

CURRICULUM VITAE

Larry W. Forrester, PhD

Associate Professor

Department of Physical Therapy & Rehabilitation Science

University of Maryland School of Medicine

Personal Information

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Education

B.A.	Duke University, Durham, NC Psychology	1972
M.A.	Wake Forest University, Winston-Salem, NC Physical Education	1984
Ph.D.	University of Maryland, College Park, MD Kinesiology: Motor Development/Motor Control	1997

Post Graduate Education & Training

Post-Doctoral Fellowship	Baltimore VAMC Stroke rehabilitation	1998-1999
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Employment History

Academic positions

1994-1998	Adjunct Lecturer, Department of Kinesiology, University of Maryland, College Park, MD (1-2 courses/yr--contractual)
1999-2006	Assistant Professor, Department of Physical Therapy and Rehabilitation Science, University of Maryland School of Medicine, Baltimore, MD
1999-2005	Director of Research Laboratories, Department of Physical Therapy and Rehabilitation Science, University of Maryland School of Medicine, Baltimore, MD
2000-present	Research Associate, Rehabilitation Research & Development Division, Baltimore Veterans Affairs Medical Center, Baltimore, MD
2001-present	Associate Member of Graduate Faculty, University of Maryland Graduate School
2002-present	Affiliate Faculty Member Doctoral Program in Gerontology, University of Maryland, Baltimore and University of Maryland, Baltimore County
2003-2006	Assistant Professor, Department of Neurology, University of Maryland School of

2003-present Medicine, Baltimore, MD (2^o appointment)
 Director of Human Motor Performance Laboratory, Rehabilitation Research & Development Division, BVAMC, Baltimore, MD

2006-present Associate Professor, Department of Physical Therapy and Rehabilitation Science, Department of Neurology, University of Maryland School of Medicine, Baltimore, MD

Other positions

1974-1976 Director of Physical Education, Carolina Friends School, Durham, NC

1976-1977 Director Physical Education & Athletics, Friends Seminary, New York, NY

1977-1982 Director of Athletics, Physical Education, & Outdoor Education, The Cambridge School, Weston, MA

1984-1987 Pediatric Child-life Specialist, Duke University Medical Center, Durham, NC

1986-1987 Assistant Men's Cross-country and Track Coach, Department of Athletics, Duke University, Durham, NC

1987-1993 Graduate Assistant, Department of Kinesiology, University of Maryland, College Park, MD

1994-1998 Research Assistant, Department of Physical Therapy, University of Maryland School of Medicine, Baltimore, MD

Professional memberships

1982- American Alliance for Health, Physical Education, Recreation & Dance

1988- North American Society for the Psychology of Sport and Physical Activity

2000- American Society of Neurorehabilitation

2000- National Stroke Association

2004- World Federation for Neurorehabilitation

2005- Society for Neuroscience

Honors and Awards

1968-1972 Varsity Letterman Duke University (8 times)

1970 Atlantic Coast Conference Champions (Cross-country)

1970-1972 All-ACC Track (2) /Cross-country (1)

1971-1972 NCAA Div. I Championships Qualifier (3 times)

1972 Penn Relays Champion

2000-2002 National Stroke Association Research Fellow

2001-2004 Junior Faculty Awardee, University of Maryland Claude D. Pepper OAIC,

Administrative Service

Institutional Service

UM School of Medicine

Department of Physical Therapy & Rehabilitation Science:	
Research Committee	1998-2002
Technology Committee	1998-2002
IRB & PhD Program Committee	2002-present
School of Medicine Council	

PTRS Representative <i>University of Maryland, Baltimore</i>	2005-present
Claude D. Pepper OAIC: PI Advisory Committee	2004-present
Grant reviewer Pepper Pilot Awards <i>Baltimore VAMC/ VA Maryland Health Care System</i>	2004-present
Research & Development Committee	2002-present
BVAMC Research Space Committee	2002-present
<u>National Service</u>	
<i>Journal Reviewer</i>	
Archives of Physical Medicine and Rehabilitation	2004-present
American Journal of Physical Medicine and Rehabilitation	2004-present
Journal of Motor Behavior	2005-present
Journal of Rehabilitation Research & Development	2005-present
Stroke	2006
<i>Abstract Reviewer</i>	
IEEE International Conference on Rehabilitation Robotics	2005
<i>Grant Reviewer</i>	
Veterans Affairs Merit Reviews: Subcommittee-Gulf War Research	2005
Veterans Affairs Merit Reviews: Rehabilitation Research & Development	2006

