# Characterization of Brain Metabolic State under Injury using Two-Photon Microscopy

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# Objective and summary of the project

Objective: characterize brain metabolism after traumatic brain injury

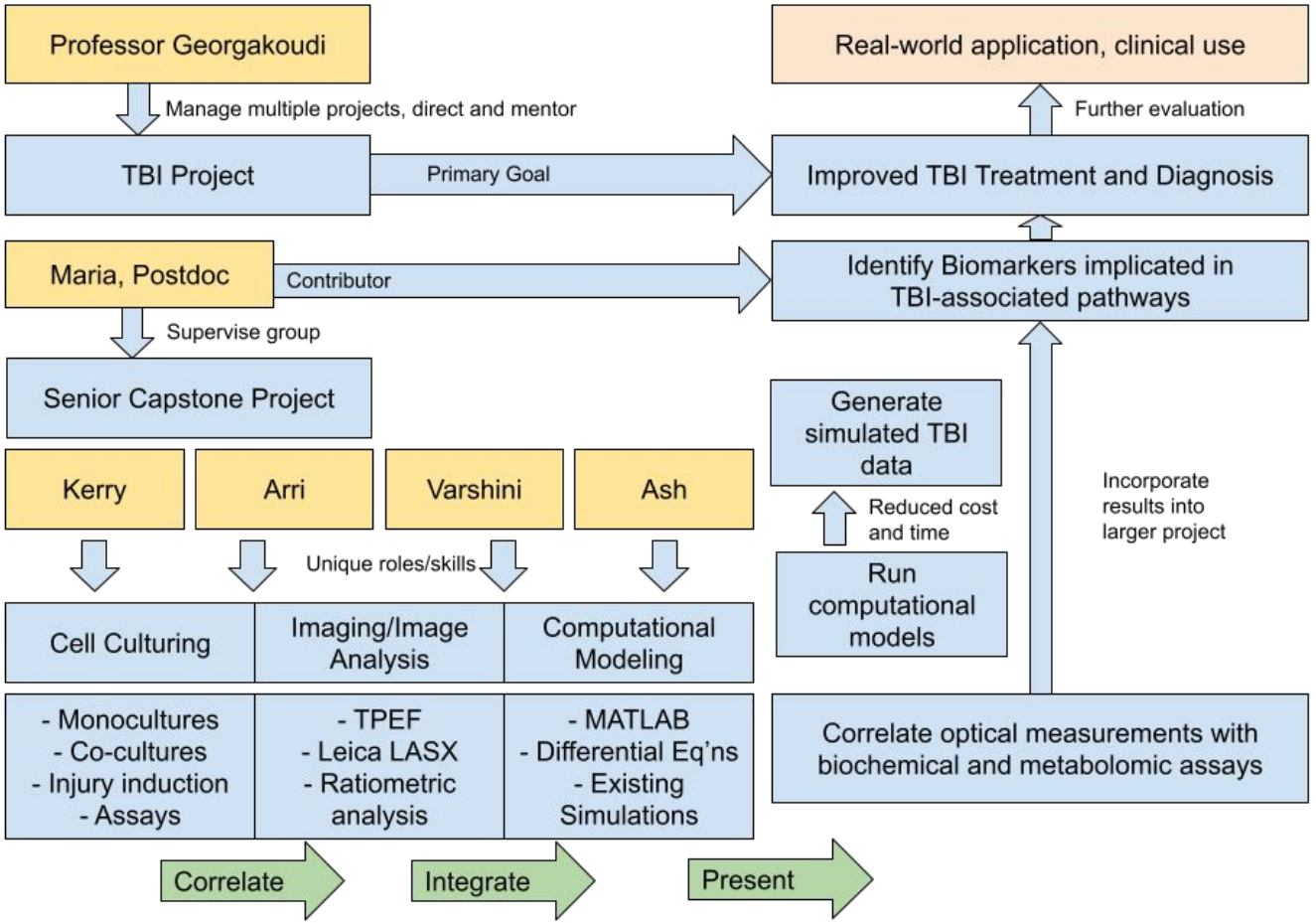
- Identify pathways related to TBI
- Fulfill the clinical need for better TBI diagnosis and treatment
- Reduce the time and cost from cell culturing using computer models

How will we achieve our goal?

- Cell culturing, imaging, assays and image analysis
- Relate optical readouts to biochemical changes
- Develop an machine learning algorithm to generate metabolic data from optical readouts

TBI diagnosis is a highly researched field and the novelty of our research depends on the identification of TBI biomarkers.

