharm. Research 27 (2010) 841-54.

Hutchinson, M.R., Loram, L.C., Zhang, Y., Shridhar, M., Rezvani, N., Berkelhammer, D., Phipps, S., Foster, P.S., Landgraf, K., Falke, J.J., Rice, K.C., Maier, S.F., Yin, H., **Watkins, L.R.**, Evidence that tricyclic small molecules possess toll-like receptor-4 (TLR4)/MD-2 activity, Neuroscience, 168 (2010) 551-563. PMC2872682

Frank, M., Barrientos, R., Hein, A., Biedenkapp, J., **Watkins, L.R.** & Maier, S.F., IL-1RA blocks E. coli-induced suppression of Arc and long-term memory in aged F344xBN rats, Brain, Behavior & Immunity, 24 (2010) 254-62. PMID: PMC2818379

Bilbo, S., Wieseler, J., Barrientos, R., Tsang, V., **Watkins, L.R.** & Maier, S.F., Neonatal bacterial infection alters fever to live and simulated infections in adulthood, Psychoneuroendocrinology 474 (2010) 52-57. PMID in progress

Loram, L., Harrison, J., Sloane, E., Hutchinson, M., Sholar, P., Taylor, R., Berkelhammer, D., Coats, B., Poole, S., Milligan, E., Maier, S., Rieger, J., & **Watkins, L.R.**, Enduring reversal of neuropathic pain by a single intrathecal injection of adenosine 2A receptor agonists: a novel therapy for neuropathic pain, Journal of Neuroscience, 29 (2009) 14015-25. PMID: PMC2799253

Joce, C., Stahl, J.A., Shridhar, M., Hutchinson, M.R. **Watkins, L.R.**, Fedichev, P.O. & Yin, H., Application of a novel in silico high-throughput screen to identify selective inhibitors for protein-protein interactions, Bioorganic & Medicinal Chemistry Letters, 20 (2010) 5411-5413. PMID: PMC2930491

Sloane, E., Langer, S., Jekich, B., Mahoney, J., Hughes, T., Seibert, W., Huberty, G., Coats, B., Harrison, J., Klinman, D., Poole, S., Maier, S., Johnson, K.W., Chavez, R., **Watkins, L.R.**, Leinwand, L., Milligan, E.D., Immunological priming potentiates non-viral anti-inflammatory gene therapy treatment of neuropathic pain, Gene Therapy, 16 (2009) 1210-22. PMID: PMC2762489

Barrientos, R.M., **Watkins, L.R.**, Rudy, J.W. & Maier, S.F., Characterization of the sickness response in young and aging rats following E. coli infection, Brain, Behavior & Immunity, 23 (2009) 3450-4. PMID: PMC2783183

- Wieseler, J., Ellis, A., Sprunger, D., Brown, K., McFadden, A., Mahoney, J., Rezvani, N., Maier, S.F., & **Watkins, L.R.**, A novel method for modeling facial allodynia associated with migraine in awake and freely moving rats, Journal of Neuroscience Methods, 185 (2010) 236-245. PMID: PMC2814932
- Baratta, M.V., Zarza, C.M., Gomez, D.M., Campeau, S., **Watkins, L.R.** & Maier, S.F., Selective activation of dorsal raphe nucleus-projecting neurons in the ventral medial prefrontal cortex by controllable stress, European Journal of Neuroscience 30 (2009) 1111-6. PMID: PMC2757732
- Hutchinson, M.R., Zhang, Y., Shridhar, M., Evans, J., Slivka, P.F., Buchanan, M.M., Zhao, T.X., Rezvani, N., Wieseler, J., Hughes, T.S., Falke, J.J., Leinwand, L.A., Maier, S.F., Yin, H., Rice, K.C. & **Watkins, L.R.**, Evidence that opioids may have toll like receptor 4 and MD-2 effects, Brain, Behavior & Immunity 24 (2009) 83-95. PMID: PMC2788078
- Rodgers, K.M., Hutchinson, M.R., Northcutt, A., Maier, S.F., **Watkins, L.R.** & Barth, D.S., The innate immune response of cortical glial cells increases neuronal excitability leading to seizures, Brain, 132 (2009) 2478-86. PMID: PMC2732268
- Soderquist, R.G., Milligan, E.D., Sloane, E.M., Harrison, J.A., Douvas, K.K., Potter, J.M., Hughes, T.S., **Watkins, L.R.** & Mahoney, M.J., PEGylation of brain-derived neurotrophic factor for preserved biological activity and enhanced intrathecal delivery, Journal of Biomedical Materials Research, 91 (2009) 719-29. PMID in progress
- Soderquist, R.G., Miligan, E.D., Harrison, J.A., Chavez, R.A., Johnson, K.W., **Watkins, L.R.** & Mahoney, M.J. PEGylation of interleukin-10 for the mitigation of enhanced pain states, Journal of Biomedical Materials Research, 93 (2010) 1169-79.
- Lewis, S.S., Hutchinson, M.R., Rezvani, N., Zhang, Y., Maier, S.F., Rice, K.C., **Watkins, L.R.**, Morphine-3-glucuronide causes enhanced pain through pro-inflammatory glial mechanisms, Neuroscience 165(2010) 569-583 PMID: PMC2795035
- Hutchinson, M.R., Ramos, K., Loram, L., Wieseler, J., Lewis, M., Crysdale, N., Sholar, P.W., Kearney, J.J., Zhang, Y., Harrison, J., Maier, S.F., Rice, K.C. & **Watkins, L.R.**, Evidence for a role of heat shock protein-90 (HSP90) in TLR4 mediated pain enhancement, Neuroscience, 164 (2009) 1821-1832. PMID: PMC2783248
- Rozeske, R.R., Der-Avakian, A., Bland, S.T., Beckley, J.T., **Watkins, L.R.** & Maier, S.F., The medial prefrontal cortex regulates the differential expression of morphine conditioned place preference following a single exposure to controllable or uncontrollable stress Neuropsychopharmacology 34 (2009) 834-43
- Slivka, P.F., Shridhar, M., Lee, Gui-in, Sammond, D.W., Hutchinson, M.R., Martinko, A.J.,

- Buchanan, M.M., Sholar, P.W., Kearney, J.J., Harrison, J.A., **Watkins, L.R.** & Ying, H., A peptide antagonist of the TLR4/MD2 interaction, ChemBioChem, 10 (2009) 645-649. PMID: PMC2982775
- Bland, S.T., Hutchinson, M.R., Maier, S.F., Watkins, L.R. & Johnson, K.W., The glial activation inhibitor AV411 reduces morphine-induced nucleus accumbens dopamine release, Brain, Behavior & Immunity 23 (2009) 492-497. PMID: PMC2783267
- Hughes, T.S., Langer, S.J., Virtanen, S., Chavez, R.A., **Watkins, L.R.**, Milligan, E.D. & Leinwand, L.A., Immunogenicity of intrathecal plasmid gene delivery: cytokine release and effects on transgene expression, Journal of Gene Medicine, 11 (2009) 782-790. PMID in progress
- Hughes, T.S., Langer, S.J., Johnson, K.W., Chavez, R., Milligan, E.D., **Watkins, L.R.**, & Leinwand, L.A., Intrathecal injection of naked plasmid DNA provides long-term expression of secreted proteins, Molecular Therapy 17 (2009) 88-94. PMID: PMC2834984
- Christianson, J. P., Thompson, B., **Watkins, L. R.**, & Maier, S. F., Medial prefrontal cortical activation modulates the impact of controllable and uncontrollable stressor exposure on a social exploration test of anxiety, Stress, 12 (2009) 445-450. PMID: PMC2787917
- Christianson, J.P., Bension, A., Amat, J., Baratta, M., Paul, E., Kaufamn, R., **Watkins, L.R.**, Campeau, S., Barth, D., Maier, S.F., The sensory insular cortex mediates the stress-buffering effects of safety signals but not behavioral control, Journal of Neuroscience 18 (2008) 13703-13711.
- Sloane, E., Ledebor, A., Seibert, W., Coats, B., VanStrien, M., Maier, S.F., Johnson, K.W., Chavez, R. **Watkins, L.R.**, Leinwand, L., Milligan, E.D., VanDam, A.M., Anti-inflammatory cytokine gene therapy decreases sensory and motor dysfunction in experimental multiple sclerosis, Brain, Behavior & Immunity, 23 (2008) 92-100. PMID: PMC2631931
- Hutchinson, M.R., Lewis, S.S., Coats, B.D., Skyba, D.A., Cysdale, N.Y., Berkelhammer, D.L., Brzeski, A., Northcutt, A., Vietz, C.M., Judd, C.M., Maier, S.F., **Watkins, L.R.** & Johnson, K.W., Reduction of opioid withdrawal and potentiation of acute opioid analgesia by systemic AV411 (ibudilast), Brain, Behavior & Immunity, 23 (2008) 240-250. PMID: PMC2662518
- Hutchinson, M.R., Northcutt, A., Chao, L.W., Loram, L.C., Rozeske, R.R., Bland, S.T., Maier, S.F., Gleeson, T.T. & **Watkins, L.R.**, Minocycline, a microglial inhibitor, suppresses morphine-induced respiratory depression, suppresses morphine-induced reward,

- and enhances systemic morphine-induced analgesia, Brain, Behavior & Immunity 22 (2008) 1248-1256. PMID: PMC2783326
- Hutchinson, M.R., Coats, B.D., Lewis, S.S., Sprunger, D.B., Baker, E.M., Somogyi, A.A., Martin, D., Poole, S., Judd, C.M., Maier, S.F. & **Watkins, L.R.**, Proinflammatory cytokines oppose opioid induced acute and chronic analgesia, Brain, Behavior & Immunity 22 (2008) 1178-1189. PMID: PMC2783238
- Christianson, J.P., Paul, E.D. Irani, M., Thompson, B.M., Hubala, K.H., Yirmiya, R., **Watkins, L.R.**, Maier, S.F., The role of prior stressor controllability and the dorsal raphe nucleus in sucrose preference and social exploration, Behavioral Brain Research 193 (2008) 87-93.
- Baratta, M. V., Lucero, T. R., Amat, J. **Watkins, L. R.**, & Maier, S. F., Role of the ventral medial prefrontal cortex in mediating behavioral control-induced resistance to later fear conditioning. Learning and Memory, 15 (2008) 84-87.
- Hutchinson, M.R., Zhang, Y., Brown, K., Coats, B.D., Shridhar, M., Sholar, P.W., Patel, S.J., Crysdale, N.Y., Maier, S.F., Rice, K.C. & **Watkins, L.R.**, Non-stereoselective reversal of neuropathic pain by naloxone and naltrexone: involvement of toll-like receptor 4 (TLR4), European Journal of Neuroscience 28 (2008) 20-29. PMC2588470
- Amat, J., Paul, E., Watkins, L.R. & Maier, S.F., Activation of the ventral medial prefrontal cortex during an uncontrollable stressor reproduces both the immediate and long-term protective effects of behavioral control, Neuroscience 154 (2008) 1178-1186.
- Bilbo, S. Amat, J., Paul, E., **Watkins, L.R.**, Yirmiya, R., Maier, S.F., Bacterial infection early in life protects against stressor-induced depressive-like symptoms in adult rats, Psychoneuroendocrinology, 33 (2008) 261-269.
- Barrientos, R.M. Frank, M.G., Hein, A.M, Higgins, E.A., **Watkins, L.R.**, Rudy, J.W. & Maier, S.F., Timecourse of hippocampal interleukin-1beta and memory impairments in aging rats following peripheral infection, Brain Behav. Immun. 23 (2008) 46-54. PMID: PMC2630971
- Hein, A.M., Stutzman, D.L., Bland, S.T., Barrientos, R.M., **Watkins, L.R.**, Rudy, J.W. & Maier, S.F., Prostaglandins are necessary and sufficient to induce contextual fear learning impairments after interleukin-1beta injections into the dorsal hippocampus, Neuroscience, 150 (2007) 754-763. PMID: PMC2246066
- Bilbo, S., Barrientos, R., Eads, A., Northcutt, A., Rudy, J.W., **Watkins, L.R.** & Maier, S.F., Early-life infection leads to altered BDNF and IL-1beta mRNA expression in rat hippocampus following learning in adulthood, Brain, Behavior & Immunity, 22 (2007) 451-455

- Bland, S.T., Tamlyn, J.P., Barrientos, R.M., Greenwood, B.N., **Watkins, L.R.**, Campeau, S., Hay, H.E. & Maier, S.F., Expression of fibroblast growth factor-2 and brain-derived neurotrophic factor mRNA in the medial prefrontal cortex and hippocampus after uncontrollable or controllable stress, Neuroscience, 144 (2007) 1219-1228.
- Baratta, M. V., Christianson, J. P., Gomez, D. M., Zarza, C. M., Amat, J., **Watkins, L. R.**, & Maier, S. F. Controllable versus uncontrollable stressors bidirectionally modulate conditioned but not innate fear. Neuroscience, 146 (2007) 1495-1503.
- Spataro, L.E., Downs, H., Wieseler, J., **Watkins, L.R.** & Oaklander, A.L., The persistent sciatic inflammatory neuropathy (SIN) rat model of neuropathic pain does not involve small-fiber axon damage, Journal of Neuropathic Pain & Symptom Palliation, 2 (2007) 41-47.
- Milligan, E.D., Soderquist, R.G., Malone, S., Mahoney, J.H., Hughes, T.S., Langer, S.J., Sloane, E.M., Maier, S.F., Leinwand, L.A., **Watkins, L.R.** & Mahoney, M.M., Neuro-pathic pain is controlled by i.t. interleukin-10 gene delivery using polymer-based nonviral vectors: an initial investigation, Neuron Glia Biology 2 (2007) 293-308.
- Der-Avakian, A., Bland, S.T., Rozeske, R.R., Tamblyn, J.T., Hutchinson, M.R., **Watkins, L.R.** & Maier, S.F., The effects of a single exposure to uncontrollable stress on the subsequent conditioned place preference responses to oxycodone, cocaine and ethanol in rats, Psychopharmacology, 191 (2007) 909-917.
- Der-Avakian, A., Rozeske, R.R., Bland, S.T., **Watkins, L.R.** & Maier, S.F., The effects of a single session of inescapable tailshock on the subsequent locomotor response to brief footshock and cocaine administration in rats, Psychopharmacology, 101 (2007) 899-907.
- Holguin, A., Frank, M. G., Biedenkapp, J. C., Nelson, K., Lippert, D., **Watkins, L.R.**, Rudy, J. W., & Maier, S. F. Characterization of the temporospatial effects of chronic bilateral intrahippocampal cannulae on interleukin-1 beta. Journal of Neuroscience Methods, 161 (2007) 185-376.
- Ledeboer, A., Liu, T., Shumilla, J.A., Mahoney, J.H., Vijay, S., Gross, M.I., Vargas, J.A., Sultzbaugh, L., Claypool, M.D., Sanftner, L.M., **Watkins, L.R.**, & Johnson, K.W., The glial modulatory drug AV411 attenuates mechanical allodynia in rat models of neuropathic pain, Neuron-Glia Biology Special issue on immune & glial regulation of pain, 2(2007) 279-291. PMID: PMC2174834
- Schoeniger-Skinner, D., Ledebor, A., Frank, M.G., Milligan, E.D., Poole, S., Martin, D., Maier, S.F., & **Watkins, L.R.**, Interleukin-6 mediates low threshold mechanical allodynia induced by intrathecal HIV-1 envelope glycoprotein gp120, Brain Behavior & Im-

munity, Special issue on immune & glial regulation of pain 21 (2007) 660-667. PMCID: PMC1991283

Bilbo, S.D., Newsom, N., Sprunger, D., Rudy, J., **Watkins, L.R.**, & Maier, S.F., Differential effects of neonatal handling on early life infection-induced alterations in cognition in adulthood, Brain Behavior & Immunity 21 (2007) 332-342.

Ledeboer, A., Jekich, B., Sloane, E., Mahoney, J., Langer, S., Milligan, E.D., Maier, S.F., Johnson, K.W., Leinwand, L., Chavez, R., & **Watkins, L.R.**, Intrathecal interleukin-10 gene therapy attenuates paclitaxel-induced mechanical allodynia and proinflammatory cytokine expression in dorsal root ganglia in rats, Brain Behavior & Immunity, 21 (2007) 686-698. PMCID: PMC2063454

Frank, M.G., Der-Avakian, A., Bland, S.T., **Watkins, L.R.** & Maier, S.F., Stress-induced glucocorticoids suppress the antisense molecular regulation of FGF-2 expression, Psychoneuroendocrinology 32 (2007) 376-384.

Wieseler-Frank, J., Jekich, B.M., Maier, S.F. & **Watkins, L.R.**, A novel immune-to CNS communication pathway: cells of the meninges surrounding the spinal cord CSF space produce proinflammatory cytokines in response to HIV-1 gp120, Brain, Behavior & Immunity, 21 (2007) 711-718.

Ledeboer, A., Mahoney, J.H., Milligan, E.D., Martin, D., Maier, S.F., & **Watkins, L.R.**, Spinal cord glia and interleukin-1 do not appear to mediate persistent allodynia induced by intramuscular acidic saline in rats, Journal of Pain, 7 (2006) 757-767.

Frank, M.G., Baratta, M.B., Sprunger, D., **Watkins, L.R.**, & Maier, S.F., Microglia serve as a neuroimmune substrate for stress-induced potentiation of CNS proinflammatory cytokine responses, Brain, Behavior & Immunity 21 (2007) 47-59.

Kleibeuker, W., Ledebor, A., Eijkelkamp, N., **Watkins, L.R.**, Maier, S.F. Zijlstra, J., Heijnen, C.J. & Kavelaars, A., A role for G protein-coupled receptor kinase 2 in mechanical allodynia, Eur. J. Neurosci., 25 (2007) 1696-1704.

Bland, S.T., Schmid, M.J., Greenwood, B., **Watkins, L.R.**, Maier, S.F., Behavioral control of the stressor modulates stress-induced changes in neurogenesis and fibroblast growth factor-2, Neuroreport 17 (2006) 593-7.

Milligan, E.D., Sloane, E.M., Langer, S.J., Hughes, T.S., Jekich, B.M., Frank, M.G., Mahoney, J.H., Levkoff, L.H., Maier, S.F., Cruz, P.E., Flotte, T.R., Johnson, K.W., Mahoney, M.M., Chavez, R.A., Leinwand, L.A. & **Watkins, L.R.**, Repeated intrathecal injections of plasmid DNA encoding interleukin-10 produce prolonged reversal of neuropathic pain, Pain, 126 (2006) 294-308.

- Barrientos, R. M., Higgins, E. A., Biedenkapp, J. C., Sprunger, D. B. Wright-Hardesty, K. J., **Watkins, L. R.**, Rudy, J. W., Maier, S. F. Peripheral infection and aging interact to impair hippocampal memory consolidation. Neurobiology of Aging, 27 (2006) 723-732.
- Amat, J., Paul, E., Zarza, C., **Watkins, L. R.**, & Maier, S. F. Previous experience with behavioral control over stress blocks the behavioral and dorsal raphe activating effects of later uncontrollable stress: Role of the ventral medial prefrontal cortex. Journal of Neuroscience, 26 (2006) 13264-13272.
- Bilbo, S. D., Rudy, J. W., **Watkins, L. R.**, & Maier, S. F., A behavioural characterization of neonatal infection-facilitated memory impairments in adult rats. Behavioural Brain Research, 169 (2006) 39-47.
- Der-Avakian, A., Bland, S.T., Schmid, M.J., **Watkins, L.R.**, Spencer, R.L., & Maier, S.F., The role of glucocorticoids in the uncontrollable stress-induced potentiation of nucleus accumbens shell dopamine and conditioned place preference responses to morphine, Psychoneuroendocrinology, 31 (2006) 653-663.
- Frank, M.G., Wieseler-Frank, J.L., **Watkins, L.R.** & Maier, S.F., Rapid isolation of highly enriched and quiescent microglia from adult rat hippocampus: immunophenotypic and functional characteristics, Journal of Neurosci. Methods, 151 (2006) 121-130.
- Frank, M.G., Barrientos, R.M., Biedenkapp, J.C., Rudy, J.W., **Watkins, L.R.**, & Maier, S.F., mRNA up-regulation of MHCII and pivotal pro-inflammatory genes in normal brain aging, Neurobiology of Aging, 27 (2006) 717-722.
- Milligan, E., Zapata, V., Schoeniger, D., Chacur, M., Green, P., Poole, S., Martin, D., Maier, S.F. & **Watkins, L.R.**, An initial investigation of spinal mechanisms underlying pain enhancement induced by fractalkine, a neuronally-released chemokine, Eur. J. Neuroscience, 22 (2005) 2775-2782.
- Bilbo, S.D., Biedenkapp, J.C., Der-Avakian, A., **Watkins, L.R.**, Rudy, J.W. & Maier, S.F., Neonatal infection-induced memory impairment lafter lipopolysaccharide in adulthood is prevented via caspase-1 inhibition, Journal of Neuroscience, 25 (2005) 8000-8009.
- Bland, S.T., Schmid, B.A., Der-Avakian, A., **Watkins, L.R.**, Spencer, R.L. & Maier, S.F., Expression of c-fos and BDNF mRNA in subregions of the prefrontal cortex of male and female rats after acute uncontrollable stress, Brain Research, 1051 (2005) 90-99.
- Milligan, E.D., Sloane, E.M., Langer, S.J., Cruz, P.E., Chacur, M., Spataro, L., Wieseler-Frank, J., Hammack, S.E., Maier, S.F., Flotte, T.R., Forsayeth, J.R., Leinwand, L.A., Chavez, R. & **Watkins, L.R.**, Controlling neuropathic pain by adeno-associated virus

driven production of the anti-inflammatory cytokine, interleukin-10, Molecular Pain 1 (2005) 9; <http://www.molecularpain.com/content/1/1/9>.

Amat, J., Baratta, M. V., Paul, E., Bland, S. T., **Watkins, L. R.**, & Maier, S. F. The ventral medial prefrontal cortex determines how behavioral control over stress impacts behavior and dorsal raphe nucleus activity, Nature Neuroscience, 8 (2005) 365-371.

Ledeboer, A., Gamanos, M., Lai, W., Martin, D., Maier, S.F., **Watkins, L.R.** & Quan, N., Role of spinal cord nuclear factor kappaB (NF-kB) activation in rat models of pain facilitation, European Journal of Neuroscience 22 (2005) 1977-1986.

Takase, L. F., Nogueira, M. I., Bland, S. T., Baratta, M. V., **Watkins, L. R.**, Maier, S. F., Fornal, C. A., & Jacobs, B. L., Effect of number of tailshocks on learned helplessness and activation of serotonergic and noradrenergic neurons in the rat. Behavioral Brain Research, 162 (2005) 299-306

Bilbo, S. D., Levkoff, L. H., Mahoney, J. H., **Watkins, L. R.**, Rudy, J. R., & Maier, S. F. Neonatal infection induces memory impairments following immune challenge in adulthood, Behavioral Neuroscience, 119 (2005) 293-301.

Milligan, E.D., Langer, S.J., Sloane, E.M., He, L., Wieseler-Frank, J., O'Connor, K., Martin, D., Forsayeth, J.R., Maier, S.F., Johnson, K., Chavez, R.A. Leinwand, L.A. & **Watkins, L.R.**, Controlling pathological pain by adenovirally driven spinal production of the anti-inflammatory cytokine, interleukin-10, Eur. J. Neurosci. 21 (2005) 2136-2148.

Barrientos, R. M., Higgins, E. A., Biedenkapp, J. C., Sprunger, D. B. Wright-Hardesty, K. J., **Watkins, L. R.**, Rudy, J. W., Maier, S. F. Peripheral infection and aging interact to impair hippocampal memory consolidation. Neurobiology of Aging, 27 (2006)723-32.

Twining, C.M., Sloane, E.M., Schoeniger, D.K., Milligan, E.D., Martin, D., Marsh, H., Maier, S.F. & **Watkins, L.R.** Activation of the spinal cord complement cascade may contribute to mechanical allodynia induced by three animal models, Journal of Pain 6 (2005) 174-183.

Ledeboer, A., Sloane, E.M., Milligan, E.D., Frank, M., Maier, S.F. & **Watkins, L.R.**, Selective inhibition of spinal cord microglial activation attenuates mechanical allodynia and proinflammatory cytokine expression in rat models of pain facilitation, Pain 115 (2005) 71-83.

Der-Avakian, A., Will, M.J., Bland, S.T., Deak, T., Nguyen, K.T., Schmid, M.J., Spencer, R.L., **Watkins, L.R.**, and Maier, S.F., Surgical and pharmacological suppression of glucocorticoids prevents the enhancement of morphine conditioned place preference by uncontrollable stress in rats, Psychopharmacology, 179 (2005) 409-417.

- Bland, S. T., Schmid, M., **Watkins, L. R.**, & Maier, S. F., Prefrontal serotonin is required for stress potentiation of morphine-induced dopamine in the nucleus accumbens. NeuroReport, 15 (2004) 2637-2642.
- O'Connor, K. A., Ginsberg, A. B., Maksimova, E., Wiesler-Frank, J. L., Johnson, J. D., Spencer, R. L., Campeau, S., **Watkins, L.R.**, & Maier, S. F. Stress-induced sensitization of the hypothalamic-pituitary-adrenal axis is associated with alterations of hypothalamic and pituitary gene expression. Neuroendocrinology, 80 (2004) 252-263.
- Amat, J., Tamblyn, J. P., Paul, E. D., Bland, S. T. Amat, P., Foster, A.C., **Watkins, L. R.**, and Maier, S. F. (2003). .Microinjection of urocortin II into the dorsal raphe nucleus activates serotonergic neurons and increases extracellular serotonin in the basolateral amygdala and Fos in 5-HT neurons of the DRN. Neuroscience, 129 (2004) 509-519.
- Milligan, E.D., Zapata, V., Chacur, M., Schoeniger, D., Biedenkapp, J., O'Connor, K., Verge, G.M., Chapman, G., Green, P., Foster, A.C., Naeve, G.S., Maier, S.F. & **Watkins, L.R.**, Evidence that exogenous and endogenous fractalkine can induce spinal nociceptive facilitation, European Journal of Neuroscience 20 (2004) 2294-2302.
- Spataro, L., Sloane, E., Milligan, E.D., Wieseler-Frank, J., Schoeniger, D., Jekrich, B.M., Barrientos, R.M., Maier, S.F. & **Watkins, L.R.**, Spinal gap junctions: potential involvement in pain facilitation, Journal of Pain, 5 (2004) 392-405.
- Johnston, I.N., Milligan, E.D., Wieseler-Frank, J., Frank, M.G., Zapata, V., Langer, S., Martin, D., Green, P., Leinwand, L., Maier, S.F. & **Watkins, L.R.**, A role for pro-inflammatory cytokines and fractalkine in analgesia, tolerance and subsequent pain facilitation induced by chronic intrathecal morphine, J. Neuroscience, 24 (2004) 7353-7365.
- Barrientos, R.M., Sprunger, D.B., Campeau, S., **Watkins, L.R.**, Rudy, J.W. and Maier, S.F., BDNF mRNA expression in hippocampus following contextual learning is blocked by intrahippocampal interleukin-1beta administration, J. Neuroimmunology 155 (2004) 119-126.
- Steiner, A.A., Dogan, M.D., Ivanov, A.I., Patel, S., Rudaya, A.Y., Jenings, D.H., Orchinik, M., Pace, T.W., O'Connor, K.A., **Watkins, L.R.** & Romanovsky, A.A., A new function of the leptin receptor mediation of the recovery from lipopolysaccharide hypothermia, FASEB Journal, 18 (2004) 1949-1951.
- Verge, G.M., Milligan, E.D., Maier, S.F., **Watkins, L.R.**, Naeve, G.S., & Foster, A.C., Fractalkine (CX3CL1) and fractalkine receptor (CX3CR1) distribution in spinal cord and dorsal root ganglia under basal versus neuropathic pain conditions, Eur. J. Neurosci., 20 (2004) 1150-1160.

