

Modeling Parkinsonian Symptoms in Rats Using Paraquat and Glyphosate Post Mild TBI

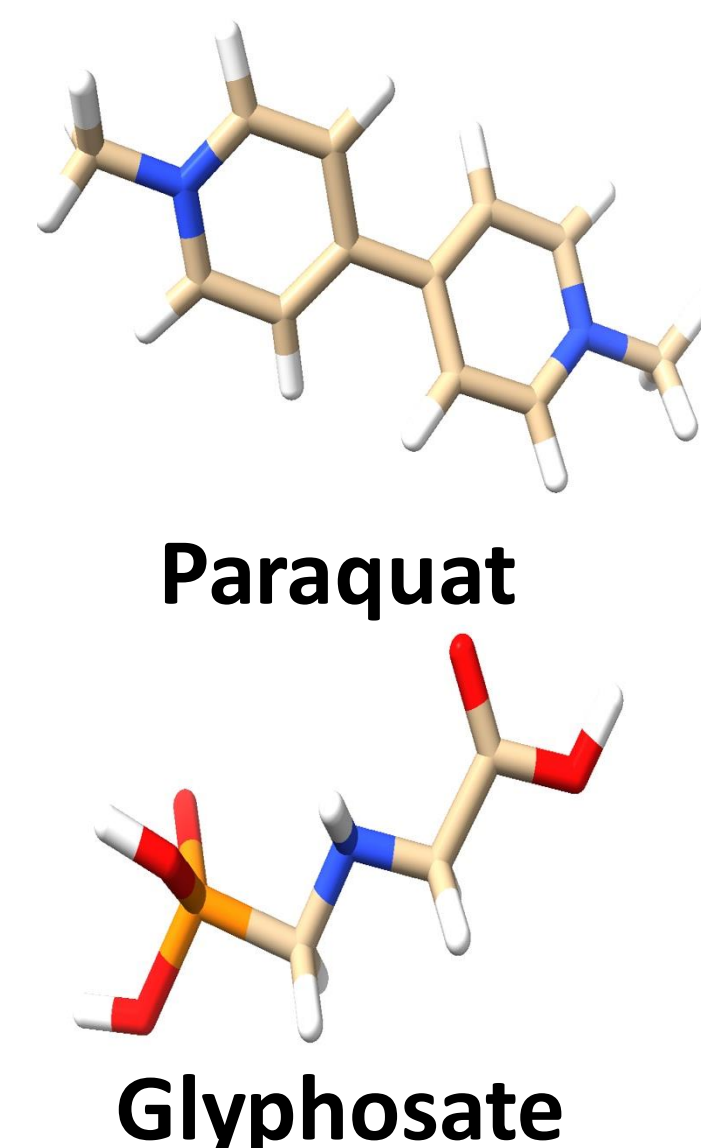
Reyna Ahuja, Tochi Chukwuemeka, Deena Weiss, Kaashyap Balaji, Shruti Kedharnath, Eva Bennet, Nevetha Vijayan

Praveen Kulkarni, PhD & Craig Ferris, PhD

Background & Goals

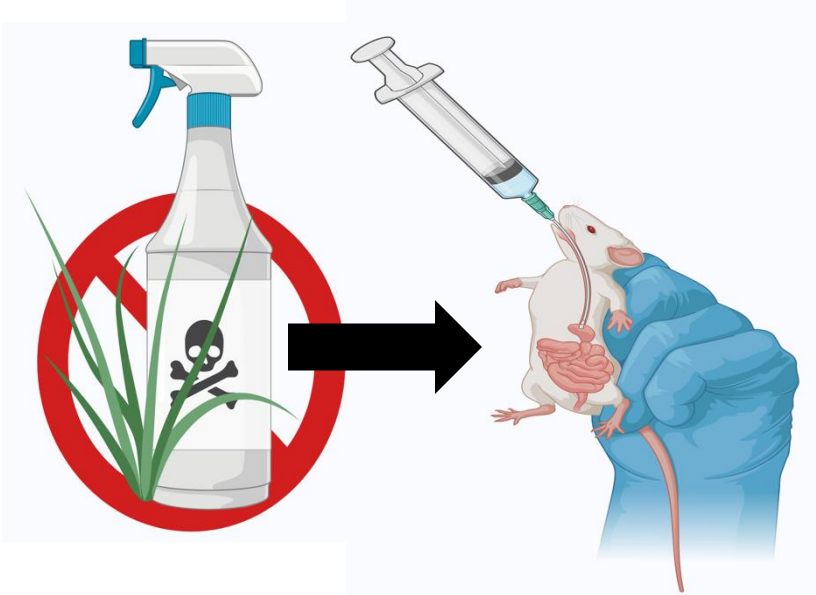
Glyphosate (Roundup), a globally used herbicide, has been linked to significant neurotoxicity in dopaminergic signaling throughout the brain, potentially contributing to the development of **Parkinson's Disease**, a chronic neurodegenerative condition affecting over **10 million people** worldwide.

