CATHERINE ECKELS LANG PT, PHD

CURRICULUM VITAE

Professor

Program in Physical Therapy
Program in Occupational Therapy
Department of Neurology
Washington University

EDUCATION

1993	BS	Physical Therapy	University of Vermont, Burlington VT
1997	MS	Physical Therapy	University of Vermont, Burlington VT
2001	PhD	Movement Science	Washington University, St. Louis MO
2001-2004		Postdoctoral Fellowship	University of Rochester, Rochester NY

ACADEMIC POSITIONS/EMPLOYMENT

1993-1994	Physical therapist, New England Rehabilitation Hospital, Portland ME
1994-1995	Physical therapist, Traveling Medical Professionals, Eastern USA
1995-1997	Physical therapist (part-time), Fletcher Allen Health Care, Burlington VT
1995-1997	Student & Teaching Fellow, University of Vermont, Department of Physical Therapy, Burlington VT
1997-2001	Student & Research Assistant, Movement Science Program and Program in Physical Therapy, Washington University, St. Louis MO
2001-2004	Postdoctoral Research Fellow, Department of Neurology, University of Rochester, Rochester NY
2004-2005	Instructor, Program in Physical Therapy, Washington University, St. Louis MO
2005-2011	Assistant Professor, Program in Physical Therapy, Program in Occupational Therapy, Department of Neurology, Washington University, St. Louis MO
2011-present	Associate Professor with tenure, Program in Physical Therapy, Program in Occupational Therapy, Department of Neurology, Washington University, St. Louis MO

UNIVERSITY AND HOSPITAL APPOINTMENTS AND COMMITTEES

2004-present	Coordinator, Emergency Recovery Team, Program in Physical Therapy, Washington University
2004-present	Member, Research Advisory Council, Program in Physical Therapy, Washington University
2006-present	Coordinator, Visiting Lecture Series in Movement Science, Program in Physical Therapy, Washington University
2008-present	Member, Research Committee, The Rehabilitation Institute of St. Louis
2009-present	Reviewer, Clinical and Translational Research Funding Program, Barnes-Jewish Hospital Foundation and Washington University Institute of Clinical and Translational Sciences

2009-present Co-Director, Brain Recovery Core, a partnership between Washington University, Barnes Jewish Hospital, and the Rehabilitation Institute of Saint Louis to coordinated stroke rehabilitation across the continuum of care
2010-present Member, Physical Therapy Committee on Academic and Professional Evaluation of Students, Washington University
2011-2013 Member, Post-Acute Care Work Group, BJC Stroke Integrated Practice Unit
2013-present Member, Faculty Rights Committee, Washington University Medical School
2013-present Member, Curriculum Committee, Program in Physical Therapy, Washington University
2014-present Member, Quality Assurance Committee, Human Research Protection Office, Washington University

CURRENT PHYSICAL THERAPY LICENSURE

Missouri #2004025518

HONORS and AWARDS

1991 Academic All-American, Field Hockey
National Collegiate Athletic Association, Division I
1993 Margaret Corbin Award for Outstanding Academic and Clinical Student
Department of Physical Therapy, University of Vermont
1999-2000 Doctoral Opportunities for Clinicians and Scholars, PODS Level I
Foundation for Physical Therapy
2000-2001 Doctoral Opportunities for Clinicians and Scholars, PODS Level II
Foundation for Physical Therapy
2000 MaryLou Barnes Adopt-A-Doc Award**,** Neurology Section,
American Physical Therapy Association
2005 Junior Faculty Scholarship, III Step Conference
American Physical Therapy Association, Neurology and Pediatric Sections
2007 Golden Synapse Award for best paper
Journal of Neurologic Physical Therapy
2009 Special Recognition for Excellence in Mentoring
Graduate School of Arts & Sciences, Washington University
2014 Special Recognition for Excellence in Mentoring
Graduate School of Arts & Sciences, Washington University

MANUSCRIPT REVIEWER/EDITORIAL RESPONSIBILITIES

2009-present Associate Editor, Journal of Neurologic Physical Therapy
2012-present Associate Editor for Rehabilitation, Motor Control
2014 Guest Editor, Special Issue on Motor Learning, Vol. 38, No. 3
Journal of Neurologic Physical Therapy

Reviewer for: American Journal of Occupational Therapy; Archives of Physical Medicine & Rehabilitation; Australian Occupational Therapy Journal; Brain; Brain Impairment; Canadian Medical Association Journal; Cerebral Cortex; Clinical Neurophysiology; Clinical Rehabilitation; Experimental Brain Research; Journal of Applied Biomechanics; Journal of Hand Therapy; Journal of Motor Behavior; Journal of Neurologic Physical Therapy; Journal of Neurophysiology; Journal of Orthopedic & Sports Physical Therapy; Journal of Rehabilitation Medicine; Journal of Rehabilitation Research and Development; Motor Control; Muscle and Nerve; NeuroImage; Neurology; Neurorehabilitation and Neural Repair; Neuroscience Letters; Physical Therapy; Physiotherapy Canada; Physiotherapy Theory and Practice; PLOS One; Somatosensory & Motor Research; Stroke

PROFESSIONAL SOCIETIES AND ORGANIZATIONS

Ad Hoc Grant Reviewer

NSF Division of Behavioral & Cognitive Sciences
NIH NICHD-Special Emphasis Panels
NIH NINDS-Neurological Sciences and Disorders K (NSD-K)
NIH CSR Member Conflicts in Motor Function, Language, and Cognition
Motor Function Speech and Rehabilitation (MFSR)
Musculoskeletal Rehabilitation Sciences (MRS)
Acute Neural Injury and Epilepsy (ANIE)
Fellowships in Physiology and Pathobiology of Musculoskeletal, Oral, and Skin Systems (ZRG F10B-B)
Neurological Foundation of New Zealand
Thrasher Research Fund

Member 2011-2013, Scientific Review Committee, Foundation for Physical Therapy

Member Society for Neuroscience
Society for the Neural Control of Movement
American Heart Association/American Stroke Association
American Society for Neurorehabilitation
World Federation of Neurorehabilitation
American Physical Therapy Association, Neurology and Research Sections
2009-2011 Abstract Review Committee, Annual Conference
Academic Womens' Network, Washington University School of Medicine
2009 – 2012, Abstract Review Committee, International Stroke Conference,
2011-present, International Stroke Think Tank for upper extremity rehabilitation
2014-present, American Heart Association, Stroke Council, Rehabilitation and Recovery Committee

Chairperson 2008 – 2010, Upper Limb Assessment Group, International Functional Electrical Stimulation Society