- Chacur, M., Gutierrez, J.M., Milligan, E.D., Wieseler-Frank, J., Britto, L.R.G., Maier S.F., **Watkins, L.R.** and Cury, Y., Snake venom components enhance pain upon subcutaneous injection: an initial examination of spinal cord mediators, Pain 111 (2004) 65-76.
- Holguin, A., Biedenkapp, J., Campisi, J., Wieseler-Frank, J., O'Connor, K.A., Milligan, E.D., Maksimova, E., Bravmann, C., Hansen, M.K., Martin, D., Fleshner, M., Maier, S.F. & **Watkins, L.R.**, HIV-1 gp120 stimulates proinflammatory cytokine-mediated pathological pain via activation of nitric oxide synthase-I (nNOS), Pain 110 (2004) 517-530.
- Johnson, J. D., O'Connor, K. A., **Watkins, L. R.**, & Maier, S. F. (2004). The role of IL-1beta in stress-induced sensitization of proinflammatory cytokine and corticosterone responses. Neuroscience, 127 (2004) 569-577.
- Twining, C.M., Sloane, E.M., Milligan, E.D., Chacur, M., Martin, D., Poole, S., Marsh, H., Maier, S.F. & **Watkins, L.R.**, Peri-sciatic proinflammatory cytokines, reactive oxygen species, and complement induce mirror-image neuropathic pain in rats, Pain 110 (2004) 299-309.
- Bland, S. T., Hargrave, D., Pepin, J. L., Amat, J., **Watkins, L. R.**, & Maier, S. F. Stressor controllability modulates stress-induced dopamine and serotonin efflux and morphine induced serotonin efflux in the medial prefrontal cortex. Neuropsychopharmacology, 28 (2004) 1589-1596..
- Takase, L. T., Nogueira, M. I., Baratta, M., Bland, S. T., **Watkins, L. R.**, and Maier, S. F., Fornal, C. A., & Jacobs, B. L. Inescapable shock activates serotonergic neurons in all raphe nuclei of the rat. Behavioural Brain Research, 153 (2004) 233-239.
- Bland, S. T., Twining, C., Schmid, M.J., Der-Avakian, A., **Watkins, L. R.**, & Maier, S. F. . Stress potentiation of morphine-induced dopamine in the nucleus accumbens shell is dependent upon stressor controllability and is mediated by the dorsal raphe nucleus, Neuroscience, 126 (2004) 705-715.
- Chacur, M., Milligan, E.D., Sloan, E.M., Wieseler-Frank, J., Barrientos, R., Martin, D., Poole, S., Gutierrez, J.M., Maier, S.F., Cury, Y., and **Watkins, L.R.**, Snake venom phospholipase A2s (Asp49 and Lys49) induce mechanical allodynia upon peri-sciatic administration: involvement of spinal cord proinflammatory cytokines and nitric oxide, Pain, 108 (2004) 180-191.
- Day, H.E.W., Greenwood, B.N., Hammack, S.E., **Watkins, L.R.**, Fleshner, M., Maier, S.F. & Campeau, S., Differential expression of 5HT-1A, alpha1beta adrenergic, CRH-R1 and CRH-R2 receptor mRNA in serotonergic, GABAergic and catecholaminergic cells of the rat dorsal raphe nucleus, J. Comp. Neurol. 474 (2004) 364-378.

- O'Connor, K.A., Holguin, A., Hansen, M.K., Maier, S.F. & **Watkins, L.R.**, A method for measuring multiple cytokines from small samples, Brain, Behavior & Immunity 18 (2004) 274-280.
- Hammack, S.E., Richey, K.J., **Watkins, L.R.** & Maier, S.F., Chemical lesion of the bed nucleus of the stria terminalis blocks the behavioral consequences of uncontrollable stress, Behavioral Neuroscience, 118 (2004) 443-448.
- Gazda, L.S., Smith, T.P., **Watkins, L.R.**, Maier, S.F., and Fleshner, M. Stress inhibits antigen specific T-cell and B-cell responses. Stress: The International Journal on the Biology of Stress, 6(4) (2003) 259-267.
- Will, M. J., Der-Avakian, A., Bland, S. T., Grahn, R. E., Hammack, S. E., Sparks, P. D., Pepin, J. L., **Watkins, L. R.**, & Maier, S. F., Electrolytic lesions and pharmacological inhibition of the dorsal raphe nucleus prevent stressor potentiation of morphine conditioned place preference. Psychopharmacology, 171 (2003) 191-198.
- Hammack, S. E., Pepin, J. L., DesMarteau, J. S., **Watkins, L. R.**, & Maier, S. F. Low doses of corticotropin-releasing hormone injected into the dorsal raphe nucleus block the behavioral consequences of uncontrollable stress. Behavioural Brain Research, 147 (2003) 55-64.
- O'Connor, K.A., Johnson, J.D., Hansen, M.K., Wieseler-Frank, J.L., **Watkins, L.R.**, & Maier, S.F., Peripheral and central proinflammatory cytokine response to a severe acute stressor. Brain Research, 991 (2003) 123-132.
- O'Connor, K.A., Hansen, M.K., Pugh, C.R., Deak, M.M., Biedenkapp, J.C., Milligan, E.D., Johnson, J.D., Wang, H., Maier, S.F., Tracey, K.J., & **Watkins, L.R.**, Further characterization of high mobility group box 1 (HMGB1) as a proinflammatory cytokine: Central nervous system effects. Cytokine, 24 (2003) 254-265.
- Bland, S. T., Twining, C., **Watkins, L. R.**, & Maier, S. F. Stressor controllability modulates stress-induced serotonin but not dopamine efflux in the nucleus accumbens shell. Synapse, 49 (2003) 206-210.
- Barrientos, R. M., Sprunger, D. B., Campeau, S., Higgins, E. A., Watkins, L. R., Rudy, J. R., & Maier, S. F. BDNF mRNA downregulation produced by social isolation is blocked by intrahippocampal IL-1 receptor antagonist (IL-1ra). Neuroscience, 121 (2003) 847-853.
- Brennan, F. X., Grahn, R. E., **Watkins, L. R.**, & Maier, S. F. Plasma cholesterol levels and stressor controllability. Physiology & Behavior, 79 (2003) 757-760.

- Campisi, J., Hansen, M.K., O'Connor, K.A., Biedenkapp, J.C., **Watkins, L.R.**, Maier, S.F. & Fleshner, M., Circulating cytokines and endotoxin are not necessary for the activation of the sickness or corticosterone response produced by peripheral *E.coli* challenge, J. Applied Physiology 95 (2003) 1873-1882.
- Milligan, E.D., Twining, C., Chacur, M., Biedenkapp, J., O'Connor, K., Poole, S., Tracey, K., Martin, D., Maier, S.F. & **Watkins, L.R.**, Spinal glia and proinflammatory cytokines mediate mirror-image neuropathic pain, J. Neurosci. 23 (2003) 1026-1040.
- Johnson, J.D., O'Connor, K.A., Hansen, M.K., **Watkins, L.R.** & Maier, S.F., Effects of prior stress on LPS-induced cytokine and sickness responses, Amer. J. Physiol., 284 (2003) R422-R432.
- Hammack, S.E., Schmid, M.J., LoPresti, M.L., Foster, A.C., **Watkins, L.R.** & Maier, S.F., Corticotropin releasing hormone type 2 receptors in the dorsal raphe nucleus mediate the behavioral consequences of uncontrollable stress, J. Neurosci 23 (2003) 1020-1026.
- Will, M.J., Der-Avakian, A., Pepin, J.L., Durkan, B.T., **Watkins, L.R.** & Maier, S.F., Modulation of the locomotor properties of morphine and amphetamine by uncontrollable stress, Pharmac. Biochem & Behav., 71 (2002) 345-351.
- Barrientos, R.M., Higgins, E.A., Sprunger, D.B., **Watkins, L.R.**, Rudy, J.W., Maier, S.F. Memory for context is impaired by a post context exposure injection of interleukin-1 beta into dorsal hippocampus. Behavioural Brain Research, 134 (2002) 291-298.
- Johnson, J. D., O'Connor, K. A., Deak, T., Spencer, R. L., **Watkins, L. R.**, & Maier, S. F., Prior stressor exposure primes the HPA axis, Psychoneuroendocrinology, 27 (2002) 353-365.
- Johnson, J. D., O'Connor, K. A., Deak, T., Stark, M., **Watkins, L. R.**, & Maier, S. F. Prior stressor exposure sensitizes LPS-induced cytokine production. Brain Behav. Immunity, 16 (2002) 461-476.
- O'Connor, K. A., Johnson, J. D., Hammack, S. E., Brooks, L. M., Spencer, R. L., **Watkins, L. R.**, & Maier, S. F. Inescapable shock induces resistance to the effects of dexamethasone. Psychoneuroendocrinology 28 (2003) 481-500.
- Grahn, R.E., Hammack, S.E., Will, M.J., O'Connor, K.A., Deak, T., Sparks, P.D., **Watkins, L.R.**, & Maier, S.F., Blockade of alpha-1 adrenoceptors in the dorsal raphe nucleus prevents enhanced conditioned fear and impaired escape performance following uncontrollable stressor exposure in rats. Behavioral Brain Research, 134 (2002) 387-392.

- Moraska, A., Maier, S. F., **Watkins, L. R.**, & Fleshner, M. Elevated IL-1beta contributes to antibody suppression produced by stress. Journal of Applied Physiology, 93 (2002) 207-215.
- Hammack, S. E., Richey, K. J., **Watkins, L. R.**, & Maier, S. F. The role of corticotropin releasing hormone in the dorsal raphe nucleus in mediating the behavioral consequences of uncontrollable stress. Journal of Neuroscience, 22 (2002) 1020-1026.
- Amat, J., Sparks, P. D., Matus-Amat, P., Griggs J., **Watkins, L. R.**, & Maier, S. F., The role of the habenular complex in the elevation of dorsal raphe nucleus serotonin and interference with escape behavior produced by uncontrollable stress. Brain Research, 917 (2001) 188-126.
- Gazda, L.S., Milligan, E.D., Hansen, M.K., Twining, C.M., Paulos, N., Chacur, M., O'Connor, K.A., Armstrong, C., Maier, S.F., **Watkins, L.R.** & Myers, R.R., Sciatic inflammatory neuritis (SIN): behavioral allodynia is paralleled by peri-sciatic proinflammatory cytokine and superoxide production, Journal of the Peripheral Nervous System, 6 (2001) 111-129.
- Chacur, M., Milligan, E.D., Gazda, L.S., Armstrong, C., Wang, H., Tracey, K.J., Maier, S.F. & **Watkins, L.R.**, A new model of sciatic inflammatory neuritis (SIN): induction of unilateral and bilateral mechanical allodynia following acute unilateral peri-sciatic immune activation in rats, Pain 94 (2001) 231-244.
- Milligan, E.D., O'Connor, K.A., Nguyen, K.T., Armstrong, C.B., Twining, C., Gaykema, R., A., Martin, D., Maier, S.F. & **Watkins, L.R.**, Intrathecal HIV-1 envelope glycoprotein gp120 induces enhanced pain states mediated by spinal cord proinflammatory cytokines, Journal of Neuroscience, 21 (2001) 2808-2819.
- Goehler, L.E., Gaykema, R.P.A., Hansen, M.K., Kleiner, J.L., Maier, S.F. & **Watkins, L.R.**, Staphylococcal enterotoxin B (SEB) induces fever and elevated plasma corticosterone in rats, Amer. J. Physiology, 280 (2001) R1434-R1539.
- Milligan, E.D., O'Connor, K.A., Armstrong, C.B., Martin, D., Tracey, K.J., Maier, S.F. and **Watkins, L.R.**, Systemic administration of CNI-1493, a p38 MAP kinase inhibitor, blocks HIV-1 gp120-induced enhanced pain states in rats, Journal of Pain, 2 (2001) 326-333.
- Hansen, M.K., O'Connor, K.A., Goehler, L.E., **Watkins, L.R.** & Maier, S.F., The contribution of the vagus nerve in interleukin-1beta-induced fever is dependent on dose, Amer. J. Physiol. 280 (2001) R929-R934.

- Fleshner, M., Deak, T., Nguyen, K.T., **Watkins, L.R.** & Maier, S.F., Endogenous glucocorticoids play a positive regulatory role in the anti-KLH in vivo antibody response, Journal of Immunology, 166 (2001) 3813-3819.
- Gaykema, R.P.A., Goehler, L.E., Hansen, M.K., Maier, S.F. & **Watkins, L.R.**, Subdiaphragmatic vagotomy blocks interleukin-1beta induced fever but not reduce IL-1beta levels in the circulation, Autonomic Neuroscience, 85 (2000) 72-77.
- Hansen, M. K., Nguyen, K. T., Goehler, L. E., Gaykema, R. P. A., Fleshner, M., **Watkins, L. R.**, & Maier, S. F., Effects of vagotomy on lipopolysaccharide-induced brain interleukin-1 beta protein in rats, Autonomic Neuroscience, 85 (2000) 119-126.
- Hansen, M. K., Daniels, S., Goehler, L. E., Gaykema, R. P. A., Maier, S. F., & **Watkins, L. R.**, Subdiaphragmatic vagotomy does not block intraperitoneal lipopolysaccharide-induced fever. Autonomic Neuroscience, 85 (2000) 83-87.
- Van Dam, A.M.W., Bol, J.G.J.M., Gaykema, R.P.A., Goehler, L.E., Maier, S.F., **Watkins, L.R.**, & Tilders, F.J.H. Vagotomy does not inhibit high dose LPS-induced interleukin-1b immunoreactivity in rat brain and pituitary gland. Neuroscience Letters, 285 (2000)169-172.
- Borovikova, L.V., Ivanova, S., Zhang, M., Yang, H., Botchikina, G.I., **Watkins, L.R.**, Wang, H., Abumrad, N., Eaton, J., Tracey, K.J., Vagus nerve stimulation attenuates the systemic inflammatory response to endotoxin, Nature, 405 (2000) 458-462.
- Pugh, C.R., Johnson, J.D., Martin, D., Rudy, J.W., Maier, S.F. & **Watkins, L.R.**, Human immunodeficiency virus-1 coat protein gp120 impairs contextual fear conditioning: a potential role in AIDS related learning and memory impairments, Brain Research, 861 (2000) 8-16.
- Nguyen, K. T., Deak, T., Will, M. J., Hansen, M., Hunsaker, B. N., Fleshner, M., **Watkins, L. R.**, & Maier, S. F. Timecourse and corticosterone sensitivity of the brain, pituitary, and serum interleukin-1b response to acute stress. Brain Research, 859 (2000) 193-201.
- Grahn, R. E., **Watkins, L. R.**, & Maier, S. F., Impaired escape performance and enhanced conditioned fear following exposure to an uncontrollable stressor are mediated by glutamate and nitric oxide in the dorsal raphe nucleus. Behavioural Brain Research, 112 (2000) 33-41.
- Hansen, M.K., Nguyen, K.T., Fleshner, M., Goehler, L.E., Gaykema, R.P.A., Maier, S.F. & **Watkins, L.R.**, Effects of vagotomy on circulating levels of serum endotoxin, cy-

- tokines, and corticosterone after intraperitoneal lipopolysaccharide, Amer. J. Physiol., 278 (2000) R331-336.
- Milligan, E.D., Mehmert, K., Hinde, J.L., Harvey, L.O., Martin, D., Tracey, K.J., Maier, S.F. & **Watkins, L.R.**, Thermal hyperalgesia and mechanical allodynia produced by intrathecal administration of the human immunodeficiency virus-1 envelope glycoprotein, gp120, Brain Res, 861 (2000)105-116.
- Milligan, E.D., Hinde, J.L., Mehmert, K., Maier, S.F. & **Watkins, L.R.**, A method for increasing the viability of the external portion of lumbar catheters placed in the spinal subarachnoid space of rats, J. Neurosci. Methods, 90 (1999) 81-86.
- Goehler, L.E., Gaykema, R., Nguyen, K., Hansen, M., Maier, S.F. & **Watkins, L.R.**, Interleukin-1b in immune cells of the abdominal vagus nerve: a link between the immune and nervous systems?, J. Neurosci. 19 (1999) 2799-2806.
- Deak, T., Nguyen, K.T., Cotter, C.S., Fleshner, M., **Watkins, L.R.**, Maier, S.F. & Spencer, R.L., Long term changes in mineralocorticoid and glucocorticoid receptor occupancy following exposure to an acute stressor, Brain Res. 847 (1999) 221-220.
- Grahn, R.E., Will, M.J., Hammack, S.E., Maswood, S., McQueen, M.B., **Watkins, L.R.** & Maier, S.F., Activation of serotonin-immunoreactive cells in the dorsal raphe nucleus in rats exposed to an uncontrollable stressor, Brain Res, 826 (1999) 35-43.
- Pugh, C.R., Nguyen, K.T., Gonyea, J.L., Fleshner, M., **Watkins, L.R.**, Maier, S.F. & Rudy, J.W., Role of interleukin-1beta in impairment in contextual fear conditioning caused by social isolation, Behav. Brain Neurosci. 106 (1999) 109-118.
- Hammack, S.E., Sutton, L.C., Hartley, C.E., Lea, S.E., Maier, S.F. & **Watkins, L.R.**, Inescapable shock-induced potentiation of morphine analgesia in rats: sites of action, Behav. Neurosci. 446 (1999) 795-803.
- Deak, T., Nguyen, K.T., Fleshner, M., **Watkins, L.R.** & Maier, S.F., Acute stress may facilitate recovery from a subcutaneous bacterial challenge, Neuroimmunomodulation 6 (1999) 344-354.
- Grahn, R.E., Maswood, S., McQueen, M.B., **Watkins, L.R.** & Maier, S.F., Opioid-dependent effects of inescapable shock on escape behavior and conditioned fear responding are mediated by the dorsal raphe nucleus, Behav. Brain Res. 99 (1999) 153-167.
- Helmreich, D.L., **Watkins, L.R.**, Deak, T., Maier, S.F., Akil, H. and Watson, S.J., The effect of psychological factors on stress-induced neuropeptide mRNA expression within the paraventricular nucleus of the hypothalamus, J. Neuroendo. 11 (1998) 121-129.

- Pugh, C.R., Kumagawa, K., Fleshner, M., **Watkins, L.R.**, Maier, S.F., & Rudy, J.W., Selective effects of peripheral lipopolysaccharide administration on contextual and auditory-cue fear conditioning, Brain Behav. Immunity, 12 (1998) 212-229.
- Amat, J., Matus-Amat, P., **Watkins, L.R.**, & Maier, S.F., Escapable and inescapable stress differentially alter extracellular levels of 5-HT in the basolateral amygdala of the rat, Brain Res. 812 (1998) 113-120.
- Milligan, E.D., Nguyen, K.T., Deak, T., Hinde, J.L., Fleshner, M., **Watkins, L.R.**, & Maier, S.F., The long term acute phase-like responses that follow acute stressor exposure are blocked by alpha-melanocyte stimulating hormone, Brain Res., 810 (1998) 48-58.
- Deak, T., Maier, S.F., Nguyen, K.T., Ehrlich, A., **Watkins, L.R.**, Licinio, J., Wong, M.L., Chrousos, G.P., Webster, E., & Gold, P.W., The impact of the non-peptide corticotropin-releasing hormone antagonist antalarmin on behavioral and endocrine responses to stress, Endocrin. 140 (1998) 79-86.
- Goehler, L.E., Gaykema, R.P.A., Hammack, S.E., Maier, S.F. & **Watkins, L.R.**, Interleukin-1 induces c-Fos immunoreactivity in primary afferent neurons of the vagus nerve, Brain Res., 804 (1998) 306-310.
- Fleshner, M., Nguyen, K.T., Cotter, C.S., **Watkins, L.R.** & Maier, S.F., Acute stressor exposure both suppresses acquired immunity and potentiates innate immunity, Amer. J. Physiol., 275 (1998) R870-R878.
- Amat, J., Matus-Amat, P., **Watkins, L.R.** & Maier, S.F., Escapable and inescapable stress differentially and selectively alter extracellular levels of 5-HT in the ventral hippocampus and dorsal periaqueductal gray of the rat, Brain Research, 84 (1998) 306-310.
- Gaykema, R.P.A., Goehler, L.E. Tilders, F.J.H., Bol, J.G.J.M., McGorry, M., Maier, S.F. & **Watkins, L.R.**, Bacterial endotoxin induces Fos immunoreactivity in primary afferent neurons of the vagus nerve, NeuroImmunoModulation, 5 (1998) 234-240.
- Fleshner, M., Goehler, L.E., Schwartz, B.A., McGorry, M., Martin, D., Maier, S.F. and **Watkins, L.R.**, Thermogenic and corticosterone responses to intravenous cytokines (IL-1alpha and TNF-beta) are attenuated by subdiaphragmatic vagotomy, J. Neuroimmunology, 86 (1998) 134-141.
- Will, M.J., **Watkins, L.R.** & Maier, S.F., Uncontrollable stress potentiates morphine's rewarding properties, Pharmacol. Biochem. Behav. 60 (1998) 655-664.
- Nguyen, K.T., Deak, T., Owens, S.M., Kohno, T., Fleshner, M., **Watkins, L.R.** & Maier, S.F., Exposure to acute stress induces brain interleukin-1beta protein in the rat, J. Neurosci., 18 (1998) 2239-46.

- Maswood, S., Barter, J.E., **Watkins, L.R.** & Maier, S.F., Exposure to inescapable but not escapable shock increases extracellular levels of 5-HT in the dorsal raphe nucleus of the rat, Brain Res, 783 (1998) 115-120.
- Watkins, L.R.**, Wiertelak, E.P., McGorry, M., Martinez, J., Schwartz, B., Sisk, D. & Maier, S.F., Neurocircuitry of conditioned inhibition of analgesia: effects of amygdala, dorsal raphe, ventral medullary, and spinal cord lesions on anti-analgesia, Behavioral Neurosci. 112 (1998)360-378.
- Fleshner, M., Silbert, L., Deak, T., Goehler, L.E., Martin, D., **Watkins, L.R.** & Maier, S.F., Tumor necrosis factor-alpha induced corticosterone elevation but not serum protein or corticosterone binding globulin reduction is vagally mediated, Brain Research Bull, 44 (1997) 701-706.
- Deak, T., Meriwether, J.L., Fleshner, M., Spencer, R.L., Abouhamze, A., Moldawer, L.L., Grahn, R.E., **Watkins, L.R.** & Maier, S.F., Evidence that brief stress may induce the acute phase response in rats, American J. Physiol, 273 (1997) R1998-2004.
- Milligan, E., McGorry, M.M., Fleshner, M., Gaykema, R.P.A., Goehler, L.E., **Watkins, L.R.** & Maier, S.F., Subdiaphragmatic vagotomy does not prevent fever following intracerebroventricular prostaglandin E2: Further evidence for the importance of vagal afferents in immune-to-brain communication, Brain Research 766 (1997) 240-3.
- Sutton, L.C., Lea, E.S., Will, M.J., Hartley, C.E., **Watkins, L.R.** & Maier, S.F., Inescapable shock-induced potentiation of morphine analgesia, Behav. Neurosci 111 (1997) 1105-13.
- Sutton, L.C., Grahn, R., Wiertelak, E.P., Maier, S.F. & **Watkins, L.R.**, Inescapable shock induces potentiation of morphine analgesia: involvement of opioid, GABAergic and serotonergic mechanisms in the dorsal raphe nucleus, Behav. Neurosci., 111 (1997) 816-824.
- Goehler, L.E., Relton, J.K., Dripps, D., Kiechle, R., Tartaglia, N., Maier, S.F. & **Watkins, L.R.**, Vagal paraganglia bind biotinylated interleukin-1 receptor antagonist (IL-1ra) in the rat: a possible mechanism for immune-to-brain communication, Brain Research Bull. 43 (1997) 357-364.
- Watkins, L.R.**, McGorry, M., Schwartz, B., Sisk, D., Wiertelak, E.P. & Maier, S.F., Reversal of spinal cord non-opiate analgesia by conditioned anti-analgesia in the rat, Pain 71 (1997) 237-247.

