Information for Post-Doctoral Fellows and Applicants

John DeLuca, Ph.D.
Vice President for Research and Training

Nancy Chiaravalloti, Ph.D.
Coordinator, Neuropsychology Fellowship &
Coordinator, Traumatic Brain Injury Fellowship

Trevor Dyson-Hudson, M.D.
Coordinator, Spinal Cord Injury Fellowship

Gail Forrest, Ph.D.
Coordinator, Human Performance and Engineering Fellowship

Peter Barrance, Ph.D.
Coordinator, Human Performance and Engineering Fellowship

A. M. Barrett, MD
Coordinator, Stroke Rehabilitation Research Fellowship

Guang Yue, Ph.D.
Director, Human Performance and Engineering Fellowship

The Kessler Foundation fellowship program would like to acknowledge the following sponsors for our research-training program:

National Institute on Disability and Rehabilitation Research (NIDILRR)
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Kessler Foundation
National Multiple Sclerosis Society

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ADVANCED REHABILITATION RESEARCH TRAINING PROGRAM

Information for Fellows and Applicants

Rutgers New Jersey Medical School, in conjunction with the Kessler Foundation, is pleased to offer an advanced, multidisciplinary training program in medical rehabilitation research.

Introduction

This Research Training program is designed to respond to the shortage of doctoral-level investigators to work on important, unsolved problems relevant to the ever-increasing physically disabled population. The Program solicits pre- and postdoctoral applicants from biomedical sciences and clinical rehabilitation disciplines, including fields such as biomechanics, physiology, psychology, psychiatry, neurology, nursing, physical therapy, occupational therapy, and rehabilitation engineering. The program particularly seeks to attract applicants from the field of physical medicine rehabilitation, rehabilitation sciences and rehabilitation engineering, where the need for research training is intense. The program has several innovative features:

- Self-direction. Upon initiation of the fellowship, the fellow, in collaboration with his or her mentors, constructs a research training plan. This research training plan guides the fellow through the fellowship years. The essence of advanced training is to nurture promising young investigators, who will present their own ideas and goals in response to an environment rich in research opportunities.

- Mentors from other areas of biomedical and social research. Though most are accomplished in rehabilitation, a number of potential mentors are highly experienced scientists in other disciplines, who have the potential to make great contributions to rehabilitation. By working with talented Research Fellows, some of these mentors are likely to create new rehabilitation research programs. Similarly, fellows benefit significantly from working with mentors outside of the rehabilitation field, allowing them to examine their work from alternative angles.

- Team building: A central task for the Fellow. Productive rehabilitation research requires a multidisciplinary research team. Successful Research Fellows will spend their subsequent careers creating and working in research teams, and a core feature of our Advanced Research Training Program is the provision of Fellows with a formative experience in developing their own research teams.

- Prior commitment to rehabilitation research. A commitment statement will be required from applicants, ensuring commitment to the research program. An interest in an academic career is desirable with plans for placement in an academic or research environment upon completion of the fellowship. Use of residency as a recruitment and evaluation tool. For the M.D. resident training track, residents are selected from nationwide applicants on the basis of their research promise. Their abilities will be seen firsthand as they participate in required research training activities.

- Beyond institutional boundaries. Though the emphasis is on faculty at the Rutgers New Jersey Medical School, Fellows are encouraged to seek collaborations with best scientists in the New Jersey - New York Metropolitan area.

The Fellowship and Research Experience

Each Fellowship will be based on an individualized Research Training Plan written by the Fellow with the advice and consent of his/her mentors. In general terms, each Fellowship will consist of:

- Intensive work and training with a team of mentors who are highly experienced in: a) rehabilitation research; b) a special discipline or topic relevant to rehabilitation; and/or c) a necessary methodological tool. Some Fellows will spend most (up to 2/3) of their time with a single Primary Mentor who is an extremely qualified senior investigator, while others will split their time between members of their mentoring team. A mentoring team may consist of up to three Primary or Associate Mentors, who have substantial influence and power of consent over the Fellow's Research Training Plan, despite the Fellow's experience or directed study with other persons (Assistant Mentors).

- Formal coursework or directed study to remedy deficiencies and master a) advanced knowledge of rehabilitation, b) a scientific or medical specialization area, c) a statistical or research design skill, and d) a research tool.

- Attendance and participation in conferences, lectures, and seminars offered by the Department of PM&R, by other departments at Kessler Foundation, Rutgers, and other institutions in New Jersey and the New York Metropolitan Area. The Fellow will be exposed to rehabilitation administration and encouraged to participate in a grant-writing project to enable future funding.

- Above all, research experience in the laboratory or office of more senior investigators, completion of published research projects, and an NIH grant application submission.

Productive research training will be possible in a variety of areas by combining the abilities of researchers skilled in diverse areas relevant to rehabilitation. Outstanding single-subject areas include: Neuropsychology and neuropsychological recovery processes, mobility and motor function rehabilitation, musculoskeletal biomechanics, neuromuscular and sensorimotor physiology, neuroscience, functional assessment, spinal cord injury (SCI), stroke, traumatic brain injury (TBI), outcome and effectiveness research, and physiatry.

Coursework and guided study requirements**:** Three areas. This Fellowship program provides an opportunity to either broaden Fellows' skills by remedying deficiencies in important areas relevant to their type of rehabilitation research or to increase the depth of their knowledge or skill in an advanced topic. At a conceptual level, Fellows beginning a career in rehabilitation research need skills in each of the following three areas:

1. ***Knowledge of biological/disease processes, disablement, and rehabilitation****.* Understanding the scientific and theoretical basis of the intervention under study (e.g., neural mechanisms of behavior) is needed to advance rehabilitation knowledge. As described above, advanced courses and/or directed readings (e.g., neuroanatomy, learning theory) may be required. A wealth of educational resources is available to solidify Fellows' understanding of the pathophysiological and recovery processes, including numerous CME courses offered through Rutgers New Jersey Medical School and Kessler Foundation. Other valuable didactic opportunities include: grand rounds; numerous courses and lectures offered to residents, and directed readings. Measures of case severity, disease stage, case complexity, impairment, disability, and handicap need to be understood for the groups under study. Fellows with little prior experience in clinical rehabilitation will be asked to observe or participate in relevant rehabilitative settings (e.g., team conferences, interviews with and service to disabled persons at home, etc.).

2. ***Knowledge of statistics, methodology, and research design*.** All Fellows must attain a basic competency in statistics and research design or add to their previous knowledge during the Fellowship. M.D./D.O. Fellows proposing a full one-to two-year Fellowship who have not had a course in either topic are required to complete a course in basic biostatistics and in research design. Fellows will be required to study and show proficiency in the following:

- ***How to ask a relevant and testable experimental question (hypothesis);***
- Basic research design: The randomized true experiment and common pitfalls for investigators using this method;
- Systematic approach to demonstrating observations in single-subject and case series reports and appropriate statistical comparisons for these settings;
- Strong quasi-experimental designs (e.g., time series) versus weaker ones (e.g., case control, matching, covariance, correlational designs);
- Descriptive and correlational studies (e.g., cross-sectional) and inference of causality; cohort and retrospective study design; interpretation of descriptive statistical results;
- Prognosis and prediction (e.g., longitudinal) principles and studies;
- Specification of research subjects and sampling techniques;
- Principles and methods of functional assessment and measurement, including reliability, precision, and validity of measurement; methods of assessment of impairment, disability, handicap, and the qualities of everyday life;
- Evaluation of relevant diagnostic tests;
- Sample size and power requirements;
- Structure for a planned analysis in a research proposal, including *a priori* vs. *post hoc* investigations, control procedures and variables;
- Project management; use of consultants (e.g., statistical)
- Organizing a pilot study - pretest, quality control;
- Basic descriptive and inferential statistical principles; Use of SPSS, Stata, or other statistical programs; correlation coefficients, non-parametric statistics, basic ANOVA and ANCOVA;
- Organizing data collection for accuracy and efficient data entry and analysis; Data cleaning;
- Use and secondary analyses of databases.

Fellows without a deficiency in basic methodology should advance their skills by mastery of statistical or methodological tools that will give them an edge in research quality within their research area(s). Optional statistical and methodological skills, (depending upon the rehabilitation research topics) might include:

- Advanced research design (e.g., randomized block designs, multiple interrupted time series, regression discontinuity);
- Intermediate statistical methods (e.g., multiple regression, techniques for the analysis of partial variance, Classification and Regression Trees);
- Advanced statistical techniques (e.g., structural equation modeling, LISREL, Poisson and Cox regression, Class);
- Actual secondary analysis of disability-related health care databases, e.g., UDS, National Medical Care Expenditure Survey, MedPars);
- Meta-analysis techniques;
- Rasch analysis versus traditional factor analysis and test reliability;
- And many other possibilities.

3. Other specialized research tools and subjects. Research involves a number of refined skills. Proficiency in the following must be demonstrated or acquired during the Fellowship:

- Defining a research question likely to yield productive, testable hypotheses;
- Library reference search and computer searches (e.g., Medline);
- Internet access;
- Critical review of the scientific literature in a selected area;
- Technical skills in equipment and procedures, as needed;
- Scientific writing;
- Grant preparation - basic NIH formats and processes;
- Oral presentation;
- Computer use - word processing, database, statistics;
- Questionnaire and interview design, choice, and interpretation;
- Choosing, encouraging, and working with collaborators.

As required, deficiencies in the above skills can be remedied by attending the summer research course for residents at Rutgers NJMS, by directed independent study, or by formal coursework at Rutgers NJMS or another institution.

