

CATHERINE ECKELS LANG PT, PHD
CURRICULUM VITAE

DATE June 16, 2023

CITIZENSHIP USA

CONTACT INFORMATION Program in Physical Therapy
4444 Forest Park Blvd
Campus Box 8502
St. Louis, MO 63108
314-286-1945 (office)
314-633-8450 (lab)
langc@wustl.edu

PRESENT POSITION Professor of Physical Therapy, Occupational Therapy, Neurology
Associate Director, Movement Science PhD Program
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
2011-2015	Associate Professor with tenure, Program in Physical Therapy, Program in Occupational Therapy, Department of Neurology, Washington University, St. Louis MO
2015-present	Professor, Program in Physical Therapy, Program in Occupational Therapy, Department of Neurology, Washington University, St. Louis MO

2017-present Associate Director, Movement Science PhD Program, Washington University, St. Louis MO

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
- 2008-2019 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
- 2005-2014 Program in Occupational Therapy
Lecturer on: Neural Control of Movement, Sensorimotor Impairments after CNS
Damage, Motor Learning

Current Responsibilities

- 2004-present Program in Physical Therapy
Course Master
Movement Science III – Biocontrol Mechanisms, PhD Curriculum
Lecturer
DPT Curriculum related to Neuroscience, Motor Control, Motor Learning,
Research Design, and PT Management After Stroke.
- 2015-present Program in Physical Therapy
Course Master for Program Seminar, PhD Curriculum

UNIVERSITY AND HOSPITAL APPOINTMENTS AND COMMITTEES

- 2004-2014 Coordinator, Emergency Recovery Team, Program in Physical Therapy, Washington University
- 2004-present Member, Research Advisory Council, Program in Physical Therapy, Washington University
- 2006-2015 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 Ad Hoc Reviewer, Clinical and Translational Research Funding Program, Barnes-Jewish Hospital Foundation and Washington University Institute of Clinical and Translational Sciences
- 2009-2016 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
- 2010-2021 Member, Physical Therapy Committee on Academic and Professional Evaluation of Students, Washington University
- 2011-2013 Member, Post-Acute Care Work Group, BJC Healthcare Stroke Integrated Practice Unit
- 2013-2017 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
- 2014-2015 Chair, Faculty Search Committee, Program in Physical Therapy, Washington University
- 2014-present Member, Senior Scientific Advisory Committee, Intellectual and Developmental Disabilities Research Center, Washington University
- 2016-2021 Member, Stroke Care Clinical Expert Council, BJC Healthcare
- 2017-2022 Member, Academic Advisory Board, Program in Occupational Therapy, Washington University
- 2021 Member, Provost's Working Group on Graduate and Professional Education, to inform the University Strategic Plan, Washington University.
- 2022 Interim Member, Doctoral Council, Office of the Provost, Washington University
- 2023-present Member, Doctoral Council, Office of the Provost, Washington University

CURRENT PHYSICAL THERAPY LICENSURE

Missouri #2004025518

HONORS and AWARDS

- 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
- 2017 Lifetime Member, Stroke Society of Australasia
- 2018 Excellence in Neurologic Research Award
Academy of Neurologic Physical Therapy
- 2018 Marian Williams Award for Research in Physical Therapy
[Honoring sustained, outstanding research in physical therapy]
American Physical Therapy Association
- 2019 Fellow, American Society of NeuroRehabilitation
- 2020 Catherine Worthingham Fellow, American Physical Therapy Association
- 2022 Steven J. Rose Excellence in Research Award
[Honoring the best orthopedic physical therapy research article of the year]
Academy of Orthopedic Physical Therapy

EDITORIAL RESPONSIBILITIES

- 2009-2022 Associate Editor, Journal of Neurologic Physical Therapy
- 2012-2015 Section Editor for Rehabilitation, Motor Control
- 2014 Guest Editor, Special Issue on Motor Learning, Vol. 38, No. 3
Journal of Neurologic Physical Therapy
- 2022 Guest Editor, Special Issue on Cognitive and Motor interactions, Vol 46, No. 1
Journal of Neurologic Physical Therapy
- 2022-present Editorial Board Member, Journal of Neurologic Physical Therapy

Reviewer for over 40 scientific journals in the areas of physical therapy, occupational therapy, neurorehabilitation, neuroscience, neurology, motor control, pediatric psychiatry, and human development.

NATIONAL PANELS, COMMITTEES, BOARDS

- 2004-present Occasional Ad Hoc Grant Reviewer for:
 - NSF Division of Behavioral & Cognitive Sciences
 - NIH NICHD-Special Emphasis Panels (P2Cs, T32, etc)
 - NIH NINDS-Neurological Sciences and Disorders K (NSD-K)
 - NIH CSR Member Conflict Special Emphasis Panels

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
Swiss National Science Foundation

- 2011-2013 Scientific Review Committee member, Foundation for Physical Therapy
- 2014-2019 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
- 2015-2018 NIH Musculoskeletal Rehabilitation Sciences (MRS) study section member
2016-2018 NIH Musculoskeletal Rehabilitation Sciences (MRS) study section chair
2020-2021 NIH NINDS/NICHD Common Data Elements Rehabilitation Working Group Chair of motor subgroup
2020-present NIH National Advisory Council for Child Health and Human Development
2021-2023 International Stroke Recovery and Rehabilitation Roundtables (SRRR) 3rd cycle, co-chair for "Taking Control of Control Interventions".

PROFESSIONAL SOCIETIES AND ORGANIZATIONS

Academic Women's Network, Washington University School of Medicine
American Congress of Rehabilitation Medicine
American Heart Association/American Stroke Association
International Stroke Conference Abstract Reviewer, 2009-2012, 2016-2019
Guidelines for Post-Acute Stroke Rehabilitation Writing Committee, 2013-2015
Rehabilitation and Recovery Committee, 2014-2018
Stroke Outcome Metrics Writing Committee, 2016-2020
American Physical Therapy Association, member since 1993
Academy of Neurological Physical Therapy member
Academy of Research member
2009-2011 Abstract Review Committee, Annual Conference
American Society for Neurorehabilitation
Program Committee 2014-2020
Program Committee Chair, 2017-2018
Treasurer/Secretary, 2019-2020
Vice President, 2021-2022
President, 2023-present
Membership Engagement Committee Chair 2021-2023
International Stroke Think Tank for upper limb rehabilitation, 2011 – 2020

International Functional Electrical Stimulation Society, Upper Limb Assessment Grp, 2008-2010
Society for the Neural Control of Movement 2001-2007
Society for Neuroscience, member since 1998
World Congress of Neurorehabilitation, Scientific Programme Committee 2021-2024

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, Sahrman 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, Sahrman 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, Department of Physical Therapy, 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.
67. Lang CE (2015) *Grantsmanship: Development of the research plan*. As part of Early Career Scientist Workshop, Neurology Section, APTA Combined Sections Mtg, Indianapolis IN.
68. Lang CE (2015) *Clinical rehabilitation perspective: Can robotics be part of the solution?* Invited lecture, 3rd Annual Rehabilitation Robotics Workshop, Arizona State University, Tempe AZ.
69. Lang CE (2015) *The endless search for better outcomes after stroke*. Invited Lecture, Department of Biokinesiology and Physical Therapy, University of Southern California, Los Angeles CA.
70. Lang CE (2015) *Matching therapies to the likelihood of meaningful change in individuals with stroke*. Satellite on Neurorehabilitation, Society for the Neural Control of Movement Annual Mtg., Charleston SC.
71. Lang CE (2016) *The endless search for better outcomes after stroke*. Distinguished Lecture, 3rd Annual Neuroscience and Motor Control Summit, Department of Applied Physiology and Kinesiology, University of Florida, Gainesville FL.
72. Lang CE (2016) *Learning principles for motor skill training*, as part of Van Dillen LR, Lanier V, and Lang CE, *Motor skill training in people with chronic low back pain: an alternative to traditional therapeutic exercise*; Educational Session, APTA Combined Sections Mtg., Anaheim CA.