Teaching
Courses

Department of Kinesiology, University of Maryland, College Park, MD

1987-1993	Laboratory Instructor KNES 300 Biomechanics of Human Motion-30 undergraduates /class, required course KNES 370 Motor Development 2 classes/term 20 undergraduates /class, required course KNES 380 Motor Learning- Skill Acquisition, 2 classes/term 30 undergraduates /class, required course KNES 480 Biophysical Aspects of Human Movement, 18 undergraduates/class, advanced elective KNES 670 Motion Analysis of Human Movement, graduate level, 4-5 students/class KNES 675 Advanced Biomechanics, graduate level, 4-5 students/class
1994-1998	Adjunct Lecturer KNES 370 <u>Motor Development</u> required for major; 120 undergraduate students/class KNES 385 <u>Motor Learning and Skill Acquisition</u> required for major; 120 undergraduate students/class

Department of Physical Therapy & Rehabilitation Science, University of Maryland School of Medicine, Baltimore, MD

1998-1999	Laboratory Teaching Assistant, Department of Physical Therapy, University of Maryland School of Medicine, Baltimore, MD (2-3 labs /yr)
1999-2004	PTAB 581 <u>Seminar on Neurorehabilitation</u> (11-15 Masters PT students, 7 x 2-hr classes /yr)

- 2001 PTRS 688 Special Topics in Human Movement Analysis (4 PhD students; 4 hrs lab; 3 hrs lecture)
- 2002 PTAB 406 Principles of Neuroscience (Teaching assistant for 40 Masters PT students, 14 times /yr.).
- 2003 PTAB 599 Independent Research (3 Masters PT students--semester long projects)
- 2003-present DPTE 526 Neuromuscular I Seminar (10-12 Doctoral PT students, 3 x semester)
- 2003-present DPTE 527 Neuromuscular II Seminar (10-12 Doctoral PT students, 3 x semester)
- 2003-present PTRS 788 Rehabilitation Research Seminar Two semester seminar for 10 PhD students, faculty, open to UM-SOM, 26 meetings/yr.

Mentoring

Post-doctoral Fellows, University of Maryland School of Medicine:

Department of Neurology

- 2001-2002 David Heydrich, MD (secondary mentor)
Surface EMG collection and analysis of hemiparetic gait on treadmill
- 2004- 2005 Frank Skidmore, MD (secondary mentor)
Gait analysis and treadmill training in Parkinson's disease
- 2005-present Shawna Patterson, MD, PhD (primary mentor)
Stroke rehabilitation and robotics
- 2005-present Lewis Wheaton, PhD (primary mentor)
Stroke rehabilitation and neuroplasticity

Department of Gerontology

- 2001-2005 Carwile LeRoy, MD (secondary mentor)
Dynamometry, strength assessment, and neuroplasticity in stroke

Department of Physical Therapy & Rehabilitation Science

- 2002-2004 Federico Villagra, PhD (secondary mentor)
Transcranial magnetic stimulation and EMG assessment in stroke
- 2004-present Margaret Finley, PhD (secondary mentor)
Upper extremity robotics training in stroke
- 2006-present Timothy Judkins, PhD (secondary mentor)
Lower extremity robotics and short-term neuromotor adaptations in stroke

Post-doctoral Fellow, Massachusetts Institute of Technology:

- 2006-present Anindo Roy, PhD (secondary mentor)
Stroke rehabilitation and robotics applications to exercise therapies

Pre-doctoral trainees, University of Maryland School of Medicine:

Department of Physical Therapy & Rehabilitation Science

- 2001-2004 Michelle Harris-Love MPT (PhD thesis committee)
Gait assessments, motor control and EMG analysis
- 2002-2004 Sandy McCombe-Waller, PhD, PT, NCS (PhD thesis committee)
Transcranial magnetic stimulation assessment in stroke
- 2002-2006 Stephanie Gracyalny, MPT (PhD primary advisor)
Gait assessments, postural control, and falls risk in stroke
- 2003-present Christopher Mizelle, MS (PhD primary thesis advisor, secondary academic advisor)
Gait analysis, motor control, robotics, neuroplasticity in stroke
- 2004-present Shih-Chiao Tseng, MPT (PhD primary academic advisor; secondary thesis advisor)

- Postural motor control, robotics, neuroplasticity, gait assessment
- 2004-present Sharmila Nabar, MSPT (PhD thesis committee)
Surface EMG spectral analysis during cycle ergometry
- 2005-present Douglas Savin, MPT (PhD secondary advisor)
Neuroplasticity and robotics specialization areas
- 2006-present Eera Khanna, BS (PhD primary advisor).
Stroke rehabilitation, robotics therapies, motor control

Grant Support

Current as PI:

- 2004-2007 Advanced Research Career Development Award, Department of Veterans Affairs: Rehabilitation Research and Development Service. “Development of an Ankle Robot Module with Treadmill Training in Chronic Stroke.” \$319,000 (**PI**, VA# B3390K).
- 2005-2010 5 yr Sub-study “Modular Lower Extremity Robotics Assisted Exercise after Stroke” \$200,000/yr. (**PI**) within VA RR&D Center of Excellence: Task-oriented exercise and robotics in neurological disease.
- 2006-2008 NIH Claude D. Pepper Older Americans Independence Center Pilot Grant: “Impedance Controlled Ankle Robot Training after Stroke: A Comparison of Bilateral Performance-based vs. Unilateral Passive Approaches,” \$20,000. (**PI**)
- 2006-2007 NIH Claude D. Pepper Older Americans Independence Center Pilot Grant: “Impedance-Controlled Ankle Robotics: A Novel Technology for Gait Rehabilitation after Stroke,” \$20,000. (**PI**)

Current as Co I:

- 2005-2010 VA RR&D Center of Excellence: Task-oriented exercise and robotics in neurological disease. **Co-I** on Center (Co- PI’s: Richard F. Macko, MD / Christopher T. Bever, MD Center, \$4,100,000). Also **PI** of the Center’s Human Performance & Neural Plasticity Core \$39,000/yr.
- 2006-2007 VA RR&D Plasticity Center of Excellence Pilot Study: Adaptations in cortical function induced by short-term robot-assisted training of foot movements in chronic stroke survivors. \$20,000 **Co-I** (PI: Andreas Luft, MD).
- 2006-2007 VA-REAP Pilot Study: Task-specific modification in cortical activation after BATRAC training. \$20,000 **Co-I** (PI: Andreas Luft, MD).
- 2006-2011 NIH Claude D. Pepper Older Americans Independence Center Grant, Neuromotor Function Core (Core 2), School of Medicine, University of Maryland, Baltimore, MD. **Co-I** of Core 2, \$120,429/yr; (PI: Andrew P. Goldberg, MD, \$4,140,000)

Past:

- 2000-2002 National Stroke Association Fellowship. Neuromuscular adaptations to treadmill training in chronic hemiparetic stroke. \$60,000. (**PI**)
- 2000-2003 Research Career Development Award, Department of Veterans Affairs: Rehabilitation Research and Development Service. Treadmill locomotor rehabilitation in chronic hemiparetic stroke \$195,000 (**PI**, VA# B2375V).
- 2001-2006 NIH Claude D. Pepper Older Americans Independence Center Grant, Quantitative Movement Assessment and Neuroplasticity Core, School of Medicine, University of Maryland, Baltimore, MD. **Co-PI** of Core B. \$162,000/yr; (PI: Andrew P. Goldberg, MD, \$8,115,842)

2002-2003 NIH Claude D. Pepper Older Americans Independence Center Pilot Grant. Short-term Effects of Treadmill Exercise on Cortico-spinal Excitability of the Lower Extremity in Chronic Hemiparetic Stroke Patients. \$25,000. (PI)