- Didactic Opportunities: In addition to working with the primary mentor, exposure to relevant rehabilitation and or neuropsychology/neuroscience issues will be ensured by the didactic opportunities offered by the various participating departments at each site (e.g., Department of PM&R), including monthly grand rounds, Physiatry Residents' weekly internal rounds, and weekly Brain Injury rounds at Kessler's Brain Injury Center. Opportunities to observe direct clinical management of patients are designated through the Fellowship Committee on an individual basis. Numerous programs are available for advanced training in the clinical neurosciences between the Psychology Department and Center for Molecular and Behavioral Neurosciences (CMBN) at Rutgers University, and the Departments of Neurosciences and Radiology at Rutgers NJMS. These include: 1) Weekly clinical rounds; 2) Rutgers Speaker Series; 3) Neuropsychology speaker series at Kessler Foundation; 4) SCI grand rounds and 5) Kessler Foundation fellowship didactics.

Current areas of research

The table below lists current areas of research by readily available mentors. Research Fellows are expected to develop their own research interests, and their research projects may combine or cut across listed research areas. Actual areas of research using Faculty at the Rutgers New Jersey Medical School and affiliated organizations go far beyond the listed areas.

Current Areas of Research

Brain Injury
Behavioral management
Cognitive rehabilitation
Driving evaluation
Effectiveness of post-acute cognitive remediation programs
Efficacy of chemodenervation treatment for post traumatic spasticity
Fatigue
Learning and memory
Neuroimaging
Neuropharmacological management of post traumatic fatigue and cognitive deficits
Role of memory and other neurobehavioral factors
Spatial cognitive disorders
Static and dynamic balance deficits

Biomechanics
Intersegmental coordination of upper and lower limbs
Kinematic and kinetic analysis
Static and dynamic gait stability
Static and dynamic posturography

Exercise Physiology
Blood lipids glucose and insulin sensitivity
Body composition
Energy consumption
Functional electrical stimulation
Motor control
Skeletal muscle physiology and morphometry

Engineering
Design and application of assistive devices including robotics
Dynamic EEG and EMG algorithms of human movement
Electrical Engineering and Electrophysiology
Imaging and neuroimaging
Motion capture and analysis
Signal and image processing

Functional Rehabilitation
Locomotor training
Electrical stimulation
Cognitive demands of driving

Neuroscience
Immunology of Multiple Sclerosis
Molecular neurobiology
Neuroanatomy
Neurodegenerative Parkinson and Alzheimer disease
Neuroendocrinology
Neurotransmitters
Reorganization of motor cortex
Reorganization of central pattern generators
Brain-behavior correlations in neurological symptoms and treatment
Noninvasive brain stimulation and brain systems
Sensorimotor and neuromuscular physiology
Structural and functional neuroimaging

Orthopedics
Musculoskeletal biomechanics
Joint pain and pathology
Orthopedic rehabilitation
Total joint arthroplasty
Viscoelastic supplementation

Outcomes Research
Functional outcome studies
Health services research
Quality of life
Vocational mentoring and role restoration

Psychology / Neuropsychology
Aphasia, normal speech and language
Cognitive rehabilitation
Information processing speed
Learning and memory
Limb apraxia, normal limb praxis
Neuroimaging
Relationship between neuropsychological assessment and functional status
Spatial cognition and spatial neglect
Working memory
Effects of noninvasive brain stimulation on cognitive function and cognitive disorders

Psychosocial Factors
Home treatment of behavioral problems

Cognitive retraining
Evaluation of ADL's
Wheelchair propulsion biomechanics
Osteoporosis after SCIPain after SCI

Multiple Sclerosis
Cognitive rehabilitation
Driving
Functional assessment
Information processing speed
Neuroimaging
New learning and memory
Working memory

Spinal Cord Injury
Alternative pain therapies
Bone, muscle and soft tissue degeneration and regeneration
Cardiovascular function and disease
Chemodenervation treatment for spasticity
Clinical trials
Diet and exercise
Drug and hormone therapies
Functional use of the wheelchair
Heart rate variability and autonomic nervous system dysfunction
Health disparities
Osteoporosis
Quality of Life
Rehabilitation
Secondary disability treatment
Shoulder pain and pathology
Supported walking
Urological function
Wheelchair propulsion biomechanics

Stroke
Amnesia and functional disability related to memory disorder
Aphasia and functional communication
Body weight supported walking
Chemodenervation treatment for spasticity
Disorders of attention
Disorders of emotional perception, representation and behavior
Disorder of movement and physical therapy
Electrical stimulation
Exercise fitness training
Gait economy
Limb apraxia and other motor-action disorders
Neuropsychological factors
Spatial cognition and spatial neglect
Virtual reality and motor recovery of hemiparesis
Noninvasive brain stimulation to investigate brain mechanisms, detect motor improvement, and as a therapeutic intervention

Technology
Telerehabilitation
Virtual Reality

The Mentoring Team

Medical rehabilitation research is multidisciplinary. The most productive rehabilitation research requires the complementary skills of several disciplines and professionals. To be specific, the most productive rehabilitation research involves the connection of three domains: 1) applied rehabilitation content; 2) a scientific, biomedical or psychosocial discipline, and/or specialization area(s); and 3) state-of-the-art laboratory techniques, statistical analysis, research design skills, and other scientific tools.

The mentoring team. The training program is based on a structured plan for a mentoring team. Each mentoring team will be comprised of these structural elements:

1) A Primary Rehabilitation Research Mentor works closely with the Fellow throughout the various stages of training, including development of the fellowship training plan, overseeing research and training activities, and ensuring the application of the proposed research and training plan is grounded in rehabilitative biological knowledge. This mentor will provide guidance in the particular rehabilitative group (e.g., TBI, stroke) and/or scientific discipline (e.g., neurophysiology, pharmacology, neuropsychology). The primary mentor will ensure the progress of the trainee by weekly meetings, direct supervision of manuscript and grant writing, and fostering collaborative relationships between the trainee and other researchers and clinicians.

2) Assistive Mentor(s) provide directed study or experience. On some teams, assistive mentors provide only a little time, ensuring quality research and providing strategic guidance, with the Primary Mentor dominating the research program. This is the classic primary mentoring structure. Even in these situations, the presence of other Mentors with formal input into the Research Training Plan is highly valuable. In other cases, Fellows have organized a broader team of mentors in which power is more diffuse, with multiple influential mentors. The experience of organizing their research team is a worthwhile learning experience for the Fellows.

Each Fellow has a single *Primary Mentor*, who is responsible for providing the Fellow with adequate opportunities to learn and to succeed in research, for monitoring the Fellow's progress, for progress reports (delegated to the Fellow in practice), and for spending adequate time with the Fellow. The Primary Mentor plays a primary role in the direction of the Fellow's Research Plan and progress.

An acceptable Mentoring Team must be constructed so that at least one Primary Mentor and one Assistive Mentor are chosen. Complete descriptions of the research interests of the faculty can be found in the enclosure "Program Faculty."

Breadth requirements. Cross-training is encouraged and a Ph.D. should spend time with other Ph.D. neuropsychologists or psysiologists as well as with clinical researchers (e.g. physiatrist). This ensures the research has relevance and enhances the individual's knowledge of clinical rehabilitation. An M.D. needs to work with a Ph.D. specialist to achieve excellence in a specialized area of research. Mentors will not be chosen entirely from the same discipline or area of research.

Primary Mentors

A. M. Barrett, M.D.
Director, Center for Stroke Rehabilitation Research

A. M. Barrett, M.D., is the Director of the Center for Stroke Rehabilitation Research at Kessler Foundation and is a Professor in the Departments of Physical Medicine & Rehabilitation (PM&R), and Neurosciences at the Rutgers-New Jersey Medical School (Rutgers New Jersey Medical School). Dr. Barrett, a behavioral neurologist, has published research on cognitive neuropsychological systems and dysfunction caused by neurological disorders for the last 22 years. Barrett was acknowledged with two University-based early career awards, for which she competed with basic science researchers, two NIH career development awards, the Norman Geschwind Prize for Behavioral Neurology research from the American Academy of Neurology, and the first International Neuropsychological Society Early Career Award. Dr. Barrett is a translational scientist who brings the concepts of cognitive neuropsychology to be tested in medical and even outcomes research models and has a current mentoring award focused on training others in translational Neurorehabilitation research. Since 1999, her lab has had continuous NIH funding and studies post-stroke spatial cognition in near and far space, the spatial neglect syndrome and its characterization and treatments, treatment of aphasia, limb apraxia, unawareness of deficit, and other post-stroke cognitive disorders including limb apraxia, emotional perceptual and processing disorders, disorders of internally-generated behaviors and memory. Dr. Barrett analyzes functional disability by its relationship to traditional neuropsychological definitions of cognitive disorder, and trains learners in adapting both classical psychological concepts and modern research methods (e.g. statistical multi-level modeling) to test translational hypotheses. Dr. Barrett served on two NIH review panels and reviewed for NSF and several foundations. She co-edited three special issues and supplements on the subject of post-stroke rehabilitation, and led the American Society of Neurorehabilitation (President, 2010-2012), as well as serving on the Executive Committee of the Behavioral Neurology and Neural Repair and Rehabilitation Sections of the American Academy of Neurology.