INVITED LECTURES

1. Bastian AJ, Earhart GM, Lang CE (2000) *Mechanisms and treatment of cerebellar ataxia*. Educational Seminar, APTA Scientific Exposition and Mtg., Indianapolis IN.
2. Lang CE, Earhart GM (2003) *Postdoctoral Study: Why and How*. Educational Seminar, APTA Combined Sections Mtg., Tampa FL.
3. Lang CE (2003) *Control of finger movements after damage to the motor cortex or corticospinal tract in humans*. Neuroscience Colloquium, University of Rochester School of Medicine and Dentistry, Rochester NY.
4. Lang CE (2004) *Upper extremity movement control in people with hemiparesis*. PT Conclave, Washington University School of Medicine, St Louis MO.
5. Lang CE (2005) *Upper extremity movement control in people with hemiparesis*. Stroke Conference, Washington University School of Medicine, St Louis MO.
6. Lang CE (2005) *Multisegmental movement control in people with hemiparesis: relationships to hand function.* Physical Therapy Research Seminar, Washington University School of Medicine, St Louis MO.
7. Lang CE (2005) *Multisegmental movement control in people with hemiparesis: relationships to hand function.* Neurology/Hope Center for Neurological Disorders Research Seminar, Washington University School of Medicine, St Louis MO.
8. Lang CE (2006) *Counting reps: an observational study of outpatient day treatment for people with hemiparesis*. The Rehabilitation Institute of Saint Louis, St Louis MO.
9. Lang CE (2006) *Recovery of upper extremity movement control in people with hemiparesis post stroke*. Department of Kinesiology Seminar, Arizona State University, Tempe AZ.
10. Lang CE (2006) *Testing Albert Pujols*. Town Hall Meeting, Facilities Management Department, Washington University School of Medicine, St Louis MO.
11. Lang CE (2007) *Implications of CIMT data for clinical practice*. As part of Lang CE, Page SJ, Dromerick AW. *Two applications of constraint-induced therapy to the clinic: Modified constraint-induced therapy in the outpatient setting and constraint-induced therapy in the acute inpatient rehabilitation setting.* Educational Seminar, APTA Combined Sections Mtg., Boston MA.
12. Lang CE (2007) *Relating the neuromuscular movement system diagnoses to medical diseases: disease prognosis and rehabilitation prognosis*. As part of Lang CE, Scheets PK, Wagner JM, Stith JS, Sahrmann SA. *Neuromuscular impairment, diagnosis, and related pathokinesiology.* Pre-conference Course, APTA Combined Sections Mtg., Boston MA.
13. Lang CE (2007) *Incorporation of disease-specific evidence into treatment selections based on the neuromuscular movement system diagnoses*. As part of Lang CE, Scheets PK, Wagner JM, Stith JS, Sahrmann SA. *Neuromuscular impairment, diagnosis, and related pathokinesiology.* Pre-conference Course, APTA Combined Sections Mtg., Boston MA.
14. Lang CE (2007) *Attempting to minimize motor disability in people with hemiparesis post stroke*. Rehabilitation Services Meeting, Carle Foundation Hospital, Urbana IL.

15. Lang CE (2007) *Selecting, grading, and measuring therapeutic activities to improve upper extremity function.* Physical and Occupational Therapist Workshop, Carle Foundation Hospital, Urbana IL.
16. Lang CE (2007) *Motor learning*. As part of Lang CE, Earhart GE, Crowner B. *Recent research and practical applications in motor control.* Conference Course, Missouri Physical Therapy Association Fall Mtg., St Louis MO.
17. Lang CE (2007) *Control of skilled movements*. As part of Lang CE, Earhart GE, Crowner B. *Recent research and practical applications in motor control.* Conference Course, Missouri Physical Therapy Association Fall Mtg., St Louis MO.
18. Lang CE (2007) *Upper extremity motor deficits after stroke*. As part of Lang CE, Earhart GE, Crowner B. *Recent research and practical applications in motor control.* Conference Course, Missouri Physical Therapy Association Fall Mtg., St Louis MO.
19. Lang CE (2007) *Upper extremity motor deficits after stroke.* Department of Kinesiology and Program in Occupational Therapy Research Seminar, University of Wisconsin, Madison WI.
20. Lang CE (2008) *Practice and activity in people with hemiparesis post stroke*. Invited Speaker, Stroke Special Interest Group, APTA Combined Sections Mtg., Nashville TN.
21. Lang CE (2008) *How much movement practice actually occurs during post stroke rehabilitation.* Physical Therapy Research Seminar, Washington University School of Medicine, St Louis MO.
22. Lang CE (2008) *Practice and activity in people with hemiparesis post stroke.* Invited Speaker, St. John's Mercy Rehabilitation Hospital, Chesterfield MO.
23. Lang CE (2008) *Upper extremity motor deficits and rehabilitation after stroke*. Department of Physical Therapy Research Seminar, Saint Louis University, St. Louis MO.
24. Lang CE (2009) *Results from the multi-site study*. As part of Lang CE, Boyd LA, Scheets PL. *Categorizing practice and counting repetitions: What are we doing for people after stroke?* Educational Seminar, APTA Combined Sections Mtg., Las Vegas NV.
25. Lang CE (2009) *Upper extremity motor deficits and rehabilitation post stroke.* Neurology Grand Rounds, Washington University, St. Louis MO.
26. Lang CE (2009) *Motor learning principles: all our patients have nervous systems.* Alumni Day Education, Program in Physical Therapy, Washington University, St. Louis MO.
27. Lang CE (2009) *Doses of movement practice and functional recovery after stroke.* Alumni Day Education, Program in Physical Therapy, Washington University, St. Louis MO.
28. Lang CE (2009) *Doses of task-specific training after stroke*. Stroke Research Day, Rehabilitation Institute of Saint Louis, St. Louis MO.
29. Lang CE (2010) *Constraints, successes, and results from the Phase II VECTORS trial*. As part of Winstein CJ, Blanton S, Lang CE, Roberts P, Velozo C, Woodbury M. *Interdisciplinary clinical trials in rehabilitation: Beyond the profession-level boundary.* American Occupational Therapy Foundation Invited Workshop, AOTA Annual Mtg., Orlando FL.
30. Lang CE (2010) *Doses of movement practice after stroke*. Invited Research Seminar, the Rehabilitation Institute of Chicago, Chicago IL.
31. Lang CE, Fucetola R, Conner LT (2010) *The Brain Recovery Core: Building a model system for organized stroke rehabilitation.* Educational Session, American Congress of

Rehabilitation Medicine –American Society of Neurorehabilitation Joint Educational Conference, Montreal, Canada.

32. Lang CE (2010) *Upper extremity motor deficits and rehabilitation post stroke.* Invited Seminar, Burke-Cornell Medical Research Institute, White Plains NY.
33. Lang CE (2010) *Rehabilitation of motor function after stroke*. 11th Annual Jack Allison Memorial Lecture, Program in Physical Therapy, University of Minnesota, Minneapolis MN.
34. Lang CE, Bland MD, Whitson M (2011) *The Brain Recovery Core: Building a model system for organized stroke rehabilitation.* Educational Session, APTA Combined Sections Mtg., New Orleans LA.
35. Hornby TG, Lang CE, Reisman DS, Moore JL (2011) *Structuring clinical interventions to maximize motor recovery after stroke and spinal cord injury: the importance of amount intensity, and type of practice.* Educational Session, APTA Combined Sections Mtg., New Orleans LA.
36. Lang CE (2011) *Top 5 reasons for compensatory approaches in neurorehabilitation*. As part of: Eugene Michel's Research Forum: Restorative vs. Compensatory Approaches. Annual invited lecture, APTA Combined Sections Mtg., New Orleans LA.
37. Lang CE (2011) *Dose specific intensity for rehabilitation*. Keynote Address of the 2011 Annual Interdisciplinary Stroke Course, Rehabilitation Institute of Chicago, Chicago IL.
38. Lang CE (2011) *Understanding therapy*. State of the Science Conference on Robotics for Stroke Rehabilitation. Chicago, IL.
39. Lang CE (2011) *Upper extremity motor deficits and rehabilitation post stroke*. Grand Rounds, Department of Physical Medicine and Rehabilitation, University of Pittsburgh, Pittsburgh PA.
40. Lang CE (2012) *Upper extremity rehabilitation post stroke*. 1st Annual Visiting Scholar, Keynote Lecture, School of Allied Health Professionals, University of East Anglia, Norwich UK.
41. Lang CE (2012) *Integrating research into an academic career*. 1st Annual Visiting Scholar, Masterclass to faculty, School of Allied Health Professionals, University of East Anglia, Norwich UK.
42. Lang CE (2012) *Integrating research into a clinical career*. 1st Annual Visiting Scholar, Masterclass to clinicians, School of Allied Health Professionals, University of East Anglia, Norwich UK.
43. Lang CE (2012) *Intensity of stroke rehabilitation in the inpatient setting: how can we squeeze in more practice?* Innovations in Stroke Rehabilitation Pre-Conference Course, American Congress of Rehabilitation Medicine –American Society of Neurorehabilitation Joint Educational Conference, Vancouver, Canada.
44. Lang CE (2013) *Assessment of upper extremity impairment, function, and activity following stroke: Foundations for clinical decision making.* Educational Session, APTA Combined Sections Mtg., San Diego CA.
45. Lang CE (2013) *Intensity in Neurorehabilitation*. Educational Session, APTA Combined Sections Mtg., San Diego CA.