By assessing behavioral changes and using MRI scans on conscious rats to examine brain structure and function, this research aims to demonstrate how these **herbicides might accelerate Parkinsonian symptoms** in conjunction with **repetitive mild traumatic brain injury (rmTBI)**.



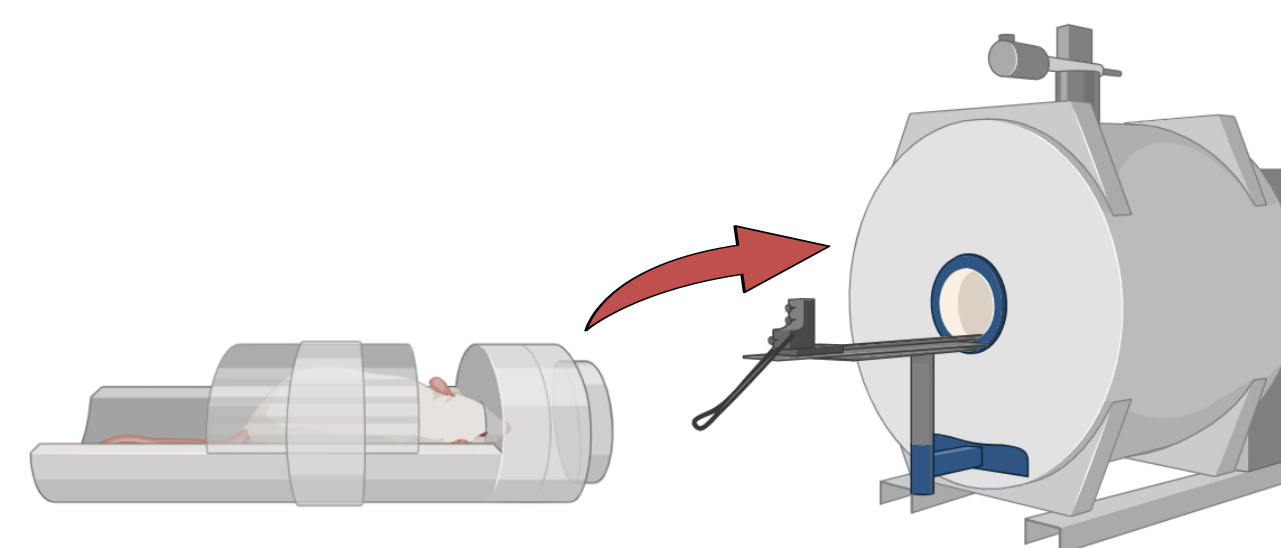
Process & Methods

9 cohorts (4 rats each) over 45 days recieved:



Drug Exposure (Days 1–43)

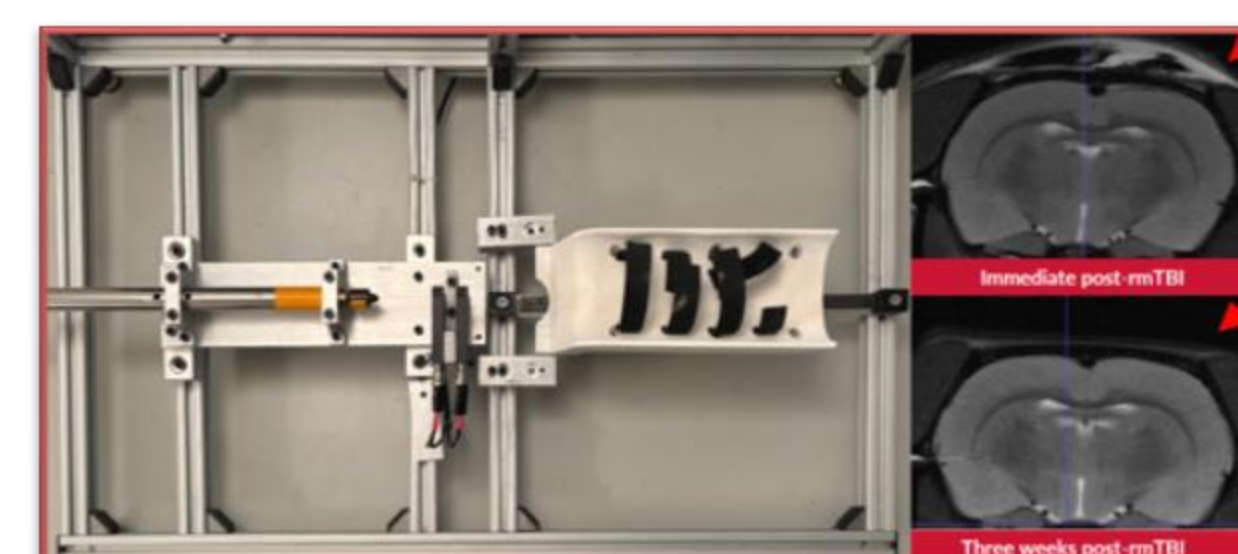
- Oral Gavage:
- Glyphosate 75 mg/kg (/day)
- Paraquat 10 mg/kg (/3 day)
- Saline 0.9% Neg. Control