- Watkins, L.R.**, Martin, D., Ulrich, P., Tracey, K.J. & Maier, S.F., Evidence for the involvement of spinal cord glia in subcutaneous formalin induced hyperalgesia in the rat, Pain, 71 (1997) 225-235.
- Wiertelak, E.P., Roemer, B., Maier, S.F. & **Watkins, L.R.**, Comparison of the effects of nucleus tractus solitarius and ventral medulla lesions on illness-induced and subcutaneous formalin-induced hyperalgesias, Brain Research, 748 (1997) 143-50.
- Lockwood, L.L., Silbert, L., Fleshner, M. **Watkins, L.R.**, Laudenslager, M., & Maier, S.F., Morphine induced alterations in antibody levels: receptors and immune mechanisms, J. Pharmacol. exp. Ther., 278 (1996) 689-96.
- Grisel, J.E., **Watkins, L.R.** & Maier, S.F., Associative and non-associative mechanism of morphine analgesic tolerance are neurochemically distinct in the rat spinal cord, Psychopharmacology, 128 (1996) 248-55.
- Maier, S.F. and **Watkins, L.R.**, Commentary on G.G. Paige's Focus Article: Proinflammatory cytokines and specific immune response, Pain Forum, 5 (1996) 234-6.
- Brennan, F.X., Cobb, C.L., Silbert, L.H., **Watkins, L.R.** & Maier, S.F., Peripheral beta-adrenoreceptors and stress-induced hypercholesterolemia in rats, Physiology & Behavior, 60 (1996) 1307-10.
- Brennan, F.X., Fleshner, M., Watkins, L.R. & Maier, S.F., Macrophage stimulation reduces the cholesterol levels of stressed and unstressed rat, Life Sci., 58 (1996) 1771-1776.
- Fleshner, M., Brennan, F.X., Nguyen, K., Watkins, L.R. & Maier, S.F., RU486 blocks the differentially suppressive effect of stress on the in vivo anti-KLH IgM, IgG, IgG1, and IgG2 response, American J. Physiol., 271 (1996) R1344-52.
- Fleshner, M., Deak, T., Spencer, R.L., Laudenslager, M.L., Watkins, L.R. & Maier, S.F., A long-term increase in basal levels of corticosterone and a decrease in corticosteroid-binding globulin following acute stressor exposure, Endocrinology, 136 (1995) 5336-5342.
- Maier, S.F. & Watkins, L.R., Intracerebroventricular interleukin-1 receptor antagonist blocks the enhancement of fear conditioning and interference with escape produced by inescapable shock, Brain Res. 695 (1995) 279-282.
- Fleshner, M., Hermann, J., Lockwood, L.L., Laudenslager, M.L., Watkins, L.R. & Maier, S.F., Stressed rats fail to expand the CD45RC+CD4+ (Th1-like) T cell subset in response to KLH: possible involvement of IFN γ , Brain, Behav. Immun., 9 (1995) 101-112.

- Maier, S.F., Busch, C.R., Maswood, S., Grahn, R.E. & **Watkins, L.R.**, The dorsal raphe nucleus is a site of action mediating the behavioral effects of the benzodiazepine receptor inverse agonist DMCM, Behav. Neurosci., 109 (1995) 759-766.
- Grahn, R.E., Kalman, B.A., Brennan, F.X., **Watkins, L.R.** & Maier, S.F., The elevated plus-maze is not sensitive to the effect of stressor controllability in rats, Pharmacol. Biochem. Behav., 52 (1995) 565-570.
- Maier, S.F., Grahn, R.E. & **Watkins, L.R.**, 8-OH-DPAT microinjected in the region of the dorsal raphe nucleus blocks and reverses the enhancement of fear conditioning and interference with escape produced by exposure to inescapable shock, Behav. Neurosci., 109 (1995) 404-412.
- Fleshner, M., Bellgrau, D., **Watkins, L.R.**, Laudenslager, M.L. & Maier, S.F., Stress-induced reduction in the rat mixed lymphocyte reaction is due to macrophages and not to changes in T cell phenotypes, J. Neuroimmunol., 56 (1995) 45-52.
- Watkins, L.R.**, Goehler, L.E., Relton, J., Brewer, M.T. & Maier, S.F., Mechanisms of tumor necrosis factor-alpha (TNF-alpha) hyperalgesia Brain Res., 692 (1995) 244-250.
- Maier, S.F., Grahn, R.E., Maswood, S. & **Watkins, L.R.**, The benzodiazepine receptor antagonists flumazenil and CGS8216 block the enhancement of fear conditioning and interference with escape behavior produced by inescapable shock, Psychopharmacology, 121 (1995) 250-258.
- Goehler, L.E., Busch, C.R., Tartaglia, N., Relton, J., Sisk, D., Maier, S.F. & **Watkins, L.R.**, Blockade of cytokine induced conditioned taste aversion by subdiaphragmatic vagotomy: further evidence for vagal mediation of immune-brain communication, Neurosci. Lett., 185 (1995) 163-166.
- Fleshner, M., Goehler, L.E., Hermann, J., Relton, J.K., Maier, S.F. & **Watkins, L.R.**, Interleukin-1b induced corticosterone elevation & hypothalamic NE depletion is vagally mediated, Brain Research Bull., 37 (1995) 605-610.
- Grisel, J.E., Wiertelak, E.P., **Watkins, L.R.** & Maier, S.F., Route of morphine administration modulates conditioned analgesic tolerance and hyperalgesia, Pharmacol. Biochem. Behav., 49 (1994) 1029-1035.
- Watkins, L.R.**, Goehler, L.E., Relton, J., Tartaglia, N., Silbert, L., Martin, D. & Maier, S.F., Blockade of interleukin-1 induced fever by subdiaphragmatic vagotomy: evidence for vagal mediation of immune-brain communication, Neurosci. Lett. 183 (1994) 1-5.
- Wiertelak, E.P., Furness, L.E., **Watkins, L.R.** & Maier, S.F., Illness-induced hyperalgesia is mediated by a spinal NMDA-nitric oxide cascade, Brain Research, 664 (1994) 9-16.

- Watkins, L.R.**, Wiertelak, E.P., Furness, L.E. & Maier, S.F., Illness-induced hyperalgesia is mediated by spinal neuropeptides and excitatory amino acids, Brain Research, 664 (1994) 17-24.
- Sutton, L.C., Fleshner, M., Mazzeo, R., Maier, S.F. & **Watkins, L.R.**, A permissive role of corticosterone in opiate analgesia: blockade of opiate analgesia is not due to stress-induced hormone release, Brain Research, 663 (1994) 19-29.
- Brett, B., Di, S., **Watkins, L.** & Barth, D.S., A horseradish peroxidase study of parallel thalamocortical projections responsible for the generation of mid-latency auditory-evoked potentials, Brain Research, 647 (1994) 65-75.
- Lockwood, L.L., Silbert, L.H., Fleshner, M., Laudenslager, M.L. **Watkins, L.R.**, & Maier, S.F., Morphine-induced decreases in *in vivo* antibody responses, Brain, Behavior & Immunity, 8 (1994) 24-36.
- Watkins, L.R.**, Wiertelak, E.P., Goehler, L.E., Smith, K.P., Martin, D. & Maier, S.F., Characterization of cytokine involvement in illness-induced hyperalgesia, Brain Research 654 (1994) 15-26.
- Wiertelak, E.P., Furness, L.E., Horan, R., Martinez, J., Maier, S.F. & **Watkins, L.R.**, Subcutaneous formalin produces centrifugal hyperalgesia at a non-injected site via the NMDA-nitric oxide cascade, Brain Research 649 (1994) 19-26.
- Wiertelak, E.P., Yang, H.-Y. T., Mooney-Heiberger, K., Maier, S.F. & **Watkins, L.R.**, The nature of conditioned anti-analgesia: spinal cord opiate and anti-opiate neurochemistry, Brain Research, 634 (1994) 214-226.
- Watkins, L.R.**, Wiertelak, E.P., Goehler, L., Mooney-Heiberger, K., Martinez, J., Furness, L., Smith, K.P., & Maier, S.F., Neurocircuitry of illness-induced hyperalgesia, Brain Research, 639 (1994) 283-299.
- Wiertelak, E.P., Smith, K.P., Furness, L., Mooney-Heiberger, K., Mayer, T., Maier, S.F. & **Watkins, L.R.**, Acute and conditioned hyperalgesic responses to illness, Pain, 56 (1994) 227-234.
- Maier, S.F., Wiertelak, E.P., Martin, D. & **Watkins, L.R.**, Interleukin-1 mediates the behavioral hyperalgesia produced by lithium chloride and endotoxin, Brain Research, 623 (1993) 321-324.
- Fleshner, M.M., Brohm, M.M., Laudenslager, M.L., **Watkins, L.R.** & Maier, S.F., Modulation of the *in vivo* antibody response by a benzodiazepine-inverse agonist (DMCM) administered centrally or peripherally, Physiology & Behavior, 54 (1993) 1149-1154.

- Lockwood, L.L., Silbert, L.H., Laudenslager, M.L., **Watkins, L.R.** & Maier, S.F., Anesthesia-induced modulation of in vivo antibody levels: a study of pentobarbital, chloral hydrate, methoxyflurane, halothane, and ketamine/xylazine, Anesthesia & Analgesia 77 (1993) 769-774.
- Watkins, L.R.**, Wiertelak, E.P. & Maier, S.F., The amygdala is necessary for the expression of conditioned but not unconditioned analgesia, Behavioral Neurosciences, 107 (1993) 402-405.
- Maier, S.F., Grahn, R.E., Kallman, B.A., Sutton, L.C., Wiertelak, E.P. & **Watkins, L.R.**, The role of the amygdala and dorsal raphe nucleus in mediating the behavioral consequences of inescapable shock, Behavioral Neurosciences, 107 (1993) 377-388.
- Grisel, J.E., Fleshner, M., **Watkins, L.R.** & Maier, S.F., Opioid and nonopioid interactions in two forms of stress-induced analgesia, Pharmacology, Biochemistry & Behavior, 45 (1993) 161-172.
- Fleshner, M., **Watkins, L.R.**, Lockwood, L.L., Grahn, R.E., Gerhart, G., Meaney, M.J., Laudenslager, M.L. & Maier, S.F., Blockade of the hypothalamic-pituitary-adrenal response to stress by intraventricular injection of dexamethasone: a method for studying the stress-induced peripheral effects of glucocorticoids, Psychoneuroendocrinology, 18 (1993) 251-263.
- Fleshner, M., **Watkins, L.R.**, Lockwood, L.L., Bellgrau, D., Laudenslager, M.L. & Maier, S.F., Specific changes in lymphocyte subpopulations: a potential mechanism for stress-induced immunosuppression, J. Neuroimmunology, 41 (1993) 131-142.
- Maier, S.F., Wiertelak, E.P. & **Watkins, L.R.**, Commentary on the commentaries, American Pain Society Journal, 1 (1992) 210-211.
- Maier, S.F., Wiertelak, E.P. & **Watkins, L.R.**, Endogenous pain facilitatory systems: anti-analgesia and hyperalgesia, American Pain Society Journal, 1 (1992) 191-198.
- Fleshner, M., **Watkins, L.R.**, Redd, J.M., Kruse, C.A. & Bellgrau, D., A 9L gliosarcoma model for adoptive immunotherapy into the brains of conscious rats, Cell Transplantation 1 (1992) 307-312.
- Watkins, L.R.**, Wiertelak, E.P., Grisel, J., Silbert, L. & Maier, S.F., Parallel activation of multiple spinal opiate systems appears to mediate "non-opiate" stress-induced analgesia, Brain Research 594 (1992) 99-108.
- Wiertelak, E.P., **Watkins, L.R.** & Maier, S.F., Conditioned inhibition of analgesia, Animal Learning and Behavior, 20 (1992) 339-349.

- Douglass, D.K., Carstens, E. & **L.R. Watkins**, Spatial summation in human thermal pain perception: comparison within and between dermatomes, Pain, 50 (1992) 197-202.
- Watkins, L.R.**, Wiertelak, E.P. & Maier, S.F., Kappa opiate receptors mediate tail-shock induced antinociception at spinal levels, Brain Research, 582 (1992) 1-9.
- Watkins, L.R.**, Wiertelak, E.P. & Maier, S.F., Delta opiate receptors mediate tail-shock induced antinociception at supraspinal levels, Brain Research, 582 (1992) 10-20.
- Wiertelak, E.P., Maier, S.F. & **Watkins, L.R.**, Cholecystokinin antianalgesia: safety cues abolish morphine analgesia, Science 256_(1992) 830-833.
- Brennan, F., **Watkins, L.R.** & Maier, S.F., Total plasma cholesterol levels of rats are increased following only three sessions of tailshock, Life Sciences, 50 (1992) 945-950.
- Thurston, C.L., Campbell, I.G., Culhane, E.S., Carstens, E. & **Watkins, L.R.**, Characterization of intrathecal vasopressin-induced antinociception, scratching behavior, and motor suppression, Peptides, 13 (1992) 17-25.
- Maier, S.F. and **Watkins, L.R.**, Conditioned and unconditioned stress induced analgesia: stimulus pre-exposure and stimulus change, Animal Learning & Behavior, 19 (1991) 295-304.
- Campbell, I.G., Carstens, E. & **Watkins, L.R.**, Comparison of the reliability of three heat pain magnitude measures in humans: flexion withdrawal, operant response, and visual analog scaling, Pain, 45 (1991) 259-268.
- Watkins, L.R.**, Thurston, C.L., & Fleshner, M., Phenylephrine-induced antinociception: investigations of potential neural and endocrine bases, Brain Research, 528 (1990) 273-284.
- Guinan, M.J., Rothfeld, J.M., Pretel, S., Culhane, E.S., Carstens, E. & **Watkins, L.R.**, Electrical stimulation of the rat ventral midbrain elicits non-opiate antinociception via the dorsolateral funiculus, Brain Research, 485 (1989) 333-348.
- Thurston, C.L., Culhane, E.S., Suberg, S.N., Carstens, E. & **Watkins, L.R.**, Antinociceptive vs motor effects of intrathecal vasopressin as measured by four pain tests, Brain Research, 463 (1988) 1-11.
- Klatt, D.S., Guinan, M.J., Culhane, E.S., Carstens, E. & **Watkins, L.R.**, The dorsal raphe nucleus: a re-evaluation of its proposed role in opiate analgesia systems, Brain Research, 447 (1988) 246-252.

- Carstens, E. & **Watkins, L.R.**, Inhibition of the responses of neurons in the rat spinal cord to noxious skin heating by stimulation in midbrain periaqueductal gray or lateral reticular formation, Brain Research, 382 (1986) 266-277.
- Watkins, L.R.**, Suberg, S.N., Thurston, C.L. & Culhane, E.S., Role of spinal cord neuropeptides on pain sensitivity and analgesia: thyrotropin-releasing hormone and vasopressin, Brain Research, 362 (1985) 308-317.
- Rothfeld, J.M., Gross, D.S. & **Watkins, L.R.**, Sexual responsiveness and its relationship to vaginal stimulation-produced analgesia in the rat, Brain Research, 358 (1985) 309-315.
- Ryan, S.M., **Watkins, L.R.**, Mayer, D.J. & Maier, S.F., Spinal pain suppression pathways may differ for phasic and tonic pain, Brain Research, 334 (1985) 172-175.
- Watkins, L.R.**, Kinscheck, I.B., Rosenquist, G., Miller, J., Wimberg, S., Frenk, H., Kaufman, E., Coghill, R., Suberg, S.N. & Mayer, D.J., The enhancement of opiate analgesia and the possible reversal of morphine tolerance by proglumide. In: Neuronal Cholecystokinin, J.J. Vanderhaeghen & J.N. Crawley (eds.), New York Academy of Sciences, New York, 1985, pp. 676-677.
- Suberg, S.N., Culhane, E.S., Carstens, E. & **Watkins, L.R.**, The potentiation of morphine-induced inhibition of spinal transmission by proglumide, a putative cholecystokinin antagonist. In: Neuronal Cholecystokinin, J.J. Vanderhaeghen & J.N. Crawley (eds.), New York Academy of Sciences, New York, 1985, pp. 660-662.
- Watkins, L.R.**, Kinscheck, I.B., Kaufman, E., Frenk, H., Miller, J. & Mayer, D.J., Cholecystokinin antagonists selectively potentiate analgesia induced by endogenous opiates, Brain Research, 327 (1985) 181-190.
- Watkins, L.R.**, Kinscheck, I.B. & Mayer, D.J., Potentiation of morphine analgesia by the cholecystokinin antagonist proglumide, Brain Research, 327 (1985) 169-180.
- Watkins, L.R.**, Frenk, H., Miller, J. & Mayer, D.J., Effect of spinal cord lesions on convulsive activity induced by intrathecal morphine, Brain Research, 310 (1984) 337-345.
- Hayes, R.L., Katayama, Y., **Watkins, L.R.** & Becker, D.P., Bilateral lesions of the dorsolateral funiculus of the cat spinal cord: effects on basal nociceptive reflexes and nociceptive suppression produced by cholinergic activation of the pontine parabrachial region, Brain Research, 311 (1984) 267-280.
- Watkins, L.R.**, Kinscheck, I.B. & Mayer, D.J., Potentiation of opiate analgesia and apparent reversal of morphine tolerance by cholecystokinin antagonists, Science, 224 (1984) 395-396.

- Kinscheck, I.B., **Watkins, L.R.** & Mayer, D.J., Fear is not critical to classically conditioned analgesia: the effect of periaqueductal gray lesions and administration of chlor-diazopoxide, Brain Research, 298 (1984) 33-44.
- Johannessen, J.N., **Watkins, L.R.** & Mayer, D.J., Non-serotonergic origins of the dorsolateral funiculus in the rat ventral medulla, J. Neurosciences, 4 (1984) 757-766.
- Frenk, H., **Watkins, L.R.**, Miller, J. & Mayer, D.J., Nonspecific convulsions are induced by morphine but not D-ala-methionine-enkephalinamide at cortical sites, Brain Research, 299 (1984) 50-59.
- Watkins, L.R.**, Frenk, H., Miller, J. & Mayer, D.J., Cataleptic effects of opiates following intrathecal administration, Brain Research, 299 (1984) 43-49.
- Frenk, H., **Watkins, L.R.** & Mayer, D.J., Differential behavioral effects induced by intrathecal microinjection of opiates: comparison of convulsive and cataleptic effects produced by morphine, methadone, and D-ala-methionine-enkephalinamide, Brain Research, 299 (1984) 31-42.
- Price, D., Rafii, A., **Watkins, L.R.** & Buckingham, B., A psychophysical analysis of acupuncture analgesia, Pain, 19 (1984) 27-42.
- Watkins, L.R.**, Katayama, Y., Kinscheck, I.B., Mayer, D.J., Hayes, R.L., Muscarinic cholinergic mediation of opiate and non-opiate environmentally induced analgesias, Brain Research, 300 (1984) 231-242.
- Watkins, L.R.**, Faris, P.L., Komisaruk, B.R. & Mayer, D.J., Dorsolateral funiculus and intraspinal pathways mediate vaginal stimulation-induced suppression of nociceptive responding in rats, Brain Research, 294 (1984) 59-65.
- Katayama, Y., **Watkins, L.R.**, Becker, D.P. & Hayes, R.L., Non-opiate analgesia induced by carbacol microinjection into the pontine parabrachial region of the cat, Brain Research, 296 (1984) 241-262.
- Watkins, L.R.**, Johannessen, J.N., Kinscheck, I.B. & Mayer, D.J., The neurochemical basis of footshock analgesia: the role of spinal cord serotonin and norepinephrine, Brain Research, 290 (1984) 107-117.
- Young, E.G., **Watkins, L.R.** & Mayer, D.J., Comparison of the effects of ventral medullary lesions on systemic and microinjection morphine analgesia, Brain Research, 290 (1984) 119-129.

- Watkins, L.R.**, Drugan, R., Hyson, R.L., Moye, T.B., Ryan, S.M., Mayer, D.J. & Maier, S.F., Opiate and non-opiate analgesia induced by inescapable tail shock: effects of dorsolateral funiculus lesions and decerebration, Brain Research, 291 (1984) 325-336.
- Watkins, L.R.**, Kinscheck, I.B. & Mayer, D.J., The neural basis of footshock analgesia: the effect of periaqueductal gray lesions and decerebration, Brain Research, 276 (1983) 317-324.
- Watkins, L.R.**, Young, E.G., Kinscheck, I.B. & Mayer, D.J., The neural basis of footshock analgesia: the role of specific ventral medullary nuclei, Brain Research, 276 (1983) 305-315.
- Lewis, J.W., Terman, G.W., **Watkins, L.R.**, Mayer, D.J. & Liebeskind, J.C., Opioid and non-opioid mechanisms of footshock analgesia: role of the spinal dorsolateral funiculus, Brain Research, 267 (1983) 139-144.
- Faris, P.L., Komisaruk, B., **Watkins, L.R.** & Mayer, D.J., Evidence for the neuropeptide cholecystokinin as an antagonist of opiate analgesia, Science, 219 (1983) 310-312.
- Watkins, L.R.** & Mayer, D.J., Organization of endogenous opiate and non-opiate pain control systems, Science, 216 (1982) 1185-1192.
- Watkins, L.R.**, Cobelli, D.A. & Mayer, D.J., Classical conditioning of front paw and hind paw footshock induced analgesia (FSIA): naloxone reversibility and descending pathways, Brain Research, 243 (1982) 119-132.
- Watkins, L.R.**, Cobelli, D.A. & Mayer, D.J., Opiate vs. non-opiate footshock induced analgesia (FSIA): descending and intraspinal components, Brain Research, 245 (1982) 97-106.
- Watkins, L.R.**, Cobelli, D.A., Newsome, H.H. & Mayer, D.J., Footshock induced analgesia is dependent neither on pituitary nor sympathetic activation, Brain Research, 245 (1982) 81-96.
- Watkins, L.R.** & Mayer, D.J., Involvement of spinal opioid systems in footshock induced analgesia: antagonism by naloxone is possible only before induction of analgesia, Brain Research, 242 (1982) 309-316.
- Watkins, L.R.**, Cobelli, D.A., Faris, P.L., Aceto, M.D. & Mayer, D.J., Opiate vs. non-opiate footshock induced analgesia (FSIA): the body region shocked is a critical factor, Brain Research, 242 (1982) 299-308.

- Johannessen, J.N., **Watkins, L.R.**, Carlton, S.M. & Mayer, D.J., Failure of spinal cord serotonin depletion to alter analgesia elicited from the periaqueductal gray, Brain Research, 237 (1981) 373-386.
- Watkins, L.R.**, Griffin, G., Leichnetz, G.R. & Mayer, D.J., Identification and somatotopic organization of nuclei projecting via the dorsolateral funiculus in rats: a retrograde tracing study using HRP slow-release gels, Brain Research, 223 (1981) 237-255.
- Watkins, L.R.**, Griffin, G., Leichnetz, G.R. & Mayer, D.J., The somatotopic organization of the nucleus raphe magnus and surrounding brainstem structures as revealed by HRP slow-release gels, Brain Research, 181 (1980) 1-15.
- Griffin, G., **Watkins, L.R.** & Mayer, D.J., HRP pellets and slow release gels: two new techniques for greater localization and sensitivity, Brain Research, 168 (1979) 595-601.
- Rothblum, L.M.**, Watkins, J.W. & Jenssen, T.A., A learning paradigm and behavioral demonstration of audition for the lizard, *Anolis grahami*, Copeia, 1979 (1979) 490-494.
- Leichnetz, G.R., **Watkins, L.**, Griffin, G., Murfin, R. & Mayer, D.J., The projection from nucleus raphe magnus and other brainstem nuclei to the spinal cord in the rat: a study using the HRP blue-reaction, Neurosci. Lett., 8 (1978) 119-124.
- Prestrude, A.M., **Watkins, L.** & Watkins, J., Interocular light adaptation effect on the Lie "specific threshold", Vision Research, 18 (1978) 855-857.
- Rothblum, L.M.** & Jenssen, T.A., Display repertoire analysis of *Sceloporus undulatus hyacinthinus* (*Sauria: Iguanidae*) from Southwestern Virginia, Animal Behavior, 26 (1978) 130-137.
- Jenssen, T.A. & **Rothblum, L.M.**, Display repertoire analysis of *Anolis townsendi* (*Sauria: Iguanidae*) from Cocos Island, Copeia, 1977 (1977) 103-109.

Abstracts

- Aleksejev, R.M., Amat, J., Christianson, J.P., Seaton, K.M., Watkins, L.R., Maier, S.F. Acute and long-term stress-protective effects of a controllable stressor are blocked by NMDA receptor antagonist in the posterior dorsal medial striatum. Soc. for Neuroscience, 2011
- Barrientos, R.M., Crysdale, N.Y., Amat, J., Hale, M.W., Stamper, C.E., Hennessey, P.A., Frank, M.G., Watkins, L.R., Lowry, C.A., Maier, S.F. Characterization of hippocampal

and circulating corticosterone levels of healthy aged rats. Society for Neuroscience, 2011.

Bluth, J.S., Loram, L.C., Brown, M.S., Hasebroockh, K.M., Miller, D.E., Watkins, L.R., and Serkova, N.J., MRI detection of spinal lesions in a rat MS model, Proceedings of the International Society of Magnetic Resonance in Medicine Conference, Melbourne, Australia, 2012.

Christianson, J. P., Drugan, R. C., Amat, J., Rozeske, R., Alekseyev, R., Watkins, L. R., Maier, S. F. The long-lasting stress-protective effects of controllable stress depend on plasticity in the prelimbic medial prefrontal cortex. Society. for Neuroscience Abstracts 2011

Ellis, A.L., Wieseler, J., Favret, J., Skarda, B.S., Maier, S.F., Rice, K., Watkins, L.R., Falci, S.P. Spinal neuropathic avulsion pain is enhanced by glial activation: a role for TLR4. Soc. for Neuroscience, 2011

Frank, M.G., Barrientos, R.M., Watkins, L.R. & Maier, S.F. Aging increases hippocampal expression of the danger associated molecular pattern HMGB1: an amplifier of pro-inflammatory immune responses. Soc. for Neuroscience, 2011.

Loram LC, Strand KA, Berkelhammer D, Taylor F, Maier SF, Rice K, Watkins LR. Sexual dimorphic differences in toll-like receptor 4 mediated responses by neonatal and adult microglia. Soc for Neuroscience, 2011

McFadden, A, Wieseler, J, Zhang, Y, Loram, L, Miles, N, Hutchinson, MR, Rice, K, Maier, SF, Watkins, LR. Morphine modulates mast cell activity via TLR4: implications for medication overuse headache and pruritus. Proc Soc Neursoci., (2011)

Northcutt, A.L., Hutchinson, M.R., Hiranita, T., O'Neill, C.E., Lewis, S., Loram, L., Kopa-jtic, T., Galer, E.L., Cochran, T.A., Bland, S.T., Maier, S.F., Bachtell, R.K., Katz, J.L., Rice, K.C., Watkins, L.R. Evidence for Toll Like Receptor-4 (TLR4) Involvement in Morphine and Cocaine Reward. Soc for Neuroscience, 2011

Ramos, K.M., Morgan, K.N., Lewis, M.T., Giganti, P.J., Huey, M.G., Greene, L.I., Maier, S.F. & Watkins, L.R. CNS endothelial cells are a critical cell type in mediating opioid-induced CNS inflammation: interaction with glia and peripheral immune cells. Soc. for Neuroscience, 2011

Sobesky, J.L., Barrientos, R., Watkins, L.R., Maier, S.F. High-fat diet-induced obese Wistar rats have decreased contextual memory as measured by a context pre-exposure fear-conditioning paradigm. Soc. for Neuroscience, 2011.

