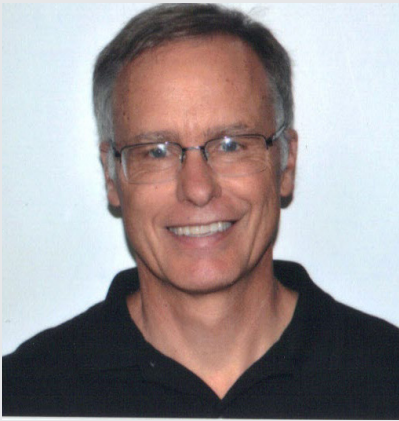


# AskTheExpert

## Q&A with Dr. Frank D. Lewis on Neural Plasticity



The NeuroRestorative team includes numerous experts in the field of brain injury rehabilitation. Each quarter, NeuroRestorative features an interview with one of our experts. We sat down with Dr. Frank D. Lewis, Director of Clinical Outcome Services for NeuroRestorative and Clinical Director for NeuroRestorative Georgia, to discuss neural plasticity and the role it plays in brain injury rehabilitation.

**NeuroRestorative:** What is neural plasticity?

**Dr. Lewis:** Neural plasticity, also known as brain plasticity or cerebral plasticity, refers to the ability of neurons in the brain to change or reorganize in response to specific experiences. The brain communicates through a complex network of more than one hundred billion neurons, each neuron potentially containing thousands of synapses. Synapses, tiny gaps between neurons, send and receive neurotransmitters (chemicals) that control virtually all of our functioning. Neural plasticity occurs when the neuron changes in shape and function increasing the number and effectiveness of the synapses.

**NeuroRestorative:** What conditions promote neural plasticity?

**Dr. Lewis:** Many researchers believe that neural plasticity is driven by goal-oriented, intensive rehabilitation. The key to maximizing positive changes in the brain is repetition of therapeutic exercises that target damaged nerve tracts. Research evidence exists that neural plasticity can be stimulated by several rehabilitative therapies, including constraint-induced movement therapy, functional electrical stimulation, body weight-supported treadmill training and robot-assisted therapy. Diet, exercise and medication can also promote neural plasticity.

**NeuroRestorative:** How can neural plasticity help individuals with brain injury?

**Dr. Lewis:** Improvement in functioning can be achieved by stimulating neural plasticity. Neural plasticity can occur in two ways:

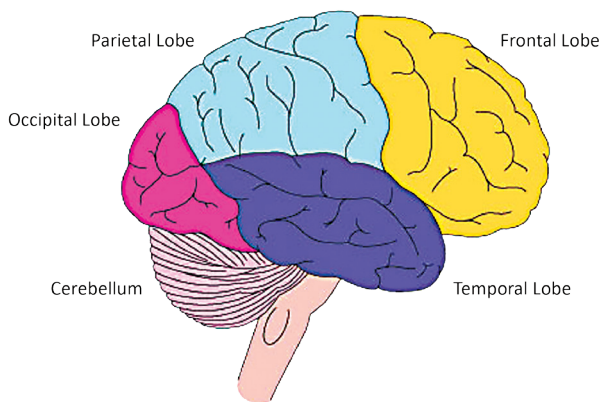
- axons, or nerve fibers, sprout buds, which form new axons that route themselves to the synapse formerly occupied by the damaged neuron; or
- the brain can reorganize in a way that allows neurons in an undamaged area of the brain to assume the functions of the neurons in the damaged area.

In both cases, the plasticity of neurons following brain injury makes it possible for improvement in speaking, balance, motor coordination, information processing, attention and memory.

**NeuroRestorative:** How do we know that neural plasticity is occurring?

**Dr. Lewis:** Neuroimaging technology, such as the MRI technique diffusion tensor imaging, allows neuroscientists to actually see the structural and functional changes that occur within the brain's neurons.

**NeuroRestorative:** Are there limits to neural plasticity?



**Dr. Lewis:** Yes. There are two factors that can limit or slow brain plasticity. The most significant is the extent of the damage. Plasticity

is much weaker when cell death is widespread throughout the brain. Age can also affect plasticity. In general, the brain's ability to change in response to experience declines as we age. New research, however, indicates that neural plasticity is evident throughout life, even into our 70s and 80s. Brain plasticity is greatest in children under the age of eight. There have been cases in which young children who have had an entire hemisphere of the brain removed due to severe seizure disorder have grown into normally functioning adults with few limitations. This is a result of the undamaged hemisphere taking over the function of the removed hemisphere.

**NeuroRestorative:** Can neural plasticity work against functional recovery?

**Dr. Lewis:** Yes. If we repeat bad habits such as poor gait pattern or slurred speech, those habits or behaviors can become stronger in connections along the pathway of the neurons controlling the behaviors. This is why it is important to begin physician- and therapist-directed rehabilitation soon after the injury takes place. For optimal recovery, neural pathways that support good habits need to be stimulated. Everyone can benefit from brain plasticity by avoiding bad habits and engaging in healthy ones such as daily exercise, reading and challenging our brain by learning new skills.

## Dr. Frank D. Lewis, Director of Clinical Outcome Services, NeuroRestorative, Clinical Director, NeuroRestorative Georgia

In addition to his dual roles at NeuroRestorative, Dr. Lewis is also an adjunct assistant professor in the Department of Surgery, Trauma & Critical Care at the Medical College of Georgia and a part-time faculty member in the Department of Psychology at Augusta State University. He is a Certified Brain Injury Specialist Trainer and has over 25 years of experience in the field of brain injury rehabilitation as an educator, researcher and administrator. Dr. Lewis is a recipient of the Leydorf Medical Clinical Review citation for best literature in the field of developmental disability and is the author of numerous peer-reviewed publications. He serves on the Editorial Board of *CareManagement*, the official journal of the Academy of Certified Case Managers. Dr. Lewis received his Ph.D. in Psychology from the University of Arkansas.