G-40-619
#7

a. Specific Aims
The Specific Aims are unchanged from the original application.

b. Studies and Results
This report presents work conducted from April 15, 2004 to March 31, 2005. During this time we completed all testing of all participants. The experimental design has not changed. Minor modifications have been made in the methods based on experience obtained during the collection of preliminary data on patients with Parkinson's disease.

Regarding the secondary outcome variables, the analysis of single motor unit (SMU) activation is complete. We still use the Cambridge Electronic Design Spike2 analysis software. This is operational in the Movement Analysis Core at Georgia Tech. We have collected information on SMUs from the first dorsal interossei (FDI) and the quadriceps muscle, i.e. vastus lateralis consistent with our overall study design. We continue to use force transducers to monitor voluntary effort during SMU activation. This allows us to study the relationship between force generation and motor unit activation, yet another index of central neural plasticity.

There have been no staff changes during this past year.

c. Significance
The enhancements to the protocol have strengthened the experimental design and are anticipated to increase the power of our methodology to detect changes in central nervous system plasticity that may occur in response to our interventions. If validated, these methods will enhance our ability to further examine the central nervous system effect of these and other CAM interventions.

d. Plans
We plan to continue to analyze the data and prepare the results for manuscript presentation.

e. Human Subjects
We currently follow all rules and regulations of IRB using now a combined Informed Consent between Emory University and Georgia Tech.

f. Publications and Presentation in which T'ai Chi applications to Parkinson's disease patients was discussed relative to the Emory CAM

Abstracts:
Hass, C., D.W. Waddell, S. Wolf, J. Juncos and R.J. Gregor The Relationship Between Knee Extensor Strength And Balance In Parkinson's Disease XXth International Congress of ISB and 29th Annual Meeting for the ASB. August 1-5, 2005.

Publications:

1. Hass, C.J., D.E. Waddell, S.L. Wolf, J.L. Juncos and R.J. Gregor Gait Initiation in Older Adults with Postural Instability American Journal of Physical Therapy (in review)
2. Hass, C.J., D.E. Waddell, R.P. Fleming, J.L. Juncos and R.J. Gregor Gait Initiation and Dynamic Balance Control in Parkinson's disease. Archives of Physical Medicine and Rehabilitation. (in press, 2005)
3. Hass, C.J., R.J. Gregor, D.E. Waddell, A. Oliver, D.W. Smith, R.P. Fleming and S.L. Wolf The Influence of Tai Chi Training on the Center of Pressure Trajectory During Gait Initiation in Older Adults. Archives of Physical Medicine and Rehabilitation. 85:1593-98, 2004.
4. Kressig, R.W., R.J. Gregor, A. Oliver, D. Waddell, W. Smith, M. O'Grady, A. Curns, M. Kutner and S.L. Wolf Temporal and Spatial Features of Gait in Older Adults Transitioning to Frailty Gait and Posture. 20:30-35, 2004.

e. Project-Generated Resources

NA

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel in the order listed on Form Page 2.
Photocopy this page or follow this format for each person.

NAME	POSITION TITLE
Robert J. Gregor	Professor

EDUCATION/TRAINING (*Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.*)

INSTITUTION AND LOCATION	DEGREE (*if applicable*)	YEAR(s)	FIELD OF STUDY
State University college, Cortland, NY	BSE	1966	Physical Education
Ball State University, Muncie, IN	M.A.	1970	Physical Education Physiology
Penn State University, University Park, PA	Ph.D.	1976	Biomechanics

RESEARCH AND PROFESSIONAL EXPERIENCE: Concluding with present position, list, in chronological order, previous employment, experience, and honors. Include present membership on any Federal Government public advisory committee. List, in chronological order, the titles, all authors, and complete references to all publications during the past three years and to representative earlier publications pertinent to this application. If the list of publications in the last three years exceeds two pages, select the most pertinent publications. **DO NOT EXCEED TWO PAGES.**

RESEARCH AND PROFESSIONAL EXPERIENCE:

1966-1969 Teacher in the New York State Public School System
1969-1970 Graduate Teaching Assistant, Ball State University
1970-1971 Instructor and Lecturer in Physical Education, Ball State University
1971-1975 Graduate Research Assistant, Penn State University, Biomechanics Laboratory
1975-1982 Assistant Professor, Department of Kinesiology, UCLA
1982-1990 Associate Professor, Department of Kinesiology, UCLA
1990-1992 Professor, Department of Kinesiology, UCLA
1992-1993 Professor, Department of Physiological Science, UCLA
1993-2002 Professor, Department of Health & Performance Sciences, Georgia Tech
1995-Present Adjunct Associate Professor of Physiology, Emory University Medical School
1997-2002 Head, Department of Health & Performance Sciences, Georgia Tech
1997-Present Director, Center for Human Movement Studies, Georgia Tech
1997-2005 Chair, IACUC, Georgia Tech
2002-Present Professor and Chair, School of Applied Physiology, Georgia Tech
2003-Present Adjunct Professor, Department of Rehabilitation Medicine, Emory University Medical School

HONORS, AWARDS, AND ACTIVITIES

Fellow, American College of Sports Medicine
Member, International Olympic Committee (IOC) Medical Commission
Sub-commission on Biomechanics and Physiology (1981-2003)
Founding Editor-in-Chief, Journal of Applied Biomechanics (1991-97)
Distinguished Alumni, Cortland State University (1992)
President, American Society of Biomechanics (1996-97)

PUBLICATIONS

Sherif MH, Gregor RJ, Lui LM, Roy RR, and Hager CL. Correlation of myoelectric activity and muscle force during selected cat treadmill locomotion J. Biomechanics. 16:691-701, 1983.

Sherif, MH, Lyman J and Gregor RJ Phasic relations in 90^0 abduction-adduction of the arm: the ARIMA Representation J. Biomechanics. 17:215-224, 1984.

Whiting WC, Gregor RJ, Roy RR, and Edgerton VR. A technique for estimating mechanical work of individual muscles in the cat during treadmill locomotion. J. Biomechanics. 17:685-694, 1984.

Lovely RG, Gregor RJ, Roy RR, and Edgerton VR. Effects of training on the recovery of full-weight-bearing stepping in the adult spinal cat. Experimental Neurology. 92:421-435, 1986.

Fowler EG, Gregor RJ, and Roy RR. Differential kinetics of fast and slow ankle extensors during the paw shake in the cat. Exp. Neurology. 99:219-224, 1988.

Gregor RJ, Roy RR, Whiting WC, Hodgson JA, and Edgerton VR. Mechanical output of cat soleus during treadmill locomotion: *In vivo* vs. *in situ* characteristics. J. Biomechanics. 21:721-732, 1988.

Pierotti DJ, Roy RR, Gregor RJ, and Edgerton VR. Electromyographic activity of cat hindlimb flexors and extensors during locomotion at varying speeds and grades. Brain Research. 481:57-66, 1989.

Lovely RG, Gregor RJ, Roy RR, and Edgerton VR. Weight-bearing hindlimb stepping in treadmill-exercised adult spinal cats. Brain Research. 514:206-218, 1990.

Tjoe J, Gregor RJ, Perell KL, and Roy RR. A comparison of the forces produced by the lateral and medial heads of the gastrocnemius in the cat across a continuum of postural and movement demands. J. Biomechanics. 24:267, 1991.

Perell KL, Gregor RJ, Joe JA, and Roy RR. Kinetic analysis of load-sharing between ankle extensors of the cat hindlimb during walking and jumping. J. Biomechanics. 24:240, 1991.

Perell K, Gregor RJ, Buford J, and Smith JL. Adaptive control of backward quadrupedal walking: IV. Hindlimb kinetics during stance and swing. Journal of Neurophysiology. 70: 2226-2240, 1993.

Fowler EG, Gregor RJ, Roy RR, and Hodgson JA. Relationship between ankle muscle and joint kinetics during the stance phase of locomotion in the cat. J. Biomechanics. 26:465-483, 1993.

Gregor RJ and Abelew T. The use of directly measured tendon forces in musculoskeletal biomechanics and neural control: a review. Medicine and Science in Sport and Exercise. 26:1359-1372, 1994.

Gregor RJ and Abelew T. Tendon Force Measurements in Musculoskeletal Biomechanics In: Sports Science Review R.C. Nelson and V. Zatsiorsky (eds.) Human Kinetics Pub, Champaign, Ill., Vol. 3, 2:8-33, 1994.