Publications

Journal articles -refereed

1. Caldwell, G.E. & Forrester, L.W. (1992). Estimates of mechanical work and energy transfers: Demonstration of a rigid body power model of the recovery leg in gait. *Medicine and Science in Sports and Exercise*, 24, pp.1396-1412.
2. Whitall, J., Forrester, L.W., & Getchell, N. (1997). The effect of nonspecific task constraints on quadrupedal locomotion: I. Interlimb coordination. *Motor Control* 1, 138-160.
3. Forrester, L.W. & Whitall, J. (1997). The effect of nonspecific task constraints on quadrupedal locomotion: II. Joint kinematics. *Motor Control* 1, 208-228.
4. Whitall, J., Forrester, L.W., & Song, S. (1999). Dual-finger preferred-speed finger tapping: Effects of coordination mode and anatomical finger/limb pairings. *Journal of Motor Behavior* 31, 325-339.
5. Forrester, L.W. & Whitall, J. (2000). Bimanual finger tapping: Effects of frequency and auditory information on timing consistency and coordination. *Journal of Motor Behavior* 32, 176-191.
6. Silver, K.H.C., Macko, R.F., Forrester, L.W., Goldberg, A.P., & Smith, G.V. (2000). Effects of aerobic treadmill training on gait velocity, cadence, and gait symmetry in chronic hemiparetic stroke. *Neurorehabilitation and Neural Repair* 14, 65-71.
7. Smith GV, Forrester LW, Silver KHC, & Macko RF. (2000). Effects of Treadmill Training on Translational Balance Perturbation Responses in Chronic Hemiparetic Stroke Patients. *Journal of Stroke and Cerebrovascular Diseases* 9, 238-245.
8. Getchell, N., Forrester, L.W. & Whitall, J. (2001). Individual differences and similarities in the stability, timing, consistency and natural frequency of rhythmic coordinated actions. *Research Quarterly for Exercise and Sport* 72, 13-21.
9. Gardner, A. W., Forrester, L.W., & Smith, G.V. (2001). Altered gait profile in subjects with peripheral arterial disease. *Vascular Medicine* 6, 31-34.
10. Harris-Love, M.L., Forrester, L.W., Macko, R.F., Silver, K.H.C., & Smith, G.V. (2001). Hemiparetic Gait Parameters in Overground Versus Treadmill Walking. *Neurorehabilitation and Neural Repair* 15, 105-112.
11. Luft, A.R., Smith, G.V., Forrester, L.W., Whitall, J., Macko, R.F., Goldberg, A.P., & Hanley, D.F. (2002). Comparing brain activation associated with isolated upper and lower limb movement across corresponding joints. *Human Brain Mapping* 17, 131-140.
12. Luft, AR, McCombe-Waller, S, Forrester, LW, Smith, GV, Whitall, J, Macko, RF, Schulz, JB, & Hanley, DF. (2004). Lesion location alters brain activation in chronically impaired stroke survivors. *Neuroimage*, 21, 924-935.
13. Harris-Love, M, Macko, RF, & Whitall, J., & Forrester, LW. (2004). Comparison of quadriceps and hamstrings EMG during overground vs. treadmill walking in chronic stroke patients. *Neurorehabilitation and Neural Repair* 18, 154-160.
14. Luft, A.R., McCombe-Waller, S., Whitall, J., Forrester, L.W., Macko, R.F., Sorkin, J.D., Schultz, J.B., Goldberg, A.G., & Hanley, D.F. (2004). Repetitive bilateral arm training and motor cortex activation in chronic stroke. *JAMA* 292, 1853-1861.

15. Haeuber, E, Shaughnessy, M, Forrester, LW, Coleman, KL, Macko, RF. (2004) Microprocessor-Linked Accelerometer Monitoring of Home and Community Based Ambulatory Activity after Stroke. *Arch. Phys Med & Rehab* 85:1997-2001.
16. Luft, A.R., Forrester, L., Macko, R.F., McCombe-Waller, S., Whitall, J., Villagra, F., Hanley, D.F. (2005). Brain activation of lower extremity movement in chronically impaired stroke survivors. *Neuroimage*, 26, 184-194.
17. Macko, R.F., Ivey, F. M., Forrester, L.W. (2005). Task-Oriented Aerobic Exercise in Chronic Hemiparetic Stroke: Training Protocols and Treatment Effects. *Topics in Stroke Rehabilitation* 12; 1: 45-57.
18. Macko, RF, Ivey, F., Forrester, L.W., Hanley, DF, Sorkin, J.D., Katzel, L. I., Silver, KH, Goldberg, A.P. (2005). Treadmill Training Improves Fitness and Ambulatory Function in Chronic Stroke Patients. *Stroke* 36: 2206-2211.
19. Liu, W, Forrester, LW, & Whitall, J. (2006). A Note on Time-frequency Analysis of Finger Tapping. *Journal of Motor Behavior*, 38 (1): 18-28.
20. Forrester, LW, Hanley, DF, Macko RF. (2006). Effects of treadmill training on TMS-induced excitability to quadriceps after stroke. *Arch. Phys Med & Rehab.*, Feb; 87 (2): 229-234.
21. Mizelle C, Rodgers M, Forrester L. Bilateral foot center of pressure measures predict hemiparetic gait velocity. *Gait Posture* 2006; 24(3):356-63.
22. Patterson SL, Forrester LW, Rodgers MM, Ryan AS, Ivey FM, Sorkin JD, Macko RF. (2007). Determinants of walking function after stroke: Differences by deficit severity. *Arch Phys Med Rehabil.* Jan; 88(1):115-119.
23. Wheaton LA, Mizelle, C, Forrester LW, Bai O, Shibasaki H, Macko RF. How does the brain respond to unimodal and bimodal sensory demand in movement of lower extremity? *Exp. Brain Res* 2007; 180: 345-354.
24. Patterson SL, Rodgers MM, Macko RF, Forrester LW. (Accepted). Effect of treadmill exercise training on spatial and temporal gait parameters in individuals with chronic stroke. *JRRD*.
25. Wheaton LA, Carpenter M, Mizelle JC, Forrester LW. (Accepted). Preparatory Band Specific Premotor Cortical Activity Differentiates of Upper and Lower Extremity Movement. (*Exp Brain Res*).