73. Lang CE (2016) *Accelerometry numbers to clinically-useful information*, as part of Lang CE, Hayward KS, Eng JJ, *Making real world arm use measurement a clinical reality in stroke*; Educational Session, APTA Combined Sections Mtg., Anaheim CA.
74. Lang CE (2016) *The endless search for better outcomes after stroke*. Grand Rounds, Department of Rehabilitation and Regenerative Medicine, Columbia University, New York NY.
75. Lang CE (2016) *The hunt for better outcomes after stroke*. Invited Seminar, Department of Physical Therapy and Human Movement Science, Northwestern University, Chicago IL.
76. Lang CE (2016) *Dosing for rehabilitation trials*. Invited talk, Rehabilitation Research at NIH: Moving the Field Forward Conference, Bethesda MD.
77. Lang CE (2016) *Dosing and timing for plasticity and participation: Adult stroke*. Invited Plenary Talk, APTA IV STEP Meeting, Columbus OH.
78. Lang CE (2016) *Stroke rehabilitation research adventures*. Invited Seminar, CARE Initiative, University of Texas – Austin, Austin TX.
79. Linblad A, Lang CE (2016) *Data and safety monitoring*. Invited presentation, NIH NCMRR Clinical Trials Meeting, Bethesda MD
80. Lang CE (2016) *Dose-response of task-specific upper limb training \geq 6 months post stroke: A Phase II, single-blind, randomized controlled trial*. Research Seminar, Program in Physical Therapy, Washington University, St. Louis MO
81. Lang CE with Wolf SL, Celnick P, Corbett D, Ward NS (2016) *Neurorehabilitation, Brain Plasticity, Recovery, and Compensation: What is "NeuroRehab" when we do it?* Invited Panel, American Society for Neurorehabilitation Annual Meeting, San Diego CA.
82. Lang CE with Dibble L, Sigward, S, Wiley R (2017) *Learning from each other: Sports and Neurology Sections discuss motor learning*. Educational Session, APTA Combined Sections Mtg., San Antonio TX.
83. Lang CE (2017) *Remote limb ischemic conditioning: a neurorecovery agent post-stroke?* Educational Session, APTA Combined Sections Mtg., San Antonio TX.
84. Lang CE with Manal TJ, Novak I (2017) *What not to do and why*. 35th annual Eugene Michels Research Forum, APTA Combined Sections Mtg., San Antonio TX.
85. Lang CE (2017) *Integration of neurorehabilitation best practices into comprehensive stroke care*. Stroke Review and Update, Boone Hospital, Columbia MO.
86. Lang CE (2017) *Stroke rehabilitation research adventures*. Invited Seminar, Burke Medical Research Institute, White Plains NY.
87. Lang CE (2017) *Dose in stroke rehabilitation: the value of explicit hypothesis testing*. Invited Seminar. Faculty of Health Sciences, University of Southampton, Southampton UK.
88. Lang CE (2017) *Current evidence for stroke rehabilitation: what we know now and where we go next*. Keynote Lecture, 27th Annual Scientific Meeting of the Stroke Society of Australasia, Queenstown New Zealand.
89. Lang CE (2017) *Five tips for a successful research career*. Invited Speaker to Early Career Luncheon, 27th Annual Scientific Meeting of the Stroke Society of Australasia, Queenstown New Zealand.

90. Lang CE (2017) *Prescription of motor therapy: issues of dosing and timing*. Invited Lecture, 27th Annual Scientific Meeting of the Stroke Society of Australasia, Queenstown New Zealand.
91. Lang CE (2017) *Rehabilitation data to drive better outcomes*. Invited Lecture, 27th Annual Scientific Meeting of the Stroke Society of Australasia, Queenstown New Zealand.
92. Lang CE (2017) *Dose in stroke rehabilitation: the value of explicit hypothesis testing*. Grand Rounds, Department of Physical Medicine and Rehabilitation, Johns Hopkins University, Baltimore MD.
93. Lang CE (2018) *Dose in stroke rehabilitation: the value of explicit hypothesis testing*. Invited Seminar, NIH-COBRE Center for Human Movement Variability, Department of Biomechanics, University of Nebraska – Omaha, Omaha NE.
94. Lang CE (2018) *Not intensity, but capacity vs. performance*. Plenary Speaker, International Neurophysiotherapy Conference, Association of Chartered Physical Therapists Interested in Neurology, Manchester UK.
95. Lang CE (2018) *Stroke Recovery and Rehabilitation*. Invited Seminar for Issues in Aging Series, Harvey A. Friedman Center for Aging, Washington University, St. Louis MO.
96. Lang CE (2018) *Not intensity, but capacity vs. performance*. Keynote Speaker, Canadian Partnership for Stroke Recovery, Ottawa Canada.
97. Lang CE (2018) *Wearable technology for rehabilitation (Part 1): why do we care and how is it useful?* Invited symposium. American Congress of Rehabilitation Medicine, Dallas TX.
98. Lang CE (2018) *Wearable technology for rehabilitation (Part 2): what have we learned so far?* Invited symposium. American Congress of Rehabilitation Medicine, Dallas TX.
99. Lang CE (2018) *Not intensity, but capacity vs. performance*. Research Seminar. Shirley Ryan Ability Lab, Chicago IL.
100. Lang CE (2019) *The view from the upper limb: impairments, prognosis, and evidence*. As part of Integrating Evidence into Neurologic Physical Therapy Education. Pre-Conference Course, APTA Combined Sections Meeting, Washington DC.
101. Lang CE (2019) *Wearable technology: why do we care and what are we measuring?* As part of Smith BA, Lang CE, Winstein CJ, and Reisman DS. Moving Technology to Clinical Practice: Sensors and Real-World Activity Assessment. Education Session, APTA Combined Sections Meeting, Washington DC.
102. Lang CE (2019) *Why NOT robotics from the upper limb perspective*. As part of Jayaraman A, Hoehl K, DeWald J, Lang CE, and Field-Fote E. Why we love and hate our robots. Educational debate, APTA Combined Sections Meeting, Washington DC.
103. Lang CE (2019) *Not intensity, but capacity vs. performance*. Invited Seminar. College of Health Professions, Medical University of South Carolina, Charleston SC.
104. Lang CE (2019) *Some unsolicited advice*. Graduation address, Physical Therapy Residency Program, Medical University of South Carolina, Charleston SC.
105. Lang CE (2019) *Is there added value in robots for neurorehabilitation?* As part of Rauter G, Klamroth-Marganska V, Burdet E, Lambercy O, O'Malley M, Lang CE, Wiskerke E, and Smith B. Simple or complex robots? Choosing appropriate tools for neurorehabilitation. Pre-conference workshop, RehabWeek 2019, Toronto Canada.