Pre-TBI Scan (Days 30-32)

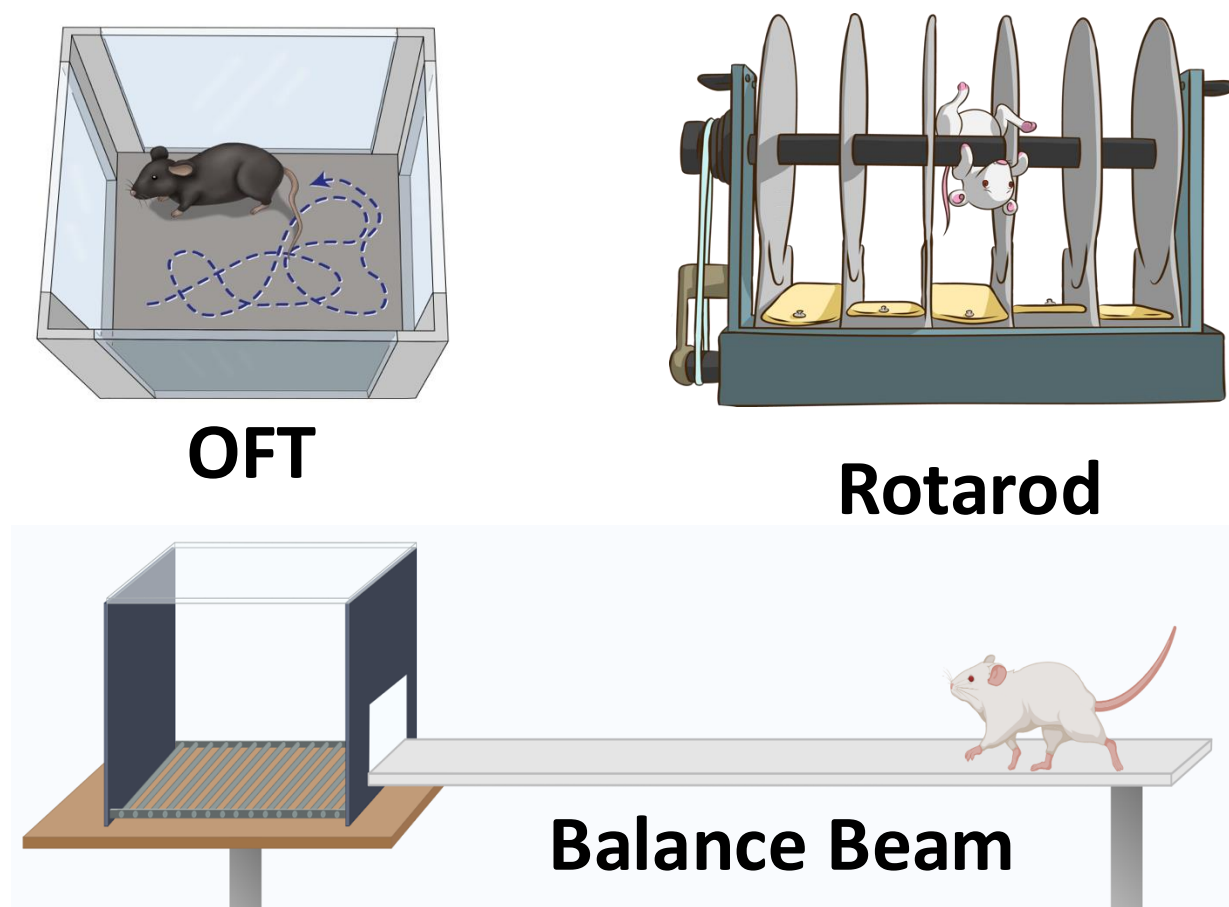
- DWI
- T2 Weighted Anatomy
- rsFC

Momentum Exchange Model of mTBI



Repetitive Mild TBI (Days 30-32)