Peter Barrance, Ph.D.
Senior Scientist, Musculoskeletal Biomotion Laboratory

Peter Barrance, Ph.D., is a Senior Scientist in the Musculoskeletal Biomotion Laboratory at Kessler Foundation. Dr. Barrance's expertise is in the area of joint biomechanics and physiology, particularly in the modeling and visualization of weight bearing joints using innovative imaging techniques. Several of his current research activities center on development and utilization of techniques for MRI imaging of the knee. The advent of vertically open MRI scanners has made imaging of the knee while a subject is weight bearing possible. The significance of this is that there is growing evidence that changes to load distribution across the cartilage surfaces are potent predictors of the development and progression of disease pathologies, such as osteoarthritis. Improved visualization of the weight bearing surfaces, combined with analytical modeling of joint contact conditions, allows detailed investigation of these processes as well as the effects of interventions. Dr. Barrance is currently the principal investigator on a federal grant to develop refined standing MRI imaging and modeling methods, with the goals of decreasing imaging time, increasing resolution, and increasing the precision of quantitative outcome measures. Dr. Barrance also has interests in biomaterials and biomechanics testing. He participates in diverse rehabilitation engineering projects, such as the development of innovative wheelchair seating devices

Nancy Chiaravalloti, Ph.D.
Director, Center for Neuropsychology and Neuroscience Research
And Center for Traumatic Brain Injury Research

Nancy Chiaravalloti, Ph.D., is the Director of the Center for Neuropsychology and Neuroscience Research and the Center for Traumatic Brain Injury Research at Kessler Foundation, Associate Professor in the Department of PM&R at the Rutgers New Jersey Medical School and a licensed psychologist in NJ and NY. She is Project Director of the currently-funded Northern New Jersey TBI Model System, funded by the National Institute on Disability and Rehabilitation Research. Dr. Chiaravalloti is the recipient of funding from the NIH (RO1) to conduct an RCT to improve memory in persons with MS and of a competitive supplement to allow for pre- and post-intervention neuroimaging. She is PI of a related RCT in TBI, funded by NIDILRR, and of a NIDILRR field-initiated grant applying fMRI to examine the outcome of that treatment. Her research has also been funded by the National Multiple Sclerosis Society, the NJ Commission on Brain Injury Research, and the National Stroke Association. Dr. Chiaravalloti has a record of over 60 peer-reviewed publications and has served as a grant reviewer for NIDILRR, NIH, NMSS, and the Italian MS Society. Dr. Chiaravalloti holds a grant from NIDILRR that supports the post-doctoral training program in Neurocognitive Rehabilitation. She has also been very active in mentoring fellows (see Table 10) in the areas of neuropsychology, neuroscience, and cognitive rehabilitation, and she has worked with several fellows in grant submittals. Dr. Chiaravalloti has served as a guest reviewer for numerous peer-reviewed journals and is on the Editorial Board of *Frontiers in Neurotrauma*. She was also Editor of Newsletter40, the newsletter for APA Division 40. Dr. Chiaravalloti has been the recipient of several early career awards including the National Academy of Neuropsychology's (NAN) Early Career Award for Contributions to Clinical Neuropsychology (2005), the Rosenthal Early Career Award for significant contributions to research in Rehabilitation Psychology from the APA, Division 22 (2007), and the APA Division 40 Early Career Award for Contributions to Clinical Neuropsychology (2009). A leader in the neuropsychological assessment of clinical populations, Dr. Chiaravalloti is a member of the NIH Toolbox Cognition Team.

John DeLuca, Ph.D.
Vice President, Research and Research Training

John DeLuca, Ph.D. is the Vice-President for Research and Training at Kessler Foundation, a Professor in the Departments of Physical Medicine & Rehabilitation (PM&R) and Neurology/Neurosciences at Rutgers-New Jersey Medical School, and a licensed psychologist in the States of New Jersey and New York. He is board certified in Rehabilitation Psychology by the American Board of Professional Psychology (ABPP). Dr. DeLuca has been involved in neuropsychology and cognitive neuroscience research for over 25 years. He is internationally known for his research on disorders of memory and information processing in a variety of clinical populations including: multiple sclerosis, traumatic brain injury, aneurysmal subarachnoid hemorrhage, and Chronic Fatigue Syndrome. He has edited 2 books, co-edited 5 books, including the newly published "Encyclopedia of Clinical Neuropsychology," written in over 200 publications and book chapters, and has presented over 350 scientific presentations and workshops. He has also received over 26 million dollars in grant support for his research. Dr. DeLuca's most recent research ventures include the cerebral mapping of human cognitive processes using functional neuroimaging (i.e., fMRI, NIRS), as well as the development of research-based techniques to improve cognitive impairment. Dr. DeLuca has been very involved in training activities during his career. He has served as co-director for several advanced research and training programs sponsored by NIDILRR, RSA, and NIH since 1990 and has served as Chairperson of the Research Fellowship Committee for the Department of PM&R at Rutgers New Jersey Medical School. His former students have been extremely successful in gaining academic and clinical research positions and have continued to conduct clinical rehabilitation research. Dr. DeLuca is an established leader in rehabilitation research

and training. He has been honored with the Levitt Early Career Award from Division 40 of the American Psychological Association (APA) and also received the Early Career Award from the National Academy of Neuropsychology. He was the recipient of the Distinguished Alumni Award from William Paterson University in 2002 and the Distinguished Researcher award from the New Jersey Psychological Association for 2005. Dr. DeLuca has served on numerous national and international committees, served as President (2002) and a Board of Trustees member for the New Jersey Neuropsychological Society and currently serves on the Advisory Board of the College of Science, Health and Mathematics at William Paterson University in New Jersey.

Trevor Dyson-Hudson, M.D.
Director, Center for Spinal Cord Injury Research & Center for Outcomes and Assessment Research

Trevor A. Dyson-Hudson, M.D. is the Director of the Center for Spinal Cord Injury Research & Center for Outcomes and Assessment Research and an Assistant Professor in the Department of Physical Medicine and Rehabilitation (PM&R) at the Rutgers – New Jersey Medical School. He is Project Director of the Northern New Jersey Spinal Cord Injury System (NNJSCIS), a NIDILRR-funded SCI Model System of care. Dr. Dyson-Hudson's research interests include preservation and restoration of function and mobility in persons with SCI and the prevention and treatment of common secondary medical complications affecting this population. He is a PI/co-investigator on numerous SCI projects funded by NIDILRR, NIH, the VA, private foundations, and industry, including current and past NIDILRR-funded SCI Model System Multi-site Collaborative and Modular projects. Dr. Dyson-Hudson has served as a "community representative" on the State Rehabilitation Council (SRC) for the [New York] State Education Department's Office of Vocational and Educational Services for Individuals with Disabilities (VESID*)* and on the Professional Standards Board for the Rehabilitation Engineering Society of North America (RESNA), and he co-authored RESNA's recent *Wheelchair Service Provision Guide*. He holds committee appointments in the American Spinal Injury Association (ASIA) and the American Paraplegia Society (APS)/Academy of Spinal Cord Injury Professionals (ASCIP). Dr. Dyson-Hudson is the recipient of the 2010 Standing Tall Award from the Alan T. Brown Foundation to Cure Paralysis and the 2012 Apple Award for publishing excellence in SCI rehabilitation/research from ASIA.

Gail Forrest, Ph.D.
Assistant Director, Center for Mobility and Rehabilitation Engineering Research

Gail Forrest, Ph.D. is currently Assistant Director of the Center for Mobility and Rehabilitation Engineering Research; Assistant Professor, Rutgers / New Jersey Medical School; an Affiliated Faculty Department of Biomedical Engineering, New Jersey Institute of Technology, Newark, NJ; and Member of the Graduate Faculty in Biomedical Science, Rutgers NJMS , Newark, NJ. Dr. Forrest has an academic background concentrating in mathematics and biomechanics. Dr Forrest is currently funded by multiple grants from the National Institute on Disability and Rehabilitation Research (NIDILRR), the Christopher and Dana Reeve Foundation, the Department of Defense, and the Craig H. Neilsen Foundation. Dr Forrest is currently Co- Director on the NIDILRR Advanced Rehabilitation Research Training grant and imposed by policy guiding postdoctoral study. In addition, Dr Forrest has received funding from multiple state and national agencies to investigate the effect of locomotor training alone and other activity based interventions such as multi muscle electrical stimulation on paralyzed muscle and the effect of the different stimulation protocols on motor control, neural and musculoskeletal recovery after SCI. Dr. Forrest is also the Kessler site Director of the NeuroRecovery Network (NRN) grant, a network of seven specialized rehabilitation centers that actively translates evidence based, activity-dependent therapeutic interventions into the clinic and evaluates them using comprehensive

standardized outcomes. Dr. Forrest has been a reviewer for more than ten peer reviewed journals since 2002 and has served as grant reviewer for National Institute of Health (since 2010) and National Foundations.

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Guang Yue, Ph.D.
Director, Center for Mobility and Rehabilitation Engineering Research

Guang Yue, Ph.D., is Director of the Center for Mobility and Rehabilitation Engineering Research at Kessler Foundation; a Professor in the Departments of Physical Medicine & Rehabilitation (PM&R) at Rutgers New Jersey Medical School; and an Associated Faculty of Biomedical Engineering at New Jersey Institute of Technology. Dr. Yue, a neuromuscular physiologist, has extensive experience in biomechanics, neuroimaging, and other fields of biomedical engineering and sensorimotor function rehabilitation. He has published research on basic science of neural control of human movement, motor dysfunction caused by neurological disorders and injuries, and recovery brought about by medical intervention for the last 22 years. Dr. Yue's research program has continuously been supported by federal agencies (NIH, DoD and VA) for more than 15 years, and his laboratory has trained nearly 50 postdoctoral fellows, clinical fellows, visiting scholars, as well as graduate and medical students. Many of these trainees are in leadership positions (e.g., Principal Investigator; Full, Associate or Assistant Professor; and Senior or Chief Scientist) in academic/research institutions or biomedical companies. Dr. Yue is a translational scientist who brings the concepts of motor control and neurophysiology for testing in medical and outcomes research models, and he has served as primary mentor in NIH- and *NIDILRR*-sponsored training programs focused on training others in translational neurorehabilitation and neuromuscular physiology research. Dr. Yue currently serves as a standing member (2011-2015) in an NIH grant review study section (Function, Integration and Rehabilitation Sciences) and has previously served as a standing member/reviewer in Motor Function, Speech and Rehabilitation study section (2004-2008). In addition, he has served as an invited or ad hoc reviewer for numerous federal, state, and private grant agencies, and international grant review panels. Dr. Yue serves on editorial boards of four scientific/medical journals and is a guest reviewer for more than 35 journals.

