CORTICOSTRIATAL PLASTICITY AFTER MIDDLE CEREBRAL ARTERY OCCLUSION

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Stroke is 5\textsuperscript{th} leading cause of death (American Heart Association, 2017)

A leading cause of long term disability (Yang et al., 2017)

What is a stroke? (American Heart Association, 2017)

- Ischemic 85%
  - Cause by a clot
- Hemorrhagic 15%
  - Caused by a bleed
Physical rehabilitation is primary treatment in humans
- Produces neuroplastic changes in rat models

Rehabilitation affects functional outcome
- Timeline - too early, too late
- Lateralization
- “good” (non-paretic) vs. “bad” (paretic) limb
Motor Cortex-essential for planning, control and execution of motor functions

Striatum- input from motor cortex to basal ganglia

Corticostriatal projections

Lateralized damage
- Middle cerebral artery occlusion (MCAo)
  - Large lesions = bigger functional change
  - Most common type of ischemia in humans
- Corticostriatal connections
  - Damaged by stroke
  - Striatum denervated (no longer receives information from motor cortex)

- Found in ipsilesional striatum after stroke, originated in contralesional cortex
- One study correlated function with behavioral measures (Rosenzweig and Carmichael 2013)
  - Damage to corticostriatal axons positively correlated with motor impairment

What is not known
- Above study has not been replicated
- Effects of rehabilitative training?
STUDY OVERVIEW

- Induce MCAo
- Rehabilitative training
- Tracer
- Quantify axons
Behavioral Methods:

- Male Long Evans Rats (3-12 months)
- Rats learn reach task (3-4wks)
- Induce stroke
  - Occlude middle cerebral artery for 60 minutes
- Rehab groups
  - Standard, control, non-paretic, delayed
- Tracer
**METHODS**

**Histology Methods**

- Sections
- Immunohistochemistry
- Slides
- Microscopy and axon quantification

(Riban and Chesselet, 2006)
Two options for data analysis.

- Compare standard rehab to control and non-paretic rehab to delayed rehab, treating the two as separate experiments.
- Compare all four groups using an ANOVA test.

**Paretic limb** - “bad” or affected limb

**Non-paretic limb** - “good” or unaffected limb

**MCAo** - middle cerebral artery occlusion (type of stroke)

**Ipsilesional** - side of the lesion

**Contralesional** - opposite from the lesion
** EXPECTATIONS **

- **Paretic limb** - “bad” or affected limb
- **Non-paretic limb** - “good” or unaffected limb
- **MCAo** - middle cerebral artery occlusion (type of stroke)
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**Diagram:**
- Motor cortex
- Lesion
- Striatum
- Axons

**Graph:**
- Control
- Standard
- Delayed
- Non-paretic

**Legend:**
- Ipsilesional
- Contralesional
ALTERNATIVES

- Standard rehab group - no increase in ipsilesional or contralesional projections
- Non-paretic rehab group and delayed rehab group - no increase in ipsilesional or contralesional projections
- Control - no increase in contralesional projections

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