

Prehabilitation for Stroke : Preparing Motor Circuits to Improve Recovery

脳卒中のプレハビリテーション
—回復を促進する運動回路の事前準備—

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Abstract

Stroke is a leading cause of long-term disability, and many survivors regain some movement through rehabilitation—but we still do not fully understand which brain circuits make recovery possible, or whether those circuits can be strengthened before a stroke occurs. In this project, we used a mouse model of motor-cortical stroke combined with a skilled forelimb reaching task to pinpoint the specific motor pathway that supports recovery. We found that after a large stroke, the intact (“contralesional”) motor cortex on the opposite side of the brain becomes essential for regained movements, and that this dependence is driven specifically by layer V corticospinal neurons, the cells that send commands from cortex to the spinal cord. Using longitudinal two-photon imaging, we observed that recovery is accompanied by the emergence of newly engaged corticospinal neurons. Finally, we show that a “prehabilitation” approach—training the motor system with repeated, brief optogenetic suppression before stroke—can bias these corticospinal circuits toward a recovery-supporting state, increase corticospinal projections in the spinal cord, and improve recovery efficiency. Together, the findings suggest that targeted circuit priming could one day complement rehabilitation in individuals at high risk of stroke.

本研究では、脳卒中後の運動機能回復を支える神経回路をマウスモデルで解析した。反対側運動野の皮質脊髄ニューロンが回復に重要な役割を果たし、脳卒中前のプレハビリテーションによって回路を強化することで、運動機能回復が促進されることを示した。

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