46. Lang CE (2013) *Upper extremity Interventions*. As part of Moore JL, Hornby TG, Lang CE, Galloway JC, Cherney L. *Variability and Error in Clinical Practice*. Continuing Education course for internal staff, Rehabilitation Institute of Chicago, Chicago IL.
47. Lang CE (2013) *How much do we need to succeed?* Rehabilitation and Participation Science Seminar, Program in Occupational Therapy, Washington University, St. Louis MO.
48. Birkenmeier RL, Bailey RR, Lang CE (2013) *Assessment of upper extremity impairment, function, and activity following stroke: Foundations for clinical decision making.* Educational Session, AOTA Annual Conference and Exposition, San Diego CA.
49. Lang CE (2013) *Stroke rehab 101: Biases from the middle of the USA*. Invited lecture, International Colloquium on Emerging Approaches to Computational Neurorehabilitation, Chateau de la Bretesche, France.
50. Lang CE (2013) *What I wish I had known sooner*. Commencement Address, School of Health Sciences, Elon University, Elon NC.
51. Lang CE (2014) *Motor rehabilitation and motor learning*. Commissioned Course in Neurorehabilitation, Hong Kong Hospital Authority, Hong Kong SAR, China.
52. Lang CE (2014) *Prediction of walking and driving abilities after stroke*. Commissioned Course in Neurorehabilitation, Hong Kong Hospital Authority, Hong Kong SAR, China.
53. Lang CE (2014) *Upper extremity assessment and treatment*. Commissioned Course in Neurorehabilitation, Hong Kong Hospital Authority, Hong Kong SAR, China.
54. Lang CE (2014) *Rehabilitation after TBI vs. stroke*. Commissioned Course in Neurorehabilitation, Hong Kong Hospital Authority, Hong Kong SAR, China.
55. Lang CE (2014) *The Brain Recovery Core: a model system of rehabilitation across the continuum of care*. Commissioned Course in Neurorehabilitation, Hong Kong Hospital Authority, Hong Kong SAR, China.
56. Lang CE (2014) *Introduction to upper extremity neurorehabilitation*. Part of: Task Specific Training for the Neurologic Upper Extremity: A Comprehensive Approach to Evaluation and Treatment. Rehabilitation Institute of Chicago Continuing Education course, Chicago IL.
57. Lang CE (2014) *Transition from assessment and prognosis to intervention: Introduction and principals of task-specific training*. Part of: Task Specific Training for the Neurologic Upper Extremity: A Comprehensive Approach to Evaluation and Treatment. Rehabilitation Institute of Chicago Continuing Education course, Chicago IL.
58. Lang CE (2014) *Task-specific training for the severely affected upper extremity*. Part of: Task Specific Training for the Neurologic Upper Extremity: A Comprehensive Approach to Evaluation and Treatment. Rehabilitation Institute of Chicago Continuing Education course, Chicago IL.
59. Lang CE (2014) *The endless search for better outcomes for people with stroke*. Invited Lecture, Departments of Occupational Therapy and Physical Therapy, University of Pittsburgh, Pittsburgh PA.
60. Lang CE (2014) *The far end of the line: pursuing better rehabilitation and outcomes for people with stroke.* Neurovascular Injury and Repair Seminar, Washington University, St. Louis MO.

61. Lang CE (2014) *The endless search for better outcomes for people with stroke*. Key Note Speaker, Mini-Symposium on Measurement and Outcomes in Upper Extremity Rehabilitation, Universiteit Hasselt, Hasselt, Belgium.
62. Lang CE (2014) *Using technology to capitalize on available therapy time*. Invited talk at Recovery Machines, an IEEE-EMBc pre-conference meeting, Chicago IL.
63. Lang CE (2014) *The endless search for better outcomes after stroke.* Invited Lecture, University of Maryland, Baltimore MD.
64. Lang CE (2014) *Task-specific training for the upper extremity.* Invited lecture at 35th Annual Neurorehabilitation Conference, Braintree Rehabilitation Hospital, Cambridge MA.
65. Lang CE (2014) *The Brain Recovery Core: Building and sustaining an organized model of stroke rehabilitation across the continuum of care*. Invited lecture at 35th Annual Neurorehabilitation Conference, Braintree Rehabilitation Hospital, Cambridge MA.
66. Lang CE (2014) *How might we do more in research and clinical practice?* As part of Lang CE, Boyd LA, Lohse K *The importance of dose in stroke rehabilitation*. Invited Symposium, American Society of Neurorehabilitation Annual Meeting, Washington DC.

CONSULTING RELATIONSHIPS AND BOARD MEMBERSHIPS

2006	Consultant to the North American Clinical Trials Network, Hand Function Task Force.
2008 – 2010	Consultant to the Somatosensation Toolbox, PI: W. Dunn, part of the NIH Neuroscience Blueprint Project, "The Toolbox of the Assessment of Neurological and Behavioral Function", PI: R. Gershon.
2008 – 2010	Consultant to the University of Southern California's NIDRR Rehabilitation Rehabilitation Engineering Resource Center, "Successful aging with disabilities: Optimizing participation through technology", PI: C. Winstein.
2009 – 2013	Advisory Council member, the Rehabilitation Institute of Chicago's NIDRR Rehabilitation Research and Training Center, "Enhancing the functional and employment outcomes of individuals who experience a stroke", PI: E. Roth.
2012-present	Expert consultant to Neurolutions, Inc.
2013-present	Advisory Board member, the Rehabilitation Institute of Chicago's NIDRR National Center for Rehabilitation Robotics, "Machines Assisting Recovery from Stroke and Spinal Cord Injury for return to Society (MARS3)", PI: J. Patton.
2013-present	Writing Group member for the update to the Guidelines for Post-Acute Stroke Rehabilitation, American Heart Association.
2014-present	Oversight Advisory Committee for the Centers of Excellence in Stroke Collaborative Research for Regeneration, Resilience, and Secondary Prevention, American Heart Association / American Stroke Association / Bugher Foundation.
2014-present	Expert Panel Member for "Clinical Practice Guideline: Core Set of Outcome Measures for Patients with Neurologic Conditions", American Physical Therapy Association, PIs: J. Moore, K. Potter, J. Sullivan.
2014-present	Charter Member, Internal Academy Advisory Board, Rehabilitation Institute of Chicago.

RESEARCH SUPPORT

Past

2002-2004 *Control of finger movements after stroke*
National Research Service Award, Postdoctoral Fellowship
NIH F32 NS044584 (PI) Direct costs $46,000/yr

This postdoctoral project investigated neural and mechanical factors contributing to control of finger movements after damage to the motor cortex or the corticospinal tract in humans.

2005-2011 *Mechanisms underlying loss of hand function after stroke*
Mentored Research Scientist Development Award
NIH K01 HD047669 (PI) Direct costs $93,000/yr

The goal of this longitudinal project is to investigate motor and somatosensory impairments underlying loss of hand function in people with hemiparesis post stroke.

2007- 2008 *Multi-site observation of PT and OT for people with hemiparesis post stroke*
Research Division Pilot Award (PI) Direct costs $1,474
Program in Physical Therapy, Washington University

The goal of this multi-site study was to examine the amount of practice currently provided during physical and occupational therapy and to determine if the amount of practice is affected by clinical setting, stroke severity, and stroke chronicity.

2008-2010 *Mechanism of Botox treatment of writer's cramp and other task-specific dystonias*
New Resource Proposal (Co-I; PI: Thach) Direct costs $7,580
McDonnell Center for Systems Neuroscience

The goal of this pilot project is to investigate mechanisms underlying the successful treatment of writer's cramp and other focal hand dystonias.

2008- 2009 *300 repetition doses to improve motor function after stroke*
Research Grant (PI) Direct costs $30,000
HealthSouth Corporation and Washington University Dept. of Neurology

Pilot funds are provided to develop and implement high repetition doses of motor training during post stroke rehabilitation.