106. [Lang CE](#) (2019) *mRehab is the future: the upper limb perspective*. Invited speaker at the LiveWell RERC State of the Science Conference at RehabWeek 2019, Toronto Canada.
107. [Lang CE](#) (2019) *Wearable sensors are changing how we think about movement and neurorehabilitation*. Invited Seminar. Department of Health and Exercise Science, Colorado State University, Fort Collins CO.
108. [Lang CE](#) (2020) *The challenges of translating cool ideas into actual benefit to patients*. As part of Bhatt T, Madhavan S, Kesar T, Bowden M, and Lang CE. Emerging interventions for improving post-stroke functional mobility: Current evidence and barriers to translation. Education Session, APTA Combined Sections Meeting, Denver CO.
109. [Lang CE](#) (2020) *Wearable sensors are changing how we think about movement and neurorehabilitation*. Community talk for the University of Nevada – Las Vegas Annual Distinguished Lecture Series. Given via Zoom to an audience in Las Vegas NV.
110. [Lang CE](#) (2020) *Attempting to improve stroke rehabilitation across the translational pathway*. Address to faculty and students as part of the University of Nevada – Las Vegas Annual Distinguished Lecture Series. Given via Zoom to an audience in Las Vegas NV.
111. [Lang CE](#) (2020) *Wearable sensors are changing how we think about movement and neurorehabilitation*. Keynote Address, Annual Trainee and Faculty Retreat for NIH HD T32 057850, Kansas University Medical Center. Given via Zoom to an audience in Kansas City MO.
112. [Lang CE](#) (2020) *Mentoring is the best part of my job*. Invited talk as part of the Foundation for Physical Therapy Research Mentoring Webinar. Given via Zoom to an audience throughout the United States.
113. [Lang CE](#) (2021) *Translating in-clinic outcomes to improvements in daily life post stroke*. Invited Seminar, California Physical Therapy Association Seminar Series. Given via Zoom to an audience throughout the state of California.
114. [Lang CE](#) (2021) *Wearable-sensing opens new windows to understand human movement*. Invited talk, Penn State University Action Club. Given via Zoom to an audience in State College, Pennsylvania.
115. [Lang CE](#) (2021) *The future of clinical practice and research*. As part of: Lang CE, Stowe AM, Hammond FL. The future of neurorehabilitation is bright, if we choose it to be. Closing session, American Society of Neurorehabilitation Annual Meeting. Given via Zoom to an international audience.
116. [Lang CE](#) (2021) *Translating in-clinic gains to improvements in daily life*. Mark Rochon Distinguished Lecture, KITE and University HealthNetwork affiliated with the University of Toronto. Given via Zoom to an audience in Toronto, Ontario, Canada.
117. [Lang CE](#) (2021) *Ischemic conditioning as a neurorecovery agent for stroke – or not*. Invite Seminar to the NeuroVascular Injury and Repair group, Washington University, St. Louis, MO.
118. [Lang CE](#) (2021) *Upper limb activity performance after stroke, as measured by wearable sensors*. As part of: Digital biomarkers for monitoring and predicting upper limb

- recovery after stroke. Special Session at IEEE-Biological Sensors and Networks. Given via Zoom to international audience.
119. [Lang CE](#), Bland MD (2021) *Do we measure up?* Invited session, Academy of Neurologic Physical Therapy Annual Conference. Given via Zoom to a national audience.
 120. [Lang CE](#) (2022) You never know where you could get to from here. DPT Induction Ceremony Key Note Address. Department of Rehabilitation and Movement Science, University of Vermont, Burlington VT.
 121. [Lang CE](#) (2022) Translation of in-clinic gains to gains in daily life after stroke. Invited Seminar and Visiting Professor, Vermont Center for Cardiovascular and Brain Health, University of Vermont, Burlington VT.
 122. [Lang CE](#) (2022) Translation of in-clinic gains to gains in daily life after stroke. NIH/NINDS StrokeNet Grand Rounds. Given via Zoom to a national audience.
 123. [Lang CE](#) (2022) with LA Wheaton, The future of neurorehabilitation is bright, if we choose it to be. Invited talk, Association of the Academic Physiatry Annual Meeting, New Orleans LA.
 124. [Lang CE](#) (2022) More questions than answers: Wearable sensors for quantifying movement activity in daily life. Invited talk, Academy of Physical Therapy Research Retreat: Advances in rehabilitation technology, Beverly MA.
 125. [Lang CE](#) (2022) Upper limb stroke rehabilitation. Invited Seminar. City Hospital of Oslo, Norway. Given via Zoom.
 126. [Lang CE](#) (2022) The complexities, challenges, and promise of rehabilitation clinical trials. Keynote address, MR3 Network 2022 Scientific Retreat, Medical Rehabilitation Research Resource Network. Given to a national audience via Zoom.
 127. [Lang CE](#) (2022) Counterpoint: Don't waste my time. Given as part of the State of the Science on Impairment Measures at the American Congress of Rehabilitation Medicine, Chicago IL.
 128. [Lang CE](#) (2022) Upper limb stroke rehabilitation. Invited Seminar. Institute for Knowledge Translation. Given to a national audience of physical therapists via Zoom.
 129. [Lang CE](#) (2022) Moving your career forward in Neurorehabilitation. Part of the Women's Forum, World Congress of NeuroRehabilitation. Vienna, Austria.
 130. [Lang CE](#) (2023) Designing a control group for your trials: Learnings from the SRRR on control interventions. Advances in Stroke Recovery Virtual Scientific Conference, Canadian Partnership for Stroke Recovery. Given to an international audience via Zoom.
 131. [Lang CE](#) (2023) Translation of in-clinic gains to gains in daily life. Invited talk, Spinal Cord Lecture Series, Spaulding Rehabilitation Hospital and Harvard University, Boston MA.
 132. [Lang CE](#) (2023) Translation of in-clinic gains to gains in daily life. Invited speaker, BIOMES Seminar Series, University of Delaware, Newark DE.
 133. [Lang CE](#) (2023) New science ideas come from the most unexpected places. As part of Schindler-Ivens SM, Stevens-Lapsley JE, and Lang CE. Research to rehab: How scientific discovery drives innovation in patient care. Educational session at American Physical Therapy Association Combined Sections Meeting, San Diego CA.

134. Lang CE (2023) Translation of in-clinic gains to gains in daily life. Neurology Grand Rounds, University of Florida, Gainesville FL.
135. Lang CE (2023) with Hayward K on behalf of the Control Intervention SRRR3 task Force. Selecting an optimal control group: A tool to facilitate decision-making. Invited Workshop, American Society of NeuroRehabilitation Annual Mtg, Charleston SC.
136. Lang CE (2023) Wearable sensors are changing how we think about movement and rehabilitation. Invited Speaker at Neurorehabilitation: Creating a Vision for the Future conference held in honor of Dr. Carolee Winstein, Department of Biokinesiology and Physical Therapy, University of Southern California, Los Angeles CA.

CONSULTING RELATIONSHIPS AND BOARD MEMBERSHIPS

- 2006 Consultant to the SCI 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 Board 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.
- 2012-2018 Expert consultant to Neuroolutions, Inc.
- 2013-2017 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
- 2014-2017 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
- 2014-2017 Charter Member, Internal Academy Advisory Board, Rehabilitation Institute of Chicago
- 2014-2017 Steering Committee and Core Consortium Member for North America, James S. McDonnell Collaborative Activities Award, "Advancing the science of rehabilitation: Translating neuroscience and rehabilitation research into everyday life" PIs: L. Carey, C. Baum, N. Josman
- 2017-2022 External Advisory Board, NIDILRR RERC, Collaborative Machines Enhancing Therapy (COMET), PIs: J. Patton, D. Reinkensmeyer.
- 2019-present External Advisory Board, NIH T32NS082168, Interdisciplinary training in movement disorders and neurorestoration, PIs: D. Vaillencourt, D Bowers
- 2019-present External Review Board, NIDILRR ARRT, Combined human and rehabilitation machine system (CHARMS) training program, PI: D. Kamper.
- 2020-present External Advisory Board, NIH T32 HD007490, PT/PhD Predoctoral training program. PI: D. Reisman.

2020-present External Advisory Committee, NIH T32 HD057850, Kansas University training program in neurological and rehabilitation sciences, PI: R. Nudo.

