## Epidural Stimulation

This study investigates the combined effects of step and stand training with simultaneous epidural stimulation in individuals who have sustained a severe spinal cord injury. Epidural stimulation involves direct electrical stimulation of the spinal cord. The information learned in this study will be used to find the best conditions to assist patients to stand and walk combining epidural stimulation and stand and step training.

## Muscle And Bone

This study explores the effects of step and stand training on bone density, muscle mass, and blood flow at different time points after spinal cord injury, and compares these results to non-injured individuals. Spinal cord injury results in immobilization and therefore, muscle and bone loss along with a decrease in blood flow. This study will show the effects of weight bearing and retraining on muscle and bone recovery.

## Susan J. Harkema, Ph.D.

Dr. Harkema is a leading researcher in the field of neurological rehabilitation. She currently holds the positions of Associate Professor in the Department of Neurological Surgery at the University of Louisville, Rehabilitation Research Director at the Kentucky Spinal Cord Injury Research Center (KSCIRC) and Director of Research at the Frazier Rehab Institute in Louisville.

At the KSCIRC, Dr. Harkema's primary focus is the study of the plasticity of the human lumbosacral spinal cord in individuals with spinal cord injury during Locomotor Training. In a Locomotor Training session, the body of a paralyzed patient is suspended in a harness over a treadmill, while specially-trained therapists and technicians move their legs to simulate walking. Her studies emphasize the importance of basic neural principles of locomotion applicable to all animals. The results of these studies contribute to the knowledge about the fundamental mechanisms that control human locomotion and may provide strategies that can be used by physical therapists for the rehabilitation of walking for patients after neurologic injury.


## Thanks to our sponsors:

- Christopher & Dana Reeve Foundation
- Frazier Rehab Institute
- Kentucky Spinal Cord and Head Injury Research Trust
- National Institute of Health
- New York State Spinal Cord Injury Research Board
- State of New Jersey Commission on Spinal Cord Research
- University of Louisville Kentucky Spinal Cord Injury Research Center


For more information, call (502) 582-7476 or visit us online at www.frazierrehab.org.

UNIVERSITY OF LOUISVILLE®
KENTUCKY SPINAL CORD INJURY RESEARCH CENTER

Frazier Rehab Institute


220 Abraham Flexner Way
Louisville, Kentucky 40202
502.581.8695 ph
502.581.8686 ph
502.582.7605 fax
www.frazierrehab.org


3/11

# Human Locomotion Research Center

Frazier Rehab Institute

## Neuroscience Collaborative Center

**A joint partnership with the Kentucky Spinal Cord Injury Research Center, University of Louisville Department of Neurological Surgery and Frazier Rehab Institute.**

### Human Locomotor Research Center

Our research team is comprised of scientists, engineers, physicians, technicians and physical therapists who work together to understand how the nervous system works during human locomotion. We focus on retraining the nervous system to facilitate the recovery of standing and stepping in individuals with spinal cord injury. Our studies investigate not only physiological characteristics that enable retraining of the nervous system to stand and walk (i.e. neuroplasticity and modulation of reflexes), they also examine a number of issues secondary to spinal cord injury including clonus, muscle and bone atrophy, decreased cardiovascular function and respiratory muscle weakness.

### Neuroplasticity

This study is to investigate whether the nerve pathways below a spinal cord injury will respond to retraining when legs are moved in a standing or stepping pattern. Repetitive training may promote spinal cord learning and strengthen the nervous system components responsible for standing and walking. The results of this study may aid in the development of new rehabilitative strategies to help individuals with spinal cord injuries to stand and walk.

### Modulation of Reflexes

This study identifies how reflexes during standing and stepping are modulated during locomotion. Stand and step training helps the nervous system develop new ways to trigger the muscles that are used in walking after spinal cord injury. The results of this study will provide a better understanding of the role of reflexes during walking and after neurologic injury.

### Clonus

This study assesses whether stand or step training can decrease clonus during different testing conditions. Clonus is one form of spasticity that can produce muscle activity that can interfere with the ability to stand and walk after spinal cord injury. Decreasing clonus will aid in our ability to increase spinal cord injured individuals' quality of life and overall ability to function.

### Functional Electric Stimulation

This study looks at the effect of stand retraining using body weight support and functional electric stimulation on improving bones, muscles, and recovering standing function in individuals with spinal cord injuries. Functional electric stimulation is a technique that uses electrical currents to activate nerves affected by paralysis.

### Cardiovascular Function

This study assesses whether an experimental training program may lead to changes in cardiovascular function after spinal cord injury. Many individuals with spinal cord injury experience low blood pressure. The results of this study may aid in the development of rehabilitative strategies to help individuals with spinal cord injuries that also have low blood pressures.

### Pulmonary Function

This study investigates whether respiratory muscle training, functional electrical stimulation (defined above) and step training can increase respiratory muscle strength and endurance in individuals after a spinal cord injury. Many individuals with spinal cord injury suffer from respiratory muscle weakness and paralysis, which may predispose them to the development of lung diseases. Increasing respiratory muscle strength and endurance in these individuals will increase their overall ability to function in daily living and enhance their quality of life.

### NeuroRecovery Network

The NeuroRecovery Network is a program created through a joint agreement between the Christopher & Dana Reeve Foundation and the Centers for Disease Control and Prevention. The Network serves to provide support for the translation of basic science and applied research into an intensive activity-based rehabilitation program that will promote the recovery function and improvement in health and quality of life. Locomotor Training is a rehabilitation strategy that allows the individuals to repetitively practice standing and stepping using body weight support and a treadmill with manual facilitation from therapists and technicians. Through the establishment of the Network, seven specialized centers with physical therapists skilled in the application of locomotor training principles provide a standardized treatment and monitor outcomes.

Not all inquiring participants will meet the necessary qualifications for each study.