Glenn Wylie, D.Phil
Associate Director, Rocco Ortenzio Neuroimaging Center
Associate Director, The Neuropsychology and Neuroscience Laboratory

Glenn Wylie, D.Phil, is the Associate Director of both the Rocco Ortenzio Neuroimaging Center and of the Neuropsychology and Neuroscience Lab at KF. He is also holds appointments at Rutgers University (Associate Professor), the Department for Veteran's Affairs (Research Scientist), and the New Jersey Institute of Technology (Associated Faculty). His research interests fall into three broad categories: cognitive control, cognitive fatigue, and the neurophysiological effects of cognitive interventions. In his cognitive control research, he has investigated control processes in healthy samples (both the young and the aged) and clinical samples (multiple sclerosis, traumatic brain injury, schizophrenia). In his cognitive fatigue research, he has investigated the neural correlates of fatigue in both multiple sclerosis (MS) and in traumatic brain injury (TBI). In his work investigating the neurophysiological effects of cognitive interventions, he has investigated the functional changes in the brain associated with an intervention designed to improve memory and more recently with exercise. In a similar vein, he is also investigating the neurophysiological changes that accompany recovery from a TBI over the first year. In order to better understand these processes, he employs several of the cognitive neuroscience tools, including functional magnetic resonance imaging (fMRI), event-related potentials (ERPs), functional Near Infrared Spectroscopy (fNIRS), Positron Emission

Tomography (PET), and behavioral measures. Dr. Wylie has been awarded funding from both Federal agencies and by Foundations and serves on a number of grant review panels.

Assistive Mentors

Kessler Foundation
Jean Lengenfelder, Ph.D. - Assistant Director, *Cognitive and Affective Neuropsychology Laboratory*
Laboratory
Lauren Strober, PhD - Clinical Research Scientist
Anthony Lequerica, PhD - Clinical Research Scientist

Kessler Institute for Rehabilitation
Steven C. Kirshblum, M.D. – Medical Director and Director, SCI Services
Todd A. Linsenmeyer, M.D. - Director of Urology
Uri Adler, M.D. - Director of Stroke Services
Karen Kepler, Ph.D., D.O. – Staff Spinal Cord Injury Physiatrist, Chester Facility

NJIT
Rick Foulds, Ph.D. - Associate Professor, Biomedical Engineering
Stan Riesmann, Ph.D. - Professor of Electrical Engineering and Biomedical Engineering
Sergi Adamovich, Ph.D. - Associate Professor, Biomedical Engineering
Tara Alvarez, Ph.D. - Associate Professor, Biomedical Engineering

VANJHCS
Frank Padberg, Jr., M.D. - Professor and Chief of Vascular Surgery
Len Pogach, M.D.
Catherine Myers, Ph.D.

Rutgers New Jersey Medical School
Eugene Tunik, Ph.D., P.T., *--Director, Laboratory of Movement Neuroscience, School of Health-Related Professions*

Rutgers University - Newark
Mark Gluck, Ph.D. - *Associate Professor, Psychology*

Rutgers University - New Brunswick
Noshir Langrana, Ph.D. - *Professor of Biomedical Engineering and Mechanical and Aerospace Engineering*
Dimitris Metaxas, Ph.D. - *Professor of Biomedical Engineering and Computer Science*
William Craelius, Ph.D. - *Professor of Biomedical Engineering*

Clinical, Laboratory, and Research Experience

Fellows will spend most of their time conducting rehabilitation research under the direction of their mentors, who are selected for their ability to further research abilities and written publications for the Fellow. Each Fellow will be expected to publish his/her research in a peer-reviewed journal.

Clinical experience. One of the outstanding assets of this training program is the size and variety of clinical populations and rehabilitative treatment programs available. Research Fellows will have easy access to resources of the Departments of Physical Medicine and Rehabilitation,

Neurosciences, and Psychiatry, all four facilities of Kessler Institute for Rehabilitation, the Veterans Administration New Jersey Health Care System at East Orange (VANJHCS), and Children's Specialized Hospital, all of which are affiliated with the Department of PM&R.

Clinical activities of the residency program (daily teaching rounds, weekly and monthly clinical rounds, clinical conferences, and lectures) at all seven facilities associated with the PM&R Department will be readily accessible to all Research Fellows. The availability of defined impairment groups at multiple facilities helps include a larger subject population than would be possible at any one facility. The combination of research experience and clinical population of our training program will make for fruitful collaboration.

Ph.D. researchers with inadequate clinical experience will be encouraged to participate in daily teaching rounds, clinical rounds, team conferences, and lectures. Mentors will encourage Fellows to test their ideas in discussions with clinical professionals. The aim is to produce Ph.D. researchers who understand clinical realities and priorities and who select research topics of clinical relevance.

Laboratory. Research experience is available at laboratories at Rutgers New Jersey Medical School, Kessler Foundation, the VANJHCS, the Center for Molecular and Behavioral Neurosciences at Rutgers University, and other affiliated organizations.

- In the Department of PM&R, there are active clinical research programs regarding the physiological, psychological, behavioral, and engineering problems in rehabilitation. In addition, there are a number of collaborative projects with other departments at Rutgers New Jersey Medical School. Research programs are currently underway to improve the functional abilities of persons with disabilities resulting from spinal cord injury, head injury, stroke, neuromuscular disease, pulmonary disease, and amputations. Projects cover such areas as functional electrical stimulation, advanced electromyography, prosthetic design, sympathetic nervous system function in spinal cord injured patients, geriatrics, fatigue, treatment of depression, sexuality, and family training, among others.

- The research wing at Kessler Foundation includes a human performance laboratory for the measurement of motor control, coordination, and gait; a temperature and humidity controlled cardiovascular laboratory for measurement of peripheral blood flow and cardiovascular function; an engineering workshop; a quantitative electrodiagnostic suite; psychological testing rooms for neuropsychology and outcome studies; neuroimaging capabilities; a virtual reality setup; and ample office space.

- The VANJHCS is a fully equipped 1,000-bed medical center with both human and animal laboratories. The cardiac rehabilitation laboratory in the Rehabilitation Medicine Department includes a 3-foot-wide treadmill, making it accessible for disabled persons.

- Extensive engineering laboratories are available at New Jersey Institute of Technology.

- The Center for Molecular and Behavioral Neurosciences at Rutgers University, Newark, also has extensive laboratory facilities.

Experience in research administration. Fellows will develop skills and experience in research administration by preparing research proposals, by submitting these proposals to the Research Committee and IRB of relevant facilities, and by completing their own research project(s), which frequently will be collaborative. Grantsmanship is a research tool used by many Fellows. Such Fellows will collaborate with primary mentors in preparation of grant proposals.

Academic commitment. Our program also seeks to instill academic values and attitudes through socialization experiences with colleagues in the academic environment. This supportive

environment includes encouragement from organizations, mentors, and peers. The core didactic criteria provide the basic content knowledge and needed methodological skills. Work habits and involvement in simultaneous projects will be instilled. Mentors will provide the socialization and development of autonomy and personal commitment necessary to sustain research activity. The local mentors, outside lecturers, and attendance at professional conferences will set the context for continuing collegial activities. Kessler Foundation continues to direct efforts on developing research throughout the PM&R Department at Rutgers New Jersey Medical School, the residency program, and affiliated institutions.

Facilities at Kessler Foundation

Kessler Foundation, currently housed in the West Orange facility of Kessler Institute for Rehabilitation (KIR), encompasses facilities supporting research in the variety of areas described in the previous section of this report. Modular office furnishings, with over 40 work stations, and various laboratories house staff in both administrative and research areas on the second and third floors of the facility.

Center for Mobility and Rehabilitation Engineering Research

The Center for Mobility and Rehabilitation Engineering Research is directed by Dr. Guang Yue, and includes five Research Scientists or principal investigators (PIs), a visiting scholar, three postdoctoral fellows, one full-time engineer, one full-time clinical trial coordinator, two full-time research assistants, biomedical engineering students, and full-time administrative support. The Center for Mobility and Rehabilitation Engineering Research occupies more than 5,000 square feet that includes laboratory and office spaces and encompasses five research divisions, all related to mobility and neuromuscular function rehabilitation led by a PI. These five research divisions (programs) in the Center for Mobility and Rehabilitation Engineering Research are described below.

I. Acquired Brain Injury Mobility Program (ABIMP). ABIMP is directed by Dr. Karen Nolan, a Research Scientist and PI in the Center for Mobility and Rehabilitation Engineering Research. The goal of the ABIMP is to advance mobility rehabilitation, to improve existing treatments, and to develop novel assessment methods for individuals with acquired brain injury. The program strives to provide evidence-base for new strategies in rehabilitation and orthotic intervention that improve or restore function and develop objective assessments to measure changes in physiological and functional motor recovery after designated clinical interventions. Current research in the ABIMP is specifically focused to improve walking ability for patients with stroke. The ABIMP lab (together with the HPMAP lab, see below) is equipped with a 12-camera motion acquisition and analysis system (Motion Analysis Corporation, Santa Rosa, CA), two Vicon motion analysis systems (Vicon, Oxford, UK) with 14 M2 cameras. The motion data captured by the motion systems are synced with electromyographic (EMG, Noraxon, USA Inc., Scottsdale, AZ) data to learn muscle firing patterns and Motion Lab Systems (Motion Lab Systems, Inc., Baton Rouge, LA) to assess gait cycles such as toe-off and heel-strike. Plantar pressure data are collected using the Novel Pedar®-x wireless pedobarography system (Novel Electronics Inc., St. Paul, MN) to monitor pressure distribution under the foot and local loads. The Pedar-x system allows multiple synchronization options with EMG and motion systems for advanced gait analysis. Four Bertec 4080 force plates are located in the gait lab for measuring ground reaction forces in three planes. Functional electrical stimulation (FES) is frequently applied to strengthen weakened muscles to improve walking ability in stroke survivors with gait deficits.