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: Engsborg)
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.

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.

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.

2013-2015 *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.

2013-2015 *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.

2012-2015 *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.

2014-2016 *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.

2015-2017 *Pilot study of ischemic conditioning as a neurorecovery agent for stroke*
Research Grant (PI) Direct costs \$27,000
HealthSouth Corporation and Washington University Dept. of Neurology

This project will test if a priming method, remote limb ischemic conditioning, can enhance learning and retention in healthy adults.

2013-2019 *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".

2013-2019 *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.

2015-2019 *Harnessing Neuroplasticity to Enhance Functional Recovery in Allogeneic Hand Transplant and Heterotopic Hand Replant Recipients*
W81XWH-15-2-0037 (Consultant; PI: Frey) Direct costs \$500,000/yr

This project seeks to develop, implement and evaluate an innovative program of post-transplant and -replant rehabilitation of the hand.

2018-2021 *Transcranial direct current stimulation for post stroke motor recovery: a Phase II trial (TRANSPORT-2)*
NIH U01NS102353 (Site PI, PIs: Feng and Schlaug) Direct costs \$2,445,380/yr

This is a Phase II multisite randomized controlled trial testing the efficacy of tDCS plus rehabilitation.

2016-2022 *Ischemic conditioning as a neurorecovery agent post stroke*
NIH R01 HD085930 (PI) Direct costs \$230,000/yr

This Phase I, translational project investigates ischemic conditioning as a novel method to enhance the benefits of rehabilitation training for stroke and other neurological conditions.

2017-2022 *Characterizing Arm Recovery in People with Severe Stroke (CARPSS)*
CIHR/IRSC 374601 (Consultant; PI: Boyd)

This project seeks to identify clinical and imaging markers to predict partial recovery in persons with severe upper limb impairment post stroke.

Current

2/12-7/27+ *Translation of in-clinic gains to gains in daily life*
NIH R01/R37 HD068290 (PI) Direct costs \$369,298/yr

The third cycle of this project has been funded as a MERIT award. The goals are to identify and validate categories of upper limb performance in daily life that will provide meaningful information of upper limb rehabilitation research and clinical care across conditions that cause upper limb disability and across the lifespan.

12/17-11/23 *Development of a Micro-ECOG Neuroprosthesis for Motor Rehabilitation in a Chronic Corticospinal Stroke Injury*
NIH R01NS101013
(Co-I, PIs: Moran and Leuthardt) Direct costs \$450,000/yr

The goal of the project is to develop primate models and technologies for the neuroprosthetic rehabilitation of chronic stroke. The project will fundamentally expand the knowledge of how the brain changes with injury and the best method to harness these dynamics with a brain computer interface to induce a functional recovery.

5/21-4/26 *Variation in early motor function in autism, cerebellar injury, and normal twins.*
NIH R01MH123723 (Co-PI with Marrus and Limperopoulos)
Direct costs \$574,309/yr

This project deploys wearable-sensor methodology in infants to identify two critical neural liabilities contributing to the development of autism: hyperactivity and impairment in motor coordination. These liabilities result in high risk of developing autism, but cannot yet be reliably measured within the first year of life.

7/93-4/26 *Doctoral Training Program in Movement Science*
NIH T32HD007434 (Current PI: Lang) Direct costs \$210, 218/yr

This grant supports training of outstanding scientists by providing interdisciplinary predoctoral and postdoctoral training in Movement Science to students from diverse backgrounds.

3/23-2/24 *Integrating wearable sensors into the clinical rehabilitation environment*
JIT funding via UL1TR002345, #JIT996 Direct costs \$4,900

This just-in-time funding covers mHealth Core services to provide scientific, legal, and regulatory assistance to postdoctoral fellow Allison Miller, as she develops a data pipeline integrating wearable sensor data into EPIC.

TRAINEE/MENTEE/SPONSORSHIP RECORD

Trainees

- 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 Fellow
Recipient of American Heart Association Postdoctoral Fellowship
- 2010-2012 Katherine Niemann Poppen OTD, OTR/L
OTD Thesis: Upper extremity real world use after stroke
- 2011-2015 Ryan Bailey MSOT, OTR/L, PhD
NIH TL1 RR024994 Predoctoral Clinical Research Fellow
PhD Dissertation: Assessment of real-world upper limb activity in adults with chronic stroke.
- 2012-2015 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
- 2012-2016 Timothy Wolf OTD, OTR/L, MSCI Assistant Professor
NIH K23 HD073190 – Primary mentor
- 2012-2016 Kendra Cherry-Allen DPT, PhD
Recipient of the Mr & Mrs Spencer T Olin Fellowship for Women
Recipient of Foundation for Physical Therapy Doctoral Scholarships (3)
PhD Dissertation: Exogenous and endogenous priming to enhance learning
- 2012-2013 Kimberly Waddell MSOT, OTR/L Rehabilitation Institute of Chicago
Recipient of the Buchanan Family Fellowship
- 2012-2015 Michael Urbin PhD Postdoctoral Research Fellow
Recipient of NIH F32 NS086392, Postdoctoral NRSA
- 2013-2019 Nico Dosenbach MD, PhD Assistant Professor
Child Neurology Foundation
PERF Scientific Research Award – Mentor for rehabilitation aspects
NIH K23 NS088590 – Mentor for rehabilitation aspects
- 2014-2019 Amar Dhand MD, PhD Assistant Professor
AHA 14CRP20080001 – Mentor for stroke outcomes aspects
NIH K23 HD083489 – Mentor for stroke outcomes aspects

2014-2015	Caitlin Doman MSOT, OTR/L Recipient of the Buchanan Family Fellowship	Rehabilitation Institute of Chicago
2015-2019	Kimberly Waddell MSOT, OTR/L, PhD NIH TL1 TR000449 Predoctoral Clinical Research Fellow PhD Dissertation: Exploring complexities of real world upper limb performance after stroke	
2016-2019	Anna Mattlage PhD	Postdoctoral Research Fellow
2017-2019	Swati Surkar PT, PhD	Postdoctoral Research Fellow
2016-2021	Sook-Lei Liew OTR/L, PhD NIH K01 HD091283 – Mentor for stroke outcomes aspects	Assistant Professor at USC
2017-2022	Heidi Schambra MD NIH K02 NS104207 – Mentor for stroke outcomes aspects	Assistant Professor at NYU
2018-2022	Jessica Barth, OTR/L NIH TL1 TR000449 Predoctoral Clinical Research Fellow PhD Dissertation: Validation, categorization, and prediction of upper limb outcomes after stroke.	PhD Student, Movement Science
2019	Kendall Werhane	Undergraduate summer student
2019-present	Jeffrey D. Konrad, PT, DPT Recipient of Foundation for Physical Therapy Research Doctoral Scholarships (2)	PhD Student, Movement Science
2021-present	Ishmael Seanez PhD NIH IREK12 HD073945 NIH K01NS127936	Assistant Professor
2022-present	Laura M. McPherson PT, DPT, PhD NIH KL2TR002346	Assistant Professor
2023-present	Kayla Bell TiDe Scholar, NIH R25HD109110	DPT student researcher

Thesis Committees / Thesis Reviews

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

- 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, OTR/L 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
- 2010-2016 Elisabetta Colucci PhD University of East Anglia, Norwich UK
PhD Dissertation: Dosage in stroke rehabilitation trials
- 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