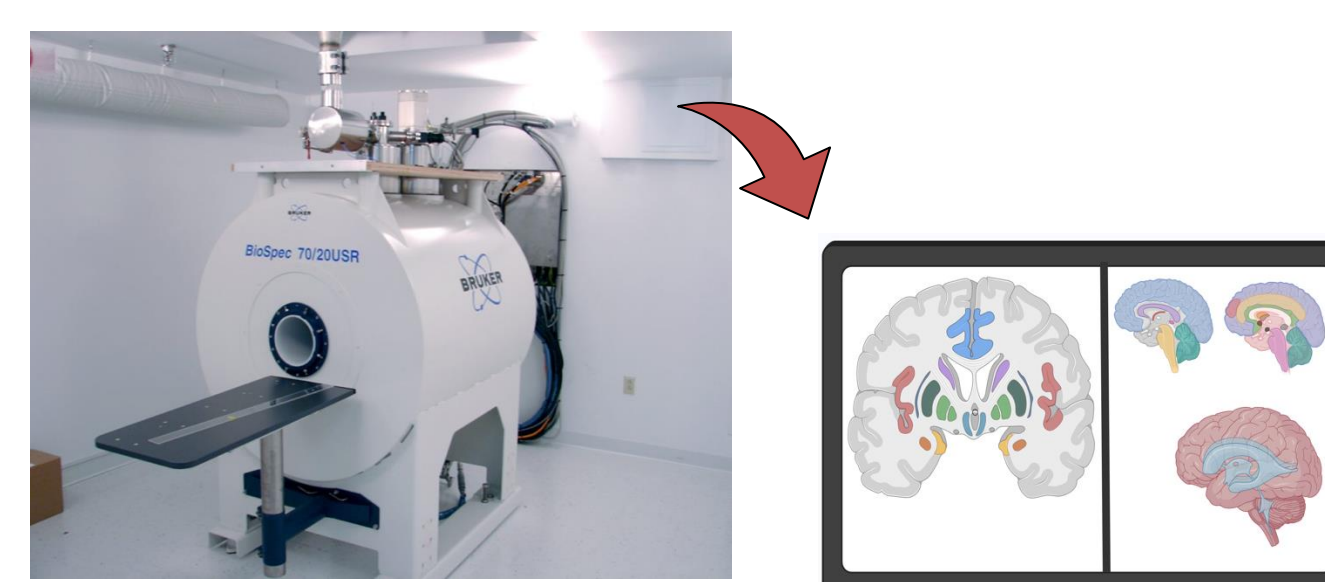
- 3 TBI over 3 Days
- All groups



Behavioral Assays (Days 33 – 37)

- Open Field Test
- Novel Object Repetition
- Rotarod
- Balance Beam

7 Tesla MRI



Post-TBI Scans (Day 44)