- Weber, M.D., Sobesky, J., Frank, M.G., Watkins, L.R., Maier, S.F. Evidence for involvement of Toll-like receptor 2 and Toll-like receptor 4 in neuroinflammation following peripherally administered LPS. Society for Neuroscience, 2011.
- Wieseler, J, McFadden, A, Miles, N, Ellis, A, Maier, SF, Watkins, LR. Facial allodynia potentiation by supradural inflammatory mediators and morphine: a model of medication overuse headache. Proc Soc Neurosci., (2011)
- Yap, J.J., Bachtell, R.K., Watkins, L.R., & Maier, S.F. Increased vulnerability to the reinstatement of morphine seeking produced by inescapable stress. Society for Neuroscience, 2011.
- Hutchinson, M.R., Wu, Y., Thomas, J., Nicotra, L., Liu, L., Rice, K.C., Watkins, L.R. and Somogyi, A.A., Neuroimmunopharmacology of opioids and alcohol: behavioral, cellular signaling and binding evidence of a role for Toll-like receptors, Society for Neuroscience, 2011.
- Watkins, L.R., Northcutt, A., Loram, L., Lewis, S., Hutchinson, M., Rice, K.C. and Maier, S.F., Rethinking CNS innate immune responses: Sex, pain and drugs of abuse, PsychoNeuroImmunology Research Conference, 2011.
- Loram, L. and Watkins, L.R., Sex makes a difference: female glial cells are more responsive than male glial cells to inflammatory mediators, NIH Pain Consortium presentation, 2011.
- Hutchinson, M.R., Wu, Y., Jaehne, E.J., Liu, L., Diener, K.R., Hayball, J.D., Rice, K.C., Watkins, L.R., Somogy, A.A., Opioid and alcohol pharmacodynamics: contributions of innate immune signaling to drug response, proceedings of the PsychoNeuroImmunology Research Conference, 2011.
- Northcutt, A.N., Sfregola, C., Miles, N.E., Amat, J., Bland, S.T., Rozeske, R., Hutchinson, M.R., Maier, S.F., Rice, K.C., Watkins, L.R.; Novel toll like receptor 4 (TLR4) involvement in drug reward. proceedings of the PsychoNeuroImmunology Research Conference, 2011.
- Hutchinson, M.R., Wu, Y., Jaehne, E.J., Liu, L., Diener, K.R., Hayball, J.D., Rice, K.C., Watkins, L.R., Somogy, A.A., Opioid and alcohol pharmacodynamics: contributions of innate immune signaling to drug response, proceedings of the International Narcotics Research Conference, 2011.
- Wu, U., Lousberg, E.L., Hayball, J.D., Coller, J.K., Rice, K.C., Watkins, L.R., Somogyi, A.A. & Hutchinson, M.R., Attenuating microglial, IL-1, & TLR4 signaling protects mice from alcohol's acute behavioral action, NIDA mini-convention, San Diego, CA 2010.

- Hutchinson, M.R., Jaehne, E.J., Liu, L., Majumder, I., Hayball, J.D., Watkins, L.R., Somogyi, A.A., Opioid analgesia, tolerance and withdrawal: contributions of innate immune signaling and sex, ASCEPT annual meeting, Melbourne, Australia, 2010.
- Hutchinson, M.R., Wu, Y., Liu, L., Phipps, S., Rice, K.C., Collier, J.K., Somogyi, A.A., & Watkins, L.R., Opioid and alcohol action: the role of brain and spinal cord innate immune signaling, PNIRS conference, Dublin, Ireland, 2010.
- Hutchinson, M.R., Wu, Y., Liu, L., Phipps, S., Rice, K.C., Collier, J.K., Somogyi, A.A. & Watkins, L.R., Opioid and alcohol action: the role of brain & spinal cord innate immune signaling, Keystone Innate Immunity meeting, Dublin, Ireland, 2010.
- Amat, J., Christianson, J.P., Alekseyev, R., Cooper, D. Watkins, L.R. & Maier, S.F. Building stress resilience. Soc. for Neuroscience, 2010
- Barrientos, R.M., Frank, M.G., Crysdale, N.Y., Watkins, L.R., Maier, S.F. The role of the liver in E. coli-induced memory impairments in aged rats. Soc. for Neuroscience, 2010.
- Ellis, A.L., Wieseler, J., Mcfadden, A., Brown, K., Maier, S.F., Watkins, L.R., Falci, S. Dorsal root avulsion leads to below level central neuropathic pain that can be attenuated by glial modulators. Soc. for Neuroscience, 2010.
- Frank, M.G., Thompson, B.M., Watkins, L.R., Maier, S.F. The glucocorticoid receptor antagonist RU486 abrogates stress-induced potentiation of hippocampal pro-inflammatory responses and expression of the alarmin HMGB1. Soc. for Neuroscience, 2010.
- Hutchinson, M.R., Wu, Y., Liu, L., Phipps, S., Rice, K.C., Collier, J.K., Somogyi, A.A., & Watkins, L.R., Opioid and alcohol action: the role of brain and spinal cord innate immune signaling, PNIRS conference, Dublin, Ireland, 2010.
- Hutchinson, M.R., Wu, Y., Liu, L., Phipps, S., Rice, K.C., Collier, J.K., Somogyi, A.A. & Watkins, L.R., Opioid and alcohol action: the role of brain & spinal cord innate immune signaling, Keystone Innate Immunity meeting, Dublin, Ireland, 2010.
- Kubala, K.H., Christianson, J.P., Watkins, L.R., Maier, S.F. Stressor controllability during adolescence blocks the behavioral and dorsal raphe nucleus activating effects of adult uncontrollable stress. Soc. for Neuroscience, 2010.
- Lewis SS, Hutchinson MR, Loram LC, Frick MM, Sammakia T, Maier SF, Rice KC, Watkins LR. Certain glucuronide metabolites cause neuroinflammation & enhanced pain. Soc for Neuroscience, 2010.
- Loram LC, Hutchinson MR, Sholar P, Wieseler JL, Babb JA, Taylor FR, Strand K, Konrad B, Day H, Maier SF, Watkins LR. Estradiol potentiates morphine-induced pro-inflam-

matory response from microglia & suppresses analgesia in male & ovariectomized female rats. Soc for Neuroscience, 2010

Northcutt, A.N., Sfregola, C., Miles, N.E., Amat, J., Bland, S.T., Rozeske, R., Hutchinson, M.R., Maier, S.F., Rice, K.C., Watkins, L.R.; Novel toll like receptor 4 (TLR4) involvement in drug reward. Soc. for Neuroscience, 2010.

Ragole, TR., Christianson, JP., Flyer, J., Watkins, LR., Maier, SF. Bed nucleus of the stria terminalis is required for uncontrollable stress induced anxiety. Soc. for Neuroscience, 2010

Ramos, K.M., Lewis, M.T., Crysedale, N.Y., Zhang, Y., Maier, S.F., Watkins, L.R. Pro-inflammatory signaling in endothelial cells and oligodendrocytes: new players in chronic pain and dysregulation of opioid efficacy. American Pain Society, 2010.

Ramos, K.M., Morgan, K.N., Lewis, M.T., Kroll, J.L., Kreuz, B.C., Zhang, Y., Hutchinson, M.R., Maier, S.F., Watkins, L.R. Opioids induce pro-inflammatory signaling in central nervous system endothelial cells: potential role in dysregulation of opioid efficacy. Soc. for Neuroscience, 2010.

Rodgers, K.M., Deming, Y., McCallum, D.L., Frey, L.C. Johnson, K.W., Watkins, L.R. & Barth, D.S., An animal model of traumatic brain injury-induced anxiety-like behavior: possible role of neuroinflammation, Soc. for Neuroscience, 2010.

Rozeske, R.R., Watkins, L.R., Lowry C.R., and Maier, S.F. The role of the medial prefrontal cortex in dorsal raphe nucleus 5-HT1A receptor adaptation following escapable and inescapable stress. Soc for Neuroscience, 2010.

Sobesky, JL., Frank, MG., Watkins, LR., Maier, SF. Time course for glucocorticoid priming of inflammatory responses to later immune challenge. Soc. for Neuroscience, 2010.

Strand K, Loram LC, Taylor LC, Sloane EM, Rieger J, Maier SF, Serkova NJ, Watkins LR. Adenosine 2A receptor (A2AR) agonists in multiple sclerosis in rats: multi-week resolution of pain or paralysis with single intrathecal (it) dosing. Soc for Neuroscience, 2010

Wall, V., Fischer, E., Howard, N., Watkins, L.R., Maier, S.F. & Bland, S.T., Adolescent social deprivation increases aggressive behavior and decreases social interaction-induced activation of the immediate early gene ARC in the medial prefrontal cortex of male and female rats. Soc for Neuroscience, 2010.

Wieseler, J., McFadden, A., Brown, K., Cady, S., Ellis, A., Johnson, K., Maier, S., Watkins, L. Supradural application of inflammatory mediators and facial allodynia: a role for glia? IASP, The 13th World Congress on Pain. 13th World Congress on Pain (2010)

- Wieseler, J., McFadden, A., Brown, K., Cady, S., Ellis, A., Johnson, K., Maier, S., Watkins, L. Facial Allodynia: Involvement of Glia & Potentiation by Prior Morphine. Soc. for Neuroscience, 2010.
- Yap, J.J., Bachtell, R.K., Watkins, L.R., Maier, S.F. Neuroinflammation, stress and drugs of abuse: Glial modulation of intravenous morphine self-administration and the neuroinflammatory priming effects of prior stress in response to methamphetamine in the mesocorticolimbic dopamine system. Soc. for Neuroscience, 2010.
- Barrientos, R.M., Ahrendsen, J., Crysdale, N.Y., Chapman, T. R., Frank, M.G., Campeau, S, Day, H.E.W., Watkins, L.R., Patterson, S.L., Maier, S.F. The effects of voluntary wheel running on infection-induced hippocampal BDNF mRNA changes in aging rats. Soc. for Neuroscience, 2009.
- Bland, S.T. Beckley, J.T., Fischer, E.K., Imonugo, O., Ortiz, N.C., Watkins, L.R., Maier, S.F., Isolation rearing and restraint stress produce sex-dependent changes in medial prefrontal cortex immediate early gene expression, Soc. for Neuroscience, 2009.
- Christianson, J.P., Kubala, K.H., Nadler, D., Watkins, L.R., Maier, S.F. Chewing during an inescapable stressor blocks the behavioral effects of the stressor: role of the medial prefrontal cortex and dorsal raphé nucleus. Soc. for Neuroscience, 2009.
- Ellis, A., Wieseler, J., Ramos, K., Mcfadden, A., Brown, K., Starnes, C., Maier, S.F., Watkins, L.R. & Falci, S., Characterization of glial activation and treatment of mechanical allodynia in a rat model of spinal cord injury, Soc. for Neuroscience, 2009.
- Frank, M.G., Miguel, Z., Watkins, L.R., & Maier, S.F., Prior exposure to glucocorticoids sensitizes the neuroinflammatory response to e. coli lipopolysaccharide, Soc. for Neuroscience, 2009.
- Hutchinson, M.R., Chan, S., Fong, S., Phipps, S., Somogyi, A.A., Yin, H., Rice, K.C., Watkins, L.R. Novel Toll Like Receptor 4 activity of opioids alters opioid response, Soc. for Neuroscience, 2009.
- Jennings, J.H., Christianson, J.P., Benison, A., Barth, D., Watkins, L.R., Maier, S.F. Safety signals mitigate the consequences of uncontrollable stress via a circuit involving the sensory insular cortex. Soc. for Neuroscience, 2009.
- Loram LC, Harrison JA, Sloane EM, Taylor FR, Sholar P, Maier SF, Rieger J, Watkins LR. Spinal adenosine modulation: enduring anti-inflammatory action in neuroinflammatory disorders. Soc. for Neuroscience, 2009.
- Loram LC, Sloane EM, Harrison JA, Sholar P, Taylor FR, Hutchinson MR, Maier SF, Rieger J, Watkins LR. Long-duration reversal of neuropathic pain via sustained release of spinal interleukin-10 is mediated by adenosine 2a receptor activation. PNIRS 2009

- Loram LC, Sloane EM, Sholar PW, Taylor FR, Harrison JA, Hutchinson MR, Maier SF, Rieger J, Watkins LR. Adenosine 2A receptor agonist produces long-duration reversal of neuropathic pain via sustained release of spinal interleukin-10. American Pain Society 2009
- Ragole, T., Christianson, J.P., Strong, P.V., Greenwood, B.N., Amat, J., Fleshner, M.R., Watkins, L.R., & Maier, S.F. Stress-induced anxiety involves serotonin release in the basolateral amygdala and the 5-HT_{2C} receptor. Soc. for Neuroscience, 2009.
- Ramos, K.M., Lewis, M.T., Crysdale, N.Y., Harrison, J.A., Sloane, E.M., Maier, S.F., & Watkins, L.R., The GLT-1 upregulating drug ceftriaxone reverses neuropathic pain, Soc. for Neuroscience, 2009.
- Ramos, K.M, Lewis, M.T., Crysdale, N.Y., Harrison, J.A., Sloane, E.M, Maier, S.F., Watkins, L.R. The GLT-1 upregulating drug ceftriaxone reverses neuropathic pain in rat models of peripheral nerve injury and multiple sclerosis. NIH 4th Annual Symposium on Advances in Pain Research, 2009.
- Rozeske, R.R., Evans, A.K., Watkins, L.R., Lowry, C.A., and Maier, S.F. Serotonin differentially inhibits in vitro neuronal firing rates in the dorsal raphe nucleus following escapable and inescapable stress. Soc. for Neuroscience, 2009.
- Shridhar, M., Hutchinson, M.R., Zhang, Y., Buchanan, M., Zhao, T., Silvka, P, Landgraf, K., Evans, J.H., Falke, J., Maier, S.F., Rice, K.C., Sammakia, T., Yin, H. & Watkins, L.R., Novel nonstereoselective toll-like receptor activity of opioids: a mechanistic approach, Soc. for Neuroscience, 2009.
- Loram, L.C., Sholar, P.W., Taylor, F.R., Harrison, J.A., Hutchinson, M.R., Maier, S.F., Rieger, J., & Watkins, L.R., Adenosine 2a receptor agonists produces long-duration reversal of neuropathic pain via sustained release of spinal interleukin-10, Proc. American Pain Society annual meeting, 2008.
- Barratta, M.V., Lewis, S.S., Hutchinson, M.R., Maier, S.F., Watkins, L.R., Characterization of a glial component in a novel model of chronic neuropathic facial pain, Society for Neuroscience, 2008.
- Barrientos, R.M., Frank, M.G., Watkins, L.R., Rudy, J.W., Campeau, S., Day, H.E.W., Maier, S.F., The effects of exercise on infection-induced memory deficits in older rats, Proc. Society for Neuroscience, 2008.
- Bland, S.T., Bilbo, S.D., Beckley, J. Watkins, L.R., Maier, S.F., Neonatal E. coli infection alters glial and cytokine responses to acute amphetamine in adolescent rats, Proc. Society for Neuroscience, 2008.

- Brown, K., Hutchinson, M., Wieseler, J., Rezvani, N., Sholar, P., Kearney, J., Shridhar, M., Zhang, Y., Maier, S.F., Watkins, L.R., Age related differences in acute & chronic morphine analgesia: a role for age induced glial priming? Proc. Society Neuroscience, (2008).
- Ellis, A.L., Wieseler, J., Ramos, K., Starnes, C., Maier, S.F., Watkins, L.R., Falci, S., A novel model of spinal cord injury: characterization of exaggerated pain behavior and glial activation, Proc. Society for Neuroscience, 2008.
- Frank, M.G., Barrientos, R.M., Hein, A.C., Biedenkapp, J.C., Rudy, J.R., Watkins, L.R., Maier, S.F., Peripheral bacterial infection suppresses hippocampal Arc in older animals, Proc. Society for Neuroscience, 2008.
- Hein, A.M., Stasko, M.R., Matousek, S.B., Walter, J.R., Scott-McKean, J.J., Watkins, L.R., Maier, S.F., Costa, A.C.S., O'Banion, M.K. Chronic hippocampal IL-1 β overexpression impairs contextual but not auditory fear memory, Proc. Society for Neuroscience, 2008.
- Hutchinson, M.R., Rezvani, N., Sholar, P.W., Kearney, J.J., Shridhar, M., Zhang, Y., Maier, S.F., Watkins, L.R., Inhibition of spinal HSP90 acutely reverses chronic constriction injury induced allodynia & potentiates intrathecal morphine analgesia, Proc. Society for Neuroscience, 2008.
- Kubala, K.H., Christianson, J.P., Watkins, L.R., Maier, S.F., Short and long-term behavioral effects of stressor controllability in adolescent rats, Society for Neuroscience, 2008.
- Lewis, S.S., Hutchinson, M.R., Maier, S.F., Watkins, L.R., Characterization of a novel model of chronic neuropathic facial pain, Tempromandibular Joint Association Meeting, 2008.
- Lewis, S.S., Hutchinson, M.R., Rezvani, N., Zhang, Y., Maier, S.F., Watkins, L.R., Morphine-3-glucuronide enhances nociception through glial-dependent mechanisms. Society for Neuroscience, 2008.
- Loram, L.C., Hutchinson, M.R., Harrison, J.A., Taylor, D.R., Maier, S.F., Rieger, J., Watkins, L.R., Enduring reversal of neuropathic pain by a single intrathecal injection of adenosine 2A receptor agonists: a novel therapy for neuropathic pain, Proc. Society for Neuroscience, 2008
- Loram, L.C., Hutchinson, M.R., Taylor, F.R., Ellis, A., Northcutt, A.L., Harrison, J.A., Maier, S.F., Rieger, J., Watkins, L.R., Enduring reversal of neuropathic pain by a single intrathecal injection of adenosine 2A receptor agonists: a novel therapy for neuropathic pain, 12th World Congress on Pain, Glasgow, Scotland.
- Paul, E.D., Amat, J., Alekseev, R., Watkins, L.R., Maier, S.F., Escapable stress blocks the behavioral and neurochemical response to later social defeat stress in the rat, Proc. So-

ciety for Neuroscience, 2008.

Ramos, K.M., Maier, S.F., Watkins, L.R., Opioid-induced pro-inflammatory signaling in endothelial cells and oligodendrocytes, Proc. Society for Neuroscience, 2008.

Ramos, K.M., Maier, S.F., Watkins, L.R., Are astrocytes and microglia the only non-neuronal cells responsive to pain-enhancing substances? Clues from endothelial cells and oligodendrocytes, International Association for the Study of Pain World Congress, 2008.

Rozeske, R.R., Der-Avakian, A., Bland, S.T., Watkins, L.R., Maier, S.F., Prior experience with escapable stress prevents subsequent inescapable stress-induced potentiation of morphine conditioned place preference, Proc. Society for Neuroscience, 2008.

Thompson, B.M., Christianson, J.P., Watkins, L.R., Maier, S.F., Medial prefrontal cortical inactivation eliminates the stress-resistance produced by behavioral control as assessed in a social exploration test of anxiety, Proc. Society for Neuroscience, 2008.

Wieseler, J., Ellis, A., Rezvani, N., Loram, L., McFadden, A., Maier, S.F. Watkins, L.R., New Animal Model of Migraine: Facial Allodynia is Associated with Glial Activation, Proc Society Neuroscience, (2008)

Miguel, Z.D., Frank, M. G., Watkins, L. R., & Maier, S. F. Involvement of stress-induced MHC-II in the hippocampus in antigen presentation to T cells. Presented at Federation of European Neuroscience Societies meetings, Geneva Switzerland, 2008.

Rozeske, R. R., Der-Avakian, A., bland, s. T., Beckley, J. T., Watkins, l. R., & Maier, S. F. The role of the medial prefrontal cortex in the differential expression of morphine conditioned place preference following exposure to controllable, uncontrollable, or controllable and uncontrollable stress. Presented at Federation of European Neuroscience Societies meetings, Geneva Switzerland, 2008.

Lewis, S.S., Hutchinson, M.R., Maier, S.F., & Watkins, L.R. , Characterization of a glial component in a novel model of neuropathic facial pain, TMJ Association annual meeting, 2008.

Ramos, K.M., Maier, S.F., Watkins, L.R., Are astrocytes and microglia the only non-neuronal cells responsive to pain-enhancing substances? Clues from endothelial cells and oligodendrocytes, International Assoc. for the Study of Pain World Congress, 2008.

Loram, L.C., Hutchinson, M.R., Taylor, F.R., Northcutt, A.L., Harrison, J.A., Maier, S.F., Rieger, J., & Watkins, L.R., Enduring reversal of neuropathic pain by a single intrathecal injection of adenosine 2A receptor agonists: a novel therapy for neuropathic pain, International Assoc. for the Study of Pain World Congress, 2008.

- Bilbo, S.D., Wieseler, J., Barrientos, R.M., Watkins, L.R. & Maier, S.F., Rats infected early in life with bacteria exhibit exaggerated fever, sickness behavior, and lack of tolerance in adulthood, PNIRS annual meeting, 2008.
- Bland, S.T., Hutchinson, M.R., Coats, B.D., Rozeske, R.R., Maier, S.F., Watkins, L.R. & Johnson, K.W., Glial inhibition reduces morphine-induced increases in nucleus accumbens dopamine release and conditioned place preference in the rat, Proc. NIDA Mini-convention on Frontiers in Addiction Research, (2007).
- Ashton, J.C., Potter, J.M., Harrison, J.A., Sloane, E.M., Maier, S.F., Watkins, L.R. & Milligan, E.D., Neuropathic pain is controlled by spinal delivery of a cannabinoid CB2 receptor agonist, Proc. Australian & New Zealand Pharmacology & Toxicology Society, 2007.
- Gross, M., Gaeta, F., Ledebor, A., Vijay, S., Watkins, L., Hutchinson, M., Gebretsadik, k., Suzuki, B. & Johnson, K., AV1013, novel orally active glial inhibitor, attenuates mechanical allodynia in rat pain models, International Neuropathic Pain Conference, Snowbird, Utah (2007).
- Ashton, J.C., Potter, J.M., Harrison, J.A., Sloane, E.M., Maier S.F., Watkins, L.R. and Milligan, E.M., Neuropathic pain is controlled by spinal delivery of the selective CB2 partial agonist, GW405833, Proc. Soc. Neurosci., (2007).
- Baratta, M.V., Christianson, J.P., Gomez, D.M., Zarza, C.M., Amat, J., Masini, C.V., Watkins, L.R., and Maier, S.F., Prior controllable stress blocks the expression of conditioned, but not unconditioned, fear: role of the medial prefrontal cortex, Proc Soc. Neurosci., (2007).
- Barrientos, R.M., Hein, A.M., Frank, M.G., Watkins, L.R., Rudy, J.W., Maier, S.F. Laparotomy four days prior to contextual fear conditioning impairs memory consolidation in aged, but not young rats. Proc. Soc. Neurosci., (2007).
- Beckley, J.T., Bland, S.T., Brevil, M., Watkins, L.R., Maier, S.F., Social isolation rearing produces a gender-specific temporal and behavioral pattern in the social exploration test, Proc. Soc. Neurosci., (2007).
- Bilbo, S.D., Barrientos, R.M., Eads, A.S., Northcutt, A., Watkins, L.R., Rudy, J.W., and Maier, S.F., BDNF and IL-1 mRNA expression in rat hippocampus following contextual learning are altered in adulthood as a result of neonatal infection, Proc Soc. Neurosci., (2007).
- Bland, S.T., Young, S., Beckley J., Eads, A., Northcutt, A., Watkins, L.R., Maier, S.F., Bilbo, S.D. Neonatal E. coli infection reduces neurogenesis in the rat hippocampus and cortex. Proc Soc. Neurosci., (2007).

- Christianson, J.P., Paul, E.D., Irani, M., Yirmiya, R., Watkins, L.R., & Maier, S.F. Social exploration but not sucrose preference is sensitive to stressor controllability and is mediated by the Dorsal Raphé Nucleus. *Proc Soc. Neurosci.*, (2007).
- Coats, B.D., Hutchinson, M.R., Lewis, S.S., Sprunger, D.B., Baker, E.M., Maier, S.F., & Watkins, L.R., Opposition of acute intrathecal morphine analgesia by glia: Mechanisms and mediators, *Proc Soc. Neurosci.*, (2007).
- Frank, M.G., Baratta, M.V., Watkins, L.R., and Maier, S.F., Glucocorticoids modulate CD200: a neural inhibitor of microglial activation., *Proc Soc. Neurosci.*, (2007).
- Hein, A.M., Stutzman, D.L., Bland, S.T., Barrientos, R.M., Watkins, L.R., Rudy, J.W., and Maier, S.F., Prostaglandins are necessary and sufficient to induce contextual learning impairments after interleukin-1 beta injections into the dorsal hippocampus, *Proc Soc. Neurosci.*, (2007).
- Hutchinson, M.R., Coats, B.D., Bland, S.T., Zhang, Y., Lewis, S.S., Sprunger, D.B., Baker, E.M., Hughes, T.S., Maier, S.F., Watkins, L.R., Rice, K.C. & Johnson, K.W., Improving the safety and efficacy of opioids by attenuating glial activation: clinical implications & the search for the novel glial activation site, *Proc Soc. Neurosci.*, (2007).
- Lewis, SS; Hutchinson MR; Shridhar, M; Maier, SF and Watkins, LR. Characterization of glial activation in chronic morphine-induced "paradoxical" allodynia. *Proc. Soc. Neurosci.*, (2007).
- Loram, L.C., Hutchinson, M.R., Coats, B.D., Zhang, Y., Lewis, S.S., Sprunger, D.B., Maier, S.F., Johnson, K.W., Rice, K.C. & Watkins, L.R., A molecular link between opioid-induced glial activation and neuropathic pain: a novel therapeutic target, *Proc Soc. Neurosci.*, (2007).
- Paul, E.D., Amat, J., Watkins, L.R., and Maier, S.F., Activation of the ventral medial prefrontal cortex during an initial uncontrollable stressor blocks the sequelae of later uncontrollable stress, *Proc. Soc. Neurosci.*, (2007).
- Rozeske, R.R., A. Der-Avakian, S.T. Bland, J.T. Beckley, L.R. Watkins, & S.F. Maier. The medial prefrontal cortex regulates the differential expression of morphine conditioned place preference following a single exposure to controllable or uncontrollable stress. *Proc Soc. Neurosci.*, (2007).
- Sloane, E.M., Ledebor, A., Coats, B., Foster, B., Meschter, C., Maier, S., Johnson, K., Van Dam, A.M., Leinwand, L., Chavez, R., Watkins, L., and Milligan, E., Treatment of Experimental Autoimmune Encephalomyelitis (EAE) with Anti-Inflammatory Cytokine Gene Therapy, *Proc. Soc. Neurosci.*, (2007).

