Stroke-induced neuroplasticity in spiny mice in the absence of tissue regeneration

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African spiny mice (*Acomys cahirinus)* have the unique ability among mammals to regenerate skin, muscle, and even spinal cord tissue with little to no scarring. Here, researchers investigated the effects of transient ischemia in *Acomys,* finding that the rodents failed to regenerate impacted brain regions yet showed rapid behavioral recovery post-stroke. Their recovery can be attributed to undamaged regions of the brain dramatically increasing their interconnectivity to compensate for damaged tissue.

After obtaining baseline behavioral and fMRI data, ischemic stroke was induced in adult male *Acomys.* The rodents' behavior was monitored for 24 weeks post injury (wpi), and magnetic resonance imaging (MRI) was periodically conducted to assess the changing structure and function of the brain post-injury. MRI visualization and quantification showed that, like in humans, the damaged area increased in size over time post-injury. However, *Acomys* demonstrated an unusually rapid behavioral recovery (i.e. minimal neurological deficit scores and behavior similar to baseline). To explain this recovery in the absence of tissue regeneration, resting-state functional MRI (rsfMRI) was used to analyze the rodents' connectome, or the map of functional connections in the brain. Unlike humans or traditional rodent subjects, *Acomys* demonstrated no significant changes in the whole brain connectome from baseline to 4 wpi. Increased connection and activity in intact brain regions, especially contralaterally to the injury, evidently allows *Acomys* to compensate for the damaged tissue.

The fact that no global changes to connectome were observed after stroke (unlike in human, rat, and mouse subjects) suggests an improved method of compensation in *Acomys.* Further studies into this neuroplasticity response in both the *Acomys* brain and possibly in the spinal cord could ultimately lead to a better understanding of how the mammalian brain develops and can be remodeled and ultimately impact treatment regimens for severe CNS injuries. .

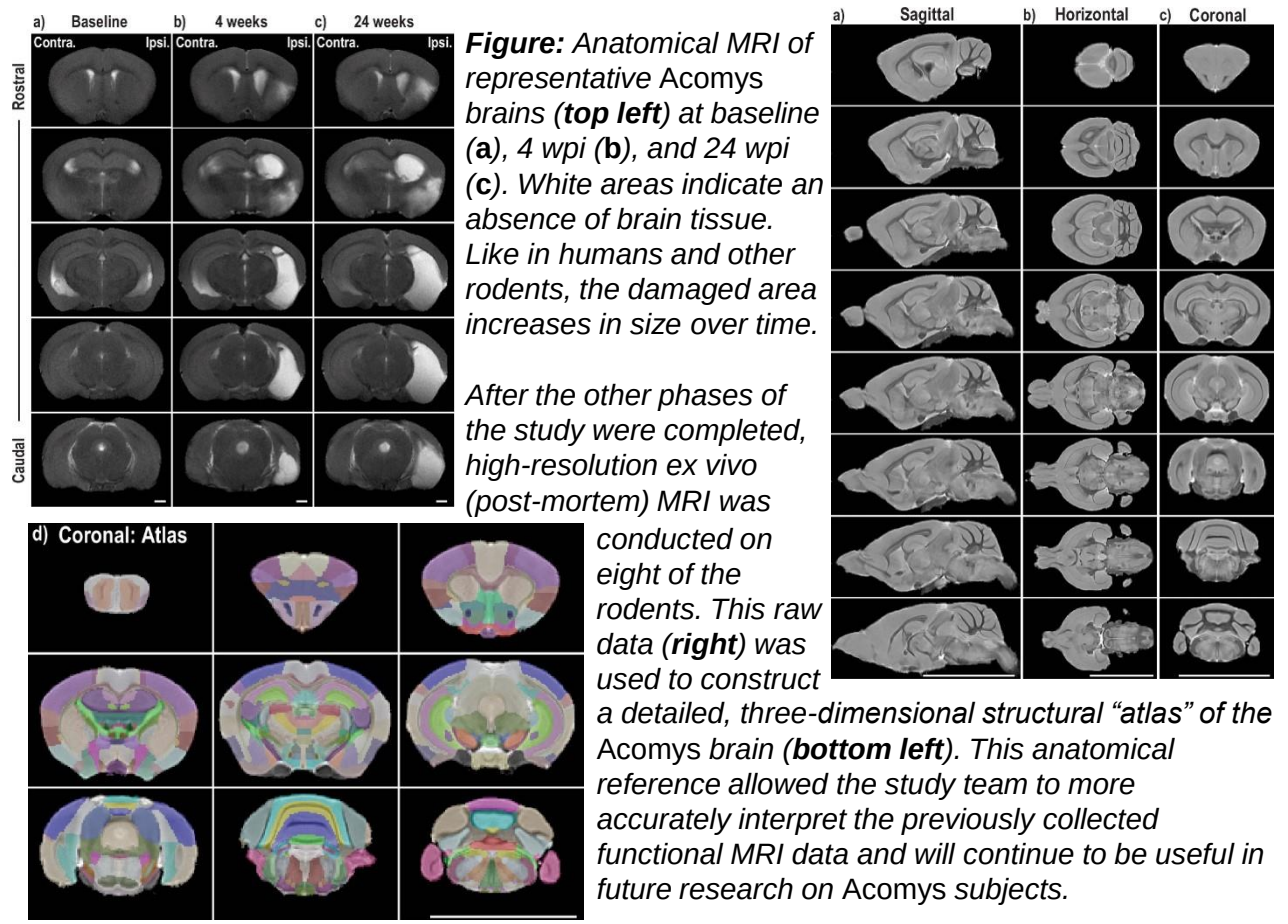

Figure: *Anatomical MRI of representative* Acomys *brains (**top left**) at baseline (**a**), 4 wpi (**b**), and 24 wpi (**c**). White areas indicate an absence of brain tissue. Like in humans and other rodents, the damaged area increases in size over time.*

*After the other phases of the study were completed, high-resolution ex vivo (post-mortem) MRI was conducted on eight of the rodents. This raw data (**right**) was used to construct a detailed, three-dimensional structural "atlas" of the* Acomys *brain (**bottom left**). This anatomical reference allowed the study team to more accurately interpret the previously collected functional MRI data and will continue to be useful in future research on* Acomys *subjects.*

Facilities and instrumentation used: AMRIS Facility; 11.1T/40cm Magnex magnet with Bruker Avance III HD MRI system. **Citation:** Kidd, B.M.; Varholick, J.A.; Tuyn, D.M.; Kamat, P.K.; Simon, Z.D.; Liu, L.; Mekler, M.P.; Pompilus, M.; Bubenik, J.L.; Davenport, M.L.; Carter, H.A.; Grudny, M.M.; Barbazuk, W.B.; Doré, S.; Febo, M.; Candelario-Jalil, E.; Maden, M.; Swanson, M.S., *Stroke-induced neuroplasticity in spiny mice in the absence of tissue regeneration,* Nature Partner Journals (npj) Regenerative Medicine, **- 9** (- 1) (2024) **doi.org/10.1038/s41536-024-00386-8**