2008-2009 *300 repetition doses to improve motor function after stroke*
Research Grant (PI) Direct costs $5,000

Missouri Physical Therapy Association

Supplemental funds for the above project to cover subject reimbursement, subject transportation, and therapy supplies.

2009-2011 *Developing virtual environment authoring tools for creating therapy interventions*
Research Grant (Co-I; PI: Engsberg)
Washington University ICTS/CTSA Direct costs $75,000/yr

The goal of this project is to develop programming tools for rehabilitation therapists to design virtual reality-based exercise programs.

2009-2012 *Effects of movement context on hemiparetic grasping early after stroke*
NIH R01 HD055964 (PI) Direct costs $200,000/yr

This project examines how various movement contexts affect the control and performance of grasping movements in people with stroke with the goal of determining optimal practice conditions for motor rehabilitation.

2009-2012 *Model system for organized stroke rehabilitation*
New Resource Proposal (PI) Direct costs $39,900
McDonnell Center for Systems Neuroscience

Pilot funds are provided to develop a model system of organized stroke rehabilitation across institutions and across the continuum of care.

2009-2014 *Understanding the effects of stroke using functional connectivity MRI*
NIH R01 HD061117 (Co-I; PI: Corbetta) Direct costs $475,000/yr

The goal of this competitive renewal is to examine neural connectivity and functional recovery in attention, language, and motor domains after stroke.

2012-2013 *Repetitive task practice training to treat neglect after stroke: a pilot study*
Pilots Across the SPIRiT (PATS) 102 (PI) Direct costs $20,271
Washington University ICTS/CTSA sponsored by NIH UL1 RR024992

This collaborative pilot award, in collaboration with Dr. Elizabeth Skidmore at the University of Pittsburgh, is designed to: 1) examine the feasibility and tolerability of the intervention in persons with neglect post stroke; 2) demonstrate feasibility of the multi-site collaboration; and 3) gather preliminary efficacy data.

Current

1/12-12/15 *A Brain Recovery Core for measuring the effectiveness of stroke care*
Barnes Jewish Hospital Foundation (Co-PI with Corbetta, Lee)
Direct costs $125,000/yr

The goals of this project are to expand the existing Brain Recovery Core to capture longer-term, patient-oriented outcomes from all persons with stroke and to test the effectiveness of tPA on these outcomes within our academic hospital system.

2/12-1/16 *Dose-response of movement practice during stroke rehabilitation*
NIH R01 HD068290 (PI) Direct costs $300,000/yr

The goal of this dose-response RCT is to define the range of doses of task-specific upper extremity practice that produce the greatest improvements in outcomes in people with chronic stroke.

4/13-3/18 *Spinal control during functional activities to improve low back pain outcomes*
NIH R01 HD047709 (Co-I, PI: Van Dillen) Direct costs $299,000/yr

Our overall objective is to improve the costly, long-term course of mechanical low back pain (LBP) by building on the results of our recently completed clinical trial, “Classification-directed treatment of low back pain”.

8/13-7/18 *Enhanced Medical Rehabilitation of older adults*
NIH R01 MH099011 (Co-I, PI: Lenze) Direct costs $386,000/yr

This project will test Enhanced Medical Rehabilitation’s (EMR) benefits over standard-of-care rehabilitation for affective and functional recovery. Our aims are to examine the effectiveness of EMR for improving functional and affective outcomes in 252 older adults admitted to SNFs for post-acute rehabilitation, and to examine EMR’s ability to overcome patient-level barriers (such as depression) to successful rehabilitation.

10/13-9/15 *Electrical Stimulation of Peripheral Nerve Repair to Improve Functional Recovery*
NIH R21 HD073767 (Co-I, PI: Tung) Direct costs $125,000/yr

The objective of this study is to perform a pilot human study of the safety and efficacy of electrical stimulation in improving success following reconstructive surgery in patients with brachial plexus and peripheral nerve injuries of the upper extremity. Our hypothesis is that ES will improve functional outcome by decreasing the time period of denervation, muscle atrophy and postoperative recovery, and improve the success rate for reconstruction of peripheral nerve injuries.

11/13-10/15 *Using biosensors to identify therapy-driven brain reorganization in children*
Pilot Project (Co-PI with Schlagger, Peterson) Direct costs $50,000/yr
Washington University Hope Center

The goals of this pilot project are to: 1) develop and validate the use of biosensors (accelerometers) as a measure of real-world ability and activity in children, and 2) preliminarily evaluate relationships between behavior and brain networks in typically-developing children and children with brain-injury participating in rehabilitation.

7/14-6/15 *Social networks and stroke recovery* Direct costs $70,000/yr
AHA National Clinical Research Program 14CRP20080001
Mentored Clinical and Population Research Award
(Mentor, PI: Dhand)

The goals of this project are to how social networks change after stroke and how network metrics are related to stroke outcomes.

9/14-8/16 *Diabetic upper extremity pathophysiology, limited joint mobility and disability*
NIH R21 DK100793 (Co-I; PI: Mueller) Direct costs $137,500/yr

The goals of this project are to examine the metabolic and movement related factors contributing to disability in people with long-standing diabetes.

CLINICAL TITLE and RESPONSIBILITIES
Not applicable at this time

TEACHING TITLE and RESPONSIBILITIES

Past Experience

1995-1997 Teaching Assistant, Department of Physical Therapy, University of Vermont, VT
Courses: Clinical Medicine: Neurology
Clinical Medicine: Orthopedics
Physical Therapy Modalities
Sensorimotor Development across the Lifespan

2000- 2001 Guest Lecturer, Program in Physical Therapy, Washington University, MO
Lectures: Sensory Cortical Plasticity
Motor Cortical Plasticity
Sensory Cortex & Cortical Plasticity
Motor Cortex & Cortical Plasticity

2002-2003 Guest Lecturer, Department of Physical Therapy, Nazareth College, NY
Lectures: Motor Cortex Anatomy, Physiology, and Function

2005-2013 Course Master, Motor Control and Motor Learning, DPT Curriculum
Program in Physical Therapy, Washington University
2006-2007 Lecturer, Washington University Medical Student Curriculum
Lecture: Neurorehabilitation
2008-2012 Residency Program in Physical Medicine and Rehabilitation
Lecturer on Motor Rehabilitation after Stroke
2012-2013 Residency Program in Neurology
Lecturer on Motor Rehabilitation after Stroke

Current Responsibilities at Washington University

2004- present Program in Physical Therapy
Course Master
Movement Science III – Biocontrol Mechanisms, PhD Curriculum
Faculty Mentor
Readings in Movement Science, PhD Curriculum
Laboratory Practicum, PhD Curriculum
Lecturer
Neuroscience, DPT Curriculum
Diagnosis & Management of Neuromuscular Conditions, DPT Curriculum
Kinesiology II, DPT Curriculum
Diagnosis, Evidence, & Analysis II, DPT Curriculum

2005-present Program in Occupational Therapy
Lecturer on: Neural Control of Movement, Sensorimotor Impairments after CNS Damage, Motor Learning

Advisement & Mentoring

2003 – 2006 Joanne M. Wagner PT, PhD, ATC
Recipient of Foundation for Physical Therapy Doctoral Scholarships (2)
PhD Dissertation: Upper extremity impairment and motor performance in post-stroke hemiparesis

2004 – 2008 Justin A. Beebe PT, PhD
Recipient of Foundation for Physical Therapy Doctoral Scholarships (2)
Winner: 2007 Outstanding Post-Professional Student Abstract,
Neurology Section of the American Physical Therapy Association.
PhD Dissertation: Recovery of upper extremity movement control and the relationships with upper extremity function in individuals with acute hemiparesis

2005 – 2010 Dustin D. Hardwick PT, PhD
Recipient of Foundation for Physical Therapy Doctoral Scholarship
Recipient of American Heart Association Predoctoral Fellowship
PhD Dissertation: Shoulder pain and movement after stroke

2006 Breanna Fulton Young Scientist Program Participant

2007 – 2008 Marghuretta D. Bland DPT, MSCI
NIH TL1 RR024994 Predoctoral Clinical Research Fellow
Masters Thesis: Restricted active range of motion at the elbow, forearm, wrist or fingers decreases hand function.