- Sprunger, D, Wieseler, J, Sloane, E, Ellis, A, Mahoney, J, Maier, SF, Zhang, R, & Watkins, LR. Exaggerated pain associated with bone cancer and inflammatory mediators. *Proc Soc Neurosci.*, (2007).
- Watkins, L.R., Hutchinson, M.R., Zhang, Y., Coats, B.D., Sprunger, D.B., Hughes, T.S., Maier, S.F., Johnson, K.W., & Rice, K.C., Identification and characterization of a novel opioid site of action: implications for opioid-induced glial activation, *Proc Soc. Neurosci.*, (2007).
- Wieseler, J, Sprunger, D, Ellis, A, Mahoney, J, Maier, SF, Kori, S, Nelsen, A, & Watkins, LR. Meningeal inflammation induces exaggerated pain behavior in awake and freely moving rats. *Proc Soc Neurosci.*, (2007).
- Kavelaars, A, Kleibeuker, W., Eijkelkamp, N., Ledeboer, A., Watkins, L., Maier, S, Heijnen, C.J., Reduced GRK2 as an intracellular mechanism for neuronal sensitization in inflammatory pain, *PNIRS annual meeting 2007*.
- Hutchinson, M.R., Coats, B.D., Zhang, Y., Lewis, S.S., Sprunger, D.B., Baker, E.M., Maier, S.F., Watkins, L.R. & Johnson, K.W., Opioid induced glial activation via a non-classical opioid receptor: clinical implications & the search for the target, Symposium abstract for VIIIth European Meeting on Glial Cells in Health and Disease, September 2007.
- Baratta, M.V., Watkins, L.R., & Maier, S.F., Controllable stress compared to uncontrollable stress reduces subsequent fear conditioning and facilitates fear extinction, *Proc. Soc. Neurosci.* (2006).
- Barrientos, R.M., Watkins, L.R., Rudy, J.W. & Maier, S.F., Characterization of sickness behavior in aging rats following bacterial infection, *Proc. Soc. Neurosci.* (2006).
- Bilbo, S.D., Newsom, N.J., Mahoney, J.H., Sprunger, D.B., Watkins, L.R., Rudy, J.W., & Maier, S.F., Maternal care modulation of neonatal-infection facilitated cognitive impairment in adulthood, *International Congress of Neuroendocrinology Abstracts*, (2006).
- Bland, S.T., Evans, T., Zarza, C., Day, H.E., Watkins, L.R., Maier, S.F., Time and subfield dependent effects of controllable and uncontrollable stress on hippocampal FGF-2 mRNA, *Proc. Soc. Neurosci.* (2006).
- Busha, D.A., Langer, S., Coats, B., Hutchinson, M.R., Maier, S.F., Sapolsky, R.M., Leinwand, L., Watkins, L.R., Harrison, J.K., Studies of chronic fractalkine-induced allodynia & hyperalgesia in rats, *Proc. Soc. Neurosci.* (2006).
- Coats, B.D., Hutchinson, M.R., & Watkins, L.R., Opioid inactive (+)-naloxone potentiates morphine analgesia: Further evidence that opioid analgesia is opposed by opioid in-

- duced glial activation, Proc Soc. Neurosci., (2006).
- Lewis, S.S., Hutchinson, M.R., Coats, B.D., Brzeski, A.L., Maier, S.F., Watkins, L.R., Johnson, K.W., AV411, a blood brain barrier permeable glial activation inhibitor, reduces morphine withdrawal behaviors in rats, Proc Soc. Neurosci., (2006).
- Hughes, T.S., Langer, S.J., Sloane, E.M., Jekich, B., Maier, S.F., Johnson, K.W., Chavez, R.A., Milligan, E.D., Watkins, L.R., & Leinwand, L.A., Exploration of the role of ITRs in the efficacy of intrathecal gene therapy, Proc American Gene Therapy Society annual meeting, (2006).
- Hutchinson, M.R., Coats, B.D., Lewis, S.S., Maier, S.F., & Watkins, L.R., Spinal pro-inflammatory cytokines oppose acute opioid analgesia following intrathecal & subcutaneous opioid administration, Proc Soc. Neurosci., (2006).
- Rozeske, R.R., Der-Avakian. A., Bland, S.T., Tamblyn, J.P., Hutchinson, M.R., Watkins, L.R., and Maier, S.F., Behavioral control over a stressor determines potentiated conditioned place preference to oxycodone, but not cocaine or ethanol, Proc Soc. Neurosci., (2006).
- Young, S., Bland, S.T., Bilbo, S.D., Watkins, L.R., Maier, S.F., Effects of neonatal E. coli on microglial proliferation in the hippocampus, Proc Soc. Neurosci., (2006).
- Langer, S.J., Hughes, T., Busha, D., Maier, S.F., Milligan, E.D. Watkins, L.R. & Leinwand, L.A., In vivo over-expression of Fractalkine, a putative neuron-to-glia signal, to characterize underlying mechanisms of neuropathic pain, Proc American Gene Therapy Society annual meeting, (2006).
- Milligan, E.D., Soderquist, R. Watkins, L.R. & Mahoney, M.J., Microparticle delivery of IL-10 gene reverses neuropathic pain in rodents, Proc Biomedical Engineering Society annual meeting, (2006).
- Hutchinson, M.R., Coats, B.D., Lewis, S.S., Sprunger, D.B., Baker, E.M., Maier, S.F. & Watkins, L.R., Glial activation via a non-classical opioid receptor: search for the target, Proc Society for Neuroimmunopharmacology, 2007.
- Milligan, E.D., Langer, S.J., Hughes, T., Sloane, E.M., Mahoney, J., Jekich, B., Maier, S.F., Leinwand, L.A. & Watkins, L.R., Plasmid DNA encoding the anti-inflammatory cytokine gene, interleukin-10 (IL-10) for chronic pain control: taking advantage of nuclear scaffold/matrix attachment regions, Proc. Amer. Soc. Gene Therapy, 2006.
- Hughes, T., Langer, S.J., Sloane, E.M., Mahoney, J., Jekich, B., Johnson, K.W., Chavez, R.E., Milligan, E.D., Watkins, L.R. & Leinwand, L.A., ITRs necessary for IL-10 encoding naked plasmid induced reversal of chronic pain state in rat, Proc. Amer. Soc. Gene Therapy, 2006.

- Sloane, E., Langer, S., Milligan, E., Jekich, B., Mahoney, J., Huberty, G., Hughes, T., Coats, B., Sommer, J., Klinman, D., Poole, S., Maier, S., Johnson, K., Leinwand, L., Chavez, R. & Watkins, L.R., A Novel Anti-Inflammatory Cytokine Based Non-Viral Gene Therapy: Controlling Neuropathic Pain & Beyond, Proc. American Association of Immunology, 2006.
- Hutchinson, M.R., Skyba, D., Lewis, S., Mahoney, J., Watkins, L.R. & Johnson, K.W., Systemic AV411, a glial inhibitor, inhibits naloxone precipitated opioid withdrawal & morphine induced microglial activation, Presented at the Society for Neurosciences meeting, Washington, DC 2005
- Hutchinson, M.R., Milligan, E.D., Jekich, B., Coats, B., Lewis, S., Maier, S.F. & Watkins, L.R., Elevations of spinal proinflammatory cytokines are mediated via non-classical opioid mechanisms, 12th Society for Neuroimmune Pharmacology, 2006.
- Milligan, E.D., Mahoney, M.J., Soderquist, R., Sloane, E.M., Mahoney, J., Coats, B., Langer, S.J., Maier, S.F., Leinwand, L.A., Chavez, R.A. & Watkins, L.R., Polymer-based spinal cord gene transfer of plasmid DNA encoding the anti-inflammatory cytokine, interleukin-10 (IL-10) controls chronic neuropathic pain in rats, American Pain Society annual meeting, (2006).
- Busha, D., Murphy, C., Milligan, E.D., Mahoney, J., Coats, B., Langer, S.J., Leinwand, L.A., Chavez, R., Maier, S.F., Watkins, L.R., Spinal cord gene transfer using naked plasmid DNA coding the anti-inflammatory gene, interleukin-10 (IL10) leads to long-term reversal of thermal hyperalgesia in chronic constriction injury (CCI) rats, American Pain Society annual meeting, (2006).
- Milligan, E.D., Mahoney, M.J., Soderquist, R., Sloane, E.M., Mahoney, J., Coats, B., Langer, S.J., Maier, S.F., Leinwand, L.A., Chavez, R.A. & Watkins, L.R., Polymer-based spinal cord gene transfer of plasmid DNA encoding the anti-inflammatory cytokine, interleukin-10 (IL-10) controls chronic neuropathic pain in rats, American Pain Society annual meeting, (2006).
- Liu, T., Ledebor, A., Shumilla, J.A., Hutchinson, M.R., Skyba, D., Pater, C., Watkins, L.R. & Johnson, K.W., AV-411, a novel attenuator of neuropathic pain, Proceedings of the 8th International Conference on the Mechanisms and Treatment of Neuropathic Pain, San Francisco, CA, 2005.
- Chavez, R., Milligan, E.D., Sloane, E.M., Hughes, T., Langer, S.J., Mahoney, J., Jekich, B.M., Cruz, P., Maier, S.F., Johnson, K., Flotte, T., Leinwand, L.A. & Watkins, L.R., Controlling pathological pain by intrathecal (i.t.) delivery in rats of non-viral vectors encoding the anti-inflammatory cytokine gene, interleukin-10 (IL10). Proceedings of the 8th International Conference on the Mechanisms and Treatment of Neuropathic Pain, San Francisco, CA, 2005.
- Chavez, R., Sloane, E., Langer, S., Milligan, E., Jekich, B., Mahoney, J., Huberty, G.,

- Hughes, T., Coates, B., Klinman, D., Poole, S., Maier, S., Johnson, K., Leinwand, L., & Watkins, L.R., Resolution of neuropathic pain by intrathecal (IT) gene therapy to drive the production of interleukin-10 (IL10): initial investigations into underlying mechanisms, Proceedings of the 8th International Conference on the Mechanisms and Treatment of Neuropathic Pain, San Francisco, CA, 2005.
- Frank, M. G., Baratta, M. V., Watkins, L. R., & Maier, S. F. Uncontrollable stress potentiates hippocampal microglia responses to lipopolysaccharide *ex vivo*. Presented at Psychoneuroimmunology Research Society, Denver, 2005.
- Kleibeuker, W., Ledebuer, A., Zijlstra J., Maier, S. F., Watkins, L. R., Heijnen, C. J., & Kavelaars, A. IL-1 induced reduction in spinal cord GRK2 as an underlying mechanism for chronic , inflammatory hyperalgesia. Presented at Psychoneuroimmunology Research Society, Denver, 2005.
- Spataro, L. E., Wiesler-Frank, J., Milligan, E., Jekich, M., Sprunger, D. B., Maier, S. F., Fleshner, M., Johnson, J. D., & Watkins, L. R. Prior peripheral challenge may exacerbate later immune responses. Presented at Psychoneuroimmunology Research Society, Denver, 2005.
- Barrientos, R. M., Higgins, E. A., Biedenkapp, J. C., Frank, M. G., Watkins, L. R., Rudy, J. W., & Maier, S.F. Differences in IL-1 expression in brain and periphery between young and aging rats 2h to 2wk following an i.p. *E. coli* injection. Presented at Psychoneuroimmunology Research Society, Denver, 2005.
- Baratta, M.V., Watkins, L.R. & Maier, S.F., Stressor controllability differentially activates gabaergic cells in the ventral medial prefrontal cortex, Proc. Soc. Neurosci. (2005).
- Barrientos, R.M., Higgins, E.A., Biedenkapp, J.C., Frank, M.G., Sprunger, D.B., Watkins, L.R., Rudy, J.W., Maier, S.F., Exaggerated and prolonged pro-inflammatory cytokine response in hippocampus of aged, but not young rats following *E. coli* injection, Society for Neuroscience Abstracts, Washington, Proc. Soc. Neurosci. (2005).
- Bilbo, S.D., Biedenkapp, J.C., Watkins, L.R., Rudy, J.W., Maier, S.F., Neonatal infection-induced memory impairment following lipopolysaccharide in adulthood is prevented via caspase-1 inhibition, Proc. Soc. Neurosci. (2005).
- Bland, S.T., Schmid, M.J., Frank, M., Der-Avakian, A., Greenwood, B., Watkins, L.R., & Maier, S.F., Effects of escapable and inescapable tailshock on neurogenesis and fibroblast growth factor-2 in the rat hippocampus, Proc. Soc. Neurosci. (2005).
- Der-Avakian, A., Bland, S.T., Schmid, M.J., Watkins, L.R., & Maier, S.F., Initial stressor controllability determines the effects of later mild footshock on cocaine-induced locomotor activity, Proc. Soc. Neurosci. (2005).

- Frank, M.G., Baratta, M.V., Watkins, L.R., Maier, S.F., Uncontrollable stress potentiates hippocampal microglia responses to lipopolysaccharide ex vivo, Proc. Soc. Neurosci. (2005).
- Harder, N.M., Milligan, E.D., Banck, M.S., Wittenberg, B., Storek, B., Walsh, C.E., J.H. Morrison, J.H., Watkins, L.R., & Beutler, A.S., Intrathecal (IT) long-term gene expression by self-complementary AAV for the comparison of 3 analgesic genes in a rat model of neuropathic pain, Proc. Soc. Neurosci. (2005).
- He, L., Chavez, R.A., Vijay, S., Smith, P., Liu, T., Sommer, J., Pater, C., Milligan, E.D., Watkins, L.R., & Johnson, K.W., Intrathecal pharmacokinetics and neuropathic pain efficacy of IL-10 plasmid DNA in rats, Proc. Soc. Neurosci. (2005).
- Holguin, A., Frank, M.G., Biedenkapp, J.C., Lippert, D., Nelson, K., Watkins, L.R., Rudy, J.W., & Maier, S.F., The spatio-temporal responses of glia to a peripheral acute immune challenge in animals with chronic intracranial cannulae, Proc. Soc. Neurosci. (2005).
- Hutchinson, M.R., Milligan, E.D., Maier, S.F. & Watkins, L.R., Interleukin-1 receptor antagonist (IL1ra) "unmasks" analgesia following both R- & S-methadone: Evidence for induction of spinal proinflammatory cytokines (PICs) via non-classical opioid receptors, Proc. Soc. Neurosci. (2005).
- Jekich, B.M., Wieseler-Frank, J., Frank, M., Mahoney, J., Mahoney, M., Maier, S.F., Johnson, K., Chavez, R., Watkins, L.R. & Milligan, E.D., Intrathecal interleukin-10 (IL-10) gene therapy for neuropathic pain: immunohistochemical & real time PCR analyses of effects on spinal cord, meninges & dorsal root ganglia (DRG), Proc. Soc. Neurosci. (2005).
- Maier, S.F., Der-Avakian, A., Watkins, L.R., Bilbo, S.D., Cytokine and microglial cell marker gene expression in the hippocampus of neonate pups following peripheral *Escherichia coli* infection, Proc. Soc. Neurosci. (2005).
- Moineau, J.M., Barrientos, R.M., Higgins, E.A., Northcutt, A.L., Watkins, L.R., & Maier, S.F., ICV surgery and a peripheral immune challenge interact to effect hippocampal viability and neurodegeneration in aged and young rats, Proc. Soc. Neurosci. (2005).
- Spataro, L.E., Wieseler-Frank, J., Milligan, E.D., Jekich, B.M., Sprunger, D.B., Maier, S.F., & Watkins, L.R., Prior peripheral immune/traumatic challenge may exacerbate later immune & pain responses, Proc. Soc. Neurosci. (2005).
- Wieseler-Frank, J., Jekich, B.M., Frank, M.G., Kwiecien, O., Maier, S.F., & L. R. Watkins, L.R., An initial characterization of microglia rapidly isolated from the dorsal spinal cord of adult rats pretreated with intrathecal HIV-gp120, Proc. Soc. Neurosci. (2005).

- Hutchinson, M.R., Milligan, E.D., Maier, S.F. & Watkins, L.R., Interleukin-1 receptor antagonist (IL1ra) "unmasks" analgesia following both R- & S-methadone: evidence for induction of spinal proinflammatory cytokines (PICs) via non-classical opioid receptors, Front Range Neuroscience meeting, 2005.
- Hughes, T., Langer, S.J., Sloane, E.M., Jekich, B., Maier, S.F., Johnson, K.W., Chavez, R.E., Milligan, E.D. Watkins, L.R. & Leinwand, L.A., ITRs are necessary for IL-10 encoding naked plasmid induced reversal of chronic pain states in rat, American Gene Therapy Society annual meeting, 2005.
- Milligan, E.D., Mahoney, M.J., Langer, S.J., Tughes, T., Sloane, E.M., Mahoney, J., Jekich, B., Cruz, P.E., Flotte, T.R., Maier, S.F., Johnson, K.W., Leinwand, L.A., Chavez, R.A. & Watkins, L.R., Gene therapy for chronic pain control: microencapsulated plasmid DNA encoding the anti-inflammatory cytokine gene, interleukin-10 (IL-10), American Gene Therapy Society annual meeting, 2005.
- Milligan, E.D., Sloane, E.M., Hughes, T., Langer, S.J., Mahoney, J., Jekich, B.M., Cruz, P., Maier, S.F., Johnson, K., Flotte, T., Chavez, R., Leinwand, L.A. & Watkins, L.R., Controlling pathological pain by intrathecal (i.t.) delivery in rats of non-viral vectors encoding the anti-inflammatory cytokine gene, interleukin-10 (IL10). International Association for the Study of Pain World Congress, 2005.
- Sloane, E., Langer, S., Milligan, E., Jekich, B., Mahoney, J., Huberty, G., Hughes, T., Coates, B., Klinman, D., Poole, S., Maier, S., Johnson, K., Leinwand, L., Chavez, R., & Watkins, L.R., Resolution of neuropathic pain by intrathecal (IT) gene therapy to drive the production of interleukin-10 (IL10): initial investigations into underlying mechanisms, International Association for the Study of Pain World Congress, 2005.
- Ledeboer, A., Langer, S.J., Milligan, E.D., Mahoney, J.H., Sloane, E.M., Maier, S.F., Johnson, K., Leinwand, L.A., Chavez, R.A. & Watkins, L.R., Taxol-induced mechanical allodynia is inhibited by spinal delivery of nonviral vectors (NVV) encoding the anti-inflammatory cytokine interleukin-10 (IL10), International Association for the Study of Pain World Congress, 2005.
- Spataro, L.E., Wieseler-Frank, J., Bloss, E., Maier, S.F. & Watkins, L.R., Peripheral inflammation sensitizes dorsal spinal cord glia: enhanced glial responsiveness and pain facilitation, Proc. American Pain Society, 2005.
- Chacur, M. Gutierrez, J.M., Milligan, E.D., Wieseler-Frank, J., Maier, S.F., Watkins, L.R., Britto, L.R.G. & Cury, Y., Spinal glial cells, glutamate, neurokinins, cytokines and nitric oxide mediate pain facilitation induced by Lys49 and Asp49 myotoxic phospholipases A2, Proc. Soc. Neurosci. (2004).
- Baratta, M.V., Frank, M.G., Sprunger D.B., Watkins, L.R. & Maier, S.F. Brain regional changes in glial activation markers following exposure to uncontrollable stress, Proc.

Soc. Neurosci. (2004).

- Barrientos, R.M., Biedenkapp, J.C., Sprunger, D.B., K.J. Wright-Hardesty, K.J., Higgins, E.A., Frank, M.G., Watkins, L.R., Rudy, J.W., & Maier, S.F., Anterograde effects of *e. coli* on hippocampal-dependent memory in aged rats, Proc. Soc. Neurosci. (2004).
- Biedenkapp, J.C., Wright-Hardesty, K. F., Watkins, L.R., Maier, S.F. and Rudy, J.W. Peripheral Injection of the Live Bacteria *E.coli* Interferes with the Maintenance of a Contextual-Fear Memory Proc. Soc. Neurosci. (2004).
- Bilbo, S.D., Mahoney, J.H., Rudy, J.W., Watkins, L.R., & Maier, S.F., Neonatal infection alters hippocampal glia and induces memory impairments and cytokine alterations following an immune challenge in adulthood, Proc. Soc. Neurosci. (2004).
- Bland, S.T., Schmid, M.J., Der-Avakian, A., Watkins, L.R., & Maier, S.F., Serotonin in the medial prefrontal cortex is required for uncontrollable stress sensitization of morphine-induced nucleus accumbens dopamine efflux, Proc. Soc. Neurosci. (2004).
- Der-Avakian, A., Bland, S.T., Schmid, M.J., Spencer, R.L., Watkins, L.R., & Maier, S.F., The role of corticosterone in the potentiated mesolimbic dopamine and conditioned place preference responses to morphine following uncontrollable stress, Proc. Soc. Neurosci. (2004).
- Frank, M.G., M.V. Baratta, M.V., J.C. Biedenkapp, J.C., Watkins, L.R. & S.F. Maier, S.F., Inescapable shock induces glial activation in hypothalamus and hippocampus, Proc. Soc. Neurosci. (2004).
- Holguin, A., Biedenkapp, J., Sprunger, D., Nelson, K., Wright, K., Watkins, L.R., Rudy, J.W., & Maier, S.F., LPS-induced an exaggerated Interleukin-1 response several weeks after intracranial surgery, Proc. Soc. Neurosci. (2004).
- Ledeboer A., Lai W., Gamanos M., Maier, S.F., Quan, N., Watkins, L.R., Role of spinal cord nuclear factor κ b activation in rat models of pain facilitation, Proc. Soc. Neurosci. (2004).
- Milligan, E.D., Langer, S.J., Sloane, E.M., Mahoney, J., Levkoff, L., Wieseler-Frank, J., Frank, M.G., Cruz, P., Flotte, T.R., Maier, S.F., Forseyeth, J.R., Johnson, K. Leinwand, L., Chavez, R.A., Watkins, L.R., Chronic constriction injury allodynia is controlled long-term by spinal delivery of non-viral vectors encoding the anti-inflammatory gene, interleukin-10 (IL10) , Proc. Soc. Neurosci. (2004).
- Nickerson, M., Wieseler-Frank, J., Watkins, L.R., Fleshner, M., A potential role for adrenergic receptors in the modulation of glial Hsp72, Proc. Soc. Neurosci. (2004).

- Schmid, M.J., Bland, S.T., Girotti, M., Der-Avakian, A., Watkins, L.R., Maier, S.F., Spencer, R.L., Sex comparison of plasma corticosterone and c-fos mRNA expression in the medial prefrontal cortex after uncontrollable stress in rats, Proc. Soc. Neurosci. (2004).
- Sloane, E.M., Langer, S.J., Milligan, E.D., Mahoney, J., Jeckich, B., Levkoff, L., Wieseler-Frank, J., Hughes, T., Cruz, P., Flotte, T.R., Maier, S.F., Forsyeth, J.R., Johnson, K., Leinwand, L., Chavez, R.A., & Watkins, L.R., Non-Viral Vectors (NVV) encoding the anti-inflammatory cytokine Interleukin-10 (IL10) control Chronic Constriction Injury (CCI) allodynia long term following a variable two injection schedule, Proc. Soc. Neurosci. (2004).
- Spataro, L.E., Walsh, M.G., Levkoff, L.H., Wieseler Frank, J.L., Frank, M., Eisenach J., Maier, S.F., & Watkins, L.R., Laparotomy sensitizes dorsal spinal cord glia: enhanced glial response to later challenge, Proc. Soc. Neurosci. (2004).
- Tamblyn, J., Bland, S.T., Barrientos, R.M., Severson, B., Campeau, S., Watkins, L.R. & Maier, S.F., Effect of stressor controllability on BDNF mRNA expression in hippocampus & medial prefrontal cortex, Proc. Soc. Neurosci. (2004).
- Wieseler-Frank, J., Kwiecien, O., Jekich, B., Maier, S.F., & Watkins, L.R., Putative neuron-to-glia signals synergize to enhance interleukin-1 production by rat dorsal spinal cord glial cells *in vitro*, Proc. Soc. Neurosci. (2004).
- Steiner, A.A., Dogan, M.D., Ivanov, A.I., Patel, S.h Rudaya, A.Y., Pace, T.W., Spencer, R.L., Jennings, D.H., Orchinik, M., O'Connor, K.A., Watkins, L.R. & Romanovsky, A.A., A new function of the leptin receptor: mediation of the recovery from lipopolysaccharide hypothermia, Physiology & Pharmacology of Temperature Regulation (2004)
- Milligan, E.D., Langer, S.J., Sloane, E.M., Wieseler-Frank, J., Frank, M., Levkoff, L., Mahoney, J., Chavez, R., Forsayeth, J., Cruz, P., Flotte, T.R., Leinwand, L.A., Maier, S.F., Watkins, L.R., Gene therapy using naked plasmid DNA coding the anti-inflammatory gene, interleukin-10 (IL10): repeated injections lead to long-term pain control in chronic constriction injury (CCI) rats, Proc Amer Pain Society, 2004.
- Sloane, E.M., Langer, S.J., Milligan, E.D., Wieseler-Frank, J., Mahoney, J., Levkoff, L., Cruz, P., Flotte, T.R., Leinwand, L., Maier, S.F., & Watkins, L.R., Chronic constriction injury induced pathological pain states are controlled long term via intrathecal administration of a non-viral vector (NVV) encoding the anti-inflammatory cytokine interleukin-10 (IL-10), Proc Amer Pain Society, 2004.
- Chacur, M., Guitierrez, S.M., Milligan, E.D., Sloane, E., Wieseler-Frank, J., Maier, S.F. and Watkins, L.R., Central mediators and glial cells involved in the algogenic effect of Lys49 and Asp49 myotoxic phospholipases A2 isolated from Bothrops asper snake

venom, 4th Congress of the European Federation of the International Association for the Study of Pain, 2003.

Spataro, L.E., Sloane, E., Milligan, E.D., Jekich, B.M., Wiesler Frank, J.L., Maier, S.F. & Watkins, L.R., Gap junctions mediate pathological pain produced by sciatic inflammatory neuropathy (SIN), chronic constrictive injury (CCI), & intrathecal HIV-1 gp120, *Proc Soc Neurosci* 29 (2003).