II. Human Performance and Movement Analysis Program (HPMAP). The HPMAP is led by Dr. Gail Forest, a PI and Assistant Director of the Center for Mobility and Rehabilitation Engineering Research. The primary underlying goal of the HPMAP is to improve recovery of function in patients with spinal cord injury (SCI) and other neurological disorders. The secondary goal is to improve the underlying medical consequences associated with the injury such as muscle/bone health. The tertiary goal is to better understand both the neurological and biomechanical mechanisms implicit to recovery of function. The ultimate research goal of the HPMAP is to enhance both overall community integration and quality of life of patients. A major ongoing project in the HPMAP lab is training patients with motor complete and incomplete SCI to improve gait function and muscle and bone health and to understand underlying neuromuscular mechanisms. Intense gait training usually on a treadmill equipped with a body-support system (Robomedica, Inc., Mission Viejo, CA) and FES are often used as therapies to

achieve the improvements. While much of the major equipment is shared in the gait lab, the HPMAP has a wearable Ekso™ robot or exoskeleton from Ekso Bionics (Richmond, CA) to help paralyzed patients stand up and walk. The HPMAP lab is also equipped with a Pro V6 Hocoma's Lokomat (Hocoma AG, Switzerland), a driven gait orthosis that automates locomotion to facilitate gait therapy by reducing amount therapists' physical involvement. Motion data associated with gait training and testing are often captured and analyzed to evaluate walking quality and changes following the treatment. A Lunar Prodigy Advance bone densitometry scanner (GE Healthcare, Madison, WI) is available in the lab for investigation of bone health as a result of SCI and gait or FES therapy. A Fischer Scientific – 20 degree freezer is used for storing blood samples collected during exercise testing.

III. Musculoskeletal Rehabilitation Research and Engineering Program (MRREP). The MRREP is led by Peter Barrance, Ph.D., a Senior Research Scientist with a 20-year history of research and publication in orthopaedic and musculoskeletal research. The MRREP strives for excellence in the application of engineering practice to achieve discoveries that improve rehabilitation for mobility disorders, *with an emphasis on those of musculoskeletal origin*. Current research of the MRREP seeks to advance the field of image-based evaluation of lower extremity biomechanics. The program has pioneered a bio-feedback system that allows accurate and repeatable subject/patient positioning during weight-bearing MRI of the knee joint. This work has produced a computer model based method to accurately measure changes in joint positioning and cartilage contact areas with high sensitivity. While pursuing the translation of this technology to the improvement of conservative and surgical treatment for a number of lower extremity conditions, Dr Barrance is also collaborating with Dr Gail Forrest, Center for Mobility and Rehabilitation Engineering Research Assistant Director, in studies of musculoskeletal changes after spinal cord injury. Current areas of interest are changes in composition and size of muscles associated with activity based therapies, as well as alterations to connective tissue properties. Key facilities and equipment possessed by the MRREP include:

- Highly accurate Optotrak Certus emitting marker position tracking system;
- 18" digitizing screen and three digitizing tablets facilitate image segmentation and analysis;
- MRI-compatible 'Shapesensor-MRI' sensor, along with custom developed; interface provides realtime monitoring and feedback of knee angle for functional MRI scanning;
- Neurocomm Research Platform: a computer controlled movable support surface with dedicated force plates and 6 camera Vicon motion analysis system allows investigation of balance strategies and impairment; and
- Dedicated shop for lab equipment fabrication, with fully equipped bioinstrumentation facilities.

IV. Neuroimaging Research Program (NIRP). The NIRP's research is focused on understanding structural and functional plasticity of the human central nervous system (CNS) after neuromuscular diseases/injuries and on rehabilitative treatment aimed at improving mobility and neuromuscular function. Ongoing research projects include (1) evaluating structural injury of the spinal cord and activation level of spinal motor neurons using both structural and functional MRI in patients with incomplete spinal cord injury before and after rehabilitation, (2) identifying biomarkers of traumatic brain injury by analyzing brain white matter structures, and (3) elucidating potential damage to the brain by chemo drugs used for treating breast cancer. Facilities available for the NIRP include workstations that run NeuroDebian Linux distribution and Windows 7. These workstations have 3.06GHz Intel Xeon CPU (quad cores) and 1G dedicated video memory. Linux workstation is loaded with major neuroimaging software packages such

as FSL, AFNI, Freesurfer and Mricron. MATALB is available on all workstations for custom offline image analysis of the MRI data. A windows laptop is also available that has E-Prime installed for stimulus presentation during functional MRI experiments. Biopac systems are available and are used to collect physiological data (e.g., blood pressure, heart rate, skin temperature, muscle force and electrical activities) simultaneously with MRI scanning. A laptop loaded with EPrime is equipped with PCMCIA slots so parallel ports can be added to trigger Biopac acquisition to be synced with MR scan if needed.

V. Neuromuscular Physiology Research Program (NPRP). The NPRP is led by Dr. Didier Allexandre, a Research Scientist and PI in the Center for Mobility and Rehabilitation Engineering Research. The research of the NPRP aims at understanding neuromuscular physiology of movement disorders and recovery as a result of medical rehabilitation and focuses on upper extremities. The NPRP lab is outfitted with state of the art equipment to perform a wide range of neuromuscular and electrophysiological experiments. It is equipped with the latest two single-pulse transcranial magnetic stimulators (TMS) "BiStim^2" (MagStim Company Ltd., Wales, U.K.) with two figure-of-eight coils. The TMS system is integrated with Brainsigth, a neuronavigation system to guide the position of the TMS coil on the anatomical MRI-registered subject's head to stimulate the desired brain region and an acquisition system with a FE132 BioAmp and LabChart Pro Software from ADinstruments for TMS triggered sequential recording of motor evoked potentials. This complete TMS system allows various experimental paradigms to assess and better understand motor control mechanisms in healthy and brain function-impaired individuals. The lab can also perform various online neuroimaging using our imaging center's 3T MR scanner and electrophysiological studies by means of high density EEG (Neuroscan Labs, El Paso, TX) and EMG systems. The lab also possesses various equipment items such as response pads, a signal generator, and Stimtracker (Cedrus, San Pedro, CA) with Eprime (Psychology Software Tools, Inc.) to conduct event related potential experiments. A Grass digital stimulator, a portable digital Grass Model 15RX Physiodata EEG or EMG amplifier system, a number of transducers for finger and arm joint force measurements allow us to perform various sensorimotor function evaluations. The electrophysiological and biomechanical data are analyzed using major software packages such as Curry, eeglab and BESA.

Center for Neuropsychology and Neuroscience Research

The Center for Neuropsychology and Neuroscience Research conducts research and training in the study of human cognition and its rehabilitation in clinical populations using the investigative approaches of neuropsychology, functional brain imaging, and cognitive neuroscience. Current research examines neuropsychological deficits associated with MS, TBI, and stroke. Research examining the impact of cognitive impairment on functional status is a strong focus.

The Center for Neuropsychology and Neuroscience Research is equipped with four testing rooms that are used for patient interviews, neuropsychological testing, and feedback sessions. All testing rooms are equipped with a one-way mirror for training and observation purposes. Specialized computer programs have been developed within the lab for testing attention, working memory, and language processing. Numerous standardized NP tests as well as a variety of books and journals relating to neuropsychology, neuroscience and neuroimaging are available within the lab.

The lab currently has 23 desktop workstations, 2 Mac notebooks, and a number of laptop computers equipped with numerous software packages, including statistical packages such as SPSS, reference management software (Endnote), and stimulus delivery software (E-Prime) to

support the research conducted. All investigators, including graduate students, post-docs, and clinical scientists, have access to a laptop.

The newest addition to the Center for Neuropsychology and Neuroscience Research is a computer workstation dedicated to virtual reality software to more effectively assess everyday life cognition. The system is composed of an HP Z600 Quad Core Xeon 2.4GHz 6GB Workstation with a GeForce GTX 560 video card and all the required auxiliary equipment.

Functional Imaging Resources in the Neuropsychology and Neuroscience Laboratory at Kessler Foundation

Functional neuroimaging is an important component in much of the neuropsychological research conducted within the Center for Neuropsychology and Neuroscience Research. Because of this, there are multiple facilities where this work is conducted. The Center for Neuropsychology and Neuroscience Research maintains an optical imaging system (NIRx-DYNOT) in-house which allows for on-site brain imaging research to be conducted in conjunction with traditional neurocognitive assessment. This system is truly state-of-the-art (there are only 2 brain imaging systems like it in the country) and provides investigators with an expandable, portable, modular system design for the assessment of a variety of motor, sensory, and cognitive functions. It has a large dynamic range ($1:10^9$) and multiwavelength DC illumination (up to 4 laser diode sources). The DYNOT system provides the opportunity to examine on-task brain functioning without many of the limitations inherent in MR-based research (e.g., subject confinement, limitation in paradigm development).

The Center for Neuropsychology and Neuroscience Research additionally maintains an in-house Neuroimaging analysis laboratory. Analysis of large imaging data sets are supported by the use of 2 dedicated laptops, 4 Linux computers, and a Windows machine. A 6 terabyte data server is backed up daily.

The Center for Neuropsychology and Neuroscience Research has a strong presence in the *Department of Radiology* at Rutgers-New Jersey Medical School, where much of its imaging research is currently conducted. The Department of Radiology is a full-service diagnostic and therapeutic academic department, with 32 attending radiologists (26 full-time, 6 part-time) and 18 resident physicians-in-training. The imaging modalities available in the Radiology Department include:

- Magnetic Resonance Imaging (MRI): There are two GE Horizon 1.5T MRIs on the Newark campus, one located in University Hospital and one in the Doctors' Office Center (DOC) building. In addition, there is a 3T MRI located in the Advance Imaging Center where more limited volume head scans are performed. Patient monitoring is accomplished via OmniTrak MRI Patient Monitoring System for monitoring of ECG, respiration, and non-invasive blood pressure.

- CT Scan: Two helical GE CT scanners are situated in University Hospital and one helical GE CT is located at the DOC. Two of these scanners are in the process of being upgraded to 16-slice units. There is a state of the art GE PET/CT scanner located in the Advanced Imaging Center.

