



The historic investment in research through the American Recovery and Reinvestment Act is funding promising science that is improving health, while contributing to the economy. View more stories at [www.sfn.org/recovery](http://www.sfn.org/recovery).

## STROKE:

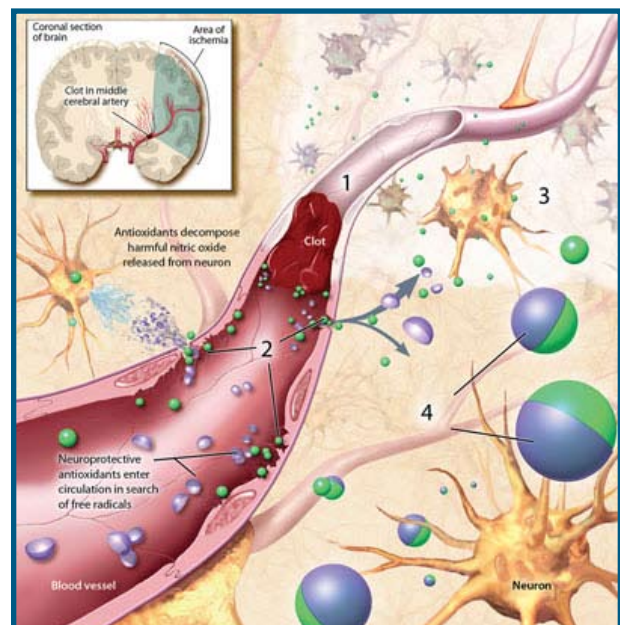
### “Cortical Stimulation to Enhance Experience-Dependent Plasticity After Stroke”

Theresa Jones, University of Texas Austin, Austin, Texas

*Supported by the National Institute of Neurological Disorders and Stroke, National Institutes of Health*

#### GRANT DESCRIPTION

This project is focused on understanding the neural basis of a novel treatment approach for loss of function after stroke. Loss of function in one hand and arm is a leading long-term disability resulting from stroke. Physical rehabilitative therapies are typically only partially effective for improving function. Recent animal studies and clinical trials in humans have found that motor cortical stimulation (CS) can improve use of the upper extremity. However, it is not always effective. Currently, it is unclear what differentiates its successful versus unsuccessful administration because its neural mechanisms have not been identified. The study will investigate this in rats using a well-established model of motor rehabilitative training, in which the animals re-learn how to perform fine motor movements with their forepaws after stroke like damage to one hemisphere. Previous studies have found that CS coupled with training speeds recovery and results in more enduring functional improvements than training or CS alone. The study will investigate whether this functional improvement is coupled and dependent upon plasticity of the structure and connections of surviving neurons. The goal is to contribute to a better understanding of how to use this treatment approach to improve function and life quality after stroke.



A stroke occurs when a blood vessel bringing oxygen and nutrients to the brain bursts or is clogged by a blood clot (1). This lack of blood leads to a cascade of neurochemical abnormalities that can cause cell death within minutes. Free radicals are released, causing damage to endothelial cells (2) and the mitochondria (3) of neurons. Normally the body readily disarms free radicals (4), but in stroke, endothelial cell damage allows many more than can be controlled to move into brain tissue. Depending on its location, a stroke can have different symptoms such as paralysis on one side of the body or a loss of speech.

## STROKE:

### “Cortical Stimulation to Enhance Experience-Dependent Plasticity After Stroke”

(CONTINUED)

#### SCIENCE AND HEALTH IMPLICATIONS

With advancements in treatment, stroke survival rates have been increasing for many years. As a result, so has the population coping with long-term disability. Many stroke survivors never regain normal use of the stroke-affected arm and hand and this is a major detriment to life quality. Physical therapy and other behavioral treatments can promote improvements in the hand and arm, and this is linked with reorganization of remaining brain tissue. However, these behavioral therapies often require weeks or months of toilsome training; they are variable in their effects and the improvements are not always long lasting. The modulation of cortical activity with electrical stimulation is an approach that shows promise for greatly enhancing the effects of rehabilitative training. But there is limited understanding of how it works to guide its administration in stroke survivors. By studying the neural effects of cortical stimulation (CS), and how these differ with optimized versus alternative CS parameters, this study will contribute to knowledge that could be used to guide its administration in stroke survivors (e.g., by using noninvasive imaging approaches to verify that therapeutically effective changes are being achieved).

#### RESEARCH IMPACT: IN THEIR WORDS

“My research group has many highly talented, devoted scientists and trainees who strive and work incredibly long hours for small salaries, the joy of discovery, and a sense of duty for advancing scientific knowledge and medical treatment. The ARRA funds have helped us keep from losing this talent. This is true for my research group and many others at my institution. I imagine that this scene is repeated across the country.”

–Theresa Jones, Primary Investigator

The Society for Neuroscience (SfN) is the world's largest organization of scientists and physicians devoted to advancing understanding of the brain and nervous system. Since its inception in 1969, the Society has grown from 500 members to more than 40,000.