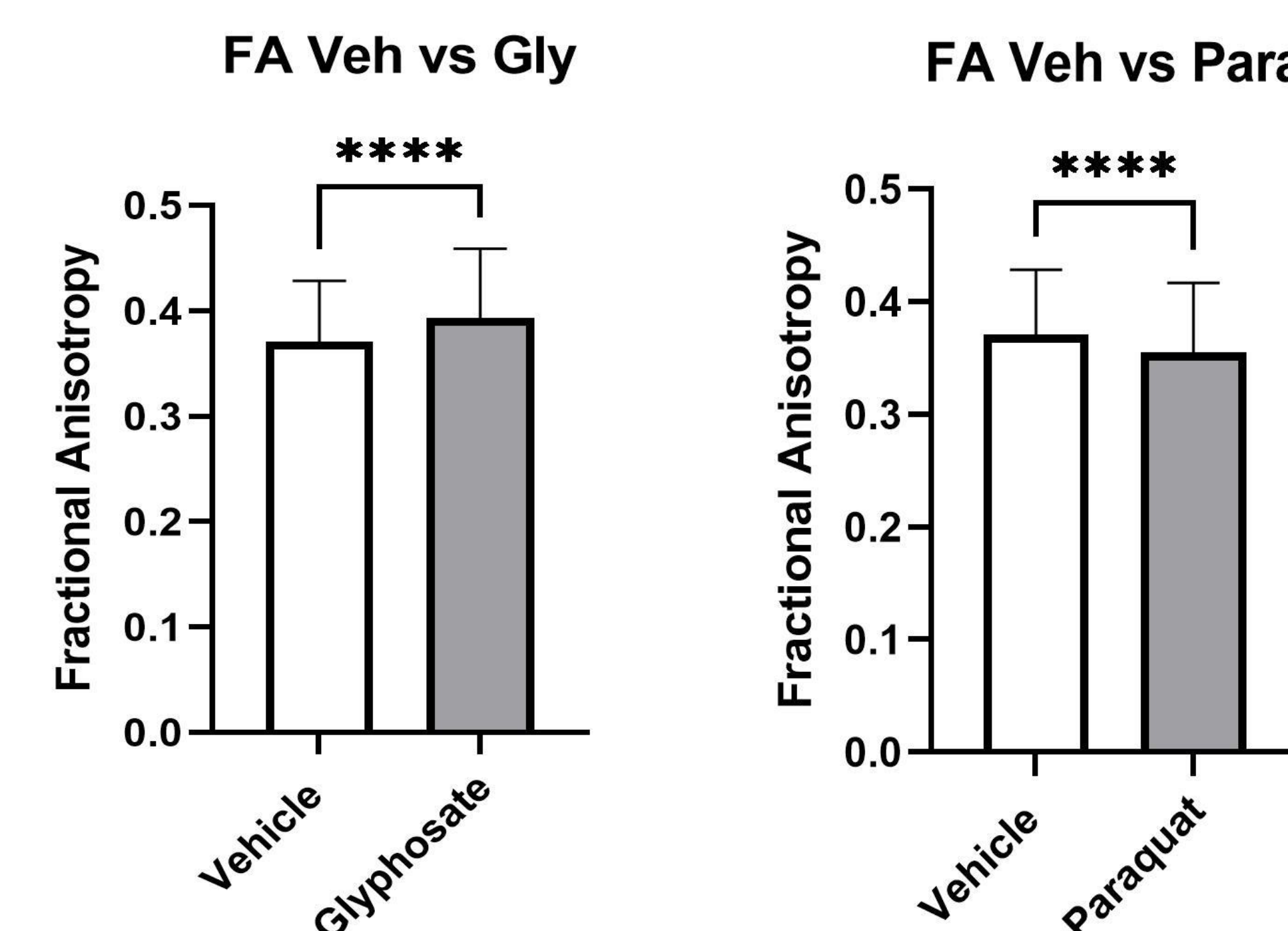
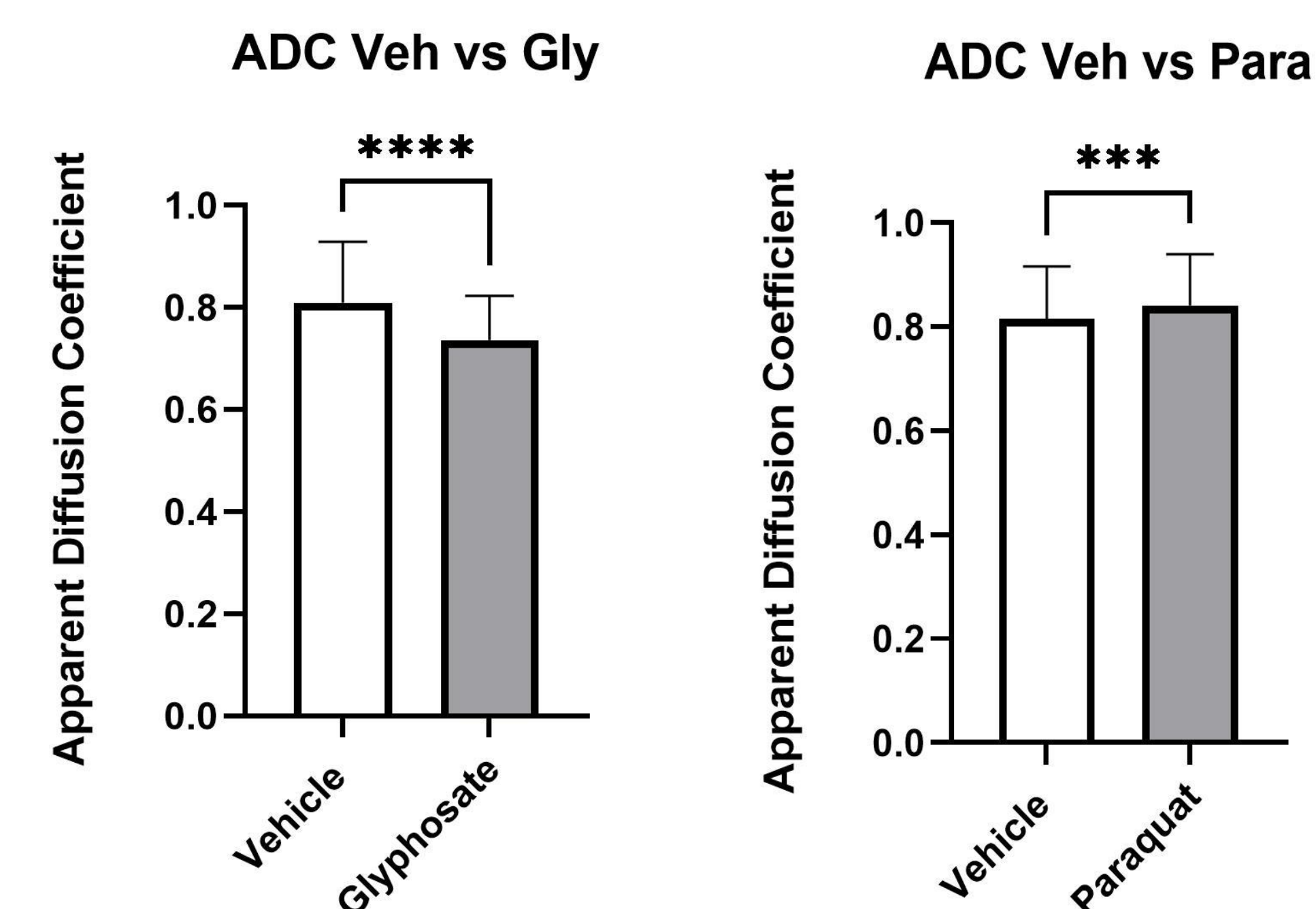
- Same imaging as pre-TBI
- Olfactory stimulus fMRI
- Hypercapnic challenge

