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Editorial

The Wave of Brain Research and New Neuroscience Journal Endow Stroke with New Hope

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Editorial

The brain is the most complicated human organ. Although great advances have been made in brain research, the brain is still mysterious to us. As a consequence, the major challenge to fight against intractable neurological diseases is still clarifying how the brain works, which is a tough task for neuroscientists to decode the brain structure and functions.

In 2013, President Barack Obama announced the launch of the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) initiative, a robust effect to push brain research forward and deepen our understanding of our brain. By coincidence, the European Union funded a 10-year project, the Human Brain Project established in 2013, aiming to explore the brain functions and facilitate the development of therapeutic strategies against neurological disorders. These ambitious efforts would make more breakthroughs to help us to acquire better diagnostic methods and find more effective approaches tackle the disorders of the central nervous system. With these efforts implemented two years' ago, you should expect a plenty of insightful gains in neuroscience and neurology in near future. In this respect, the journal "Austin Neurology & Neuroscience" finds the right time to launch in order to meet the challenge of another wave for publications in brain research.

In regard to stroke, the exploded studies have greatly advanced our understanding of pathophysiological mechanisms of ischemic neuronal death since 1980s [1], when the reliable animal model of stroke was established. However, the development of novel treatment for this devastating disease is sluggish.

Currently, stroke is still a leading cause of serious, long-term disability in the developed countries, but the effective approach for management in patients is limited. To restore the blood flow of the brain by using tissue plasminogen activator is the only approved treatment for ischemic stroke in the United States. As a result, to find novel approaches to improve the recovery and increase the quality of life of patients with ischemic stroke is still challenging. With further work and insight into pathophysiological mechanisms during ischemic brain injury may formulate more practical approaches for the management of ischemic stroke.

The numerous progresses in pathophysiology in experimental ischemic stroke have been made over last 30 years. The excitotoxicity and calcium overload was primarily proposed to initiate the cascade of ischemic neuronal cell death [2-4]. Afterward, the oxidative stress [5,6], inflammation [7], mitochondrial dysfunction, and many other mechanisms have been demonstrated to contribute to ischemic neuronal death. However, the neuroprotective approaches targeting these ischemic cascades, which were high effective in animal ischemia, fail to show any significant benefit in patients with ischemic stroke. The results implicate that stroke requires comprehensive management based on the severity, cause, and accompanied conditions.

Returning the regional cerebral blood flow is the key step to stop the deterioration and rescue the penumbral regions. However, the major aim of long-term strategies should improve the functional recovery. To gain this aim, angiogenesis, neuroregeneration, and recovery of the neuronal circuit might be crucial targets of future management for patients with ischemic stroke. Of course, the physical therapy has proved to be effective in functional recovery [8], the outcome of which is far from satisfaction. In addition, the identification of new endogenous repair system after stroke may help us to find innovative methods to treat ischemic stroke. Recently, new proteins have been found to regulate the neuronal regenerative process [9,10].

The induction of axonal sprouting has been considered as an important factor to improve the neuronal circuit and promote the recovery in the penumbral cortex after brain infarction. Growth and Differentiation Factor 10 (GDF10) is one newly found protein that functions to initiate axonal sprouting [9]. More importantly, GDF10 can be induced in the peri-infarct neurons and has been shown to promote axonal outgrowth and enhance functional recovery after stroke. Cerebral ischemia can also induce the expression of ephrin-A5, a glycosylphosphatidylinositol-anchored protein, in reactive astrocytes in the penumbral area. In contrast to GDF10 as a stimulus of axonal sprouting, ephrin-A5 is an inhibitor of the axonal sprouting. As a consequence, blockade of ephrin-A5 promotes the formation of new axonal projections in motor, premotor, and prefrontal circuits of the cortex and improves the recovery after stroke in animal models [10]. The findings may pave the new road to improve the regenerative process after stroke. The Post-Synaptic Density-95 protein (PSD-95) is also a promising target to improve neuronal function after stroke. Application of PSD-95 inhibitor in both rats and non-human primates reduces infarct volumes and improves neurological function after stroke [11,12]. Targeting the above signals might acquire the novel means to promote the recovery of neuronal circuit and neurological functional recovery following stroke.

Despite the massive funds with new initiatives of brain research, you can't expect to create a cure for stroke in a day. Any advances in

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neuroscience might need concurrent development of new techniques and technologies. For example, the neurogenetic diagnosis is possible only after the completion of human genome project and innovation of molecular techniques [13]. The live observation of the brain vascular system develops with emerging of high-resolution image system. The implementation of reliable genetic sequencing services is the consequence of the well development of next generation of DNA sequencing systems [14]. The innovation of stroke therapy should have predisposing clarification of clinical pathological mechanisms that lead to ischemic neuronal dysfunction. With the upcoming breakthrough in neuroscience and neurology, I believe that stroke will get benefit with great gain for its therapeutic strategies.

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