- Interventional Radiology: There are three interventional suites within the Radiology Department at University Hospital, two of which are equipped for single-plane vascular angiography and one for bi-plane capabilities often needed in neurological radiology. These rooms are operational most of the time in order to handle the volume of inpatient, outpatient and emergency trauma cases that come through our ED.

- Ultrasonography: All visceral and small parts ultrasound is accomplished in radiology with equipment manufactured by GE and Acuson, two of the leaders in ultrasonography equipment. University Hospital also has a separate vascular lab for the performance of vascular Doppler studies.

- Radiography/Fluroscopy: All exams considered integral components of diagnostic imaging are performed at both University Hospital and the DOC.

- Nuclear Medicine: Four separate cameras handle the imaging needs of this busy sub-department in the hospital radiology division. All standard bone, pulmonary and cardiac imaging are performed here.
- The Functional Imaging Laboratory, located in the Department of Radiology (room UH-110), is a 441 sq. ft. space with four Sun workstations connected to the MRI scanning area by a dedicated high-speed fiberoptic ETHERNET cable. The two Sun Ultra 10, one Ultra 60 and one Blade 2000 workstations, all with 21" monitors, serve as the main stream for high power computation. The various peripherals including Apex 4.6 GB MO drives, DAT drive, and three expandable high-capacity multi-pack hard disk storage devices also are connected and available in the laboratory. In addition, three Apple Macintosh computers (Power Mac G3 400 MHz), all with 21" monitors and multiple external drives; and one PC (166 MHz clone with 17" monitor) are also available for word processing and slice preparation. Several software packages are installed in the Sun workstations for functional data processing including Statistical Parametric Mapping from Welcome department of Neuroscience (London) and AFNI (NIH). High-end computer language such as Interactive Data Language (IDL) and Matlab are also available for researcher to develop software for their own application.

Center for Outcomes and Assessment Research

The Center for Outcomes and Assessment Research is led by Trevor Dyson-Hudson, M.D., Director of the Center for Spinal Cord Injury Research and of the Center for Outcomes and Assessment Research**.** The lab is staffed by a research scientist (Amanda Botticello, Ph.D., MPH) and a part-time research assistant. The planned growth of the lab in the upcoming year includes the addition of a research scientist as well as ongoing grant-writing and dissemination efforts. The Center for Outcomes and Assessment Research has extensive experience in developing and validating new measures of cognitive and neuropsychological functioning. The group also has experience developing new measures using Virtual Reality and is interested in utilizing new technological advances in science to improve measurement. Currently, the Outcomes and Assessment researchers are heavily involved in multisite collaborative projects to improve the measurement of Health-Related Quality of Life in diverse patient populations such as individuals with spinal cord injuries, traumatic brain injuries, and wounded warriors. This group also functions in a consulting capacity with other Kessler Foundation researchers by collaborating across labs in research related to medical rehabilitation outcomes and measurement. A number of statistical software packages including STATA, PARSCALE, SPSS, HLM, and Winsteps, reference management software Reference Manager, database management software Access, qualitative analysis software NVivo, and the stimulus delivery software E-Prime, are employed by these researchers to write grants, store data and conduct complex analyses for measurement development and data dissemination.

Kessler Foundation researchers are developing new outcome measurement tools that will be integrated with leading measurement initiatives funded by the NIH such as the Patient Reported Outcomes Measurement Information System (PROMIS), Quality of Life in Neurological Disorders (Neuro-QOL), and the Toolbox for the Behavioral and Neurological Functioning projects. These next generation initiatives will be used as the leading outcome measures in forthcoming federally funded clinical trials research and clinical practice. Item Response Theory

(IRT) is the basis for development of these new outcome measures; many limitations of existing instruments are addressed through development of IRT-informed Computerized Adaptive Tests (CAT). The scales are built using a participatory action research approach to the development process steeped in grounded theory where individuals with a disability have had a voice in the development of condition specific targeted item banks to evaluate the symptoms, concerns, or other HRQOL issues that stem from the specific conditions. The NIH is seeking to provide researchers with a uniform, standardized outcome measure that can be used in NIH-funded research studies so that outcomes across conditions can be compared and contrasted.

The Kessler Foundation Center for Outcomes and Assessment Research are also funded to develop new measures of cognitive functioning and have been actively developing new measures of working memory and processing speed. The Center for Outcomes and Assessment Research is a primary development site for the NIH funded Toolbox for Neurological and Behavioral Functioning.

Center for Spinal Cord Injury Research

The Center for Spinal Cord Injury Research at Kessler Foundation is led by Trevor Dyson-Hudson, M.D., Director of the Center for Spinal Cord Injury Research and Steven Kirshblum, MD, the Medical Director and Director of SCI Services at Kessler Institute It is comprised of two doctoral-level Research Scientists (Denise Fyffe, Ph.D. and Jeanne Zanca, Ph.D., P.T.), a full-time research coordinator, full-time research assistants, and full-time administrative support. It conducts studies designed to prevent the loss of function, restore lost functions, eliminate medical complications, and improve quality of life in persons with SCI. At the center of this multidisciplinary laboratory is a grant from the National Institute on Disability and Rehabilitation Research (NIDILRR) designating the spinal cord injury program as a “model system” of care and research, which provides funding at a level of approximately $457,000 per annum for the current grant cycle. The Northern New Jersey Spinal Cord Injury System (NNJSCIS) is one of 14 such designated model spinal cord injury systems in the U. S. and is a cooperative effort of Kessler Foundation, Kessler Institute, and Rutgers.

Research in the SCI Lab has been funded by NIDILRR, the NIH (National Institute on Child and Human Development/National Center on Medical Rehabilitation Research and the National Institute on Neurological Disorders and Stroke), the New Jersey Commission for SCI Research, and the Kessler Foundation. Collectively, the Center for Spinal Cord Injury Research is one of the most active Spinal Cord Injury Research Labs in the country. Kessler Institute is a major affiliate of Kessler Foundation, providing an interdisciplinary approach to physical medicine and rehabilitation and offers comprehensive inpatient and outpatient services for individuals who have experienced brain injury, spinal cord injury, stroke, amputation, neuromuscular disorders, and musculoskeletal or orthopedic conditions.

All SCI investigators have access to a laptop and a desktop workstation. The Center for Spinal Cord Injury Research has a Virtual Reality (VR) system comprised of three 24” flat panel monitors and a 5-speaker audio system combined with virtual reality software designed specifically for the lab as a state-of-the-art driving simulator. The NNJSCIS has access to a sophisticated eye-tracking system, head-mounted display units, and engineering and information technology support for research involving virtual reality technology. The SCI Lab also has access to those resources listed under other Kessler Foundation Labs.

Center for Stroke Rehabilitation Research

The Center for Stroke Rehabilitation Research is led by A.M. Barrett, M.D., Director of the Center for Stroke Rehabilitation Research and is staffed with a coordinator and technical staff. To maximize the potential for translational research relevant to real-life function, the laboratory is equipped with video apparatus to measure visual-action performance in both near and far

space (beyond reaching distance). With a video camera-monitor setup, researchers can manipulate visual feedback so as to fractionate errors into perceptual and motor components. An additional video apparatus set up for tabletop tasks is also in use. The lab is equipped with rooms for patient interviews, behavioral and clinical evaluation testing, data analysis and coding, and feedback sessions. A set of standard neuropsychological tests, standard equipment for stimulus administration, including 2 slide projectors and an LED projector, and four video cameras are available for recording patient interviews and examination, neuropsychological testing equipment, and personal computers to support lab activities are available. Evaluation, recruitment, and testing of subjects for stroke research takes place at all four Kessler hospital facilities, at Rutgers New Jersey Medical School, and at other hospitals, academic, and care centers in the nearby community.

General support for all research is provided by the *Biomedical Engineering and Computing* facility. Standard test equipment includes a Tectonics TDS 544A 4-channel digital color oscilloscope with enhanced memory, floppy disk and PC interface, and real-time spectrum analyzer options. A BK Precision analog oscilloscope is also available. Triple-output and dual-output bench power supplies, an analog waveform generator, and a digital Arbitrary Waveform generator support the development of custom electronic devices and instrument modifications. Complete solder station, wire-wrap, and prototyping systems are available for custom device development and testing.

Biomedical engineering provides specific support to researchers working in the areas of biological signal processing, neuromuscular function, and human interface/assistive technology. Electro-physiologic research is supported by a complete set of general-purpose bioelectric instruments which are interfaced by engineering staff according to project needs and goals. An 8-channel biopotential amplifier (Gould 6600 series) supports traditional research involving EKG, EMG, and EEG studies. For higher frequency signals, an 8-channel 10kHz system (Gould 3500 series) is available. All systems include patient isolation and interface to the Data Network for on-line storage and analysis. Motor evoked potential and EMG research is supported by a Cadwell MES-10 magnetic stimulator with 9 cm. round and butterfly coils. A Dantec Mag 2 magnetic stimulator with round coil and an 8-channel Dantec Keypoint EMG/evoked potential/EEG computer provide facilities for 16-channel fine wire kinematic EMG studies. All instruments are interfaced to computers for additional data acquisition and processing.

Center for Traumatic Brain Injury Research

The Center for Traumatic Brain Injury Research at Kessler Foundation is led by Nancy Chiaravalloti, Ph.D., Director of TBI Research. The focus of research in the Center for Traumatic Brain Injury Research is to examine the social and cognitive deficits associated with acquired brain injury and related impairments and to develop interventions to ameliorate these problems. Neuroimaging studies in the Center for Traumatic Brain Injury Research identify the location and size of lesions for the purposes of structure-function mapping. Additional studies examine the brain correlates of cognitive and social functions. The Center for Traumatic Brain Injury Research has Windows-based desktop computers and notebooks as well as Apple computers and response boards for test administration, scoring, and data processing. A number of software packages are used for conducting studies and entering data for analysis. These include statistical packages (Statistica and SPSS), reference management software (EndNote), and stimulus delivery software (E-Prime, Presentation, and SuperLab).