Tissue Extraction and Histology (Day 45)

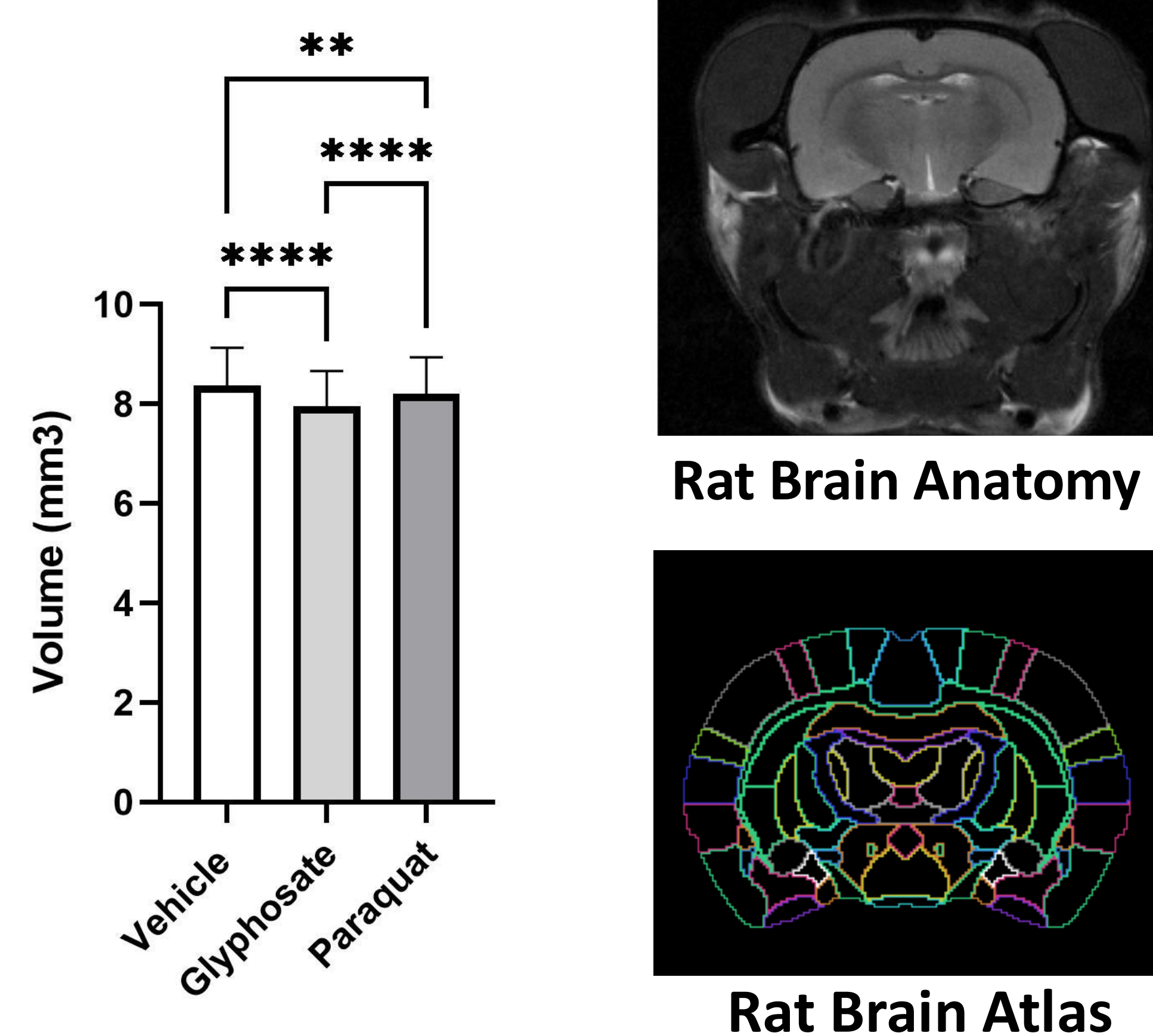
- Brain, liver, kidney, heart, skeletal muscle, and blood samples