BME7: Characterization of Brain Metabolic State under Injury using Two-Photon Microscopy (F'22)



# Progress

Cell culturing (monocultures and co-cultures)

- Established technique for microglial monoculture and LPS induction
- Ordered materials needed for monoculture and some needed for co-culture

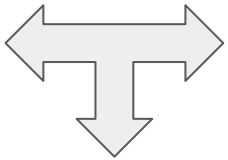
Computational modeling

- Compiled existing models: dynamic model of astrocytes and astrocyte-neuron interaction.
- Expansion of phasor-method fluorescence lifetime analysis

# Planned goals

Cell culturing (monocultures and co-cultures)*

- Establish protocol, complete cell culture and introduce injury
- Use TPEF and metabolic assays to assess damage



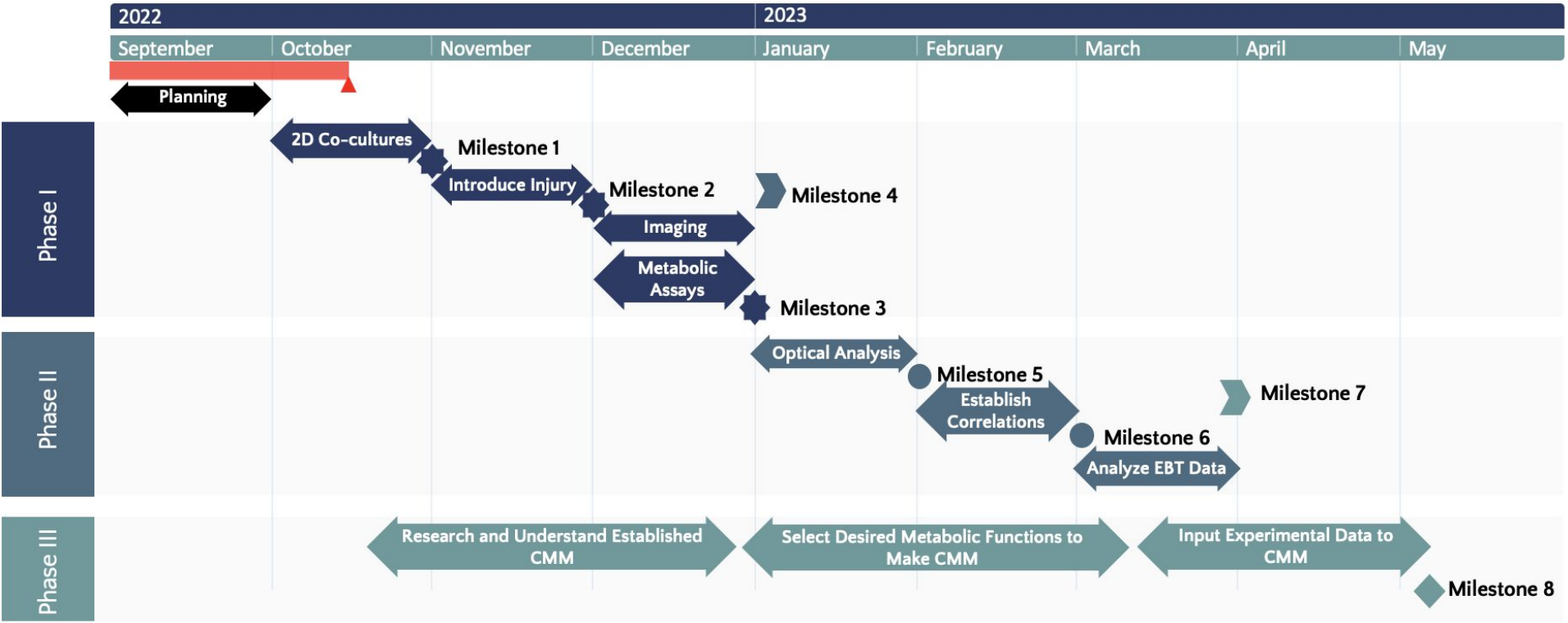
Computational modeling

- Compile existing models
- Select desired functions (TBI pathway) to incorporate into our simulation
- Input metabolic data to get altered metabolic pathways

Correlation between optical readouts and altered metabolic pathways

*Cell culturing data must be acquired before the computational model can be completed

# Project Timeline



# Challenges and Solutions

## Challenges

- Injury experiments take a large amount of time to set-up
  - Computational timeline may be pushed back by lack of data
- Seahorse assay may not be accessible
  - Located in Grafton, graduate campus

## Solutions

- Establish computational model outline in conjunction with imaging
- Find alternate mitochondrial assay options which are comparable to seahorse