Baratta, M.V., Amat, J., Bland, S.T., Watkins, L.R. & Maier, S.F., The role of the medial prefrontal cortex in the activation of dorsal raphe nucleus serotonergic neurons produced by uncontrollable stress, *Proc Soc Neurosci* 29 (2003).

Der-Avakian, A., Bland, S.T., O'Connor, K.A., Watkins, L.R., Maier, S.F., Corticosterone response to morphine, but not to uncontrollable stress, is necessary for uncontrollable stress enhancement of morphine reward, *Proc Soc Neurosci* 29 (2003).

Amat, J. Paul, E. Amat, P. Pepin, J. Bland, S. Watkins, L. and Maier, S., Effect of Microinjection of Urocortin II Into the Dorsal Raphe Nucleus on Serotonin Release in the Basolateral Amygdala, *Proc. Soc. Neurosci.* 29 (2003).

Bland, S.T., Twining, C., Der-Avakian, A., Watkins, L.R., & Maier, S.F., Stressor controllability modulates morphine-induced dopamine but not serotonin release in the nucleus accumbens by a mechanism involving the dorsal raphe nucleus, *Proc Soc Neurosci* 29 (2003).

Zapata, V., Milligan, E.D., Maskimova, E., Maier, S.F. & Watkins, L.R., Role of nitric oxide in fractalkine-induced mechanical allodynia, *Proc Soc Neurosci* 29 (2003).

Wieseler-Frank, J.L., Maskimova, E., Milligan, E.D., Campisi, J., Fleshner, M., Maier, S.F. & Watkins, L.R., Modulation of dorsal spinal cord glial function by the chronic pain mediator, fractalkine, *Proc Soc Neurosci* 29 (2003).

Johnston, I.N., Milligan, E.D., Martin, D., Maier, S.F. & Watkins, L.R., Spinal proinflammatory cytokines modulate morphine analgesia and subsequent tolerance, hyperalgesia & allodynia, *Proc Soc Neurosci* 29 (2003).

Milligan, E.D., Langer, S.J., Sloane, E.M., Chacur, M., Wieseler-Frank, J., Frank, M.G., Flotte, T.R., Cruz, P., Leinwand, L., Maier, S.F. & Watkins, L.R., Inflammatory and chronic constriction injury-induced pain states are controlled by spinal delivery of viral and non-viral vectors encoding the anti-inflammatory gene, interleukin-10 (IL10), *Proc Soc Neurosci* 29 (2003).

Ledeboer, A., Sloane, E., Chacur, M., Milligan, E.D., Maier, S.F. & Watkins, L.R., Selective inhibition of spinal cord microglial activation attenuates mechanical allodynia in rat models of pathological pain, *Proc Soc Neurosci* 29 (2003).

- Day, H.E., Greenwood, B.N. Hammack, S.E., Fleshner, M., Watkins, L.R., Maier, S.F. & Campeau, S., Differential expression of 5HT-1A, 1B adrenergic, CRH-R1 and CRH-R2 receptor mRNA in serotonergic, gabaergic and catecholaminergic cells of the rat dorsal raphe nucleus, *Proc Soc Neurosci* 29 (2003).
- Johnston, I.N., Milligan, E.D., Martin, D., Maier, S.F., Watkins, L.R., Pro-inflammatory cytokines in morphine analgesia: Effect of intrathecal IL-1 receptor antagonists and IL-10 gene therapy on analgesia, analgesic tolerance, hyperalgesia and allodynia from morphine, *International Narcotics Research Conference* (2003).
- Chacur, M., Gutierrez, J.M., Cury, Y., Millgan, E.D., Maier, S.F., & Watkins, L.R., Snake venom toxins (isolated active components ASP49-PLA2 & LYS49-PLA2), differentially produce thermal hyperalgesia and mechanical allodynia in rats, *Amer. Pain Society Abs* (2002).
- Johnston, I.N., Chacur, M., O'Dell, K., Martin, D., Milligan, E.D., Maier, S.F. & Watkins, L.R., Role of interleukin-1 in morphine analgesia and morphine tolerance, *Amer. Pain Society Abs* (2002).
- Milligan, E.D., Langer, S.J., Chacur, M., Slaon, E., O'Connor, E.A., Leinwand, L., Maier, S.F., & Watkins, L.R., Inflammatory- and chronic constriction injury-induced pathological pain states are controlled by spinal delivery of adenoviral and adeno-associated viral vectors encoding the anti-inflammatory gene, interleukin-10 (IL10), *Amer. Pain Society Abs* (2002).
- Spataro, L.E., Sloane, E., Milligan, E.D., Maier, S.F., Watkins, L.R., Gap junctions mediate neuropathic pain produced by inflammatory neuropathy (SIN) and chronic constriction injury (CCI), *Amer. Pain Society Abs* (2002) .
- Barrientos, R.M., Sprunger, D.B., Campeau, S., Watkins, L.R., Rudy, J.W., Maier, S.F., The role of IL-1 beta and BDNF in the hippocampal-dependent memory impairments produced by social isolation, *Proc Soc Neurosci* 28 (2002).
- Der-Avakian, A., Twining, C., Taylor, B.A., Watkins, L.R., Maier, S.F., Stress-Paired Cue Reinstates a Morphine Conditioned Place Preference, *Proc Soc Neurosci* 28 (2002) .
- Bland, S.T., Sloane, E., Hargrave, D., Pepin, J., Watkins, L.R. & Maier, S.F. Stressor controllability affects morphine induced dopamine and serotonin release in the medial prefrontal cortex, *Proc Soc Neurosci* 28 (2002).
- Johnson, I.N., Milligan, E.D., Soane, E., Maier, S.F. & Watkins, L.R., Spinal neurochemistry of sciatic inflammatory neuritis (SIN), *Proc Soc Neurosci* 28 (2002).

- Bove, G.M., Houghton, L., Watkins, L.R., Milligan, E.D., & Lin, H.-C., Further characterization of sciatic neuritis: increased nav1.8 protein, immune cell recruitment and sodium and potassium channel immunohistochemistry, Proc Soc Neurosci 28 (2002).
- Milligan, E.D., O'Connor, K.A., Hammack, S.E., Langer, S.J., Leinwand, L.A., Wieseler Frank, J.L., Maier, S.F., Watkins, L.R., Gene therapy treatment in rats for controlling various pathological pain states: intrathecal (i.t.) viral vectors encoding the anti-inflammatory cytokine, interleukin-10 (IL10), Proc Soc Neurosci 28 (2002).
- Schoeniger, D., Twining, C., Milligan, E., Martin, D., Pattey, C., Maier, S., Watkins, L.R., Peri-sciatic proinflammatory cytokines mediate allodynia produced by sciatic inflammatory neuropathy (SIN), Proc Soc Neurosci 28 (2002).
- Wieseler-Frank, J.L., O'Connor, K.A., Gazda, L.S., Fleshner, M., Watkins, L.R. & Maier, S.F., Adrenal mediators potentiate innate immunity following acute stress, Proc Soc Neurosci 28 (2002).
- Hammack, S.E., MesMarteau, J.S., Watkins, L.R. & Maier, S.F., Low, but not high, doses of corticotropin releasing hormone block the behavioral effects caused by urocortin II administered into the dorsal raphe nucleus and those caused by uncontrollable shock, Proc Soc Neurosci 28 (2002).
- Verge, G., Milligan, E.D., Twining, C., Maier, S.F., Watkins, L.R., Foster, A.C. & Naeve, G.S., Mapping fractalkine and its receptor (CX3CR1) in a rat model of sciatic inflammatory neuropathy (SIN), Proc Soc Neurosci 28 (2002).
- Watkins, L.R. Glial activation as a mediator of pathological pain: implications for clinical pain control, Proc. of the World Congress of the International Association for the Study of Pain, Pain, Suppl. (2002).
- Milligan, E.D., O'Connor, K.A., Hammack, S.E., Wiesler-Frank, J.L., Langer, S.J., Leinwand, L.A., Maier, S.F. & Watkins, L.R. A novel gene therapy approach for controlling pathological pain states: intrathecal (i.t.) delivery in rats of viral vectors encoding the anti-inflammatory cytokine, interleukin-10, Proc. of the World Congress of the International Association for the Study of Pain, Pain, Suppl. (2002).
- Verge, G.A., Milligan, E.D., Twining, C., Maier, S.F., Watkins, L.R. & Naeve, G.S., Mapping fractalkine and its receptor (CX3CR1) in a rat model of inflammatory neuropathy, Proc. of the World Congress of the International Association for the Study of Pain, Pain, Suppl. (2002).
- Watkins, L.R., Milligan, E.D., Twining, C.M., Chapman, G.A., O'Connor, K.A. & Maier, S.F., Fractalkine in the spinal cord plays a key role in exaggerated pain states, Proc. of the World Congress of the International Association for the Study of Pain, Pain, Suppl. (2002)..

- Wieseler-Frank, J.L., Cheepsunthorn, P. Milligan, E.D., O'Connor, K.A., Maier, S.F. & Watkins, L.R., Characterization of adult rat microglia and astrocyte response properties: toward an understanding of how glia produce pathological pain, Proc. of the World Congress of the International Association for the Study of Pain, Pain, Suppl. (2002).
- Barrientos, R. M., Higgins, E. A., Sprunger, D. B., Watkins, L. R., Rudy, J. R., & Maier, S. F. Interleukin-1b impairs hippocampal-dependent memory formation. Presented at meetings of the Psychoneuroimmunology Research Society, Madison WI, 2002. Abstract in *Brain, Behavior, and immunity*, 16, p. 169.
- Johnson, J. D., O'Connor, K. A., Biedekapp, J. C., Watkins, L. R., & Maier, S. F. Prior administration of central IL-1b sensitize the cytokine and HPA response. Presented at meetings of the Psychoneuroimmunology Research Society, Madison WI, 2002. Abstract in *Brain, Behavior, and immunity*, 16, p. 193.
- O'Connor, K. A., Hansen, M. K., Brooks, L. M., Johnson, J. D., Biedekapp, J. C., Watkins, L. R., & Maier, S. F. Effects of inescapable shock on central and peripheral cytokine mRNA. Presented at meetings of the Psychoneuroimmunology Research Society, Madison WI, 2002. Abstract in *Brain, Behavior, and immunity*, 16, p. 203.
- Milligan, E.D., Twining, C.M., Chapman, G.A., O'Connor, K.A., Maier, S.F. & Watkins, L.R., Spinal cord fractalkine, a chemokine, is involved in exaggerated pain states, Presented at meetings of the Psychoneuroimmunology Research Society, Madison WI, 2002. Abstract in *Brain, Behavior, and immunity*, 16, p. 201.
- Holguin, A., O'Connor, K.A., Hansen, M.K., Milligan, E.D., Cheepsunthorn, P., Bravmann, C., Cochran, K., Biedenkapp, J., Martin, D., Maier, S.F., Watkins, L.R. HIV-1 gp120-induced spinal proinflammatory cytokine production and low threshold mechanical allodynia are mediated by nitric oxide, Presented at meetings of the Psychoneuroimmunology Research Society, Madison WI, 2002. Abstract in *Brain, Behavior, and immunity*, 16, p. 191
- Milligan, E.D., Verge, G., Twining, C., Chapman, G., Maier, S.F., Naeve, G. & Watkins, LR, The potential role of fractalkine, a neural chemokine, in creating spinally mediated exaggerated pain states, Journal of Pain Supplement 2 (2002).
- Holguin, A., O'Connor, K.A., Hansen, M.K., Milligan, E.D., Cheepsunthorn, P., Bravmann, C., Cochran, K., Biedenkapp, J., Martin, D., Maier, S.F. & Watkins, L.R., Nitric oxide mediates HIV-1 gp120-induced spinal proinflammatory cytokine production and low threshold mechanical allodynia, Journal of Pain Supplement 2 (2002).
- Sparks, P.D., Griggs, J.B., Bland, S.T., Watkins, L.R., & Maier, S.F., Monoamine levels in the medial prefrontal cortex (mPFC) are elevated to a greater extent during exposure to controllable, as compared to uncontrollable, tailshock. *Proc. Soc. Neurosci.*, 27(2001).

- Der-Avakian, A., Durkan, B.T., Watkins, L.R., & Maier, S.F. Stress-induced reinstatement of a morphine conditioned place preference, Proc. Soc. Neurosci., 27(2001).
- O'Connor, K.A., Johnson, J.D., Biedenkapp, J.C., Brooks, L.M., Spencer, R.L., Watkins, L.R., & Maier, S.F. Inescapable shock induces resistance to the effects of dexamethasone, Proc. Soc. Neurosci., 27(2001).
- Johnson, J.D., O'Connor, K.A., Biedenkapp, J.C., Watkins, L.R., & Maier, S.F. Prior stressor exposure can sensitize or inhibit LPS-induced cytokine production depending on route of administration, Proc. Soc. Neurosci., 27(2001).
- Twining, C.M., Milligan, E.D., Chapman¹, G.A., O'Connor, K.A., Maier, S.F., & Watkins, L.R.
Spinal fractalkine induces allodynia and hyperalgesia, Proc. Soc. Neurosci., 27(2001).
- Milligan, E.D., O'Connor, K.A., Twining, C.M., Barrientos, D., Martin¹, Maier, S.F., & Watkins, L.R. Spinal Nmda and Ca²⁺ permeable channels are partially involved with HIV-1 gp120-induced exaggerated pain states, Proc. Soc. Neurosci., 27(2001).
- Schoeniger, D., O'Connor, K., Milligan, E.D., Poole¹, S., Barrientos, R., Martin, D., Maier, S.F., & Watkins, L.R. Spinal interleukin-6 as a potential mediator of HIV-1 Gp120-induced exaggerated pain states, Proc. Soc. Neurosci., 27(2001).
- Holguin*, A., O'Connor, K.A., Bravmann, C., Cochran, K., Biedenkapp, J., Martin, D., Maier, S.F., & Watkins, L.R. Inhibition of nitric oxide blocks HIV-1 gp120-induced spinal proinflammatory cytokine production and low threshold mechanical allodynia, Proc. Soc. Neurosci., 27(2001).
- Hammack*, S.E., Richey, K.J., Watkins, L.R., & Maier, S.F. Corticotropin releasing hormone in the dorsal raphe nucleus is necessary and sufficient for the development of learned helplessness, Proc. Soc. Neurosci., 27(2001).
- Maier, S.F., Hammack, S.E., Pelleymounter, M.A., Richey, K.J., Schmid, M.J., & Watkins, L.R. Corticotropin releasing hormone type 2 receptors in the dorsal raphe nucleus are necessary for the development of learned helplessness, Proc. Soc. Neurosci., 27(2001).
- Barrientos, R.M., Higgins, E., Sprunger, D., Watkins, L.R., Rudy, J.W., & Maier, S.F. Interleukin-1 beta impairs hippocampal dependent memory consolidation for contextual fear, Proc. Soc. Neurosci., 27(2001).
- Barrientos, R.M., Sprunger, D., Higgins, E., Watkins, L.R., Maier, S.F., & Rudy, J.W. IL-1beta impairs memory consolidation supported by the dorsal hippocampus, Proc. Soc. Neurosci., 27(2001).

- Milligan, E.D., O'Connor, K.A., Twining, C.M., Hansen, M.K., Tracey, K.J., Wang, H., Maier, S.F., & Watkins, L.R. (2001). Proinflammatory cytokines and HIV-1 gp120-induced pain. Proc. of the Psychoneuroimmunology Research Society.
- O'Connor, K.A., Johnson, J.D., Watkins, L.R., & Maier, S.F. (2001). Inescapable shock impairs dexamethasone-induced suppression of the endocrine and cytokine response to lipopolysaccharide. Proc. of the Psychoneuroimmunology Research Society.
- Watkins, L.R., Milligan, E.D., Gazda, L., Hansen, M.K., Twining, C.M., Chacur, M., Armstrong, C.B., Martin², D., Myers³, R.R., & Maier, S.F. (2001). Exaggerated pain (allodynia) induced by sciatic inflammatory neuritis (SIN): Characterization of potential peripheral and central mediators. Proc. of the Psychoneuroimmunology Research Society.
- Hansen, M.K., Campisi, J., Johnson, J.D., O'Connor, K.A., Fleshner, M., Watkins, L.R., & Maier, S.F. Effects of live E. coli and air-pouch lipopolysaccharide on fever, activity, and cytokine levels in the circulation and brain, Proc. Soc. Neurosci., 27(2001).
- Milligan, E.D., O'Connor, K.A., Twining, C., Hansen, M.K., Maier, S.F., & Watkins, L.R., Proinflammatory cytokine and pain, Journal of Pain, Vol. 2 Supp. 1 (2001) 22.
- Watkins, L.R., Milligan, E.D., Twining, C., Chacur, M., Gazda, L., Armstrong, C.B., Hansen, M.K., Martin, D., Myers, R.R. & Maier, S.F., Unilateral and bilateral allodynia induced by sciatic inflammatory neuritis (SIN): characterization of potential peripheral and central mediators, Journal of Pain, Vol. 2 Supp. 1 (2001) 22.
- Gazda, L.S., Fleshner, M., Smith, T.P., Watkins, L.R., & Maier, S.F. Stress suppresses the adaptive immune response. Presented at meetings of the Psychoneuroimmunology Research Society, Wilmington, NC, 2000.
- Johnson, J.D., O'Connor, K.A., Deak, T., Watkins, L.R., & Maier, S.F. Prior stressor exposure primes immune response to lipopolysaccharide. Presented at meetings of the Psychoneuroimmunology Research Society, Wilmington, NC, 2000.
- Moraska, A., Maier, S., Watkins, L., & Fleshner, M. A priming effect of stress on the IL-1b response to bacterial lipopolysaccharide in Sprague-Dawley rats. Presented at meetings of the Psychoneuroimmunology Research Society, Wilmington, NC, 2000.
- O'Connor, K.A., Johnson, J.D., Stark, M., Watkins, L.R., & Maier, S.F. Inescapable shock increases central and peripheral interleukin-1 beta. Presented at meetings of the Psychoneuroimmunology Research Society, Wilmington, NC, 2000.
- Pugh, C. R., Johnson, J.D., Martin, D., Maier, S.F., Rudy, J.W., & Watkins, L.R. gp120 impairs contextual fear conditioning: A potential role in AIDS related dementia complex.

Presented at meetings of the Psychoneuroimmunology Research Society, Wilmington, NC, 2000.

Milligan, E.D., O'Connor, K.A., Borovikova, L., Tracey, K.J., Martin, D., Maier, S.F. & Watkins, L.R., Systemic administration of CNI-1493, a cytokine synthesis and release inhibitor, blocks per-spinal gp120-induced enhanced pain: a possible novel therapeutic approach to pain treatment, *Proc. American Pain Soc.* (2000).

Chacur, M., Armstrong, C.B., Milligan, E.D., Myers, R.R., Gazda, L., Martin, D., Tracey, K.J., Maier, S.F. & Watkins, L.R., Sciatic inflammatory neuritis (SIN) produces exaggerated pain that may involve spinal cord glial activation, *Proc. American Pain Soc.* (2000).

Holguin, A., Armstrong, C.B., Twinning, C. Milligan, E.D., McGorry, M., O'Connor, K., Quan, N., Martin, D., Lappi, D.A., Maier, S.F. & Watkins, L.R., Gp-120 induced allodynia by glial activation after intrathecal lumbar administration, *Proc. American Pain Soc.* (2000).

Chacur, M., Armstrong, C.B., Milligan, E.D., Myers, R.R., Gazda, L., Martin, D., Tracey, K.J., Maier, S.F. & Watkins, L.R., Exaggerated pain from sciatic inflammatory neuritis (SIN) is mediated by spinal cord glial activation, *Proc. Soc. Neurosci.*, 26 (2000).

Deak, T., Johnson, J.D., O'Connor, K.A., Spencer, R.L., Watkins, L.R. & Maier, S.F., The role of glucocorticoid negative feedback in stress-induced increases in basal corticosterone, *Proc. Soc. Neurosci.*, 26 (2000).

Der-Avakian, A., Will, M.J., Pepin, J.L., Durkan, B.T., Watkins, L.R. & Maier, S.F., Effects of uncontrollable stress on morphine-induced psychomotor activity, *Proc. Soc. Neurosci.*, 26 (2000).

Gazda, L.S., Fleshner, M., Smith, T.P., Watkins, L.R. & Maier, S.F., Stress suppresses the adaptive immune response, *Proc. Soc. Neurosci.*, 26 (2000).

Gaykema, R.P.A., Wright, B., Goehler, L.E., Maier, S.F., Watkins, L.R., Rodriguez, J.L. & Lyte, M., Subclinical bacterial infection activates central neural populations in mice, *Proc. Soc. Neurosci.*, 26 (2000).

Goehler, L.E., Gaykema, R.P.A., Maier, S.F. & Watkins, L.R., Vagal afferents innervate deep cervical and ileac lymph nodes in the rat, *Proc. Soc. Neurosci.*, 26 (2000).

Hansen, M.K., Pugh, C.R., Johnson, J.D., Wang, H., Tracey, K.J., Maier, S.F. & Watkins, L.R., Characterization of high mobility group-1 (HMG-1) as an endogenous pyrogen, *Proc. Soc. Neurosci.*, 26 (2000).

- Holguin, A., Armstrong, C.B., Twining, C.M., Milligan, E.D., Hansen, M.K., McGorry, M., O'Connor, K.A., Quan, N., Martin, D., Lappi, D.A., Maier, S.F. & Watkins, L.R., Anatomical evidence for glial activation after intrathecal lumbosacral HIV-1 glycoprotein, gp120-induced allodynia, Proc. Soc. Neurosci., 26 (2000).
- Johnson, J.D., O'Connor, K.A., Deak, T., Stark, M., Watkins, L.R. & Maier, S.F., Prior stressor exposure primes LPS-induced cytokine production, Proc. Soc. Neurosci., 26 (2000).
- McGorry, M.M., Hansen, M.K., O'Connor, K.A., Maier, S.F. & Watkins, L.R., Effects of intraperitoneal lipopolysaccharide on interleukin-1b, tumor necrosis factor-a, and high mobility group-1 mRNA, Proc. Soc. Neurosci., 26 (2000).
- Milligan, E.D., O'Connor, K.A., Borovikova, L., Tracey, K.J., Martin, D., Maier, S.F. & Watkins, L.R., Inhibition of cytokine release by intraperitoneal CNI-1493 blocks peri-spinal gp120-induced enhanced pain, Proc. Soc. Neurosci., 26 (2000).
- O'Connor, K.A., Johnson, J.D., Deak, T., Watkins, L.R. & Maier, S.F., Induction of interleukin-1b by inescapable shock depends on shock intensity, Proc. Soc. Neurosci., 26 (2000).
- Sparks, P.D., Amat, J., Matus-Amat, P., Hammack, S.E., Griggs, J.B., Hinde, J.L., Watkins, L.R. & Maier, S.F., Bupivacaine injections into medial prefrontal cortex (mPFC) in the rat disinhibit the release of serotonin (5-HT) in the dorsal raphe nucleus (DRN) in response to controllable tailshock, Proc. Soc. Neurosci., 26 (2000).
- Milligan, E.D., O'Connor, K.A., Hansen, M.K., Nguyen, K.T., Martin, D., Tracey, K.J., Maier, S.F. & Watkins, L.R. Hyperalgesia and allodynia produced by the HIV-1 glycoprotein gp120: involvement of glial activation in spinal cord, presentation at the Psychoneuroimmunology Research Society meeting, 2000.
- Chacur, M., Milligan, E.D., Myers, R.R., Gazda, L., Martin, D., Tracey, K.J., Maier, S.F. & Watkins, L.R., Spinal cord glial activation mediates exaggerated pain from sciatic inflammatory neuritis (SIN), presentation at the Psychoneuroimmunology Research Society meeting, 2000.
- Milligan, E.D., O'Connor, K., Hansen, M.K., Nguyen, K.T., Martin, D., Tracey, K.J., Maier, S.F. & Watkins, L.R., Hyperalgesia and allodynia are produced by the HIV-1 glycoprotein, gp120, via spinal glial activation, Proc. European Soc. Neurosci., (2000).
- Gaykema, R.P.A., Goehler, L.E., Hansen, M.K., Maier, S.F. & Watkins, L.R., Subdiaphragmatic vagotomy blocks interleukin-1beta induced fever without affecting increased circulating levels of this cytokine, FASEB Proc., (2000).

- Hansen, M.K., Daniels, S., Goehler, L.E., Gaykema, R.P.A., Maier S.F. & Watkins, L.R., Subdiaphragmatic vagotomy does not block intraperitoneal LPS-induced fever, FASEB Proc., (2000).
- Hansen, M.K., Nguyen, K.T., Goehler, L.E., Gaykema, R.P.A., Fleshner, M., Maier, S.F. & Watkins, L.R., Effects of vagotomy on LPS-induced brain interleukin-1beta protein in rats, FASEB Proc., (2000).
- Amat, J., Sparks, P.D., Matus-Amat, P., Grahn, R.E., Watkins, L.R. & Maier, S.F., Habenula lesions reduce the elevation of monoamines in the dorsal raphe nucleus produced by inescapable tailshock, Soc. Neurosci. Abs., 26 (1999).
- Sparks, P.D., Will, M., Fifkova, E., Watkins, L.R. & Maier, S.F., Exposure to an uncontrollable stressor differentially potentiates the release of dopamine in the accumbens in response to morphine, Soc. Neurosci. Abs., 26 (1999).
- Gazda, L.S., Francis, K.E., Fleshner, M., Watkins, L.R. & Maier, S.F., Inescapable tail shock induces changes in innate immunity, Soc. Neurosci. Abs., 26 (1999).
- Gaykema, R.P.A., Goehler, L.E., Hansen, M.K., Kleiner, J., Maier, S.F. & Watkins, L.R., Subdiaphragmatic vagotomy blocks interleukin-1-induced fever even in the presence of circulating interleukin-1, Soc. Neurosci. Abs., 26 (1999).
- Goehler, L.E., Gaykema, R.P.A., Kleiner, J., Hinde, J.L., Hansen, M.K., Maier, S.F. and Watkins, L.R., Intraperitoneal staphylococcus enterotoxin B (SEB) causes fever and serum corticosterone elevation in rats, Soc. Neurosci. Abs., 26 (1999).
- Khorsand, J.L., Goehler, L.E., Gaykema, R.P.A., Spencer, R.L., Tilders, F.J.H., Maier, S.F. & Watkins, L.R., Intraperitoneal staphylococcus enterotoxin B (SEB) induces interleukin-1 in immune cells within the abdominal vagus nerve in rats, Soc. Neurosci. Abs., 26 (1999).
- Hansen, M.K., Nguyen, K.T., Fleshner, M., Goehler, L.E., Gaykema, R.P.A., Maier, S.F. & Watkins, L.R., Interleukin-1beta protein and IL-1beta, IL-1 receptor type I and IL-1 receptor accessory protein mRNA are present in normal brain and are modulated by LPS, Soc. Neurosci. Abs., 26 (1999).
- Nguyen, K.T., Deak, T., Hansen, M.K., Fleshner, M., Martin, D., Watkins L.R. & Maier, S.F., Stress-induced increases in circulating interleukin-6 is attenuated by peripheral interleukin-1 receptor antagonist, Soc. Neurosci. Abs., 26 (1999).
- Hammack, S.E., Milligan, E.D., Gazda, L., Martin, D., Maier, S.F. & Watkins, L.R., Spinal interleukin-1 receptor antagonist blocks allodynia from zymosan-induced neuritis, Soc. Neurosci. Abs., 26 (1999).