Findings

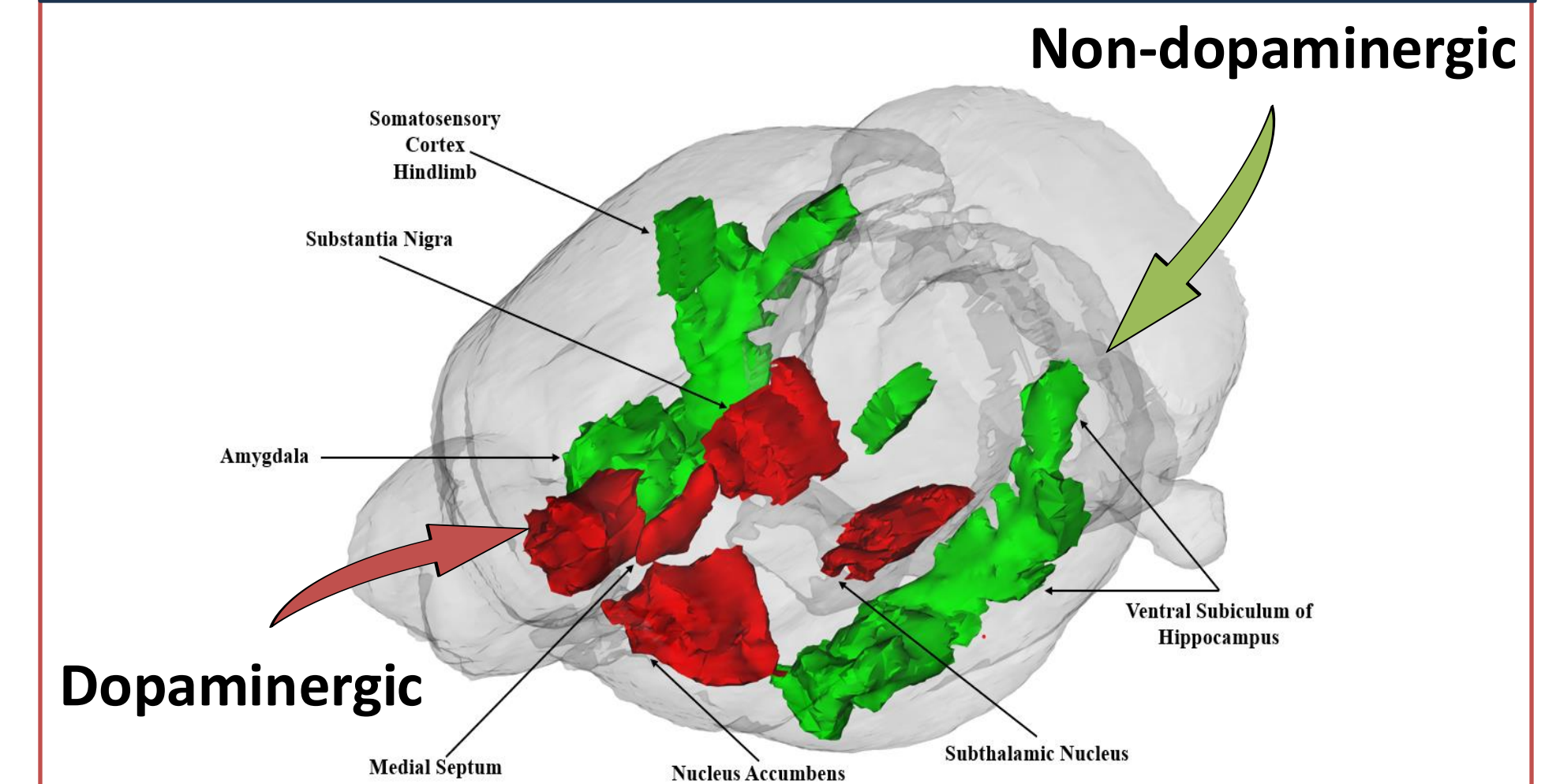
Diffusion Weighted Imaging



Volumetric Based Morphometry



Dopaminergic System



Regions of the brain exhibited a significant reduction in dopaminergic signaling following a 30-day administration period. With the increased **fractional anisotropy** values and significantly decreased **apparent diffusion coefficient**.

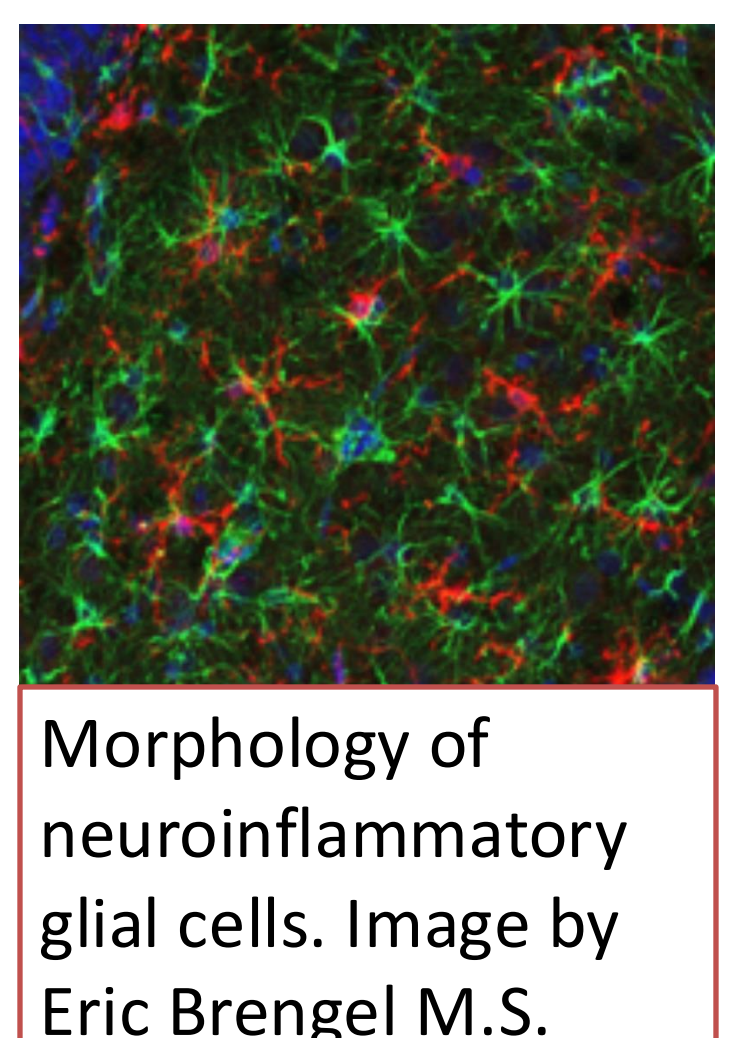
Conclusion & Next Steps

Glyphosate potentially causes neuroinflammation in **dopaminergic regions associated with Parkinson's disease**.

Potential exploration of neuroinflammation using immunohistochemistry

Explored how two neurodegenerative risk factors—**mTBI and herbicide exposure**—synergistically contribute to **dopaminergic signal loss** and the onset of Parkinson's Disease.

Established a potential **novel rat model of Parkinson's**, paving the way for further research into treatments, uncovering disease causes, and symptom reduction.



Acknowledgements: Eric Brengel, M.S., Ash Maheswari & Shreyas Balaji