- 2011-2015 David Bundy PhD Washington University, Biomedical Engineering
PhD Dissertation: Human ipsilateral motor physiology and neuroprosthetic applications in chronic stroke.
- 2012-2013 Greg Seymour OTD, OTR/L Washington University, Occupational Therapy
OTD thesis: Comparing upper extremity movement among persons with and without stroke while manipulating tablet devices
- 2012-2016 Lenny Ramsey PhD Washington University, Neuroscience
PhD Dissertation: Behavioral and neurophysiological mechanisms of recovery post stroke
- 2012-2015 Kerri Morgan OTR/L, PhD Washington University, Movement Science
PhD Dissertation: Wheelchair training program for new manual wheelchair users.
- 2012-2014 Kshamata Shah PT, PhD Washington University, Movement Science
PhD Dissertation: Diabetes Mellitus and limited joint mobility in the upper extremity
- 2013 Sandeep Subramanian PhD McGill University, Physical & Occupational Therapy
PhD Dissertation: Motor learning in stroke: Role of Extrinsic Feedback
- 2013-2015 Christopher Sorenson PhD Washington University, Movement Science
PhD Dissertation: Validation and use of an induced-pain paradigm to investigate risk factors for low back pain development during prolonged standing
- 2013-2015 Rachel Tinius PhD Washington University, Movement Science
PhD Dissertation: Physical activity and maternal and neonatal outcomes in obese pregnant women
- 2014 Ilse Lamers PT, PhD Universiteit Hasselt, Belgium
PhD Dissertation: Upper limb function in multiple sclerosis: assessment and relationships between the levels of the International Classification of Functioning
- 2014-2016 Sam Nemanich PhD Washington University, Movement Science
PhD Dissertation: Motor adaptation and automaticity in people with Parkinson's disease and freezing of gait
- 2015-2017 Andrej Marich PT, PhD Washington University, Movement Science

PhD Dissertation: Examining the lumbar movement pattern during functional activities in people with low back pain

- | | | | |
|--------------|-------------------------|---|---|
| 2016-2018 | Adam Bittel PT, PhD | Washington University, Movement Science | PhD Dissertation: Effects of resistance exercise on postprandial metabolism in obese men with prediabetes |
| 2017-2018 | Elinor Harrison, PhD | Washington University, Movement Science | PhD Dissertation: Singing as a therapeutic technique to improve gait for people with Parkinson Disease. |
| 2018-2020 | Stefanie Foster PT, PhD | Washington University, Movement Science | PhD Dissertation: Hip and pelvic floor strength and mobility in women with and without urgency and frequency predominant lower urinary tract symptoms |
| 2018-2020 | Hyo-Jung Jeong PT, PhD | Washington University, Movement Science | PhD Dissertation: Midfoot and ankle movement dysfunction in people with diabetes mellitus and peripheral neuropathy |
| 2019-2020 | Adam Horin PhD | Washington University, Movement Science | PhD Dissertation: Rhythmic auditory cueing of gait in Parkinson Disease |
| 2020-2021 | Quenten Hooker PhD | Washington University, Movement Science | PhD Dissertation: Movement Patterns during Functional Activities in People with Chronic Low Back Pain |
| 2020-2022 | David May DPT, PhD | Washington University, Movement Science | PhD Dissertation: Advancing the assessment and treatment of signs and symptoms of Parkinson Disease |
| 2021-present | Lauren Tueth DPT | Washington University, Movement Science | |
| 2022 | Meng-Fen Tsai BS | University of Toronto, Biomedical Engineering | PhD Dissertation: Monitoring hand use and hand role of stroke survivors at home using egocentric video |

PATENTS

NA

BIBLIOGRAPHY

*Senior authorship designated by **

Award winning paper designated by †

Peer-reviewed original research in refereed journals

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, Sahrman 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, Sahrman 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, Sahrman 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, Sahrman 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, Sahrman 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](#), Sahrman 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. *[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.
28. *[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.
29. 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.
30. *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.
31. 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.

32. *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.
33. *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.
34. *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.
35. *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.
36. *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.
37. 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.
38. *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.
39. *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.
40. *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.
41. 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.
42. *DeJong SL, Lang CE (2012) Comparison of unilateral versus bilateral upper extremity task performance after stroke. *Topics in Stroke Rehabilitation*, 19:294-305.
43. *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.
44. *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.
45. *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.

46. *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.
47. *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.
48. *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.
49. *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.
50. *Bailey RR, [Lang CE](#) (2013) Upper extremity activity in adults: Referent values using accelerometry. *Journal of Rehabilitation Research and Development*, 50:1213-1222.
51. *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.
52. 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.
53. *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.
54. *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.
55. 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.
56. 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.
57. *[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.
58. *Urbin MA, Bailey RR, [Lang CE](#) (2015) Validity of Body-Worn Sensor Acceleration Metrics to Index Upper Extremity Function in Hemiparetic Stroke. *Journal of Neurologic Physical Therapy*, 39:111-118.
59. *Bailey RR, Birkenmeier RL, [Lang CE](#) (2015) Real-World Affected Upper Limb Activity in Chronic Stroke: An Examination of Potential Modifying Factors. *Topics in Stroke Rehabilitation*, 22:26-33.

60. Corbetta M, Ramsey L, Callejas A, Baldassarre A, Siegel JS, Hacker CD, Astafiev SV, Rengachary J, Zinn K, Lang CE, Connor LT, Fucetola R, Strube MJ, Carter AR, Shulman GL (2015) Common behavioral clusters and subcortical anatomy in stroke. *Neuron*, 85: 927-941.
61. Shah KM, Clark BR, McGill JB, Lang CE, Mueller MJ (2015) Shoulder limited joint mobility in people with diabetes mellitus. *Clinical Biomechanics*, 30:308-313.
62. Dorsch AK, Thomas S, Xu X, Kaiser W, Dobkin BH on behalf of the SIRRACT investigators (2015) Stroke Inpatient Rehabilitation Reinforcement of Activity (SIRRACT) Trial: Feedback About Walking Practice Enabled by Wireless Sensing. *Neurorehabilitation and Neural Repair*, 29:407-415.
63. *Bland MD, Whitson M, Harris H, Edmiaston J, Connor LT, Fucetola R, Carter A, Corbetta M, Lang CE (2015) A descriptive data analysis examining how standardized assessments are used to guide post-acute discharge recommendations for rehabilitation services after stroke. *Physical Therapy Journal*, 95:710-719.
64. *Urbin MA, Waddell KJ, Lang CE (2015) Acceleration metrics are responsive to change in upper extremity function of stroke survivors. *Archives of Physical Medicine and Rehabilitation*, 96:854-861.
65. *Bailey RR, Klaesner JW, Lang CE (2015) Quantifying real-world upper limb activity in nondisabled adults and adults with chronic stroke. *Neurorehabilitation and Neural Repair*, 29:969-978.
66. *Cherry-Allen KM, Gidday J, Lee JM, Hershey T, Lang CE (2015) Remote limb ischemic conditioning enhances motor learning in healthy humans. *Journal of Neurophysiology*, 113:3708-3719.
67. Shah KM, Clark BR, McGill JB, Lang CE, Mueller MJ (2015) Relationship between skin intrinsic fluorescence, an indicator of advanced glycation end products, and upper extremity impairments in individuals with diabetes mellitus. *Physical Therapy Journal*, 95:1111-1119.
68. *Urbin MA, Harris-Love ML, Carter AR, Lang CE (2015) High-intensity, unilateral resistance training of a non-paretic muscle group increases active range of motion in a severely paretic upper extremity muscle group after stroke. *Frontiers in Neurology*, 6:119. doi: 10.3389/fneur.2015.00119.
69. *Waddell KJ, Birkenmeier RL, Bland MD, Lang CE (2015) An exploratory analysis of the self-reported goals of individuals with chronic upper-extremity paresis following stroke. *Disability and Rehabilitation*, 8:1-15.
70. Grattan ES, Lang CE, Birkenmeier R, Holm M, Rubinstein E, Van Swearingen J, Skidmore ER (2016) Examining the feasibility, tolerability, and preliminary efficacy of repetitive task-specific practice for individuals with unilateral spatial neglect. *American Journal of Occupational Therapy*, 70(4).
71. *Doman CA, Waddell KJ, Bailey RR, Moore JL, Lang CE (2016) Observation of changes in UE functional capacity and daily performance during outpatient occupational therapy for people with stroke. *American Journal of Occupational Therapy*, 70:1-11.