- Milligan, E.D., Nguyen, K.T., Hansen, M.K., Martin, D., Maier, S.F. & Watkins, L.R., The human immunodeficiency virus-1 envelope glycoprotein, gp120, induces hyperalgesia and allodynia via glial activation and interleukin-1beta, Soc. Neurosci. Abs., 26 (1999).
- Grahn, R.E., Hammack, S.E., Will, M.J., O'Connor, K.A., Deak, T., Sparks, P.D., Watkins, L.R. & Maier, S.F., The noradrenergic alpha-1 antagonist benoxathian microinjected into the dorsal raphe nucleus prevents enhanced conditioned fear and escape failure produced by inescapable tailshock in rats, Soc. Neurosci. Abs., 26 (1999).
- McGorry, M.M., O'Connor, K.A., Johnson, J.D., Fleshner, M., Watkins, L.R. & Maier, S.F., Inescapable shock differentially alters nitric oxide production in 3 rat strains, Soc. Neurosci. Abs., 26 (1999).
- O'Connor, K., Johnson, J., Nagel, T., Fleshner, M., Watkins, L. & Maier, S., Role of hormones in stress-induced nitric oxide production, Soc. Neurosci. Abs., 26 (1999).
- Johnson, J.D., O'Connor, K.A., Fleshner, M., Watkins, L.R. & Maier, S.F., Stress induced increases in interleukin-1beta, Soc. Neurosci. Abs., 26 (1999).
- Will, M.J., Pepin, J.L., Hammack, S.E., Grahn, R.E., Watkins, L.R. & Maier, S.F., Dorsal raphe nucleus lesion blocks stressor-potentiated morphine place preference, Soc. Neurosci. Abs., 26 (1999).
- Deak, T., Johnson, J.D., Nguyen, K.T., Culp, K.E., Watkins, L.R. & Maier, S.F., Evidence for a more rapid corticosterone response to lipopolysaccharide in previously stressed rats, Soc. Neurosci. Abs., 26 (1999).
- Pugh, C.R., Johnson, J.D., Martin, D., Maier, S.F., Rudy, J.W. & Watkins, L.R., gp120 impairs contextual fear conditioning: a potential role in AIDS related dementia complex, Soc. Neurosci. Abs., 26 (1999).
- Watkins, L.R., Milligan, E.D., Hammack, S.E., Gazda, L., Martin, D. & Maier, S.F., Allodynia and hyperalgesia produced by sciatic neuritis is blocked by spinal administration of interleukin-1 receptor antagonist, Presented at the American Pain Society Meeting, Fall, 1999.
- Milligan, E.D., Nguyen, K.T., Hansen, M.K., Martin, D., Maier, S.F., Tracey, K.J. & Watkins, L.R., Spinal administration of the HIV-1 envelope glycoprotein, gp120, induces glial activation and interleukin-1beta production and release: a mechanism for hyperalgesia and allodynia, Presented at the American Pain Society Meeting, Fall, 1999.
- Maier, S., Hansen, M., Nguyen, K., Goehler, L., Gaykema, R., Fleshner, M. & Watkins, L., Vagotomy does not alter circulating levels of endotoxin or cytokines following the in-

traperitoneal administration of lipopolysaccharide, Presented at the ISNIM meeting, Fall, 1999.

Watkins, L.R., Milligan, E., Nguyen, K., Hansen, M., Gaykema, R., Lee, J., Martin, D., Tracey, K. & Maier, S.F., gp120 from human immunodeficiency virus-1 (HIV-1) induces exaggerated pain via glial activation and IL-1 release in spinal cord of rats, Presented at the ISNIM meeting, Fall, 1999.

Hansen, M., Nguyen, K., Goehler, L., Gaykema, R., Fleshner, M., Maier, S. & Watkins, L., Intraperitoneal administration of human recombinant interleukin-1beta induces rat IL-1beta protein in blood and brain: implications for immune-to-brain communication, Presentation at the national Psychoneuroimmunology meeting, Galveston, TX, April, 1999.

Goehler, L.E., Gaykema, R.P.A., Khorsand, J.J., Armstrong, C.B., Maier, S.F. & Watkins, L.R., Staphylococcus enterotoxin B (SEB) induces c-Fos expression in brain regions associated with host defense via a vagally dependent mechanism, Presentation at the national Psychoneuroimmunology meeting, Galveston, TX, April, 1999.

Gaykema, R.P.A., Goehler, L.E., Armstrong, C.B., Khorsand, J.L., Maier, S.F. and Watkins, L.R., Differential Fos expression in rat brain induced by lipopolysaccharide and staphylococcus enterotoxin B, Presentation at the national Psychoneuroimmunology meeting, Galveston, TX, April, 1999.

O'Connor, K., Johnson, J., Fleshner, M., Watkins, L. & Maier, S., Stress-induced changes in nitric oxide production: strain differences, Presentation at the national Psychoneuroimmunology meeting, Galveston, TX, April, 1999.

Watkins, L.R., Milligan, E., Nguyen, K., Hansen, M., Gaykema, R., Lee, J., Xue, D. & Maier, S.F., gp120 from human immunodeficiency virus-1 induces exaggerated pain via glial activation and IL-1 release in spinal cord of rats, Presentation at the national Psychoneuroimmunology meeting, Galveston, TX, April, 1999.

Nguyen, K., Deak, T., Hunsaker, B., Fleshner, M., Watkins, L. & Maier, S., Effects of stress on interleukin-1beta and interleukin-6 protein in the brain and periphery, Presentation at the national Psychoneuroimmunology meeting, Galveston, TX, April, 1999.

Nguyen, K., Hansen, M., Fleshner, M., Goehler, L., Gaykema, R., Maier, S. & Watkins, L., Effects of vagotomy on circulating levels of endotoxin, proinflammatory cytokines, and corticosterone following lipopolysaccharide, Presentation at the national Psychoneuroimmunology meeting, Galveston, TX, April, 1999.

Hansen, M., Nguyen, K., Goehler, L., Gaykema, R., Fleshner, M., Maier, S. & Watkins, L., Intraperitoneal administration of human recombinant interleukin-1beta induces rat IL-1beta protein in blood and brain: implications for immune-to-brain communication,

Presentation at the national Psychoneuroimmunology meeting, Galveston, TX, April, 1999.

Johnson, J., Fleshner, M., O'Connor, K., Watkins, L. & Maier, S., The role of hormones in the stress induced increases in nitric oxide production, Presentation at the national Psychoneuroimmunology meeting, Galveston, TX, April, 1999.

Hinde, J.L., Hammack, S.E. Gaykema, R.P.A., Goehler, L.E., Maier, S.F. & Watkins, L.R., Intraperitoneal injections of interleukin-1beta induce c-fos immunoreactivity in vagal sensory neurons, Proc. Soc. Neurosci, 24 (1998).

Grahn, R.E., Watkins, L.R. & Maier, S.F., Interference with NMDA receptor activation in the dorsal raphe nucleus prevents poor escape responding and enhanced conditioned fear caused by exposure to an uncontrollable stressor, Proc. Soc. Neurosci, 24 (1998).

Johnson, J.J., Fleshner, M., Deak, T., Goehler, L.E., Maier, S.F. & Watkins, L.R., The role of the vagus nerve in immune responses, Proc. Soc. Neurosci, 24 (1998).

Milligan, E.D., Nguyen, K.T., Hinde, J.L., Mehmert, K., Bohl, M., Maier, S.F. & Watkins, L.R., Allodynia and increased dorsal spinal cord interleukin-1beta induced by intrathecal (IT) gp120, an HIV-1 envelope glycoprotein, Proc. Soc. Neurosci, 24 (1998).

Nguyen, K.T., Deak, T., Will, M.J., Busby, A.C., Hunsaker, B.N., Fleshner, M., Watkins, L.R., & Maier, S.F., Timecourse and controllability effects on the brain interleukin-1beta protein response to acute stress, Proc. Soc. Neurosci, 24 (1998).

Maier, S.F., Amat, J., Matus-Amat, P., Sparks, P.D., & Watkins, L.R., Stressor controllability modulates extracellular serotonin in the amygdala, Proc. Soc. Neurosci, 24 (1998).

Deak, T., Nguyen, K.T., Fleshner, M., Watkins, L.R. & Maier, S.F., Exposure to acute stress facilitates recovery from peripheral infection, Proc. Soc. Neurosci, 24 (1998).

McGorry, M.M., Deak, T., Nguyen, K.T., Milligan, E.D., Fleshner, M., Watkins, L.R. & Maier, S.F., Parallels between immune activation and acute stressor exposure, Proc. Soc. Neurosci, 24 (1998).

Will, M.J., Bisetegne, R., Nguyen, K.T., Deak, T., Watkins, L.R. & Maier, S.F., Role of adrenal steroids in stress-induced potentiation of morphine's rewarding properties, Proc. Soc. Neurosci, 24 (1998).

Pugh, C.R., Gonyea, J.L., Fleshner, M., Watkins, L.R., Maier, S.F. & Rudy, J.W., Zymosan and LPS have similar effects on contextual and auditory-cue fear: further evidence for a role of pro-inflammatory cytokines in learning and memory, Proc. Soc. Neurosci, 24 (1998).

- Goehler, L.E., Gaykema, R.P.A., Khorsand, J., Kleiner, J., Schwartz, B., Maier, S.F. & Watkins, L.R., Staphylococcal enterotoxin B induces c-fos immunoreactivity in rat nervous system, Proc. Soc. Neurosci, 24 (1998).
- Gaykema, R.P.A., Goehler, L.E., Nguyen, K.T., Schwartz, B.A. Bohl, M., Khorsand, J., Maier, S.F. & Watkins, L.R., Endotoxin signaling roles for vagus nerve and circumventricular organs: correlates with dose-related induction of c-fos and interleukin-1, Proc. Soc. Neurosci, 24 (1998).
- Hammack, S.E., Nguyen, K.T., Hinde, J.L., Gaykema, R.P.A., Goehler, L.E., Maier, S.F. and Watkins, L.R., Does IL-1beta activate the vagus nerve? LPS induces IL-1beta in the vagus nerve and intraperitoneal IL1beta injections increase firing rate in vagal afferents, to be presented at the national Psychoneuroimmunology meeting, Bristol, England, April 1998.
- Deak, T., Nguyen, K.T., Fleshner, M., Watkins, L.R. & Maier, S.F., Exposure to acute stress facilitates recovery from peripheral infection, to be presented at the national Psychoneuroimmunology meeting, Bristol, England, April 1998.
- Maier, S.F., Nguyen, K.T., Watkins, L.R. & Maier, S.F., Acute stress suppresses KLH-specific but not mitogenic (Con-A) proliferative responses, to be presented at the national Psychoneuroimmunology meeting, Bristol, England, April 1998.
- Nguyen, K.T., Deak, T., Busby, A.C., Hunsaker, B.N., Fleshner, M., Watkins, L.R. & Maier, S.F., Evidence for a circadian rhythm of brain IL-1beta protein, to be presented at the national Psychoneuroimmunology meeting, Bristol, England, April 1998.
- Nguyen, K.T., Deak, T., Owens, S.M., Busby, A.C., Hunsaker, B.N., Fleshner, M., Watkins, L.R. & Maier, S.F., Characterization of brain interleukin-1beta after LPS and acute stress, to be presented at the FASEB meeting, CA, March, 1998.
- Grahn, R.E., Hammack, S.E., Will, M.J., Karimzad, F., McQueen, M.B., Gaykema, R.P.A., Goehler, L.E., Watkins, L.R. and Maier, S.F., C-fos expression in the dorsal raphe nucleus in rats after escapable or inescapable tailshock, Proc. Soc. Neurosci, 23 (1997).
- Hammack, S.E., Grahn, R.E., Will, M.J., McQueen, M.B., Goehler, L.E., Gaykema, R.P.A., Watkins, L.R. & Maier, S.F., C-fos expression in the dorsal raphe nucleus and projection regions 24 hours after inescapable shock, Proc. Soc. Neurosci, 23 (1997).
- Hinde, J.L., Milligan, E.D., McGorry, M.M., Fleshner, M., Gaykema, R.P.A., Goehler, L.E., Maier, S.F. & Watkins, L.R., Subdiaphragmatic vagotomy does not prevent fever after intracerebroventricular prostaglandin E2, Proc. Soc. Neurosci, 23 (1997).

- Maier, S.F., Nguyen, K.T., Watkins, L.R. & Fleshner, M., Acute stress suppresses KLH-specific but not mitogenic (Con-A) proliferative response: evidence for reduced T cell expansion, Proc. Soc. Neurosci, 23 (1997).
- Milligan, E.D., Hinde, J.L., Maier, S.F. and Watkins, L.R., The HIV-1 coat protein, gp 120, produces thermal hyperalgesia in rats, Proc. Soc. Neurosci, 23 (1997).
- Deak, T., Nguyen, K.T., Ehrlich, A.L., Watkins, L.R., Licinio, J., Gold, P.W., Wong, M.-L., Webster, E., Chrousos, G.P. & Maier, S.F., The impact of the nonpeptide CRH antagonist antalarmin on behavioral and endocrine responses to stress, Proc. Soc. Neurosci, 23 (1997).
- Pugh, C.R., Fleshner, M., Watkins, L.R., Maier, S.F. & Rudy, J.W., LPS administered after fear conditioning disrupts contextual but not auditory cue fear conditioning: a possible role for brain cytoines in memory consolidation, Proc. Soc. Neurosci, 23 (1997).
- Nguyen, K.T., Deak, T., Owens, S.M., Fleshner, M., Watkins, L.R. & Maier, S.F., Effects of LPS and acute stress on rat brain interleukin-1beta, Proc. Soc. Neurosci, 23 (1997).
- Will, M.J., Zappone, C.A., Watson, M.M., Watkins, L.R. & Maier, S.F., Stressor controllability determines the stressor-induced potentiation of morphine's rewarding properties, Proc. Soc. Neurosci, 23 (1997).
- Gaykema, R.P.A., Goehler, L.E., McGorry, M.M., Milligan, E.D., Fleshner, M., Tilders, F.J.H., Maier, S.F., and Watkins, L.R., Subdiaphragmatic vagotomy inhibits fos expression in brain and pituitary after intraperitoneal but not intravenous administration of endotoxin, Proc. Soc. Neurosci, 23 (1997).
- Goehler, L.E., Gaykeam, R.P.A., VanDam, A.-M., Tilders, F.J.H., Milligan, E.D., McGorry, M.M., Maier, S.F. and Watkins, L.R., Endotoxin induces interleukin-1b in the area postrema and brainstem choroid plexus, Proc. Soc. Neurosci, 23 (1997).
- McGorry, M.M., Goehler, L.E., Gaykema, R.P.A., Rudy, J., Maier, S.F. & Watkins, L.R., Intravenous LPS induced cfos in vagal primary afferents: attenuation by subdiaphragmatic vagotomy, Proc. Soc. Neurosci, 23 (1997).
- Milligan, E.D., Hinde, J.L., Nguyen, K., Deak, T., Fleshner, M., Watkins, L.R. and Maier, S.F., Central alpha-MSH given immediately but not 24 hrs prior to inescapable tail shock, blocks the long term effects of stress-induced acute phase responses, Presentation at the national Psychoneuroimmunology meeting, Boulder, CO, June 1997.
- Cotter, C., Fleshner, M., Nguyen, K.T., Watkins, L.R. & Maier, S.F., The effect of surgery in lymphoid cell nitrite production, Presentation at the national Psychoneuroimmunology meeting, Boulder, CO, June 1997.

- Nguyen, K.T., Deak, T., Owens, S.M., Fleshner, M., Watkins, L.R. & Maier, S.F., Impact of LPS and acute stress on brain IL-1beta protein, Presentation at the national Psychoneuroimmunology meeting, Boulder, CO, June 1997.
- Nguyen, K.T., Deak, T., Owens, S.M., Fleshner, M., Spencer, R.L., Watkins, L.R. & Maier, S.F., Evidence for induction of brain IL-1beta protein after LPS, Presentation at the national Psychoneuroimmunology meeting, Boulder, CO, June 1997.
- Deak, T., Nguyen, K.T., Fleshner, M., Watkins, L.R., Maier, S.F. & Spencer, R.L., Adrenalectomy does not alter the long term elevations in core body temperature or changes in acute phase proteins produced by inescapable shock, Presentation at the national Psychoneuroimmunology meeting, Boulder, CO, June 1997.
- Pugh, C.R., Fleshner, M., Watkins, L., Maier, S.F. & Rudy, J.W., LPS administered after fear conditioning disrupts contextual but not auditory cue fear conditioning: a possible role for brain cytokines in memory consolidation, Presentation at the national Psychoneuroimmunology meeting, Boulder, CO, June 1997.
- Fleshner, M., Deak, T., Nguyen, K.T., Watkins, L.R. & Maier, S.F., A normal regulatory role of glucocorticoids in the anti-KLH in vivo antibody response, Neuroimmunomodulation meeting, Bethesda, November, 1996.
- Goehler, L.E., Gaykema, R.P.A., Tilders, F.J.H., Maier, S.F. and Watkins, L.R., Endotoxin induces Fos immunoreactivity in rat vagal sensory ganglion cells, Neuroimmunomodulation meeting, Bethesda, November, 1996.
- Watkins, L.R. & Maier, S.F., Stress and cytokine interactions, Presented at the 40th OHOLO Conference, Zichron Ya'akov, Israel, March, 1996.
- Maier, S.F., Fleshner, M. & Watkins, L.R., Neural endocrine & immune mechanisms of stress-induced immunomodulation, Presented at the 40th OHOLO Conference, Zichron Ya'akov, Israel, March, 1996.
- Nguyen, K.T., Woodmansee, W., Watkins, L.R., Maier, S.F., & Fleshner, M., Nitric oxide levels are increased 48 to 96 hrs after stress in KLH immunized rats, Presented at the national Psychoneuroimmunology meeting, San Diego, CA, April, 1996.
- Fleshner, M., Nguyen, K.T., Brennan, F.X., Deak, T., Watkins, L.R. & Maier, S.F., Stress may suppress specific immunity by stimulating macrophages, Presented at the national Psychoneuroimmunology meeting, San Diego, CA, April, 1996.
- Grahn, R.E., McQueen, M.B., Maswood, S., Watkins, L.R. & Maier, S.F., An opioid contribution to the effects of inescapable shock on escape responding and conditioned fear in rats, Proc. Soc. Neurosci., 22 (1996).

- McQueen, M.B., Grahn, R.E., Watkins, L.R. & Maier, S.F., Inhibition of nitric oxide synthesis in the dorsal raphe nucleus prevents poor escape responding and enhanced conditioned fear in rats exposed to inescapable shock, Proc. Soc. Neurosci, 22 (1996).
- Goehler, L.E., Gaykema, R.P.A., Tilders, F.J.H., Maier, S.F. & Watkins, L.R., Localization of immune and inflammatory markers in the rat vagus nerve and liver hilus, Proc. Soc. Neurosci, 22 (1996).
- Deak, T., Meriwether, J.L., Fleshner, M., Spencer, R.L., Abouhamze, A., Moldawer, L.L., Watkins, L.R., & Maier, S.F., Evidence for acute phase activation following exposure to an acute stressor, Proc. Soc. Neurosci, 22 (1996).
- Nguyen, K.T., Fleshner, M., Watkins, L.R. & Maier, S.F., Stress-induced nitric oxide suppresses specific immunity in KLH immunized rats, Proc. Soc. Neurosci, 22 (1996).
- Amat, J., Maswood, S., Amtus-Amat, P., Barter, J., Watkins, L.R. & Maier, S.F., Effects of inescapable and escapable stress on the release of serotonin in the ventral hippocampus of the rat, Proc. Soc. Neurosci, 22 (1996).
- Will, M.J., Watkins, & Maier, S.F., Nature of stress induced potentiation of morphine's rewarding properties, Proc. Soc. Neurosci, 22 (1996).
- Hartley, C.E., Hammack, S.E., Sutton, L.C., Maier, S.F. & Watkins, L.R., Inescapable shock (IS) potentiates morphine analgesia 24 hrs later: the role of the mu opioid receptors in the lumbosacral spinal cord, Proc. Soc. Neurosci, 22 (1996).
- Hammack, S.E., Hartley, C.E., Sutton, L.C., Maier, S.F. & Watkins, L.R., Inescapable shock (IS) potentiates morphine analgesia 24 hrs later: the role of mu opioid receptors in the dorsal raphe nucleus (DRN), Proc. Soc. Neurosci, 22 (1996).
- McGorry, M., Schwartz, B., Sisk, D., Wiertelak, E.P., Maier, S.F. & Watkins, L.R., Spinal mechanisms of anti-analgesia: learned safety signals block non-opiate as well as opiate analgesias, Proc. Soc. Neurosci, 22 (1996).
- Schwartz, B.A., Fleshner, M., McGorry, M., Goehler, L.E., Martin, D., Maier, S.F. & Watkins, L.R., Responses to intravenous cytokines (IL-1b and TNF-a) are attenuated by subdiaphragmatic vagotomy, Proc. Soc. Neurosci, 22 (1996).
- Milligan, E.D., Nguyen, K.T., Deak, T., Fleshner, M., Watkins, L.R. & Maier, S.F., Central a-MSH (1-13) blocks stress-induced alterations in temperature corticosterone and CBG, Proc. Soc. Neurosci, 22 (1996).
- Fleshner, M., Silbert, L., Deak, T., Goehler, L.E., Martin, D., Maier, S.F. & Watkins, L.R., Subdiaphragmatic vagotomy selectively blocks TNFa effects on carrier proteins and serum corticosterone, Proc. Soc. Neurosci, 22 (1996).

- Love, J., Pugh, R., Tremblay, D., Rudy, J.W., Rose, G., Diamond, D., Mazzeo, R.S., Watkins, L.R., Maier, S.F. & Fleshner, M., Dehydroepiandrosterone (DHEA) and dehydroepiandrosterone sulfate (DHEA-S) in the rat: converging evidence of anti-glucocorticoid properties, *Proc. Soc. Neurosci*, 22 (1996).
- Sutton, L., Maier, S.F. & Watkins, L.R., Inescapable shock (IS)-induced potentiation of morphine analgesia: timecourse, pharmacology, and sites of opiate action, *Pain Supple* (1996)
- Watkins, L.R., Deak, T., Goehler, L.E., Relton, J., Martin, D., Tracey, K. & Maier, S.F., Glial involvement in diverse forms of hyperalgesia, *Pain Supple* (1996)
- Watkins, L.R., Walters, E.T., Oka, T., & DeLeo, J.A., Pain and the immune system, *Proc. 8th World Congress on Pain* (1996)
- Maier, S.F., Sisk, D., McGorry, M., Schwartz, B., Wiertelak, E.P. & Watkins, L.R., Investigation into the mechanism of anti-analgesia: learned safety signals block non-opiate as well as opiate analgesic states, *Proc. 8th World Congress on Pain*, (1996).
- Watkins, L.R., Wiertelak, E., Goehler, L., Relton, J., Martin, D. & Maier, S.F., Illness-induced hyperalgesia: peripheral, vagal & central mediators, Presented at Cytokines as Communication Factors Between the Immune System and the Central Nervous System, Arachon, France, Sept. 1995.
- Fleshner, M., Deak, T., Spencer, R.L., Laudenslager, M.L., Watkins, L.R. & Maier, S.F., A long-term increase in basal levels of corticosterone and a decrease in corticotropin-binding globulin following acute stressor exposure, *Proc. Soc. Neurosci*, 21 (1995).
- Brennan, F.X., Fleshner, M., Deak, T., Watkins, L.R. & Maier, S.F., Stress may suppress specific immunity by stimulating macrophages, *Proc. Soc. Neurosci*, 21 (1995).
- Deak, T., Fleshner, Meriwether, J.L., Goehler, L., Watkins, L.R., Spencer, R.L. & Maier, S.F., Mechanisms of acute stressor-induced changes in corticosteroid binding globulin (CBG), *Proc. Soc. Neurosci*, 21 (1995).
- Goehler, L.R., Relton, J., Laudenslager, M., Maier, S.F. & Watkins, L.R., Biotinylated interleukin-1 receptor antagonist binds to vagal paraganglia in diverse vertebrate species, *Proc. Soc. Neurosci*, 21 (1995).
- Will, M.J., Poole, J.C., Satin, R.E., Branstetter, S.A., Watkins, L.R. & Maier, S.F., Inescapable tailshock potentiates the rewarding properties of morphine, *Proc. Soc. Neurosci*, 21 (1995).