Journal Articles Submitted

1. Forrester LW, Wheaton LA, Luft AR. Exercise-mediated Locomotor Recovery and Lower Extremity Neuroplasticity after Stroke (*JRRD*).
2. Luft AR, Macko RF, Forrester LW, Villagra F, Ivey, F, Sorkin JD, Whitall J, McCombe-Waller S, Goldberg AP, Hanley DF. Treadmill exercise recruits subcortical neural networks to improve walking speed and fitness in stroke survivors. (*PNAS*).
3. McCombe Waller S, Forrester LW, Villagra F, Whitall J. Central motor excitability with unilateral dominant, unilateral nondominant, and bilateral movement tasks in left and right handed adults. (*J Clin. Neurophys*).
4. Wheaton LA, Judkins TN, Mizelle JC, Macko RF, Krebs HI, Hogan N, Forrester LW. Rapid adaptations to unexpected perturbations of ankle movements: behavior and neurophysiology. (*Exp Brain Res*).
5. Roy A, Krebs HI, Williams DJ, Bever CT, Forrester LW, Macko RF, Hogan N. Robot-aided neurorehabilitation: a robot for ankle rehabilitation. (*IEEE-TNSRE*).

Chapters

1. Forrester, L.W., Phillips, S.J., & Clark, J.E. (1993). Locomotor coordination in infancy: The transition from walking to running. In G.J.P. Savelsbergh (Ed.) The development of coordination in infancy (pp.359-394). Amsterdam: Advances in Psychology Series, North Holland.

Abstracts (refereed):

1. Caldwell, G.E., Forrester, L.W., Phillips, S.J., & Clark, J.E. (1989). Segmental energy contributions in walking and running. In Proceedings from the XIIth International Congress of Biomechanics, Los Angeles, CA.
2. Clark, J.E., Truly, T.L., & Forrester, L.W. (1990, November). Take home ideas for elementary school teachers. MAHPERD, Westminster, MD.
3. Forrester, L.W., Clark, J.E. & Caldwell, G.E. (1990, May). Developmental changes in locomotor coordination: The role of mechanical energy transfers. Paper presented at the annual meeting of the North American Society for the Psychology of Sport and Physical Activity, Houston, TX.
4. Marshall, T.R., Forrester, L.W., & Fox, N.A. (1990). Phase space analysis of human EEG during photic stimulation. *Psychophysiology*, 27, p. S49.
5. Forrester, L.W., Phillips, S.J., & Clark, J.E. (1991, June). Are walking and running the same pattern of coordination? Paper presented at the meeting of the North American Society for the Psychology of Sport and Physical Activity, Asilomar, CA.
6. Caldwell, G.E. & Forrester, L.W. (1991). Mechanical work and the time course of energy transfer in the swing phase of gait. In C.L. Vaughan & P.E. Martin (Eds.) Proceedings of the 15th Annual Meeting of the American Society of Biomechanics (pp. 40-41), Tempe, AZ.
7. Forrester, L.W., Phillips, S.J., Caldwell, G.E., & Clark, J.E. (1993, June). Continuity in the developmental transition from walking to running. *Journal of Sport & Exercise Psychology*, 15, p. S15.
8. Forrester, L.W., Phillips, S.J., Caldwell, G.E., & Clark, J.E. (1994, June). Developing gait patterns and lower limb coordination: A study of intralimb relative phasing. *Journal of Sport & Exercise Psychology*, 16, p. S53.
9. Whitall, J., Forrester, L.W., Getchell, N., & Clark, J.E. (1994, July) Transitions in locomotor coordination: The emergence of running. Paper presented at XIII Biennial meeting of the International Society for the Study of Behavioural Development, Amsterdam, Netherlands.
10. Whitall, J., Forrester, L.W., & Getchell, N. (1995, June) On the monkey crawl and crab walk: The influence of task constraints on interlimb coordination. Paper presented at the meeting of the North American Society for the Psychology of Sport and Physical Activity, Asilomar, CA.
11. Whitall, J., Forrester, L.W., Kelsey, C., & Getchell, N. (1997, June). Development of dual-task locomotion: Clapping with walking/galloping. Paper presented at the 13th International Symposium-Multisegmental Control of Posture & Gait, Paris, France.
12. Getchell, N., Forrester, L.W., & Whitall, J. (1999, June). Individual differences in the stability, timing consistency and natural frequency of coordinated actions. Paper presented at the meeting of the North American Society for the Psychology of Sport and Physical Activity, Clearwater, FL.
13. Forrester, L.W. & Whitall, J. (1999, August). Dual finger tapping: Effects of frequency and external auditory signals on timing and coordination. Paper presented at the Progress in Motor Control: II Conference, State College, PA.