72. *Lohse KR, Bland MD, [Lang CE](#) (2016) Quantifying change during outpatient stroke rehabilitation: A retrospective regression analysis. *Archives of Physical Medicine and Rehabilitation*, 97:1423-1430.
73. *[Lang CE](#), Strube MJ, Bland MD, Waddell KJ, Cherry-Allen KM, Nudo RJ, Dromerick AW, Birkenmeier RL (2016) Dose-response of task-specific upper limb training in people at least 6 months post stroke: A Phase II, single-blind, randomized, controlled trial. *Annals of Neurology*, 80:342-354.
74. Bland MD, Birkenmeier, RL, Barco P, Lenard E, [Lang CE](#), Lenze EJ (2016) Enhanced medical rehabilitation: effectiveness of a clinical training model. *NeuroRehabilitation*, 39:481-498.
75. *Lohse KR, Schaefer SY, Raikes A, Boyd LA, [Lang CE](#) (2016) Asking new questions with old data: The Centralized Open-Access Rehabilitation database for Stroke (SCOAR). *Frontiers in Neurology*, 7:153, DOI:10.3389/fneur.2016.00153.
76. *Cherry-Allen KM, Gidday JM, Lee JM, Hershey T, [Lang CE](#) (2017) Remote limb ischemic conditioning at two cuff inflation pressures yields learning enhancements in healthy adults. *Journal of Motor Behavior*, 49:337-348.
77. *Waddell KJ, Strube MJ, Bailey RR, Klaesner JW, Birkenmeier RL, Dromerick AW, [Lang CE](#) (2017) Does task-specific training improve upper limb performance in daily life post-stroke? *Neurorehabilitation and Neural Repair*, 31:290-300.
78. Marich AV, Hwang CT, Salish GB, [Lang CE](#), Van Dillen LR (2017) Consistency of a lumbar movement pattern across functional activities in people with low back pain. *Clinical Biomechanics*, 44:45-51.
79. *[Lang CE](#), Waddell KJ, Klaesner JW, Bland MD (2017) A method for quantifying upper limb performance in daily life using accelerometers. *Journal of Visualized Experiments*, 122 doi: 10.3791/55673.
80. Sorensen CJ, Hastings MK, [Lang CE](#), McGill JB, Clark BR, Bohnert KL, Mueller MJ (2017) Relationship of shoulder activity and skin intrinsic fluorescence with low level shoulder pain and disability in people with type 2 diabetes. *Journal of Diabetes and Its Complications*, 31:983-987.
81. Ramsey L, Siegel JS, [Lang CE](#), Strube MJ, Shulman GL, Corbetta M (2017) Behavioral clusters and predictors of performance during recovery from stroke. *Nature Human Behavior*, 1. pii: 0038. doi: 10.1038/s41562-016-0038.
82. Colucci E, Clark A, [Lang CE](#), Pomeroy VM (2017) A rules-based, dose-finding design for use in stroke rehabilitation research: methodological development. *Physiotherapy*, 103:414-422.
83. Salsich GB, Yemm B, Steger-May K, [Lang CE](#), Van Dillen LR (2017) A feasibility study of a novel, task-specific movement training intervention for women with patellofemoral pain. *Clinical Rehabilitation*, 32:179-190.
84. Mohabbati-Kalejahi N, Alamdar Yazdi MA, Megahed FM, Schaefer SY, Boyd LA, [Lang CE](#), Lohse KR (2017) Streamlining science with structured data archives: insights from stroke rehabilitation. *Scientometrics*, 113:969-983.

85. *Waddell KJ, [Lang CE](#) (2018) Comparison of self-report vs. sensor-based methods of upper limb activity outside the clinic. *Archives of Physical Medicine and Rehabilitation*, 99:1913-1916.
86. Marich AV, Lanier VM, Salsich GB, [Lang CE](#), Van Dillen LR (2018) Immediate effects of a single session of motor skill training on the lumbar movement pattern during a functional activity in people with low back pain: A repeated measures study. *Physical Therapy*, 98:605-615.
87. Mueller MJ, Sorensen CJ, McGill JB, Clark BR, [Lang CE](#), Chen L, Bohnert KL, Hastings MK (2018) Effect of a shoulder movement intervention on joint mobility, pain and disability in people with diabetes: A randomized controlled trial. *Physical Therapy*, 98:745-753.
88. Hayward KS, Lohse KR, Bernhardt J, [Lang CE](#), Boyd LA. (2018) Characterising Arm Recovery in People with Severe Stroke (CARPSS): Protocol for a 12-month observational study of clinical, neuroimaging and neurophysiological biomarkers. *BMJOpen*, 8(11):e026435. doi: 10.1136/bmjopen-2018-026435.
89. Lanier V, [Lang CE](#), Van Dillen LR (2019) Motor skill training in musculoskeletal pain: a case report in chronic low back pain. *Disability and Rehabilitation*, 41: 2071-2079.
90. *Sutter EN, Mattlage AE, Bland MD, Cherry-Allen KM, Harrison E, Surkar SM, Gidday JM, Chen L, Hershey T, Lee JM, [Lang CE](#) (2019) Remote limb ischemic conditioning and motor learning: Evaluation of factors influencing response in older adults. *Translational Stroke Research*, 10:362-371.
91. Dhand A, Luke DA, [Lang CE](#), Tsiaklides M, Feske SK, Lee JM (2019) Social networks and risk of delayed hospital arrival after acute stroke. *Nature Communications*, 10:1206. doi: 10.1038/s41467-019-09073-5.
92. *Mattlage AE, Sutter EN, Bland MD, Surkar, SM, Gidday JM, Lee JM, Hershey T, Chen L, [Lang CE](#) (2019) Dose of remote limb ischemic conditioning for enhancing learning in young adults. *Experimental Brain Research*, 237:1493-1502.
93. Hoyt CR, Van AN, Ortega M, Koller JM, Everett EA, Nguyen AL, [Lang CE](#), Schlagger BL, Dosenbach NUF (2019) Detection of pediatric upper extremity motor activity and deficits with accelerometry. *JAMA Network Open*. 2(4):e192970. doi: 10.1001/jamanetworkopen.2019.2970.
94. Lenze EJ, Lenard E, Bland MD, Barco P, Miller JP, Yingling M, [Lang CE](#), Morrow-Howell N, Baum CM, Binder EF, Rodebaugh TL (2019) Effect of enhanced medical rehabilitation on functional recovery in older adults receiving skilled nursing post-acute rehabilitation: A randomized clinical trial. *JAMA Network Open*, 2(7):e198199. doi: 10.1001/jamanetworkopen.2019.8199.
95. *Waddell KJ, Tabak RG, Strube MJ, Haire-Joshu D, [Lang CE](#) (2019) Belief, confidence, and motivation to use the paretic upper limb in daily life over the first 24 weeks after stroke. *Journal of Neurologic Physical Therapy*, 43:197-203.
96. Dhand A, [Lang CE](#), Luke DA, Kim A, Li K, McCafferty L, Rosner B, Feske SK, Lee JM (2019) Social network mapping and functional recovery within 6 months of ischemic stroke. *Neurorehabilitation and Neural Repair*, 33:922-932.