Rocco Ortenzio Neuroimaging Center

Kessler Foundation's Neuroimaging Center is located in the the Kessler Institute for Rehabilitation facility. It is led by Glenn Wylie, D.Phil, Associate Director, and Brian Yao, Ph.D., Manager and Physicist. A Siemens Skyra 3T dedicated research scanner is solely dedicated to research for Kessler Foundation scientists and their collaborators. Research conducted in the scanner includes standard structural neuroimaging, diffusion tensor imaging, MR spectroscopy, resting

state functional MRI, functional MRI, and MR real-time feedback among other methods. Specific studies conducted at the Neuroimaging Center depend upon the goals of the Laboratories. Kessler Foundation is the only Freestanding Rehabilitation Facility in the United States to have a research-dedicated scanner when it becomes operational.

Kessler Foundation

Kessler Foundation is a nonprofit, public charity dedicated to supporting rehabilitation research, education and community programs. The Foundation is a major funding source for Kessler Foundation and is currently providing $5.5 million each year for its operation. The Foundation is also focusing a large portion of its grantmaking on programs related to increasing employability for people with disabilities, as well as supporting not-for-profit agencies throughout New Jersey that provide services for people with disabilities.

Kessler Foundation

Kessler Foundation is a non-profit medical rehabilitation research and education organization, a subsidiary of a public charity, Kessler Foundation, Inc. The primary purpose of this organization is to promote high quality rehabilitation research and development activities that will improve health, promote wellness, and ultimately improve the quality of life for persons with physical disabilities. Kessler Foundation presently has a full-time staff of 65 individuals, with an annual operating budget of over 6 million dollars. Kessler Foundation is located within the Kessler Institute for Rehabilitation - West Orange facility and contains laboratories and programs in Neuropsychology and Neuroscience; Stroke; Traumatic Brain Injury; Rehabilitation Outcomes; Spinal Cord Injury; Human Performance and Movement Analysis; and Rehabilitation Engineering. Kessler Foundation has an external Scientific Advisory Board, chaired by Marcus Fuhrer, Ph.D., Director Emeritus, and National Center for Medical Rehabilitation Research, National Institutes of Health, which provides an objective critique of all research activity conducted at Kessler Foundation on an annual basis. The education division of Kessler Foundation organizes and hosts the nation’s largest PM&R review course. The dedication of Kessler Foundation scientists to rehabilitation research provides broad opportunities for developing and sharing expertise in rehabilitation engineering, statistical analysis, computer programming, database management, research dissemination, and Internet applications.

Facilities of Adjacent Rehabilitation Hospital Kessler Institute for Rehabilitation (KIR)

Kessler Institute for Rehabilitation (KIR) has three inpatient facility locations. These include: West Facility, a licensed 78-bed facility located in West Orange (Essex County); North Facility, a licensed 52-bed facility located in Saddle Brook (Bergen County); and Welkind Rehabilitation Hospital with 72 beds in Chester (Morris County), a sister corporation. With a licensed capacity of 300 beds and over 5,000 admissions per year, KIR is one of the largest rehabilitation facilities in the nation. It draws 90% of its patients from a 6-county region of 3 million people, located within 50 miles of one of the Kessler facilities. KIR (230 beds) and its affiliates (72 beds) comprise 92% of the 330 rehabilitation beds in this region. Each of its facilities offers a full range of medical and rehabilitation services, including physiatry, nursing, psychological counseling, social services, vocational counseling, and rehabilitation therapies on special program emphasis and in general rehabilitation. Among its 33 specialized treatment programs are: the cancer pain management program, the industrial rehabilitation/work hardening program, the performing arts medicine program, the post-polio rehabilitation & research services, the sexuality and fertility clinic, the sports medicine center, and the ventilator-dependent quadriplegia program. The Center for Ventilator Management Alternatives and Pulmonary Rehabilitation, directed by Dr. John Bach, offers intensive breathing instruction using non-invasive respiratory techniques that eliminate the need for a tracheostomy. This is currently one of only two centers in the United States that permits patients with no respiratory muscle function to develop freedom from mechanical ventilators/phrenic pacemakers.

KIR also provides *subacute rehabilitation* through the Kessler Care Center at Cedar Grove, a 196-bed skilled nursing facility. This facility provides comprehensive subacute rehabilitation services in addition to long-term nursing care. In addition, KIR maintains outpatient services at all its facilities and has 23 outpatient satellites located in the Bergen, Essex, Hudson, Hunterdon, Middlesex, Morris, Ocean, Passaic, Somerset and Union counties in New Jersey. By means of its satellites, KIR brings its expertise, experience and skilled service providers to people right in their communities. The outpatient satellites provide physical therapy for musculoskeletal disorders, work related injuries, neck, mid-back and low-back pain care to improve the quality of life for many individuals who previously had minimal access to such services. These centers also provide lectures, screenings, educational seminars and support groups in order for patients and family members to share their insight with one another.

The *Program Evaluation Program* is supported by four professionals in charge of Total Quality Management, Infection Control, Utilization Review and Program Evaluation. The program evaluation system, utilizing the Functional Independence Measure (FIM) for all inpatients, has been in place for almost 15 years. The program evaluation system and medical records provide a core data set available for research projects.

Collegial and Collaborative Activities

Research Fellows will have extensive opportunities to meet experienced rehabilitation and biomedical researchers in New Jersey and New York City. Collaboration with a prominent researcher in a specific area is not only encouraged but required as part of the individual Fellow's Research Training Plan. The process of structuring a mentoring team will cause Fellows to make personal contacts with researchers throughout the Northeast U.S.

Rutgers New Jersey Medical School

Rutgers New Jersey Medical School is approved by the Accreditation Council for Graduate Medical Education and offers a broad array of clinical and academic training services. The University Hospital has 518 beds apportioned among 11 clinical departments. In addition to the usual medical services, the hospital offers a wide variety of specialty services.

The *Department of Physical Medicine and Rehabilitation* at Rutgers New Jersey Medical School maintains close ties to the Kessler Foundation, the Kessler Institute for Rehabilitation, the Department of Veterans Affairs New Jersey Health Care System, the Atlantic Healthcare System, and Children's Specialized Hospital. Under the supervision of the Department's clinical faculty based at these locations, PM&R residents, medical students and clinical fellows rotate through these affiliated sites in order to gain clinical experience. Much of the Department's research and academic work is also conducted at these facilities.

The Department includes seven full-time faculty members based in Newark at University Hospital, 47 full-time paid faculty based at major clinical affiliates, and approximately 50 voluntary faculty members who support the department's teaching programs on a part-time basis. Approximately 16 faculty members have completed research fellowship training, and 18 have completed clinical fellowship training. Total research funding from all sources is approximately $6.7 million per year. Approximately 80 scientific research papers, 12 book chapters, and two textbooks are published each year. In addition to extensive representation on major national organizations within the specialty of rehabilitation medicine, Rutgers New Jersey Medical School faculty also maintain a national presence on leading medical policy organizations such as the American Board of Medical Specialties, the Educational Commission for Foreign Medical Graduates, the Association of Academic Physiatrists, the Special Medical Advisory Group (VA), and the Association of American Medical Colleges. Since 1992, the Department has been a national leader in the use of the objective structured clinical examination within graduate medical education.

The Department's residency training program is recognized as being among the nation's best graduate medical education programs. The Department has received a full five-year accreditation (the longest term offered) from the Accreditation Council for Graduate Medical Education for both its general PM&R residency as well as for its fellowship in spinal cord injury medicine. More than 35 applications are received for each vacant residency slot. The curriculum includes mandatory training for each resident in the theory, design, and conduct of medical research. For the past 15 consecutive years, 100% of the residents who have taken Part I (written) of the PM&R board examination during their year of graduation have passed on their first attempt. The program's residents consistently author articles in leading journals, obtain appointments to national committees and offices, earn highly visible awards, and receive offers of employment from some of the nation's best-known fellowships and rehabilitation facilities. Over the past five years, 48% of the Department's graduating residents have entered fellowships, 18% have accepted positions in academic medicine, and 34% have pursued private practice opportunities.

In cooperation with its teaching affiliates and various sponsoring organizations, the Department conducts a "mandatory" clerkship for medical students at NJMS and also offers medical fellowships in seven subspecialty areas. Additionally, the Department offers federally-funded postdoctoral research fellowships in the subspecialties of rehabilitation outcomes as well as neuropsychology and neuroscience. The number of postdoctoral fellows undergoing training ranges from four to eight, depending on the quality of the applicant pool. The Department also sponsors an annual board review course that is the nation's largest and most popular course for graduates preparing for the board examination.

The *Department of Radiology* provides critical elements in supporting functional neuroimaging research. Primary among these resources is access to two 1.5 Tesla GE Signa MRI scanners equipped with Echo-planar imaging capability. A PET scanner has also recently been added to the Department. Additional resources include computing resources, lab facilities and administrative support.

The *Department of Neuroscience* conducts basic and clinical research on neurological disorders, such as multiple sclerosis, neuronal and retinal regeneration, Parkinson's disease, peripheral neuropathy, obesity, violence and aggression, learning disabilities resulting from membrane anomalies, stroke, and chronic fatigue syndrome. Because of the eclectic nature of the department, some research projects are directed towards revealing the basic mechanisms of disease, while other projects focus on improving clinical therapies.

The *School of Allied Health.* An array of speech/language pathology, occupational therapy, and physical therapy services are offered in the PM&R department and the Stanley S. Bergen Building, which houses the School of Allied Health Professions. Over and above the usual therapies, specialty clinics (e.g., hand, plastics) have been developed. The division of Physical Therapy provides services to both inpatients and outpatients in the following specialty areas: medical/surgical, orthopaedics, pain management, pediatrics, and neurology.