- Sutton, L.C., Will, M.J., Lea, S.E., Grahn, R.E., Maswood, S., Sptizer, S., Watkins, L.R. & Maier, S.F., Inescapable shock (IS) potentiates morphine analgesia 24 hours later: role of the dorsal raphe nucleus (DRN), *Proc. Soc. Neurosci*, 21 (1995).
- Lea, S.E., Sutton, L.C., Schwartz, B.A., Hartley, C.E., Maier, S.F. & Watkins, L.R., Inescapable shock (IS) potentiates morphine analgesia 24 hours later: sites of action, *Proc. Soc. Neurosci*, 21 (1995).
- Grahn, R.E., Maswood, S., Watkins, L.R. & Maier, S.F., The benzodiazepine antagonists flumazenil and CGS-8216 prevent the effects of inescapable shock on conditioned fear and shuttlebox escape performance in rats, *Proc. Soc. Neurosci*, 21 (1995).
- Maier, S.F., Busch, C.R., Maswood, S., Grahn, R.E. & Watkins, L.R., The benzodiazepine receptor inverse agonist DMCM microinjected in the region of the dorsal raphe nucleus mimics the effects of inescapable shock, *Proc. Soc. Neurosci*, 21 (1995).
- Watkins, L.R., Deak, T., Silbert, L., Martinez, J., Goehler, L., Relton, J., Martin, D. & Maier, S.F., Evidence for involvement of spinal cord glia in diverse models of hyperalgesia, *Proc. Soc. Neurosci*, 21 (1995).
- Grisel, J.E., Maier, S.F. & Watkins, L.R., MK-801 non-differentially attenuates both associative and non-associative morphine tolerance, *Proc. Soc. Neurosci.*, 20 (1994) 1231.
- Goehler, L.E., Relton, J.K., Laudenslager, M., Maier, S.F. & Watkins, L.R., Vagal parasympathetic nerves from diverse vertebrate species bind recombinant human interleukin-1 receptor antagonist: a possible mechanism for vagal mediation of immune-to-brain communication, Presented at Cytokines as Communication Factors Between the Immune System and the Central Nervous System, Arachon, France, Sept. 1995.
- Lockwood, L.L., Silbert, L.H., Fleshner, M.R., Watkins, L.R., Laudenslager, M.L. & Maier, S.F., Morphine-induced alterations in immunoglobulin class switching mechanisms, *Proc. Soc. Neurosci*, 20 (1994).
- Brennan, F.X., Fleshner, M., Watkins, L.R. & Maier, S.F., Stimulation of macrophages reduces cholesterol levels in stressed and unstressed rats, *Proc. Soc. Neurosci*, 20 (1994).
- Lea, S.E., Sutton, L., Grahn, R.E., Watkins, L.R. & Maier, S.F., Supersensitivity to morphine analgesia induced by inescapable tailshock: timecourse of effect, *Proc. Soc. Neurosci*, 20 (1994).
- Sutton, L., Grahn, R.E., Will, M.J., Maier, S.F. & Watkins, L.R., Supersensitivity to morphine analgesia induced by inescapable tailshock: neuropharmacology, *Proc. Soc. Neurosci*, 20 (1994).

- Maier, S.F., Watkins, L.R. & Fleshner, M., Hormonal mediators of stress-induced reductions in the KLH-specific antibody response, Presented at the national Psychoneuroimmunology meeting, Key Biscayne, FL, Nov. 1994.
- Watkins, L.R., Goehler, L.E., Relton, J., Fleshner, M., Tartaglia, N., Barter, J., Silbert, L., Hermann, D., Martin, D., Wiertelak, E.P., & Maier, S.F., Induction of illness behaviors by intraperitoneal IL-1: mediation by the subdiaphragmatic vagus, Presented at the national Psychoneuroimmunology meeting, Key Biscayne, FL, Nov. 1994.
- Fleshner, M., Watkins, L.R., Laudenslager, M.L. & Maier, S.F., A CD4+ T cell shift from Th1 to Th2: a mechanism of stress-induced reduction of the KLH-specific antibody response. Presented at the national Psychoneuroimmunology meeting, Key Biscayne, FL, Nov. 1994.
- Lockwood, L.L., Silbert, L.H., McNeal, C., Hersh, G., Newman, M.T., Watkins, L.R., Laudenslager, M.L., Rice, K.C., Weber, R.J. and Maier, S.F., Morphine-induced immunomodulation of in vivo antibody production: receptor mediation, Presented at the national Psychoneuroimmunology meeting, Key Biscayne, FL, Nov. 1994.
- Mayr, R.L., Fleshner, M., Laudenslager, M.L., Watkins, L.R. & Maier, S.F., IV. Mechanisms of stress-induced immunomodulation: high levels of steroids at the time of immunization are not necessary for IS-induced immunosuppression. *Proc. Soc. Neurosci*, 20 (1994).
- Watkins, L.R., Fleshner, M., Hermann, J.L., Laudenslager, M.L., & Maier, S.F., III. Mechanisms of stress-induced immunomodulation, *Proc. Soc. Neurosci*, 20 (1994).
- Hermann, J.L., Fleshner, M., Ray, K.H., Lockwood, L.L., Silbert, L., Laudenslager, M.L., Watkins, L.R. & Maier, S.F., II. Mechanisms of stress-induced immunomodulation: a role of the macrophage, *Proc. Soc. Neurosci*, 20 (1994).
- Fleshner, M., Hermann, J., Laudenslager, M.L., Watkins, L.R. & Maier, S.F., I. Mechanisms of stress-induced immunomodulation: T cells, *Proc. Soc. Neurosci*, 20 (1994).
- Cobb, C., Fleshner, M., Shaw, B., Laudenslager, M.L., Watkins, L.R., Maier, S.F., Anderson, C.D. and Drugan, R.C., Peripheral benzodiazepine receptor involvement in stress-induced suppression of in vivo antibody response, *Proc. Soc. Neurosci*, 20 (1994).
- Wiertelak, E.P., Furness, L.E., Smalls, S., Horan, R., Watkins, L.R. & Maier, S.F., Subcutaneous (s.c.) formalin produces centrifugal hyperalgesia via spinal NMDA-nitric oxide (NO), *Proc. Soc. Neurosci*, 20 (1994).

- Furness, L.E., Wiertelak, E.P., Grahn, R., Martinez, J., Maier, S.F., & Watkins, L.R., Subcutaneous (s.c.) formalin produces hyperalgesia via a centrifugal nucleus raphe magnus-ventral funiculus pathway, *Proc. Soc. Neurosci*, 20 (1994).
- Sutton, L.C., Woodmansee, W.W., Wiertelak, E.P., Maier, S.F. & Watkins, L.R., Tailshock-induced analgesia is blocked by serotonin, but not enorepinephrine, depletion in lumbar spinal cord, *Proc. Soc. Neurosci*, 19 (1993).
- Furness, L., Wiertelak, E.P., Maier, S.F. & Watkins, L.R., Illness-induced hyperalgesia: investigations of spinal cord neurochemistry, *Proc. Soc. Neurosci*, 19 (1993).
- Watkins, L.R., Wiertelak, E.P., Furness, L., Smith, K., Martinez, J. & Maier, S.F., Neurocircuitry of centrifugal pain facilitatory systems, *Proc. Soc. Neurosci*, 19 (1993).
- Maier, S.F., Wiertelak, E.P., Goehler, L., Martin, D. & Watkins, L.R., Illness-induced hyperalgesia: interleukin 1B (IL-1) IL-1 antagonist, *Proc. Soc. Neurosci*, 19 (1993).
- Wiertelak, E.P., Yang, H.Y.-T., Yang, Mooney-Heiberger, K., Maier, S.F. & Watkins, L.R., Conditioned anti-analgesia: spinal opiate and anti-opiate mechanisms, *Proc. Soc. Neurosci*, 19 (1993).
- Fleshner, M., Brohm, M.M., Laudenslager, M.L., Watkins, L.R. & Maier, S.F., Modulation of the in vivo antibody response by the benzodiazepine inverse agonist (DMCM) administered centrally or peripherally, *Proc. Soc. Neurosci*, 19 (1993).
- Grahn, R.E., Kalman, B.A., Watkins, L.R. & Maier, S.F., Chlordiazepoxide in the dorsal raphe nucleus eliminates the effects of inescapable shock on shuttlebox escape learning and fear conditioning, *Proc. Soc. Neurosci*, 19 (1993).
- Kalman, B.A., Grahn, R.E., Brennan, F.X., Watkins, L.R. & Maier, S.F., Differential sensitivity of the elevated plus-maze and social interaction tests of anxiety to prior stressor controllability, *Proc. Soc. Neurosci*, 19 (1993).
- Brennan, F.X., Cobb, C.L., Silbert, L.H., Watkins, L.R. & Maier, S.F., Peripheral B-1 adrenoreceptors are involved in stress-induced hypercholesterolemia in rats, *Proc. Soc. Neurosci*, 19 (1993).
- Grisel, J.E., Wiertelak, E.P., Frohardt, R.J. Yang, H.-Y.T, Maier, S.F. & Watkins, L.R., Conditioned tolerance to intravenous (iv) morphine: demonstration and spinal mediation, *Proc. Soc. Neurosci*, 19 (1993).
- Maier, S.F., Wiertelak, E.P. & Watkins, L.R., Endogenous anti-analgesia: effects of ventromedial medulla and dorsal raphe lesions, *Pain, Suppl.* 6 (1993).

- Wiertelak, E.P., Maier, S.F. & Watkins, L.R., Acute and conditioned hyperalgesia in response to illness-cues, *Pain*, Suppl. 6 (1993)
- Watkins, L.R., Wiertelak, E.P., & Maier, S.F., Centrifugal hyperalgesia circuitry: effects of ventromedial medulla and spinal lesions, *Pain*, Suppl. 6 (1993).
- Watkins, L.R., Duncan, G., Gebhart, G. & Fields, H., Pain facilitation, *Proc. Amer. Pain Soc.*, (1992).
- Grisel, J.E., Grahn, R.E., Sutton, L., Watkins, L.R. & Maier, S.F., "Nonopiate" cold water swim-induced analgesia attenuates morphine analgesia, *Proc. Soc. Neurosci.*, 18 (1992) 717.
- Grahn, R.E., Kalman, B.A., Sutton, L., Silbert, L.H., Wiertelak, E.P., Watkins, L.R. & Maier, S.F., The effect of inescapable shock on shuttle-box escape performance, conditioned fear, and anxiety in rats with lesions of the dorsal raphe nucleus or central nucleus of the amygdala, *Proc. Soc. Neurosci.*, 18 (1992) 534.
- Brennan, F.X., Watkins, L.R. & Maier, S.F., Stressor controllability and plasma cholesterol, *Proc. Soc. Neurosci.*, 18 (1992) 352.
- Fleshner, M., Watkins, L.R., Laudenslager, M.L. and Maier, S.F., Stress-induced reduction in MLR is dependent on macrophages but not on changes in phenotypes, *Proc. Soc. Neurosci.*, 18 (1992) 678.
- Lockwood, L.L., Silbert, L.H., Watkins, L.R., Laudenslager, M.L. & Maier, S.F., Anesthesia-induced immunomodulation of in vivo antibody production, *Proc. Soc. Neurosci.*, 18 (1992) 681.
- Sutton, L., Maier, S.F. & Watkins, L.R., Adrenalectomy blockade of opiate analgesia is not due to stress-induced release of hormones, *Proc. Soc. Neurosci.*, 18 (1992)
- Watkins, L.R., Wiertelak, E.P., Mooney-Heiberger, K., Grahn, R. & Maier, S.F., Endogenous anti-analgesia: effects of amygdala, dorsal raphe and spinal lesions, *Proc. Soc. Neurosci.*, 18 (1992) 1025.
- Wiertelak, E.P., Mooney-Heiberger, K., Van Wyhe, W., FitzPatrick II, G.R., Maier, S.F. & Watkins, L.R., Internal aversive stimuli elicit acute and conditioned hyperalgesia, *Proc. Soc. Neurosci.*, 18 (1992) 1026.
- Watkins, L.R., Wiertelak, E.P., Silbert, L.H. and Maier, S.F., "Non-opiate" analgesia is really opiate: apparent parallel activation of multiple spinal opiate systems, *International Narcotics Research Conference*, (1991).

- Grisel, J., Fleshner, M., Watkins, L. and Maier, S.F., Opiate and nonopiate interactions in two forms of stress induced analgesia, Proc. Soc. Neurosci., 17 (1991) 1012.
- Lockwood, L.L., Silbert, L.H., Fleshner, M., Watkins, L.R., Laudenslager, M.L., Rice, K.C., Weber, R.J. and Maier, S.F., Intravenous morphine-induced immunomodulation and steroid release, Proc. Soc. Neurosci., 17 (1991) 832.
- Subel, L., Wiertelak, E.P., Maier, S.F. & Watkins, L.R., Endogenous opioid mediation of analgesia conditioned to contextual vs. discrete cues, Proc. Soc. Neurosci., 17 (1991) 109.
- Wiertelak, E.P., Subel, L., Maier, S.F. and Watkins, L.R., Behavioral evidence for the existence of "anti-analgesia" systems: conditioned reversal of opioid analgesia, Proc. Soc. Neurosci., 17 (1991) 109.
- Watkins, L.R., Wiertelak, E.P., Silbert, L.H. and Maier, S.F., "Non-opiate" analgesia is really opiate: apparent parallel activation of multiple spinal opiate systems, Proc. Soc. Neurosci., 17 (1991) 109.
- Brennan, F.X., Job, R.F.S., Watkins, L.R. and Maier, S.F., Three sessions of tailshock produce an increase in the plasma cholesterol levels of rats maintained on a low-fat diet, Proc. Soc. Neurosci., 17 (1991) 145.
- Lockwood, L.L., Fleshner, M., Watkins, L.R., Laudenslager, M.L. and Maier, S.F., III. Stress-induced immunomodulation: a strain comparison, Proc. Soc. Neurosci., 16 (1990) 1199.
- Watkins, L.R., Fleshner, M., Lockwood, L.L., Bellgrau, D., Laudenslager, M.L. and Maier, S.F.D., II. Compartment specific cell trafficking: neuroendocrine bases, Proc. Soc. Neurosci., 16 (1990) 1199.
- Fleshner, M., Watkins, L.R., Lockwood, L.L., Bellgrau, D., Laudenslager, M.L. and Maier, S.F., I. Compartment specific cell trafficking: potential mechanism for stress-induced immunomodulation, Proc. Soc. Neurosci., 16 (1990) 1198.
- Douglass, D.K., Campbell, I.G., Carstens, E. and Watkins, L.R., Operant response magnitude as an indicator of noxious heat intensity in rats, Proc. Soc. Neurosci., 16 (1990) 106.
- Grisel, J., Watkins, L., Yuva, L., Ryan, S. and Maier, S., Effect of IT naltrexone on inescapable tail shock analgesia, Proc. Soc. Neurosci., 16 (1990) 99.
- Fleshner, M., Watkins, L.R., Kruse, C.A. & Bellgrau, D., Potential of allogeneic tumoricidal cytotoxicity T lymphocytes in brain tumor adoptive immunotherapy, UCLA symposia on Molecular & Cellular Biology, 1990.

- Douglass, D.K., Campbell, I.G., Carstens, E. & Watkins, L.R., Relationship between operant response magnitude and noxious heat intensity in rats, Pain, Suppl. 5 (1990) S313.
- Campbell, I.G., Carstens, E., Douglass, D.K. & Watkins, L.R., The validity of withdrawal magnitude as a pain intensity measurement, Proc. Soc. Neurosci., 15 (1989) 1188.
- Douglass, D.K., Campbell, I.G., Carstens, E. & Watkins, L.R., The validity of operant response magnitude as a pain intensity measurement, Proc. Soc. Neurosci., 15 (1989) 1188.
- Warren, D.A., Castro, C.A., Watkins, L.R., Fleshner, M., Woodmansee, W.W., & Maier, S.F., Attention to nonspatial vs. spatial cues following dorsal noradrenergic bundle (DNAB) lesions, Proc. Soc. Neurosci., 15 (1989) 610.
- Fleshner, M., Watkins, L.R., Laudenslager, M.L. & Maier, S.F., Stress-induced immunomodulation, II. Pituitary-adrenal influences, Proc. Soc. Neurosci., 15 (1989) 296.
- Watkins, L.R., Fleshner, M., Rager, D., Warren, D.A., Broussard, C., Bellgrau, D., Maier, S.F. & Laudenslager, M.L., Stress-induced immunomodulation. I. Basic Parameters, Proc. Soc. Neurosci., 15 (1989) 296.
- Watkins, L.R. & Thurston, C.L., Bases of phenylephrine (PHE) analgesia, Proc. Soc. Neurosci., 14 (1988) 710.
- Douglass, D.K., Carstens, E. & Watkins, L.R., Spatial summation in human pain perception, Proc. Soc. Neurosci., 14 (1988) 710.
- Thurston, C.L., Campbell, I.G., Carstens, E. & Watkins, L.R., Vasopressin-induced scratching and antinociception, Proc. Soc. Neurosci., 14 (1988) 710.
- Lake, K.D., Thurston, C.L., Culhane, E.S., Carstens, E. & Watkins, L.R., Analgesia induced by microinjection of arginine vasopressin into the lateral habenula of conscious rats, Proc. Soc. Neurosci., 13 (1987) 989.
- Thurston, C.L., Jones, R.J., Culhane, E.S., Carstens, E. & Watkins, L.R., Development of tolerance following intrathecal (IT) injections of arginine vasopressin (VAS), Proc. Soc. Neurosci., 13 (1987) 989.
- Culhane, E.S., Thurston, C.L., Douglass, D.K., Campbell, I.G., Carstens, E. & Watkins, L.R., Effects of intrathecal (IT) thyrotropin-releasing hormone (TRH) on IT serotonin (5HT) analgesia as measured by the tail flick (TF) and hot plate (HP) tests, Proc. Soc. Neurosci., 13 (1987) 989.

- Thurston, C.L., Culhane, E.S., Carstens, E. & Watkins, L.R., Intrathecal vasopressin induced tail flick suppression, Pain, Suppl. 4 (1987) S37.
- Klatt, D.S., Guinan, M.J., Carstens, E. & Watkins, L.R., Stability and effects of systemic naloxone and scopolamine on rat midbrain stimulation produced analgesia (SPA), Proc. Soc. Neurosci., 12 (1986) 1019.
- Thurston, C.L., Culhane, E.S., Carstens, E. & Watkins, L.R., Effect of vasopressin on the response of spinal cord dorsal horn cells to noxious heat, Proc. Soc. Neurosci., 12 (1986) 1019.
- Suberg, S.N., Culhane, E.S., Rosenquist, G., Carstens, E. & Watkins, L.R., Electrophysiological comparisons of effects of proglumide and anticholecystokinin antibody on morphine-induced suppression of spinal nociceptive transmission, Proc. International Narcotics Research Conference, 1985.
- Rothfeld, J., Guinan, M., Pretel, S., Culhane, E.S., Carstens, E. & Watkins, L.R., Stimulation of ventral midbrain produces behavioral nociception (sometimes), Proc. Soc. Neurosci., 11 (1985) 638.
- Thurston, C.L., Suberg, S.N., Culhane, E.S., Carstens, E. & Watkins, L.R., Antinociceptive and motor effects of intrathecal (IT) vasopressin (VAS), Proc. Soc. Neurosci., 11 (1985) 285.
- Suberg, S.N., Culhane, E.S., Rosenquist, G., Carstens, E. & Watkins, L.R., Effect of anticholecystokinin antibody (AB) on morphine (MOR) induced suppression of spinal nociceptive transmission, Proc. Soc. Neurosci., 11 (1985) 285.
- Suberg, S., Watkins, L.R., Culhane, E.S. & Carstens, E., Proglumide, a cholecystokinin antagonist, potentiates morphine-induced inhibition of spinal transmission, First International Conference on Neuronal Cholecystokinin, Proc. N.Y. Acad. Sci., 1984
- Watkins, L., Kinscheck, I., Rosenquist, G., Miller, J., Frenk, H., Kaufman, E., Coghill, R. & Mayer, D., Proglumide, a cholecystokinin antagonist, selectively potentiates opiate analgesia and appears to reverse morphine tolerance, First International Conference on Neuronal Cholecystokinin, Proc. N.Y. Acad. Sci., 1984.
- Carstens, E. & Watkins, L.R., Midbrain inhibition of rat lumbar neuronal responses to noxious skin heating, Proc. Soc. Neurosci., 10 (1984) 674.
- Suberg, S.N., Watkins, L.R., Culhane E.S. & Carstens, E., Morphine-induced suppression of spinal transmission is potentiated by proglumide in a naloxone reversible manner, Proc. Soc. Neurosci., 10 (1984) 106.

- Watkins, L.R., Suberg, S.N. & Thurston, C.L., Effects of intrathecal (IT) thyrotropin releasing hormone (TRH) and arginine vasopressin (VAS) on pain and analgesia, Proc. Soc. Neurosci., 10 (1984) 105.
- Kinscheck, I.B., Watkins, L.R. & Mayer, D.J., Front paw and hind paw footshock induced analgesia are neurochemically distinct independent of current intensity, Proc. Soc. Neurosci., 10 (1984) 105.
- Suberg, S.N., Watkins, L.R. & Carstens, E., Effects of D-ala-methionine enkephalinamide and the cholecystokinin antagonist proglumide on various pain tests, Pain, Suppl. 2 (1984) S352.
- Rothfeld, J.M., Watkins, L.R. & Gross, D.S., Sexual responsiveness and its relationship to vaginal stimulation-produced analgesia in the rats, Pain, Suppl. 2 (1984) S416.
- Watkins, L., Kinscheck, I., Miller, J., Coghill, R., Frenk, H & Mayer, D.J., CCK antagonists enhance opiate analgesia and appear to reverse morphine tolerance, Pain, Suppl. 2 (1984) S353.
- Lewis, J.W., Watkins, L.R., LeBars, D.H., Miczek, K.A. & Terman, G.W., Stress analgesia, Pain, Suppl. 2 (1984) S449.
- Price, D.D., Watkins, L.R. & Yang, H.-Y.T., Antagonizing the endogenous antagonists: a novel approach to pain control, Pain, Suppl. 2 (1984) S289.
- Katayama, Y., Watkins, L.R., Kinscheck, I.B. & Mayer, D.J., Activation of a cholinceptive pontine area contributes to environmentally induced nociceptive suppression, Proc. Soc. Neurosci., 9 (1983) 786.
- Fay, R.M., Watkins, L.R., Kinscheck, I.B. & Mayer, D.J., Effect of intrathecal thiorphan, a putative enkephalinase inhibitor, on footshock induced analgesia (FSIA) and classically conditioned analgesia, Proc. Soc. Neurosci., 9 (1983) 741.
- Kinscheck, I.B., Watkins, L.R., Kaufman, E. & Mayer, D.J., Evidence for a cholecystokinin (CCK)-like endogenous opiate antagonist, Proc. Soc. Neurosci., 9 (1983) 792.
- Watkins, L.R., Frenk, H. & Mayer, D.J., Centrifugal anticonvulsant systems and opiate-mediated catalepsy, Proc. Soc. Neurosci., 9 (1983) 1131.
- Frenk, H., Watkins, L.R. & Mayer, D.J., Behavioral and electrographic effects induced by intrathecally and cortically applied morphine are different from those induced by D-ala-methionine-enkephalinamide, Proc. Soc. Neurosci., 9 (1983) 1131.

- Kaufman, E.F.S., Fay, R.M., Johannessen, J.N., Watkins, L.R. & Mayer, D.J., Encephalospinal analgesia systems: noradrenergic component does not descend in the dorsolateral funiculus (DLF), Proc. Soc. Neurosci., 9 (1983) 786.
- Johannessen, J.N., Watkins, L.R., Eckenstein, F. & Mayer, D.J., Acetylcholinesterase (AChE) positive cells at the origin of the dorsolateral funiculus (DLF) in the rat ventral medulla, Proc. Soc. Neurosci., 9 (1983) 785.
- Faris, P.L., Komisaruk, B.R., Watkins, L.R. & Mayer, D.J., Cholecystokinin (CCK-8) specifically antagonizes opiate-mediated analgesias, Proc. Soc. Neurosci., 8 (1982) 144.
- Watkins, L.R., Faris, P.L., Mayer, D.J. & Komisaruk, B.R., Anatomical evidence that supraspinal efferents to the spinal cord mediate vaginal stimulation-induced antinociception in rats, Proc. Soc. Neurosci., 8 (1982) 771.
- Pechura, C.P., Watkins, L.R., Povlishock, J.T., Becker, D.P. & Hayes, R.L., Changes in blood-brain barrier function associated with conditioned fear in rats, Proc. Soc. Neurosci., 8 (1982) 849.
- Watkins, L.R. & Lewis, J.W., Environmentally-induced analgesias: Are endorphins the whole story?, Amer. Pain Soc. Abs., (1982) 1.
- Faris, P., Watkins, L., Mayer, D. & Komisaruk, B., Cholecystokinin octapeptide (CCK-8): An endogenous opiate antagonist?, Amer. Pain Soc. Abs., (1982) 7.
- Faris, P.L., Komisaruk, B., Watkins, L.R. & Mayer, D.J., Attenuation of opiate analgesia by CCK-8, AAAS Abs., 1982.
- Johannessen, J.N., Watkins, L.R. & Mayer, D.J., Non-serotonergic cells at the origin of the dorsolateral funiculus (DLF) in rat medulla, Proc. Soc. Neurosci., 7 (1981) 87.
- Young, E.G., Watkins, L.R. & Mayer, D.J., Effect of lesions of the n. raphe magnus and surrounding areas on systemic and microinjection morphine analgesia, Proc. Soc. Neurosci., 7 (1981) 87.
- Watkins, L.R., Young, E.G., Kinscheck, I.B. & Mayer, D.J., Effect of n. raphe alatus (NRA) and periaqueductal gray (PAG) lesions on footshock induced analgesia (FSIA) and classically conditioned analgesia, Proc. Soc. Neurosci., 7 (1981) 55.
- Watkins, L.R., Studies of the endogenous opioid and non-opioid pain control systems activated by front paw and hind paw shock, Dissert. Abs., (1981).
- Watkins, L.R., Cobelli, D.A. & Mayer, D.J., Footshock induced analgesia (FSIA) and classically conditioned analgesia (CCA): differential activation of opiate and non-opiate systems, Pain, Suppl. 1 (1981) 318.

- Johannessen, J. N., Watkins, L.R. & Mayer, D.J., Selective depletion of spinal cord monoamines fails to alter stimulation produced analgesia (SPA), Proc. Soc. Neurosci., 6 (1980) 247.
- Watkins, L.R., Cobelli, D.A. & Mayer, D.J., Dorsolateral funiculus (DLF) lesions block footshock produced analgesia, Proc. Soc. Neurosci., 6 (1980) 40.
- Cobelli, D.A., Watkins, L.R. & Mayer, D.J., Dissociation of opiate and non-opiate footshock produced analgesia, Proc. Soc. Neurosci., 6 (1980) 247.
- Watkins, L., Griffin, G., Leichnetz, G. & Mayer D.J., Demonstration of the nucleus raphe magnus projection in the dorsal lateral funiculus of the rat spinal cord, Proc. Second World Congress on Pain, 1 (1978) 259.
- Griffin, G., Watkins, L., Leichnetz, G., Murfin, R. & Mayer, D.J., Horseradish peroxidase (HRP) demonstration of the nucleus raphe magnus projection to the spinal cord in the rat, Fed. Proc. Abs., 37 (1978) 399.
- Rothblum, L.M. & Jenssen, T.A., Documentation of two complex display types within the repertoire of *Sceloporus undulatus hyacinthinus*, Proc. Amer. Soc. Zool.