Abelew TA, Gregor RJ, and Cho J. Muscle moment and power profiles in the medial and lateral gastrocnemius of the cat during jumping. J. Biomechanics. 27 (6):637, 1994.

Prilutsky BI and Gregor RJ. Strategy of coordination of two- and one-joint leg muscles during controlling an external force. Motor Control. 1:92-116, 1997.

Smith DW, Gregor, RJ, Prilutsky, BI, Albrecht AM, and Smith JL. Hip flexor moments during downslope walking in the adult cat. *Soc Neurosci. Asbtr*, 23:760, 1997.

Prilutsky BI, Isaka, T, Albrecht AM, and Gregor RJ. Is coordination of two-joint leg muscles during load lifting consistent with the strategy of minimum fatigue? J. Biomechanics. 31:1025-1034, 1998.

Perell, K, Gregor, RJ, and A.M.E. Scremin Lower limb cycling mechanics in subjects with unilateral CVA;s. Journal of Applied Biomechanics. 14:150-179, 1998.

Prilutsky BI, Gregor RJ, and Ryan M.M. Coordination of two-joint rectus femoris and hamstrings during the swing phase of human walking and running. Experimental Brain Research. 120:479-486, 1998.

Gregor RJ, Smith DW, Albrecht AM, Prilutsky BI, and Smith JL. Hindlimb kinetics during upslope walking in the cat. *Soc Neurosci Abstr.*, 24: 1154, 1998.

Franco, J., K.L. Perell, R.J. Gregor, and A.M. Erika Scremin Knee kinetics during functional electrical stimulation induced cycling in spinal cord injured subjects: A preliminary study. *Journal or Rehabilitation Research and Development* Vol. 36, No. 3, pp 207 216, July, 1999.

Prilutsky, B.I. and R.J. Gregor Analysis of muscle coordination strategies in cycling. *IEEE Transactions in Rehabilitation Engineering* 8:362-370, September, 2000.

Perell, K.L., R.J. Gregor, and A.M. Erika Scremin Bicycle pedal kinetics following force symmetry feedback training in subjects with unilateral Cerebrovascular accident. *Journal of Applied Biomechanics* 16:124-141, 2000.

Gregor, R.J., J.L. Smith, D.W. Smith, A. Oliver and B.I. Prilutsky Hindlimb Kinetics and Neural Control During Slope Walking in the Cat: Unexpected Findings Journal of Applied Biomechanics Vol.17, No. 4: 277-286, 2001.

Perell, KL., R.J. Gregor, and AME Scremin Muscle strength and gait speed changes following bicycle exercise in subjects with unilateral CVA. *Journal of Aging and Physical Activity* Vol. 9, No. 4: 286-297, 2001.

Prilutsky, B.I. and R.J. Gregor Swing- and support-related muscle actions differentially trigger human walk-run and run-walk transitions *J. Exp. Biology* 204:2277-2287, 2001.

Perell, K.L., S. Gregor, G. Kim, S. Rushatakankovit, A.M.E. Scremin, S. Levin and R.J. Gregor Comparison of cycling kinetics during recumbent bicycling in subjects with and without diabetes. J. Rehab. Res. and Deve. Vol 39, (1):13-20, 2002.

Gregor, S.M., Perell, K.L., Rushakanakovit, S., Miyamoto, E., Muffoletto, R. and Gregor, R.J. Lower extremity general muscle moment patterns in healthy individuals during recumbent cycling. J. Clinical Biomechanics. Vol. 17, (2): 123-129, 2002.

Wolf, S.L., R. Sattin, M. Kutner, M. O'Grady, A. Greenspan and R.J. Gregor Intense Tai Chi Exercise Training and Fall Occurrences in Older, Transitionally Frail Adults: A Randomized Controlled Trial JAGS, December, 2003.

Gregor, R.J., B.I. Prilutsky, T.R. Nichols and D.W. Smith EMG output in reinnervated medial gastrocnemius muscle during locomotion in the cat. Society for Neuroscience Abstr., New Orleans, LA, 2003.

Kressig, R.W., R.J. Gregor, A. Oliver, D. Waddell, W. Smith, M. O'Grady, A. Curns, M. Kuther and S.L. Wolf Temporal and Spatial Features of Gait in Older Adults Transitioning to Frailty Gait and Posture 20:30-35, 2004.