14. Forrester, L.W., Macko, R., Silver, K., & Smith, G.V. (1999). Relationships between lower limb strength and functional tasks: A case study of chronic cerebellar stroke rehabilitation via treadmill training. *Neurorehabilitation and Neural Repair*, 13, p. 37.
15. Forrester, L.W., Macko, R., Silver, K., & Smith, G.V. (1999). Treadmill training influences on lower extremity strength: A case study of chronic cerebellar stroke. *Neurorehabilitation and Neural Repair*, 13, p. 37.
16. Smith, G.V., Forrester, L.W., Harris-Love, M., Silver, K.H.C., & Macko, R.F. (2000, February). A case study of aerobic treadmill training in a patient with chronic cortical and cerebellar stroke. Paper presented at the Combined Sections Meeting of the American Physical Therapy Association, New Orleans, LA.
17. Silver, K.H.C., Forrester, L.W., Macko, R.F., & Smith, G.V. (2000, February). Effects of aerobic treadmill training on gait velocity, cadence, and gait symmetry in chronic hemiparetic stroke: A preliminary report. Paper presented at the 2nd National Veterans Affairs Rehabilitation research & Development Conference, Arlington, VA.
18. Smith, G.V., Forrester, L.W., Silver, K.H.C., & Macko, R.F. (2000, February). Effects of regular treadmill training on movement times following standardized translational balance perturbations in patients with chronic hemiparesis due to remote stroke. Paper presented at the 2nd National Veterans Affairs Rehabilitation research & Development Conference, Arlington, VA.
19. Smith, G.V., Forrester, L.W., & Macko, R.F. (2000). Altered lower extremity transcranial MEPs and torques output in hemiparetic stroke with fatiguing exercise. *Journal of Stroke and Cerebrovascular Diseases*, 9, p. 203.
20. Harris-Love, M.L., Forrester, L.W., Macko, R.F., Silver, K.H.C., & Smith, G.V. (2001, February). Hemiplegic gait patterns in overground vs. treadmill walking: Differential responses based on level of impairment. Paper presented at the Combined Sections Meeting of the American Physical therapy Association, San Antonio, TX.
21. Harris-Love, M.L., Forrester, L.W., Macko, R.F., Silver, K.H.C., Smith, G.V. (2001, May). Comparison of Hemiparetic Gait Patterns in Overground and Treadmill Walking. Paper presented at the American Society of Neurorehabilitation annual meeting; Philadelphia, PA.
22. Smith, G.V., Forrester, L.W., & Macko, R.F. (2001, May). Effects of a Single Bout of Submaximal Treadmill Walking on Corticospinal Excitability in Chronic Hemiparetic Stroke: A Preliminary Report. Paper presented at the American Society of Neurorehabilitation annual meeting; Philadelphia, PA.
23. McCombe Waller, S., Luft, A., Smith, G.V., Forrester, L.W., Hanley, D. & Whitall, J. (2001, August) "Integrative assessment of neuroplasticity after repetitive bilateral upper extremity training for chronic stroke: A case study." 3rd International Symposium of Progress in Motor Control: From Basic Science to Application, Montreal, Canada.
24. Harris-Love, M.L., Forrester, L.W., Macko, R.F., & Smith, G.V. (2002). Hemiparetic vastus lateralis activation patterns in overground compared with treadmill walking. *Neurorehabilitation and Neural Repair* 16, p. 379.
25. Forrester, L.W., Macko, R.F., & Smith, G.V. (2002). Short-term treadmill exercise in chronic stroke: Evidence of differential fatigue effects in quadriceps muscles. *Proceedings of the 3rd World Congress in Neurological Rehabilitation*, Monduzzi Editore, Bologna, IT, pp. 263-266.
26. A.R. Luft, S. Waller, L. Forrester, J. Whitall, J.B. Schulz, D.F. Hanley. Lesion location alters brain activation in chronically impaired stroke survivors. *Soc for Neurosci. Abstracts*, 2003.

