***For the fields marked with a \* enter “see attached.” The attached document should be a draft thesis outline. The outline doesn’t need to be exhaustive, but needs to include discrete chapters. Each chapter should include a description of the topics covered, the status of the research discussed in that chapter (what is already done and what still needs to be done), plus a plan and a timeframe for experiments still to be done. A discussion of potential challenges to achieving this timeframe would be useful.***

Introduction:

I will review existing work on astrocyte-neuron interactions, as well as the 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.