2007 – 2009 Rebecca L. Birkenmeier OTD, OTR/L
OTD Thesis: 300 or more repetition doses to improve motor function after stroke: a Phase I feasibility trial.

2007 – 2011 Stacey L. DeJong. PT, PhD, PCS
Recipient of Foundation for Physical Therapy Doctoral Scholarships (3)
PhD Dissertation: Effects of movement context on reach-grasp-lift motion and grip force after stroke.

2007 – 2008 Tina Liou Undergraduate biology student

2008 – 2010 Eliza Prager OTD, MSCI
NIH TL1 RR024994 Predoctoral Clinical Research Fellow
OTD Thesis: Exploring expectations for upper extremity motor treatment in people after stroke
Masters Thesis: Assessment at initial hospitalization weakly predicts upper extremity function 3 months post stroke.

2008 – 2012 Sydney Y. Schaefer PhD Postdoctoral Research Associate
Recipient of American Heart Association Postdoctoral Fellowship

2010 – 2012 Katherine Niemann Poppen OTD, OTR/L
OTD Thesis: Upper extremity real world use after stroke

2011-present Ryan Bailey MSOT, OTR/L PhD student, Movement Science
NIH TL1 RR024994 Predoctoral Clinical Research Fellow

2012-present Elyse Aufman MSOT, OTR/L Medical student
Recipient of the American Academy of Neurology Summer Research Fellowship
NIH TL1 RR024994 Predoctoral Clinical Research Fellow
Recipient of the American Academy of Neurology G. Milton Shy Award

2012-present Timothy Wolf OTD, OTR/L, MSCI Assistant Professor
NIH K23 HD073190 Career Development Award

2012-present Kendra Cherry-Allen DPT PhD Student, Movement Science
Recipient of the Mr & Mrs Spencer T Olin Fellowship for Women
Recipient of Foundation for Physical Therapy Doctoral Scholarships (3)

2012-2013 Kimberly Waddell MSOT, OTR/L Rehabilitation Institute of Chicago
Recipient of the Buchanan Family Fellowship

2012-present Michael Urbin PhD Postdoctoral Research Associate
NIH F32 NS086392 Postdoctoral NRSA

2013-present Nico Dosenbach MD, PhD Assistant Professor
Child Neurology Foundation
PERF Scientific Research Award – Mentor for rehabilitation aspects

2014-present Amar Dhand MD, PhD Assistant Professor
AHA 14CRP20080001 – Mentor for stroke outcomes aspects

2014-present Caitlin Doman MSOT, OTR/L Rehabilitation Institute of Chicago
Recipient of the Buchanan Family Fellowship

Additional Thesis Committees/Thesis Reviews

2005 – 2007 Kelly J. Fuller PhD Washington University, Biomedical Engineering
PhD Dissertation: The influence of gravity on arm dynamics, motor planning, and behavior.

2006 – 2007 Jannette Blennerhassett PhD School of Psychological Science
School of Occupational Therapy
La Trobe University, Bundoora, Vic. Australia
PhD Dissertation: The contribution of somatosensory impairment to pinch grip ability after stroke.

2007 Michael S. Fine PhD Washington University, Biomedical Engineering
PhD Dissertation: Trial-by-trial motor adaptation to novel force perturbations in children and adults.

2007 – 2009 Sara A. Scholtes DPT, PhD Washington University, Movement Science
PhD Dissertation: The effect of limb movement on the lumbopelvic region in people with low back pain

2007 – 2011 Jennifer A. Semrau PhD Washington University, Neuroscience
PhD Dissertation: Using visual feedback to guide movement: properties of adaptation in changing environments and Parkinson disease

2008 – 2009 Madeleine Hackney PhD Washington University, Movement Science
PhD Dissertation: Argentine Tango as therapy for Parkinson Disease

2009 – 2010 Michael J. Falvo PhD Washington University, Movement Science
PhD Dissertation: Neurophysiological adaptations to resistance training and repetitive grasping.

2009 – 2010 Rachel Profitt OTD Washington University, Occupational Therapy
OTD Thesis: Developing virtual reality tools for occupational therapy.

2010 - 2012 Marie McNeely PhD Washington University, Neuroscience
PhD Dissertation: Locomotor control in Parkinson Disease

2010 – 2012 Corey Lohnes PhD Washington University, Movement Science
PhD Dissertation: Oculomotor function and locomotion in Parkinson's Disease

2010 - 2013 Daniel Peterson PhD Washington University, Movement Science
PhD Dissertation: Biomechanical and neural factors associated with gait dysfunction and freezing in those with Parkinson disease

2010-present Elisabetta Colucci University of East Anglia, Norwich UK

2011 - 2014 Emily Grattan OTR/L, PhD University of Pittsburgh, Rehabilitation Science
PhD Dissertation: Examining the effects of a repetitive task practice program among individuals with unilateral spatial neglect

2011-present	David Bundy	Washington University, Biomedical Engineering
2012 - 2013	Greg Seymour OTD thesis: Comparing upper extremity movement among persons with and without stroke while manipulating tablet devices	Washington University, Occupational Therapy
2012-present	Lenny Ramsey	Washington University, Neuroscience
2012-present	Kerri Morgan OTR/L	Washington University, Movement Science
2012 - 2014	Kshamata Shah PT, PhD PhD Thesis: Diabetes Mellitus and limited joint mobility in the upper extremity	Washington University, Movement Science
2013	Sandeep Subramanian PhD PhD Thesis: Motor learning in stroke: Role of Extrinsic Feedback	McGill University, Physical & Occupational Therapy
2013-present	Christopher Sorenson	Washington University, Movement Science
2013-present	Rachel Tinius	Washington University, Movement Science
2014	Ilse Lamers PhD Thesis: Upper limb function in multiple sclerosis: assessment and relationships between the levels of the International Classification of Functioning	Universiteit Hasselt, Belgium
2014-present	Matt Foreman	Washington University, Rehabilitation and Participation Science
2014-present	Sam Nemanich	Washington University, Movement Science

BIBLIOGRAPHY

Peer-reviewed Papers

1. Lang CE (1998) Comparison of six and seven day physical therapy coverage on length of stay and discharge outcome for individuals with total hip and knee arthroplasty. *Journal of Orthopedic and Sports Physical Therapy*, 28:15-22.
2. Lang CE, Bastian AJ (1999) Cerebellar subjects show impaired adaptation of anticipatory EMG during catching. *Journal of Neurophysiology* 82:2108-2119.
3. Lang CE, Bastian AJ (2001) Additional somatosensory information does not improve cerebellar adaptation during catching. *Clinical Neurophysiology* 112:895-907.
4. Morton SM, Lang CE, Bastian AJ (2001) Inter- and intra-limb generalization of adaptation during catching. *Experimental Brain Research* 141:438-445.
5. Lang CE, Bastian AJ (2002) Cerebellar damage impairs automaticity of a recently practiced movement. *Journal of Neurophysiology* 87:1336-1347.

