

Research Log

PLEASE CONTACT ME FOR A FULL, DETAILED CONSTRUCTION LOG ABOUT MY PROJECT AS THIS ONLY PROVIDES VAGUE DATES

Project: Developing a neurologically effective, dual therapy approach to ALS through brain imaging and omics

Researcher: Mrigank Pandey

December 14, 2025

Began preliminary literature review on Amyotrophic Lateral Sclerosis (ALS). Focused on motor neuron degeneration mechanisms including RNA dysregulation, mitochondrial dysfunction, axonal transport impairment, and neuroinflammation. Identified that ALS pathology involves multiple overlapping biological processes, suggesting that a multimodal research approach may be beneficial.

January 5, 2026

Continued literature review on ALS molecular pathways and neuroimaging findings in ALS patients. Noted common structural and functional brain changes reported in literature, particularly in motor pathways such as the corticospinal tract and motor cortex. Began planning how neuroimaging data could be incorporated into the project.

January 28, 2026

Investigated publicly available ALS datasets that could be used for computational analysis. Identified the **Answer ALS consortium datasets** as a potential source for transcriptomic and proteomic information. Reviewed access policies and completed the **Data Use Agreement (DUA)** required to use the data.

February 18, 2026

Downloaded transcriptomic datasets derived from **the primary motor cortex** and began organizing the files. Reviewed potential pipelines for single-nucleus RNA sequencing analysis and selected the **Seurat framework** as the main analysis pipeline.

February 26, 2026

Prepared transcriptomic outputs generated using **STARsolo**. Confirmed that filtered matrices, gene files, and barcode files were available for downstream analysis. Began preparing these files for import into Seurat.

March 1, 2026

Converted STARsolo outputs into Seurat-compatible formats and created several Seurat objects for the datasets. Explored the initial steps of the Seurat pipeline including object creation and preparation for quality control filtering. Due to time constraints, further transcriptomic analysis was postponed.

March 2, 2026

Began neuroimaging analysis using **diffusion-weighted imaging (DWI)** data. Selected white matter regions of interest related to motor pathways, including the **corticospinal tract, corpus callosum, cingulum, and superior longitudinal fasciculus**. Started extracting diffusion metrics such as fractional anisotropy (FA) and mean diffusivity (MD).

March 3, 2026

Conducted **Group Independent Component Analysis (ICA)** to investigate functional brain networks. Examined components related to sensorimotor regions and began interpreting clusters and associated brain regions.

March 4, 2026

Performed **ROI-to-ROI connectivity and seed-based connectivity analyses** to investigate functional connectivity patterns between selected brain regions. Generated connectivity matrices and began interpreting connectivity differences between groups.

Compiled diffusion metric results and connectivity analyses. Integrated neuroimaging findings with biological insights from the proteomic dataset. Began assembling figures and summaries for the final project presentation.

I will have to continue this after March 4th, as my ASO design and transcriptomics pipeline have hit an error.