97. *Waddell KJ, Strube MJ, Tabak RG, Haire-Joshu D, Lang CE (2019) Upper limb performance in daily life improves over the first 12 weeks post stroke. *Neurorehabilitation and Neural Repair*, 33:836-847.
98. Hoyt CR, Brown SK, Sherman SK, Wood-Smith M, Van AN, Ortega M, Nguyen AL, Lang CE, Schlagger BL, Dosenbach NUF (2020) Using accelerometry for comprehensive measurement of motor behavior in children: relationship of real-world movement to standardized evaluation. *Research in Developmental Disabilities*, 96:103546. doi: 10.1016/j.ridd.2019.103546.
99. *Surkar SM, Bland DB, Mattlage AE, Chen L, Gidday JM, Lee JM, Hershey T, Lang CE (2020) Effects of remote limb ischemic conditioning on muscle strength in healthy young adults: A randomized controlled trial. *PLOS One*, 15(2):e0227263. doi: 10.1371/journal.pone.0227263.
100. Bland DB, Parco P, Lang CE, Lenard E, Kallmi S, Pennock S, Lenze EJ (2020) Activity level and intensity of older adults in skilled nursing rehabilitation measured via actigraphy. *Journal of Geriatric Physical Therapy*, doi: 10.1519/JPT.0000000000000259.
101. *Holleran CL, Bland MD, Reisman, DS, Ellis TD, Earhart GM, Lang CE (2020) Day-to-day variability of walking performance measures in individuals post-stroke and individuals with Parkinson disease. *Journal of Neurologic Physical Therapy*, 44:241-247.
102. *Barth J, Klaesner JW, Lang CE (2020) Relationships between accelerometry and general compensatory movements of the upper limb after stroke. *Journal of NeuroEngineering and Rehabilitation*, Oct 20;17(1):138. doi: 10.1186/s12984-020-00773-4.
103. †Van Dillen LR, Lanier VM, Steger-May K, Wallendorf M, Norton BJ, Civello JM, Czuppon SL, Francois SJ, Roles K, Lang CE (2021) Effect of motor skill training in functional activities vs strength and flexibility exercise on function in people with chronic low back pain – a randomized clinical trial. *JAMA Neurology*, 78(4):385-395. doi:10.1001/jamaneurol.2020.4821.
104. Ercal B, Rodebaugh TL, Bland MD, Barco P, Lenard E, Lang CE, Miller JP, Yingling M, Lenze EJ (2021) Executive function moderates functional outcomes of engagement strategies during rehabilitation in older adults. *American Journal of Physical Medicine and Rehabilitation*, 100:635-642.
105. Arhos EK, Lang CE, Steger-May K, Van Dillen LR, Yemm B, Salsich GB (2021) Task-specific movement training improves kinematics and pain during the Y-balance test and hip muscle strength in females with patellofemoral pain. *Journal of the International Society of Arthroscopy, Knee Surgery, and Orthopedic Sports Medicine (JISAKOS)*, 6:277-282.
106. *Lang CE, Waddell KJ, Barth J, Holleran CL, Strube MJ, Bland MD (2021) Upper limb performance in daily life approaches plateau around three to six weeks post stroke. *Neurorehabilitation and Neural Repair*, 35:903-914.
107. Liew SL, Zavaliangos-Petropulu A, Schweighofer N, Jahanshad N, Lang CE, Lohse KR and the ENIGMA Stroke Recovery Working Group (2021) Smaller spared subcortical nuclei are associated with worse post-stroke sensorimotor outcomes in 28 cohorts worldwide. *Brain Communications*, 3(4):fcab254. doi:10.1093/braincomms/fcab254, 15 pages.
108. *Barth J, Bland MD, Konrad JD, Lohse KR, Lang CE (2021) Sensor-based categorization of upper limb performance in daily life of persons with and without neurological upper limb

- deficits. *Frontiers in Rehabilitation Sciences, Special Issue on Technology*, Vol 2, doi=10.3389/fresc.2021.741393.
109. Liew SL, Zavaliangos-Petropulu A, Schweighofer N, Jahanshad N, Lang CE, Lohse KR, Banaj N, Barisano G, Baugh LA, Bhattacharya AK, Bigjahan B, Borich MR, Boyd LA, Brodtmann A, Buetefisch CM, Byblow WD, Cassidy JM, Charalambous CC, Ciullo V, Conforto AB, Craddock RC, Dula AN, Egorova N, Feng W, Fercho KA, Gregory CM, Hanlon CA, Hayward KS, Holguin JA, Hordacre B, Hwang DH, Kautz SA, Khlif MS, Kim B, Kim H, Kuceyeski A, Lo B, Liu J, Lin D, Lotze M, MacIntosh BJ, Margetis JL, Mohamed FB, Nordvik JE, Petoe MA, Piras F, Raju S, Ramos-Murguialday A, Revill KP, Roberts P, Robertson AD, Schambra HM, Seo NJ, Shiroishi MS, Soekadar SR, Spalletta G, Stinear CM, Suri A, Tang WK, Thielman GT, Thijs VN, Vecchio D, Ward NS, Westlye LT, Winstein CJ, Wittenberg GF, Wong KA, Yu C, Wolf SL, Cramer SC, Thompson PM; ENIGMA Stroke Recovery Working Group (2021) Smaller spared subcortical nuclei are associated with worse post-stroke sensorimotor outcomes in 28 cohorts worldwide. *Brain Communications*, Oct 27;3(4):fcab254. doi: 10.1093/braincomms/fcab254. eCollection 2021.
 110. *Barth J, Waddell KJ, Bland MD, Lang CE (2022) Accuracy of an algorithm in predicting upper limb functional capacity in a United States population. *Archives of Physical Medicine and Rehabilitation*, 103:44-51.
 111. *Lang CE, Holleran CL, Strube MJ, Ellis TD, Newman CA, Fahey M, DeAngelis TR, Nordahl TJ, Reisman DS, Earhart GM, Lohse KR, Bland MD (2023) Improvement in the capacity for activity vs. improvement in the performance of activity in daily life during outpatient rehabilitation. *Journal of Neurologic Physical Therapy*, 47:16-25.
 112. *Konrad J, Marrus M, Lang CE (2022) A feasibility study of bilateral wrist sensors for measuring motor traits in children with autism. *Perceptual and Motor Skills*. 129:1709-1735.
 113. *Barth J, Lohse KR, Lang CE (2023) Predicting later categories of upper limb activity from earlier clinical assessments following stroke: an exploratory analysis. *Journal of NeuroEngineering and Rehabilitation*, Feb 21;20(1):24. doi: 10.1186/s12984-023-01148-1.