6. Lang CE, Schieber MH (2003) Differential impairment of individuated finger movements in humans after damage to the motor cortex or the cortical spinal tract. *Journal of Neurophysiology* 90:1160-1170.
7. Lang CE, Schieber MH (2004) Reduced hand muscle selectivity in humans after damage to the motor cortex or the corticospinal tract. *Journal of Neurophysiology* 91:1722-1733.
8. Lang CE, Schieber MH (2004) Human finger independence: constraints due to mechanical coupling versus neural control. *Journal of Neurophysiology* 92:2802-2810.
9. Lang CE, Wagner JM, Bastian AJ, Hu Q, Edwards DF, Sahrmann SA, Dromerick AW (2005) Deficits in grasp versus reach during acute hemiparesis. *Experimental Brain Research* 166:126-136.
10. Dromerick AW, Lang CE, Birkenmeier R, Hahn MG, Sahrmann SA, Edwards DF. (2006) Relationships between upper-limb functional limitation and self-reported disability three months after stroke. *J Rehabil Res Dev*, 43:401-408.
11. *Wagner JM, Lang CE, Sahrmann SA, Hu Q, Bastian AJ, Edwards DF, Dromerick AW (2006) Relationships between sensorimotor impairments and reaching deficits in acute hemiparesis. *Neurorehabilitation and Neural Repair,* 20:406-416.
12. Earhart G, Lang CE (2006) Postdoctoral fellowships: a critical step beyond the PhD in the training of physical therapists. *Journal of Physical Therapy Education*, 20:9-11.
13. Lang CE, Wagner JM, Edwards DF, Sahrmann SA, Dromerick AW (2006) Recovery of grasp versus reach in people with hemiparesis post stroke. *Neurorehabilitation and Neural Repair*, 20:444-454.
14. Lang CE, Wagner JM, Dromerick AW, Edwards DF (2006) Measurement of upper extremity function early after stroke: properties of the Action Research Arm test. *Archives of Physical Medicine and Rehabilitation*, 87:1605-1610.
15. *Hardwick, DH, Beebe JA, McDonnell MK, Lang CE (2006) A comparison of serratus anterior muscle activation during a wallslide exercise and other traditional exercises. *Journal of Orthopedic and Sports Physical Therapy*, 36:903-910.
16. *Wagner JM, Dromerick AW, Sahrmann SA, Lang CE (2007) Changes in upper extremity muscle activations during recovery of reaching in subjects with post-stroke hemiparesis. *Clin Neurophysiol*, 118:164-176.
17. Lang CE, Beebe JA. (2007) Relating movement control at 9 upper extremity segments to loss of hand function in people with chronic hemiparesis. *Neurorehabilitation and Neural Repair*, 21:279-291.
18. Lang CE, MacDonald JR, Gnip C (2007) Counting repetitions: an observational study of outpatient therapy for people with hemiparesis post stroke. *Journal of Neurologic Physical Therapy*, 31:3-10.
19. *Wagner JM, Lang CE, Sahrmann SA, Edwards DF, Dromerick AW (2007) Sensorimotor impairments and reaching performance in subjects with poststroke hemiparesis during the first months of recovery. *Physical Therapy*, 87:751-765.
20. Lang CE, Wagner JM, Edwards DF, Dromerick AW (2007) Upper extremity use in people with hemiparesis in the first few weeks after stroke. *Journal of Neurologic Physical Therapy*, 31:56-63.

21. *Bland MD, Beebe JA, Hardwick DH, Lang CE (2008) Restricted active range of motion at the elbow, forearm, wrist, or fingers decreases hand function. *Journal of Hand Therapy*, 21:268-275.
22. Lang CE, Edwards DF, Birkenmeier RL, Dromerick AW (2008) Estimating minimal clinically important differences of upper extremity measures early after stroke. *Archives of Physical Medicine and Rehabilitation*, 89:1693-1700.
23. *Beebe JA, Lang CE (2008) Absence of a proximal to distal gradient of motor deficits in the upper extremity early after stroke. *Clinical Neurophysiology,* 119:2074-2085.
24. *Beebe JA, Lang CE (2009) Active range of motion predicts upper extremity function 3 months after stroke. *Stroke,* 40:1772-1779.
25. Dromerick AW, Lang CE, Birkenmeier RL, Wagner JM, Miller JP, Videen TO, Powers WJ, Wolf SL, Edwards DF (2009) Very early constraint induced movement during inpatient stroke rehabilitation (VECTORS): A single center RCT. *Neurology*, 73:195-201.
26. *Beebe JA, Lang CE (2009) Relationships and responsiveness of six upper extremity function tests during the first 6 months of recovery after stroke. *Journal of Neurologic Physical Therapy*, 33:96-103.
27. Schieber MH, Lang CE, Reilly KT, McNulty P, Sirigu A (2009) Selective activation of human finger muscles after stroke or amputation. *Adv Exp Med Biol*, 629:559-75.
28. Lang CE, MacDonald JR, Reisman DS, Boyd L, Kimberley TJ, Schindler-Ivens S, Hornby TG, Ross SA, Scheets PL (2009) Observation of amounts of movement practice provided during stroke rehabilitation. *Archives of Physical Medicine and Rehabilitation*, 90:1692-1698.
29. Lang CE, DeJong SL, Beebe JA (2009) Recovery of finger extension and its relationship to grasp performance after stroke. *Journal of Neurophysiology*, 102:451-459.
30. Carter AR, Astafiev SV, Lang CE, Connor LT, Rengachary J, Strube MJ, Pope DLW, Shulman GL, Corbetta M (2010) Resting Interhemispheric Functional Magnetic Resonance Imaging Connectivity Predicts Performance after Stroke. *Annals of Neurology*, 67:365-375.
31. *Birkenmeier RL, Prager EM, Lang CE (2010) Translating animal doses of task-specific training to people with chronic stroke in one hour therapy sessions: a proof-of-concept study. *Neurorehabilitation and Neural Repair*, 24:620-635.
32. Scholtes SA, Lang CE, Norton BJ, Van Dillen LR (2010) The effect of within-session instruction on lumbopelvic motion during a lower limb movement in people with and people without low back pain. *Manual Therapy*. 15:496-501.
33. Kimberley TJ, Samagria S, Moore LG, Shakya JK, Lang CE (2010). Comparison of amounts of practice during rehabilitation for traumatic brain injury and stroke. *Journal of Rehabilitation Research and Development*, 47:851-862.
34. *Hardwick DH, Lang CE (2011) Scapular and humeral movement patterns during range-of-motion exercises performed by people with stroke. *Journal of Neurologic Physical Therapy,* 35:1-8.
35. *Prager EM. Birkenmeier RL, Lang CE (2011) Exploring expectations for upper extremity motor treatment in people after stroke: A secondary analysis. *American Journal of Occupational Therapy*, 65:1-8.

36. †Sathian K, Buxbaum LJ, Cohen LG, Krakauer JW, Lang CE, Corbetta M, Fitzpatrick SM (2011) Neurological principles and rehabilitation of action disorders: common clinical deficits. *Neurorehabilitation and Neural Repair*, 25:21S-32S.
37. *Hardwick DH, Lang CE (2011) Scapular and humeral movement patterns and their relationship with pain: a preliminary investigation. *International Journal of Therapy and Rehabilitation*, 18:588-596.
38. Lang CE, Bland MD, Connor LT, Fucetola R, Whitson M, Edmiaston J, Karr C, Sturmoski A, Baty J, Corbetta M (2011) The Brain Recovery Core: Building a system of organized stroke rehabilitation and outcomes assessment across the continuum of care. *Journal of Neurologic Physical Therapy*, 35: 194-201.
39. Carter A, Patel K, Astafiev S, Snyder A, Rengachary J, Strube M, Pope D, Shimony J, Lang CE, Shulman G, Corbetta M (2012) Upstream Dysfunction of Somatomotor Functional Connectivity after Corticospinal Damage in Stroke. *Neurorehabilitation and Neural Repair*, 26:7-19.
40. *Prager EM, Lang CE (2012) Predictive ability of 2-day measurement of AROM on 3-month upper extremity motor function in people with post-stroke hemiparesis. *American Journal of Occupational Therapy*, 66:35-41.
41. *Schaefer SY, DeJong SL, Cherry KM, Lang CE (2012) Grip type and task goal modify reach-to-grasp performance in post-stroke hemiparesis. *Motor Control*, 16:245-264.
42. *DeJong SL, Schaefer SY, Lang CE (2012) The need for speed: Better movement quality during faster task performance after stroke. *Neurorehabilitation and Neural Repair*, 26:362-373.
43. Edwards DF, Lang CE, Wagner JM, Birkenmeier RL, Dromerick AW (2012) An evaluation of the Wolf Motor Function Test for arm motor trials early after stroke. *Archives of Physical Medicine and Rehabilitation*, 93:660-668.
44. *DeJong SL, Lang CE (2012) Comparison of unilateral versus bilateral upper extremity task performance after stroke. *Topics in Stroke Rehabilitation*, 19:294-305.
45. *DeJong SL, Lang CE (2012) The bilateral movement condition facilitates maximal but not submaximal paretic-limb grip force in people with post-stroke hemiparesis. *Clinical Neurophysiology*, 123:1616-1623.
46. *DeJong SL, Birkenmeier RL, Lang CE (2012) Person-specific changes in motor performance accompany upper extremity functional gains after stroke. *Journal of Applied Biomechanics*, 28:304-316.
47. Bland MD, Sturmoski A, Whitson M, Connor LT, Fucetola R, Huskey T, Corbetta M, Lang CE (2012) Prediction of discharge walking ability from initial assessment in a stroke inpatient rehabilitation facility population. *Archives of Physical Medicine and Rehabilitation*, 93:1441-1447.
48. *Schaefer SY, Lang CE (2012) Using dual tasks to test immediate transfer of training between naturalistic movements: A proof-of-principle study. *Journal of Motor Behavior*, 44:313-327.
49. †Lang CE, Bland MD, Bailey RR, Schaefer SY, Birkenmeier RL (2013) Assessment of upper extremity impairment, function, and activity following stroke: Foundations for clinical decision making. *Journal of Hand Therapy*, 26:104-114.