27. Forrester, L.W., Villagra, F., Macko, R.F., Hanley, D.F. (2004) Treadmill vs. stretching: Short-term CNS adaptations to single bouts of submaximal exercise in chronic stroke patients. Claude D. Pepper Older Americans Independence Centers Annual Meeting, Harvard University, Cambridge, MA.
28. Luft AR, McCombe-Waller S, Whittall J, Smith GV, Forrester LW, Macko RF, Hanley DF. Bilateral training induces functionally relevant recruitment of contralesional motor cortex in chronic stroke survivors. Abstract presented at the Annual Neural Control of Movement Conference: Motor Learning and Plasticity Satellite Meeting, Barcelona, Spain, March 2004.
29. Luft, AR, McCombe-Waller, S, Whittall, J, Smith, GV, Forrester, LW, Macko, RF, Hanley, DF. Bilateral training induces functionally relevant recruitment of contralesional motor cortex in chronic stroke survivors. Abstract presented at the Annual Neural Control of Movement Conference: Motor Learning and Plasticity Satellite Meeting, Barcelona, Spain, March 2004.
30. Liu, W., Forrester, L., Whittall, J. (2004). Demonstration of time-frequency analysis methods for finger tapping. *Journal of Sport & Exercise Psychology*, 26, S125
31. Mitsdörffer, M.S., Whittall, J., Forrester, L., Waller, S., Villagra, F., Macko, R., Hanley, D.F., Luft, A. R. (2004, June). Brain activation patterns during paretic movement depend on side of stroke. Proceedings of the 5th World Stroke Congress, Vancouver, BC, Canada.
32. Luft, A.R., Waller, S., Whittall, J., Forrester, L.W., Smith, G.V., Macko, R.F., Hanley, D.F. (2004, June). Bilateral training induces functionally relevant recruitment of contralesional motor cortex in chronic stroke survivors. Proceedings of the 5th World Stroke Congress, Vancouver, BC, Canada.
33. Forrester, L.W., Villagra, F, Macko, R.F., Hanley, D.F. (2004, June). Treadmill vs. stretching: Short-term CNS adaptations to single bouts of submaximal exercise in chronic stroke patients. Proceedings of the 5th World Stroke Congress, Vancouver, BC, Canada.
34. Rodgers, M.M., Forrester, L.W., Mizelle, C., Harris-Love, M. (2004, Sept.). Effects of gait velocity on COP symmetry measures in individuals with stroke. Proceedings of the 28th Annual Meeting of the American Society of Biomechanics, Portland, OR.
35. Forrester, L., Harris-Love, M., Mizelle, C, Macko, R., Rodgers, M. (2004). Foot Center of Pressure Measures Characterize Hemiparetic Gait Asymmetry in Individuals with Chronic Stroke. *Arch. Phys Med & Rehab.* 85, E14.
36. Luft, AR, McCombe Waller, S, Whittall, J, Forrester, LW, Macko, RF, Sorkin, JD, Schulz, JB, Goldberg, AP, Hanley, D. Repetitive Bilateral Arm Training and Motor Cortex Activation in Chronic Stroke: A randomized controlled trial. Annual Pepper Center Meeting, Bethesda, MD, 2005.
37. McCombe Waller, S, Villagra, F, Forrester, LW, Whittall, J. Central Motor Excitability with Unilateral Dominant, Unilateral Nondominant and Bilateral Movement Tasks in Left and Right Handed Adults. Annual Pepper Center Meeting, Bethesda, MD, 2005.
38. McCombe-Waller, S., Villagra, F., Forrester, L., Whittall, J. Central Motor Excitability with Unilateral Dominant, Unilateral Nondominant, and Bilateral Movement Tasks in Left- and Right- Handed Adults Program. No. 333.2. *2005 Abstract Viewer/Itinerary Planner*. Washington, DC: Society for Neuroscience, 2005. Online.
39. Luft, AR, Macko, R, Forrester, L, Villagra, F, Hanley, D. Subcortical Reorganization Induced by Aerobic Locomotor Training in Chronic Stroke Survivors. Program No. 865.8. *2005 Abstract Viewer/Itinerary Planner*. Washington, DC: Society for Neuroscience, 2005. Online.
40. Forrester LW, Patterson SL, Rodgers MM, Macko RF (2006, May). Spatio-temporal Effects of 6-months Treadmill Training in Individuals with Chronic Stroke. *Cerebrovasc Dis.* 21 (suppl 4), p.130.