Case reports

NA

Reviews, chapters, editorials and invited publications

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. 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.
5. *Lang CE. Impaired motor control. In: *Geriatric Physical Therapy* (2011), 3rd edition. Edited by A Guccione, R Wong, D Avers; Elsevier.
6. 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.
7. *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.
8. *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.
9. *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.
10. Santello M, Lang CE (2015) Are Movement Disorders and Sensorimotor Injuries Pathologic Synergies? When Normal Multi-joint Movement Synergies Become Pathologic. *Frontiers in Human Neuroscience*, 8:1050. doi: 10.3389/fnhum.2014.01050.
11. *Lang CE, Lohse KR, Birkenmeier RL (2015) Dose and timing in neurorehabilitation: Prescribing motor therapy after stroke. *Current Opinion in Neurology*, 28:549-555.
12. *Hayward KS, Eng JJ, Boyd LA, Lakhani B, Bernhardt J, Lang CE (2016) Exploring the role of accelerometers in the measurement of real world upper limb use after stroke. *Brain Impairment*, 17:16-33.
13. Wolf SL, Kwakkel G, Bayley M, McDonnell MN for the Upper Extremity Stroke Algorithm Working Group (2016) Best practice for arm recovery post stroke: an international application. *Physiotherapy*, 102:1-4.
14. Reinkensmeyer DJ, Burdet E, Casadio M, Krakauer JW, Kwakkel G, Lang CE, Swinnen S, Ward N, Schweighofer N (2016) Computational neurorehabilitation: modeling plasticity and learning to predict recovery. *Journal of NeuroEngineering and Rehabilitation*, 13(1):42. Doi:10.1186/s12984-016-0148-3.
15. Winstein CJ, Stein J, Arena R, Bates B, Cherney LR, Cramer SC, Deruyter F, Eng JJ, Fisher B, Harvey RL, Lang CE, MacKay-Lyons M, Ottenbacher KJ, Pugh S, Reeves MJ, Richards LG, Stiers W, Zorowitz RD; on behalf of the American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, and Council on Quality of Care and Outcomes Research (2016) Guidelines for adult stroke rehabilitation and recovery: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*, 47(6):e98-e169. doi: 10.1161/STR.0000000000000098.
16. Dhand A, Luke D, Lang CE, Lee JM (2016) Social Networks and Neurological Illness. *Nature Reviews Neurology*, 12:605-612.

17. *Basso DM, Lang CE (2017) Consideration of dose and timing when applying interventions after stroke and spinal cord injury. *Journal of Neurologic Physical Therapy*, 41: Suppl 3 IV STEP Special Issue: S24-S31.
18. *Lohse KR, Pathania A, Wegman R, Boyd LA, Lang CE (2018) On the reporting of experimental and control therapies in stroke rehabilitation trials: A systematic-review. *Archives of Physical Medicine and Rehabilitation*, 99:1424-1432.
19. Bamman MM, Cutter GR, Brienza DM, Chae J, Corcos DM, DeLuca S, Field-Fote E, Fouad MN, Lang CE, Lindblad A, Motl RW, Perna CG, Reisman D, Saag KM, Savitz SI, Schmitz KH, Stevens-Lapsley J, Whyte J, Winstein CJ, Michel ME. (2018) Medical Rehabilitation: Guidelines to Advance the Field with High-Impact Clinical Trials, *Archives of Physical Medicine and Rehabilitation*, 99:2637-2648.
20. *Smith BA, Lang CE (2019) Sensor measures of symmetry quantify upper limb movement in the natural environment across the lifespan. *Archives of Physical Medicine and Rehabilitation*, 100:1176-1183.
21. *Lang CE, Bland MD. Impaired motor control and neurologic rehabilitation. In: *Geriatric Physical Therapy* (2019), 4th edition. Edited by A Guccione, R Wong, D Avers; Elsevier.
22. Kwakkel G, Van Wegen EEH, Burrige JH, Winstein CJ, Van Dokkum LEH, Alt Murphy M, Levin MF, Krakauer JW, on behalf of the Advisory Group (2019) Standardized measurements of quality of upper limb movement after stroke: Consensus-based core recommendations from the second Stroke Recovery and Rehabilitation Roundtable. *International Journal of Stroke*, 14:783-791.
23. Stinear CM, Lang CE, Zeiler S, Byblow WD (2020) Advances and challenges in stroke rehabilitation. *Lancet Neurology*, pii: S1474-4422(19)30415-6. doi: 10.1016/S1474-4422(19)30415-6.
24. Morris J, Jones M, DeRuyter F, Putrino D, Lang CE, Jake-Schoffman D (2020) LiveWell RERC State of the Science conference report on ICT access to support community living, health, and function for people with disabilities. *International Journal of Environmental Research and Public Health*, 17 pii: E274. doi: 10.3390/ijerph17010274.
25. Cade WT and Lang CE (2020) Invited Editorial. A step towards the future of seamless measurement with wearable sensors in pediatric populations with neuromuscular diseases. *Muscle & Nerve*, 61:265-267, doi: 10.1002/mus.26795.
26. Liew SL, Zavaliangos-Petropulu A, Jahanshad N, Lang CE, Hayward KS, Lohse K, Juliano JM, Assogna F, Baugh LA, Bhattacharya AK, Borich MR, Boyd LA, Brodtmann A, Buetefisch CM, Byblow WD, Cassidy JM, Conforto AB, Craddock RC, Dimyan MA, Dula AN, Ermer E, Etherton MR, Fercho KA, Gregory CM, Hadidchi S, Holguin JA, Hwang DH, Jung S, Kautz SA, Khlif MS, Khoshab N, Kim B, Kim H, Kuceyeski A, Lotze M, MacIntosh BJ, Margetis JL, Mohamed FB, Piras F, Ramos-Murguialday A, Richard G, Roberts P, Robertson AD, Rondina JM, Rost NS, Sanossian N, Schweighofer N, Shiroishi MS, Soekadar SR, Spalletta G, Stinear CM, Suri A, Tang WKW, Thielman GT, Vecchio D, Villringer A, Ward NS, Werden E, Westlye LT, Winstein C, Wittenberg GF, Wong KA, Yu C, Cramer SC, Thompson PM. (2020). The ENIGMA Stroke Recovery Working Group: Big data neuroimaging to study brain-behavior relationships after stroke. *Hum Brain Mapp*. Apr 20. doi: 10.1002/hbm.25015. Online ahead of print.

27. *[Lang CE](#), Barth J, Holleran CL, Konrad JD, Bland MD (2020). Implementation of wearable sensing technology for movement: Pushing forward into routine physical rehabilitation care. *Sensors (Basel)*. 20(20):E5744. doi: 10.3390/s20205744.
28. Stein J, Katz DI, Black Schaffer RM, Cramer SC, Duetsch AF, Harvey RL, [Lang CE](#), Ottenbacher KJ, Prvu-Bettger J, Roth EJ, Tirschwell DL, Wittenberg GF, Wolf SL, Nedungadi TP (2021) Clinical performance measures for stroke rehabilitation: Performance measures for the American Heart Association/American Stroke Association. *Stroke*, 52(10):e675-e700.
29. *[Schaefer SY](#), McCulloch KL, [Lang CE](#) (2022) Pondering the cognitive-motor interface in neurologic physical therapy. Editorial. *Journal of Neurologic Physical Therapy*. 46:1-2.
30. Adans-Dester CP, [Lang CE](#), Reinkensmeyer DJ, Bonato P. Wearable sensors for stroke rehabilitation. In: *Neurorehabilitation Technology*, 2nd Edition (2023). Edited by Reinkensmeyer DJ & Dietz V. SpringerLink.
31. Bernhardt J, Corbett D, Dukelow S, Savitz S, Solomon JM, Stockley R, Sunnerhagen KS, Verheyden G, Walker M, Murphy MA, Bonkhoff AK, Cadilhac D, Carmichael ST, Dalton E, Dancause N, Edwards J, English C, Godecke E, Hayward K, Kamalakannan S, Kim J, Kwakkel G, [Lang CE](#), Lannin N, Levin M, Lynch E, Mead G, Saa JP, Ward N (2023) *Lancet Neurology*, Apr;22(4):295-296. doi: 10.1016/S1474-4422(23)00072-8.

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.

Abstracts at Scientific and Clinical Meetings

Dr. Lang and colleagues regularly attend and present data at various scientific and clinical meetings, including meetings of the American Physical Therapy Association, the American Occupational Therapy Association, The American Academy of Neurology, the American Society for NeuroRehabilitation, the Society for the Neural Control of Movement, the Society for Neuroscience, and the International Stroke Conference of the American Heart Association. Most often, the abstracts are presented by trainees, but occasionally by Dr. Lang herself. Specific information on abstract presentations is available upon request.

Other, non-refereed publications

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.