50. *Aufman EL, Bland MD, Barco PP, Carr DB, Lang CE (2013) Predictors of return to driving after stroke. *American Journal of Physical Medicine and Rehabilitation*, 92:627-634.
51. *Schaefer SY, Patterson CB, Lang CE (2013) Transfer of training between distinct motor tasks after stroke: Implications for task-specific approaches to upper extremity neurorehabilitation. *Neurorehabilitation and Neural Repair*, 27:602-612.
52. Bland MD, Sturmoski A, Whitson M, Harris H, Connor LT, Fucetola R, Edmaiston J, Huskey T, Carter A, Kramper M, Corbetta M, Lang CE (2013) Clinician adherence to a standardized assessment battery across settings and disciplines in a post-stroke rehabilitation population. *Archives of Physical Medicine and Rehabilitation*, 94:1048-1053.
53. *Bailey RR, Lang CE (2013) Upper extremity activity in adults: Referent values using accelerometry. *Journal of Rehabilitation Research and Development*, 50:1213-1222.
54. *Cherry KM, Lenze EJ, Lang CE (2014) Combining D-Cycloserine with motor training does not result in improved general motor learning in neurologically-intact people or in people with stroke. *Journal of Neurophysiology*, 111:2516-2524.
55. Lohse KR, Lang CE, Boyd LA (2014) Is more better? Using meta-data to explore dose-response relationships in stroke rehabilitation. *Stroke*, 45:2053-2058.
56. *Waddell KJ, Birkenmeier RL, Moore JL, Hornby TG, Lang CE (2014) The feasibility of high repetition, task-specific training for the paretic upper extremity. *American Journal of Occupational Therapy*, 68:444-453.
57. *Bailey RR, Klaesner JW, Lang CE (2014) An Accelerometry-Based Methodology for Assessment of Real-World Bilateral Upper Extremity Activity. *PLOS One*, 9(7): e103135. doi:10.1371/journal.pone.0103135.
58. *Urbin MA, Lang CE, Hong X, Carter AR (2014) Resting-state functional connectivity and its association with multiple domains of upper extremity function in chronic stroke. *Neurorehabilitation and Neural Repair*, 28:761-769.
59. Host HH, Lang CE, Hildebrand MW, Zou D, Binder EF, Baum CM, Freedland KE, Lenze EJ (2014) Patient Active Time during therapy sessions in post-acute rehabilitation: development and validation of a new measure. *Physical & Occupational Therapy in Geriatrics*, 32:169-178.
60. Lang CE, Bland MD, Cheng N, Corbetta M, Lee JM (2014) A case control study of the effectiveness of tissue plasminogen activator on 6-month patient-reported outcomes and healthcare utilization. *Journal of Stroke and Cerebrovascular Diseases*, 23:2914-2919.
61. *Urbin MA, Bailey RR, Lang CE (in press) Validity of Body-Worn Sensor Acceleration Metrics to Index Upper Extremity Function in Hemiparetic Stroke. *Journal of Neurologic Physical Therapy*.
62. *Bailey RR, Birkenmeier RL, Lang CE (in press) Real-World Affected Upper Limb Activity in Chronic Stroke: An Examination of Potential Modifying Factors. *Topics in Stroke Rehabilitation*.
63. Dorsch AK, Thomas S, Xu X, Kaiser W, Dobkin BH on behalf of the SIRRACT investigators (in press) Stroke Inpatient Rehabilitation Reinforcement of Activity (SIRRACT) Trial: Feedback About Walking Practice Enabled by Wireless Sensing. *Neurorehabilitation and Neural Repair*.

64. Bland MD, Whitson M, Harris H, Edmiaston J, Connor LT, Fucetola R, Carter A, Corbetta M, Lang CE (in press) A descriptive data analysis examining how standardized assessments are used to guide post-acute discharge recommendations for rehabilitation services after stroke. *Physical Therapy Journal*.
65. *Urbin MA, Waddell KJ, Lang CE (in press) Acceleration metrics are responsive to change in upper extremity function of stroke survivors. *Archives of Physical Medicine and Rehabilitation*.
66. †Santello M, Lang CE (in press) Are Movement Disorders and Sensorimotor Injuries Pathologic Synergies? When Normal Multi-joint Movement Synergies Become Pathologic. *Frontiers in Neurology*.
67. Shah KM, Clark BR, McGill JB, Lang CE, Mueller MJ (in press) Shoulder limited joint mobility in people with diabetes mellitus. *Clinical Biomechanics*.

*Trainee first author
†Invited paper

Books

1. Lang CE, Birkenmeier RL, with contributions from Bland MD & Seelbach JM (2013) *Upper Extremity Task-Specific Training after Stroke or Disability: A Manual for Occupational Therapy and Physical Therapy*. Alexandria; AOTA Press Inc.

Invited Book Chapters

1. Schieber MH, Reilly KT, Lang CE. Motor cortex control of a complex peripheral apparatus: the neuromuscular evolution of individuated finger movements. In: *Motor Cortex in Voluntary Movements* (2005) Edited by E Vaadia and A Riehle; Boca Raton; CRC Press LLC.
2. Lang CE, Reilly KT, Schieber MH. Human Voluntary Motor Control and Dysfunction. In: *Textbook of Neural Repair and Rehabilitation* (2006) Edited by M Selzer, S Clarke, L Cohen, P Duncan, F Gage; Cambridge; Cambridge University Press.
3. Lang CE, Schieber MH. Stroke. In: *Sensorimotor Control of Grasping: Physiology and Pathophysiology* (2009) Edited by J Hermsdorfer and D Nowak; Cambridge; Cambridge University Press.
4. Lang CE. Impaired motor control. In: *Geriatric Physical Therapy* (2011) Edited by A Guccione, R Wong, D Avers; Elsevier.
5. Lang CE, Schieber MH. Human Voluntary Motor Control and Dysfunction. In: *Textbook of Neural Repair and Rehabilitation* (2014) 2nd Edition, Edited by M Selzer, S Clarke, L Cohen, P Duncan, F Gage; Cambridge; Cambridge University Press.

Other

1. Lang CE (2007) Editor-invited summary of clinical relevance. *Physical Therapy Journal* Bottom Line: Paretic upper-limb strength best explains arm activity in people with stroke. http://www.ptjournal.org/misc/bottomline.dtl.