Maas, H., B.I Prilutsky, T. Welch and R.J. Gregor Reinnervation of gastrocnemius muscle in the cat: Immediate and long-term effects on inter-joint coordination. Society for Neuroscience Abstr., San Diego, CA Octobert 24, 2004

Prilutsky, B.I., R.J. Gregor and T.R. Nichols Coordination of cat ankle extensors during the paw shake before and after reinnervation of the gastrocnemius muscle. Society for Neuroscience Abstr., San Diego, CA Octobert 23, 2004.

Lay, A., C.J. Hass and R.J. Gregor The role of select biarticular muscles during slope walking. Proceedings of the 28th Annual Meeting of the American Society of Biomechanics, Portland, OR, September 8-11, 2004

Lay, Andrea N., Chris J. Hass, D. Webb Smith, and Robert J. Gregor Characterization of a System for Studying Human Gait During Slope Walking. Journal of Applied Biomechanics. 21(2), pp 153-166, 2005.

Lay, A.N., C.J. Hass and R. J. Gregor Backward upslope walking: implications for the knee joint. XXth International Congress of ISB and 29th Annual Meeting for the ASB. August 1-5, 2005.

Lay, A. N., D. K. Lai and R.J. Gregor Control Strategy Transitions During Slope Walking. XXth International Congress of ISB and 29th Annual Meeting for the ASB. August 1-5, 2005.

Maas, H., B.I. Prilutsky and R.J. Gregor In Vivo Fascicle Length Of Cat Medial Gastrocnemius And Soleus Muscles During Slope Walking XXth International Congress of ISB and 29th Annual Meeting for the ASB. August 1-5, 2005.

Prilutsky, B.I., H. Maas and R.J. Gregor In Vivo Fascicle Velocity Of Cat Gastrocnemius And Soleus Muscles During The Paw-Shake XXth International Congress of ISB and 29th Annual Meeting for the ASB. August 1-5, 2005.

Hass, C., D.W. Waddell, S. Wolf, J. Juncos and R.J. Gregor The Relationship Between Knee Extensor Strength And Balance In Parkinson's Disease XXth International Congress of ISB and 29th Annual Meeting for the ASB. August 1-5, 2005.

Gregor, R.J., B.I. Prilutsky and W. Smith Mechanics of Slope Walking in the Cat: Insights into Afferent Control of Activity Pattern Generation. XXXV International Congress of Physiological Sciences, San Diego, CA. March 31 – April 5, 2005

Lay, A.N., C.J. Hass and R.J. Gregor The Effects of Sloped Surfaces on Locomotion: A kinematic and Kinetic Analysis J. Biomechanics (in press)

Prilutsky, B.I., M.G. Sirota, R.J. Gregor and I.N. Beloozerova Quantification of Whole-Body Biomechanics and Motor Cortex Activity During Unconstrained Locomotion. J. Neurophysiol. (In press)

Hass, C.J., R.J. Gregor, D.E. Waddell, A. Oliver, D.W. Smith, R.P. Fleming and S.L. Wolf The Influence of Tai Chi Training on the Center of Pressure Trajectory During Gait Initiation in Older Adults. Archives of Physical Medicine and Rehabilitation (in press)

Gregor, R.J., B.I. Prilutsky and D.W. Smith, Mechanics of Slope Walking: Insights into Afferent Control of Activity Pattern Generation J. Neurophysiology (in review)

Research Support:

Current Support:

2 P01 HD32571-06A1 2/1/01-1/31/06
NIH/NICHD/NCMRR
Spinal Circuits and the Musculoskeletal Systems
PPG (A. English, PI), Neural Strategies for Movement Control
Focus of this project is the evaluation of the integration of sensory and motor commands in the control of movement.
Role: PI on Project III

AT00089-01 7/1/00 – 6/30/05
NIH/NCAM
CAM in Neurodegenerative Diseases
Center Grant (M. DeLong, PI) Director, Movement Analysis Core
Role: Co-Investigator.

Completed Research Support:

AG 14767 1997-2001
NIH/NIA
Focus of the clinical trial was on an intense Tai Chi exercise training intervention in older adults transitioning to frailty..
Role: Co-Investigator