Collaborative Facilities at the Veterans Administration New Jersey Health Care System

Kessler Foundation researchers conduct both human and animal studies in collaboration with other researchers at Veterans Administration, NJ Health Care System (VANJHCS). There is a human performance laboratory located in the Rehabilitation Medicine Service, including a wheelchair accessible treadmill, Quinton metabolic analyzer and stress ECG monitor, Peak Performance Analysis two-camera video gait analysis system, and Dantec Counterpoint 4-channel EMG.

New Jersey Institute of Technology

New Jersey Institute of Technology (NJIT) is a public research university with a specific focus on engineering, science, and technology. It is comprised of the Newark College of Engineering, the College of Science and Liberal Arts, the School of Computing Science, the School of Management, and the School of Architecture, and is New Jersey's technological university. NJIT was established in the late 1800's as part of the educational movement that saw the founding of RPI, WPI, Cooper Union, Stevens Institute of Technology, MIT, and Georgia Tech. With 8000 students (5000 undergraduate and 3000 graduate), NJIT has the largest enrollment in engineering and computing among New Jersey universities. Over the past two decades, NJIT has successfully balanced the transition from a local engineering college to a national research university. It has a dynamic research program with annual sponsored research exceeding $40 million. At the same time, however, it retains the focus on high quality education for which it has been well known. Students are attracted to NJIT because of its commitment to learning. NJIT graduates fill nearly 25% of all engineering positions in the State of New Jersey.

The NJIT campus is quite compact, comprising only 45 acres overlooking downtown Newark. All of its buildings are accessible to persons with disabilities, and the flat, small campus is ideal for persons with mobility impairments. NJIT’s concern with accessibility pre-dates Federal requirements. An active group of consumers, led by Frieda Zames (now professor emeritus), worked closely with the administration beginning in the 1960s to see that all new and renovated campus buildings were accessible.

NJIT’s research facilities provide strong support for an Advanced Research Training grant. Kessler Foundation Fellows will find the NJIT faculty to be supportive of their work and will have access to facilities needed for their research. NJIT is a technical university and its library and laboratories provide a very appropriate complement to those at Kessler Foundation. NJIT

maintains a full research machine shop, microelectronics fabrication facility, and academic computing (including access to supercomputing). The following four Biomedical Engineering research facilities are located in adjoining space in the Department's new building and occupy a total of approximately 2500 sq.-ft.:

The *Neuromuscular Engineering Laboratory* was originally established with NIDILRR funds at the University of Delaware and moved to NJIT in 1999. It includes facilities for the study of the kinematics of upper extremity movements. Current projects include studies of bimanual movement control, non-linear control of biomimetic muscles, measurement of spasticity, vestibular contributions to spasticity, the role of spasticity in dysarthric speech, rehabilitation robotics and the recognition and animation of sign language. Its equipment includes a pair of Immersion Cybergloves (19 joint sensors), three Ascension Flock of Birds systems capable of measuring human movement (position and orientation) using electromagnetic signals in a 3 ft. radius, an ISCAN point of regard system capable of tracking eye movement (single eye), two SensAble Phantom force reflecting robots capable of producing 2 N force reflection to the fingers, an FCS Haptic Master robot capable of providing 20 N force reflection to the arm in four degrees of freedom, a 16 channel Grass EMG amplifier, a five camera large baseline stereo camera system, stereographic glasses and an electroglottograph for measuring glottal impedance.

The *Motor Control and Rehabilitation Laboratory* is NJIT's newest laboratory devoted to studies of motor rehabilitation and coordinated reaching. It is presently studying the use of video game and virtual reality technology among stroke survivors and is engaged in work on motor control of Parkinson's patients. Major new work on enhancing neural plasticity in persons with neural impairment is being developed with the Neuromuscular Engineering Laboratory and shares the FSC Haptic Master. Equipment in this laboratory includes an Optotrack motion analysis system, two stereo camera systems, a P5 sensored glove and an Immersion Cybergrasp, which provides haptic sensation to the thumb and four fingers. The Cybergrasp and Haptic Master are being combined into a hybrid system capable of providing full haptic rendering for the hand and arm. No such system exists in the U.S. at this time.

The *Human Performance Laboratory* is currently dedicated to studies of a new ballistic approach to human movement; this facility includes a 2-camera Qualysis motion analysis system that provides 3-D motion capture at 1000 Hz. Also included are two ATMI force plates.

The *Neural and Vision Engineering Laboratory* is engaged in the study of neuromotor activity involved in vision. It is supported by a binocular eye movement system. This laboratory collaborates extensively with the fMRI facility at the Rutgers New Jersey Medical School. The 3T magnet of theNJMS system makes it ideal for detailed research studies. An MRI capable eye tracking system has been ordered to support this joint work. Additional research is underway with the New York University School of Optometry and studies rehabilitation methods for ocular disorders.

Rutgers, The State University of New Jersey

With over 47,000 students on campuses in Newark, New Brunswick, and Camden, Rutgers is one of the major state university systems in the nation. The Rutger's Psychology Department and its Center for Molecular and Behavioral Neurosciences (CMBN) are involved in this training grant.

The Center for Molecular and Behavioral Neuroscience is equipped with high-tech microcomputers and relevant software designed for the study of the functional properties of the brain's central motor system by means of 3-D kinematic analysis of movements. The laboratory has a Silicon Graphics IRIS 4D80GT and a Silicon Graphics Indigo 2 Superworkstation, state-of-the-art computer graphics display devices. These computers are special purpose machines

for the creation, manipulation, and modification of complex 2-D and 3-D data structures. They allow dynamic interactive graphics and display three-dimensional images with appropriate depth perspective and parallax on a high resolution cathode-ray tube. Function switches, control dials, data tablet and keyboard allow the operator to interact with the graphics processor. The 2-D and 3-D data structures resident in memory can be rotated, translated, scaled, clipped, and viewport mapped. Hence, complete data structures can be manipulated and movements can be generated and displayed in real time. The laboratory is also equipped with Macintosh and IBM-based microcomputers. In addition, the Center for Neuroscience makes available an IBM PowerStation RS-6000/540 with three-dimensional rendering hardware, Macintosh computers for word processing and communication, Apple LaserWriter printer, slide printer, MicroVax II, access to NSFnet, and video recording and editing facilities.

The *University Heights Center for Advanced Imaging* contains a new high-powered (3-Tesla) functional magnetic resonance imaging (fMRI) scanner that provides detailed pictures of specific areas of brain activity that is enabling Rutgers New Jersey Medical School and Rutgers University-Newark researchers to significantly advance neurological research and to better understand and develop potential treatments for brain injury and for devastating neurological diseases such as MS, Alzheimer's, and autism. The fMRI scanner is the centerpiece of the University Heights Center for Advanced Imaging and is one only a handful of such scanners being used nationwide. It is housed at the Rutgers NJMS campus in Newark and is jointly owned by Rutgers-Newark and Rutgers NJMS.

APPLICATION PROCESS

The initial application involves submitting a cover letter detailing your research and clinical interests, background, and training, as well as copies of your CV, graduate transcript, and representative publications or manuscripts. Following review of the completed application, appropriate candidates will be contacted and invited for a formal interview.

Applicants

- Ph.D., M.D. - Doctoral degree should be in a field relevant to rehabilitation. Ph.D. candidate planning dissertation research on topics relevant to rehabilitation are also encouraged to apply;
- Non-immigrants are eligible to apply provided they can be lawfully employed in the U.S.;
- Excellent academic record;
- Research experience: Ph.D. candidates should be proficient in basic research skills;
- Strong candidates will have either publications or publishable theses;
- M.D. candidates should have experience with research, at least on the basis of an initial project; and
- An expressed interest in pursuing a career in rehabilitation, particularly an academic or research career.

Application Instructions

In order to apply, please submit the following materials:

- Cover letter detailing research and clinical interests, background, and training;
- CV or resume;
- Copy of graduate transcripts for current students and recent graduates;
- Copies of publications or manuscripts that illustrate your research work; and
- Three letters of recommendation.

Please send letters of inquiry and application materials to:

Neuropsychology/Neuroscience Fellowship
Nancy Chiaravalloti, Ph.D.
Director, Neuroscience Research
Kessler Foundation
300 Executive Drive
West Orange, NJ 07052
973-324-8440
nchiaravalloti@kesslerfoundation.org

Outcomes Research Fellowship
Trevor Dyson-Hudson, M.D.
Director, Outcomes and Assessment Research
Kessler Foundation
1199 Pleasant Valley Way
West Orange, NJ 07052
973-324-3576
tdyson-hudson@kesslerfoundation.org

Human Performance and Engineering Fellowship
Guan Yue, Ph.D.
Director, Center for Mobility and Rehabilitation Engineering Research.
Kessler Foundation
1199 Pleasant Valley Way
West Orange, NJ 07052
(973) 324-3518
` gforrest@kesslerfoundation.org

Spinal Cord Injury Research Fellowship
Trevor Dyson-Hudson, M.D.
Director, Spinal Cord Injury Research
Kessler Foundation
1199 Pleasant Valley Way
West Orange, NJ 07052
(973) 324-3576
tdyson-hudson@kesslerfoundation.org

Cognitive Neurology and Stroke Research Fellowship
A.M. Barrett, M.D.
Director, Stroke Rehabilitation Research
Kessler Foundation
1199 Pleasant Valley Way
West Orange, NJ 07052
(973) 324-3552
abarrett@kesslerfoundation.org

Traumatic Brain Injury Fellowship
Nancy Chiaravalloti, Ph.D.
Director, Traumatic Brain Injury
Kessler Foundation
300 Executive Drive

West Orange, NJ 07052
973-324-8440
nchiaravalloti@kesslerfoundation.org

If at any time during this application process, you have any questions or need further information please do not hesitate to call or e-mail Dr. John DeLuca, Vice President of Research and Training. Visit us at http://www.kesslerfoundation.org.