Brain Mechanisms of Recovery after Stroke.

Randolph J. Nudo, Ph.D.
University of Kansas Medical Center
Kansas City, Kansas USA

Numerous studies have shown that the cerebral cortex undergoes functional and structural plasticity after injury, such as occurs in clinical stroke. While most of this work has focused on the peri-infarct cortex, recent studies from our laboratory and others have now demonstrated that a focal injury results in widespread changes throughout the ipsilesional and contralesional hemisphere. Our studies have utilized a non-human primate model of focal ischemic injury, since primates possess multiple motor representations that might potentially play a role in recovery. After damage to the distal forelimb representation in the primary motor cortex (M1), hand representations in remaining premotor areas (dorsal and ventral premotor cortex, supplementary motor area) are substantially altered. Remaining distal forelimb representations expand in a size-dependent manner: the larger the injury in M1, the larger the expansion in the premotor area. Reorganization of premotor areas is correlated with functional recovery in hand use. Furthermore, these remote motor areas in the ipsilesional cortex sprout new connections after M1 injury. In primates, the ventral premotor area sends novel intracortical fibers to terminate in the somatosensory cortex. In summary, it would appear that the remaining cortical motor network can sustain recovered functions by altering its anatomical connections and functional organization.