41. Mary Rodgers, Larry Forrester, Shawna Patterson, and Richard Macko. Biomechanical correlates to aerobic treadmill training in individuals with chronic stroke. World Congress of Biomechanics, Munich, Germany. August 1-5, 2006
42. Villagra F, Macko R, Forrester L, Hanley DF, Luft AR (2006, October). Treadmill exercise reduces microvascular brain damage. Second Neuroplasticity & Rehabilitation Conference, Hertie Institute for Clinical Brain Research, Tübingen, Germany.
43. Timothy N. Judkins, Lewis A. Wheaton, J.C. Mizelle, Hermano I. Krebs, Richard F. Macko, and Larry W. Forrester. Sensorimotor adaptation to ankle perturbations. Northeast American Society of Biomechanics Conference. College Park, MD, March 30-31, 2007.
44. Ira Khanna, Shawna Patterson, Anindo Roy, Timothy N. Judkins and Larry Forrester. Assessment of Hemiparetic Ankle Movements Using an Impedance Controlled Ankle Robot. Northeast American Society of Biomechanics Conference. College Park, MD. March 30-31, 2007.
45. Timothy Judkins, Lewis Wheaton, Chris Mizelle, Richard Macko, and Larry Forrester. Visual and proprioceptive feedback affects adaptation to perturbed ankle movements. 14th Annual Meeting of the Cognitive Neuroscience Society, New York, NY, May 5-8, 2007
46. Lewis Wheaton, Timothy Judkins, Chris Mizelle, Richard Macko, and Larry Forrester. Behavioral and neurophysiological effects of unexpected perturbations to ankle movements. 14th Annual Meeting of the Cognitive Neuroscience Society, New York, NY, May 5-8, 2007
47. Chris Mizelle, Lewis Wheaton, Larry Forrester, Richard Macko. Sensorimotor complexity differentially affects cortical activity in knee movement. 14th Annual Meeting of the Cognitive Neuroscience Society, New York, NY, May 5-8, 2007.
48. Roy A, Krebs HI, Patterson SL, Judkins TN, Khanna I, Forrester LW, Macko RF, Hogan N. Measurement of human ankle stiffness using the Anklebot. ICORR. Noordwijk, Netherlands June 13-17, 2007.
49. Judkins TN, Wheaton LA, Mizelle JC, Krebs HI, Macko RF, Forrester LW. Effect of visual uncertainty on adaptation to ankle perturbations. American Society of Biomechanics, Palo Alto, CA, August 22-25, 2007.

Major invited speeches

- 2002 “Short-term Effects of Treadmill Exercise on Corticospinal Excitability of the Lower Extremity in Chronic Hemiparetic Stroke Patients,” External Advisory Committee Annual Site Visit, Claude D. Pepper Center, University of Maryland, Baltimore, MD
- 2002 “Stroke Rehabilitation Interventions: Development of a Short-term Model for Exercise and Pharmacological Agents,” Human Cortical Physiology Section, NIH-NINDS Medical Neurology Branch, Bethesda, MD.
- 2002 “Aerobic treadmill training in chronic stroke: More than classic cardiovascular fitness,” In symposium “Kinesiological Contributions to Stroke Rehabilitation,” Annual Meeting of North American Society for the Psychology of Sport and Physical Activity, Baltimore, MD.
- 2003 “Task-oriented exercise after stroke: Mechanisms of neuromuscular plasticity,” Symposium: “Enhancing Physical Activity and Motor Skills in Aging Populations,” Annual Meeting of American Alliance for Health, Physical Education, Recreation & Dance, Philadelphia, PA.
- 2003 “Effects of Short-term Exercise on Lower Extremity CNS Excitability in Chronic Stroke Patients,” External Advisory Committee Annual Site Visit, Claude D. Pepper Center, University of Maryland, Baltimore, MD.

- 2004 “Ankle Robot: Getting Started- Phase I Experimental Protocols,” Newman Rehabilitation Robotics Research Group, Massachusetts Institute of Technology, Cambridge, MA.
- 2005 “Lower Extremity Robotics & Neuroplasticity in Patients with Stroke,” External Advisory Committee Annual Site Visit, Claude D. Pepper Center, University of Maryland.
- 2005 “Kinematic and Kinetic Effects of Ankle Robot Loads During Gait: Preliminary Findings,” Newman Rehabilitation Robotics Research Group, Massachusetts Institute of Technology, Cambridge, MA.
- 2006 “Progressive Aerobic Treadmill Exercise after Stroke: Model and Mechanisms for Gait Rehabilitation,” Second Neuroplasticity & Rehabilitation Conference, Satellite Symposium: Modern Stroke Physical Therapy, Hertie Institute for Clinical Brain Research, Tübingen, Germany.
- 2006 “Aerobic Treadmill Exercise: A New Gait Rehabilitation Model After Stroke,” National Stroke Association Regional Meeting, Orlando, FL.
- 2007 “Aerobic Treadmill Training: An Evidence-based Model for Gait Rehabilitation after Stroke,” Delaware Stroke Initiative, Physical Therapy Conference on Stroke Rehabilitation, Wilmington, DE.