**Goals for the past year**

As of the last IEP, I had *observed* glial calcium activity extensively but had not perturbed glial cells, nor had I any concrete evidence for what neuronal activity might be driving the observed calcium activity. Among my goals for the past year were to a) test glial cell perturbation and b) figure out what was upstream of the coordinated glial calcium events. A broader goal was to steer the glial project toward something publishable.

**What I accomplished**

* I found that optogenetically stimulating glial cells can suppress motor behavior
* I built a DMD-based optogenetics platform for simultaneous imaging and stimulation
* I found that activity in noradrenergic cells predicts glial population activity, which suggests that glia are excited by norepinephrine
* I developed software for data visualization and data analysis**.** In particular, I found a strategy for compressing large volumetric imaging datasets into a digestible size that has been very useful for interactively analyzing volumetric imaging data.

**Quick Prediction:**

I think I can have my thesis written and submitted by this time next year (August 2018).

**Thesis outline**

Introduction:

I will review existing work on astrocyte-neuron interactions, as well as the (scant) literature on glial cells in fish. I will talk about why volumetric imaging makes the zebrafish a compelling model for glial biology and thus neuroscience.

Chapter 1: Calcium excitability in zebrafish glia spans multiple spatial and temporal scales

I will present my imaging results characterizing the different modes of calcium activity in zebrafish glial cells. Specifically, I will provide examples of sub-cellular “spontaneous” calcium activity in singe glial cells, calcium waves that propagate inside single glial cells, calcium events that propagate between glial cells, relatively rapid activation of many cells by sensory stimulation and behavior, and spatially propagating activity patterns that entrain cells throughout the fish nervous system.

This will essentially summarize 2 years of imaging work.

The data comprising this chapter have already been collected. Completing this descriptive chapter requires gleaning my old data for examples and demonstrating the results of a few simple analyses, and **this process should not take longer than a month** or so of writing and analysis.

Chapter 2 [final title TBD]: Glial-dependent behavioral state switching mediated by norepinephrine

Here I will present the collaborative research effort I’m currently engaged in, which combines the work of multiple people in the lab. This section will strongly resemble the paper we are currently working on. This paper is not complete and may take some time to finish, but many of the aspects that I specifically contributed can be written up as-is. There may be more experiments I wish to include here, so I would give this a **5-8 month window** for completion. This chapter is fraught with the risk that something terrible happens to our project, like finding a nasty confound that invalidates or questions our work so far, but it’s not practical to plan around such things.

General Discussion:

I will put my work in the context of the broadening view of glial function. I will also proclaim the power of larval zebrafish as a model for comprehensive multiscale investigation of the vertebrate nervous system. **This will not take more than a week to write.**

Appendix:

I will write up some technical developments I participated in, including description of data analysis software I wrote as well as various experimental techniques I developed. This will be simple, taking **no more than a week** to write.