2. Lang CE (2007) Editor-invited summary of clinical relevance. *Physical Therapy Journal* Bottom Line: Deficits in surface force production during seated reaching in people after stroke. http://www.ptjournal.org/misc/bottomline.dtl.
3. Lang CE (2007) Editor-invited summary of clinical relevance. *Physical Therapy Journal* Bottom Line: Practitioner and organizational barriers to evidence-based practice of physical therapists for people with stroke. http://www.ptjournal.org/misc/bottomline.dtl.
4. Lang CE (2008) Editor-invited book review in *Somatosensory and Motor Research*. Handbook for Somatosensory Rehabilitation.
5. Fisher BE, Morton SM, Lang CE (2014) From motor learning to physical therapy and back again: The state of the art and science of motor learning rehabilitation research. Guest Editorial, *Journal of Neurologic Physical Therapy*, 38:149-150.

Recent Abstracts (last 5 years)

Lang CE, Prager EM, Birkenmeier RL (2010) Translating animal doses of task-specific upper extremity training to people with chronic stroke: a proof-of-concept study. *American Physical Therapy Assoc. Combined Sections Mtg.* Abstr.

*DeJong SL, Birkenmeier RL, Lang CE (2010) Changes in motor performance associated with improved function following high-repetition upper extremity functional task training for people with chronic stroke. *American Physical Therapy Assoc. Combined Sections Mtg.* Abstr.

*Birkenmeier RL, Prager EM, Lang CE (2010) Translating animal doses of task-specific upper extremity training to people with chronic stroke: a proof-of-concept study. *American Occupational Therapy Assoc. Annual Mtg.* Abstr.

*Prager EM, Birkenmeier RL, Lang CE (2010) Outcome expectations for 300 repetition doses to improve motor function after stroke. *American Occupational Therapy Assoc. Annual Mtg.* Abstr.

*Schaefer SY, DeJong SL, Lang CE (2010) Contextual influences during reaching during reach-to-grasp following stroke. *Society for the Neural Control of Movement* Abstr.

*Cherry KM, DeJong SL, Schaefer SY, Lang CE (2010) Comparison of 3-finger, 5-finger, and palmar grip types in healthy adults. *Society for Neuroscience* Abstr.

*DeJong SL, Schaefer SY, Lang CE (2011) The need for speed: better movement quality during faster task performance after stroke. *Society for the Neural Control of Movement* Abstr.

*Schaefer SY, Lang CE (2011) Dividing attention as a new approach to test generalization of learning between naturalistic movements. *Society for Neurosicence* Abstr.

*DeJong SL, Lang CE (2011) The bilateral movement condition facilitates maximal but not submaximal paretic-limb grip force in people with post-stroke hemiparesis. *Society for Neuroscience* Abstr.

*DeJong SL, Schaefer SY, Lang CE (2012) The need for speed: Better movement quality during faster task performance after stroke. *American Physical Therapy Assoc. Combined Sections Mtg.* Abstr.

*Schaefer SY, DeJong SL, Cherry KM, Lang CE (2012) Grip type and task goal modify reach-to-grasp performance in people with post-stroke hemiparesis. *American Physical Therapy Assoc. Combined Sections Mtg.* Abstr.

Bland MD, Sturmoski A, Whitson M, Connor LT, Fucetola R, Huskey T, Corbetta M, Lang CE (2012) Prediction of discharge walking ability from initial inpatient assessment in a stroke rehabilitation population. *American Physical Therapy Assoc. Combined Sections Mtg.* Abstr.

Bland MD, Sturmoski A, Whitson M, Connor LT, Fucetola R, Huskey T, Corbetta M, Lang CE (2012) Prediction of discharge walking ability from initial inpatient assessment in a stroke rehabilitation population. *International Stroke Conference* Abstr.

*Schaefer SY, Patterson CB, Lang CE (2012) Transfer of training between distinct motor tasks after stroke: implications for task-specific approaches to upper extremity neurorehabilitation. *Society for Neuroscience* Abstr.

*Aufman El, Bland MD, Barco PP, Carr DB, Lang CE (2013) Predictors of return to driving after stroke. *American Academy of Neurology Annual Mtg.* Abstr.

*Seelbach JM, Birkenmeier RL, Lang CE (2013) Exploring individual dose-response relationships between task-specific movement and functional recovery of the upper extremity after stroke: a secondary analysis. *American Physical Therapy Assoc. Combined Sections Mtg.* Abstr.

Bland MD, Sturmoski A, Whitson M, Harris H, Connor LT, Fucetola R, Edmaiston J, Huskey T, Carter A, Kramper M, Corbetta M, Lang CE (2013) Clinician adherence to a standardized assessment battery across settings and disciplines in a post-stroke rehabilitation population. *APTA Combined Sections Meeting* Abstr.

*Urbin MA, Hong X, Lang CE, Carter, A (2013) Resting-state functional connectivity in the somatomotor network: Associations with control and usage of the upper extremity in chronic stroke. *Washington University School of Medicine Postdoc Scientific Symposium*.

*Bailey RR, Lang CE (2013) Upper extremity activity in adults: referent values using accelerometry. *National Clinical and Translational Sciences Predoctoral Programs Meeting* Abstr.

*Cherry KM, Lenze EJ, Lang CE (2013) Does combining an NMDA receptor agonist with motor training result in greater learning? *Society for Neurosicence* Abstr.

*Urbin MA, Lang CE, Carter AR (2013) Resting state functional connectivity and its association with a continuum of upper extremity behavioral function in chronic stroke. *Society for Neurosicence* Abstr.

*Waddell KJ, Birkenmeier RL, Moore JL, Hornby TG, Lang CE (2013) The feasibility of a high-repetition, task-specific intervention for the paretic upper extremity in an inpatient rehabilitation setting. *Illinois Occupational Therapy Association* Abstr.

*Bailey RR, Klaesner J, Lang CE (2013) A quantitative method for measuring bilateral arm activity via accelerometry. *American Society of Neurorehabilitation* Abstr.

Shah K, Clark RB, McGill J, Lang CE, Mueller MJ (2013) Relationship between advanced glycation end-products and upper extremity movement impairments in people with diabetes mellitus. *Washington University Clinical and Translational Research Symposium* Abstr.

Lohse KR, Lang CE, Boyd LA (2013) Using meta-data to explore dose-response relationships in stroke rehabilitation. *Canadian Society for Psychomotor Learning and Sport Psychology annual conference* Abstr.

Lang CE, Bland MD, Corbetta M, Lee JM (2014) Comparative effectiveness of tPA on 6 month, patient-centered outcomes: a pilot analysis. *International Stroke Conference* Abstr.

*Bailey RR, Klaesner JW, Lang CE (2014) Real-world assessment of bilateral upper limb activity. *3rd Annual Occupational Therapy Summit of Scholars* Abstr.

*Bailey RR, Klaesner JW, Lang CE (2014) Real-world assessment of bilateral upper extremity activity. *National Clinical and Translational Sciences Predoctoral Programs Meeting* Abstr.

*Cherry, KM, Lenze EJ, Lang CE (2014) Does combining a partial NMDA receptor agonist with motor training result in greater learning? *American Physical Therapy Assoc. Combined Sections Mtg.* Abstr.

*Waddell KJ, Birkenmeier RL, Moore JL, Hornby TG, Lang CE (2014) The feasibility of a high-repetition, task-specific intervention for the paretic upper extremity in an inpatient rehabilitation setting. *American Occupational Therapy Assoc. Annual Mtg.* Abstr.

Bland MD, Whitson M, Harris H, Connor LT, Fucetola R, Corbetta M, Lang CE (2015) How are standardized assessments used to guide clinical recommendations for rehabilitation services post-stroke? *American Physical Therapy Assoc. Combined Sections Mtg.* Abstr.

*Cherry-Allen KM, Gidday JM, Lee JM, Lang CE (2014) Remote limb ischemic conditioning enhances motor learning. *American Society for Neurorehabilitation Annual Mtg.* Abstr.

*Urbin MA, Waddell K, Bailey RR, Lang CE (2014) Capturing upper extremity function with acceleration variability metrics. *American Society for Neurorehabilitation Annual Mtg.* Abstr.

*Trainee first author