Chapter for the public: <http://scifun.org/Thesis_Awards/chapter_guidelines.html>

**Why I’m writing this chapter**

A PhD ends in a finish full of triumphs: a published paper that will be used to inform the world of your research, a final defense that allows you to showcase all you’ve learned, and the acceptance as an expert in your field. These triumphs are important and the fruits of intense labor and rigorous mental fortitude, but more often than not research is presented without mentioning the many arduous struggles that it took to succeed. I write this chapter to identify with anyone who has ever felt inadequate, who has suffered from imposter syndrome, and who throughout failure nearly gave up. This chapter highlights my journey into a world of knowledge and success that I never thought I would have, and I hope it gives you some perspective on the daunting PhD process…

**Flipside - Postlude by Kid Quill**

Hello! Whoever you are (friend, family, stranger) thank you for taking the time to read the journey of my thesis. To personify this journey and truly share the experience in a form that I feel embodies the experiences I had throughout the past 6 years, I had to ask myself what is the best way to speak about this. It was listening to x song that I experienced a phenomena known as frisson, where my body begins to truly lose itself, as if I can feel my pores and a tingling sensation go up my spine and everything begins to feel okay. Music, my main coping mechanism throughout this time, is the way I have decided to share my life with you now.

Feel free to read this chapter however you like, and I hope you enjoy the songs that I’ve placed here. Thanks again for reading, and best of luck on whatever journey you are currently facing :D.

**Not Strong Enough by Boygenius**

**Secret for the Mad by dodie**

**The beginning of the end…?**

My thesis starts in a place where many likely should, but isn’t mentioned often enough: failure.

Picture this: It’s your second year in a completely new place, having moved far away from family and friends. You’ve been learning so much cool stuff at an intense rate, and you think you’ve got it all down in your head. You go home and get in a room with 5 of these people, excitedly telling them about some of the cool things you’ve learned in your research: Did you know that the reason jellyfish glow… Neurodivergence… another interesting thing, maybe musical. You get to share this awesome knowledge, you feel wanted and trusted, and you feel like you’re really accomplishing learning. (maybe another type of analogy here?)

In graduate school, things are slightly different. Instead of 5 friends, you’re put into a room with 5 mentors for your PhD who each have many, **many** scientific publications to each of their names. And you’re expected to talk about the beginnings of a project that you’re supposed to be the expert of AND complete within the next 4-6 years. They ask you questions about tiny details you hadn’t yet thought about, and they expect you to tell them the right answer: (random questions here that people have heard, but can’t have answers to: if a tree falls in a forest, does it make a sound? Or deep questions from the 3 you listed above...how are you going to address if it doesn’t work? What about …, etc. (maybe actual questions that I then come back to the next year?) . After an hour and a half, you leave the room, deflated, exasperated, mind afloat. You remember to breathe. Other students pass you by in the hallway and congratulate you, telling you the worst is over. You’re ready to move on and get back to doing the science that you love. You walk back into the room to hear how they felt about your project, your presentation, your ability as a scientist…and they begin with “Thank you for the presentation. We think your progress has promise, but we can’t give you a pass at this time. There are some weaknesses …”. They didn’t say the word, but in your head you’ve tuned everything else out and you know what it all means. You’ve failed.

…

I always wanna die sometimes by The 1975

Tears, crying,

You begin to see what your mentors see: the weaknesses of your project...

...

Don’t have to go into detail about the passing here, but maybe go into a bit more about the research portion; I think mixing in the science within the storytelling of this experience that built me up to be a better scientist, realize my weaknesses, etc. would be really helpful.

It's not an easy process, overcoming failure. Not much came easy to me: high school math and English…, college chemistry and biology, … I’ve been able to constantly push through those tough moments in learning, but despite that like many graduate students, I suffer greatly from …, a feeling known as imposter syndrome. Couple that with the fact that I am a minority among minorities, it’s a bit difficult to relate to others and feel like the struggle is mutual. Thoughts like: My application wasn’t that great, I only got into graduate school because they wanted to increase diversity. Or … . And then when you get here and you meet all the smart people who raise their hands to answer and ask questions in classes, who pick up concepts much faster than you, and who seem like they’ve really figured out why they came to graduate school and what they want to get out of it. I always thought that overcoming failure was taking into account all of these thoughts, machinations, ideas, etc., slamming them to the back of your mind to put yourself and the work first and to do your best to succeed.

…

**Human-Jon Bellion**

“He’ll be fine, no one fails out of our program”.

Notes:

* How do I write a paragraph stating how much this idea that someone attributed my experience to that of a default hurt me, while also saying how it moved me as a person and allowed me to succeed?
* Start to build your project narrative a bit: what is your question? What were you missing? Identify the big weaknesses piece by piece for others to understand and then tell them how you got passed each part. Maybe 3 key things about the project: past, present timeline; how to get the future?
  + Literally linking the past to the future/the unknown: that’s how you create knowledge, and I just didn’t do a good enough job of it before; need to do that better here

Should I mention covid here? In some relatable way? Maybe with the silence and how it pushed me to succeed?

Silence. At first, I thought the silence was painful. But after realizing that some people were just talking at me rather than actually listening to what I felt about this painful experience, I grew fond of it. The silence gave me space to thrive in my own mind, thinking of new ways to make my project work, explaining concepts to myself, making metaphors, crying on the floor of my room when I couldn’t get things to work and jumping with joy when I did.

…

After a couple of years I finally realized that overcoming failure isn’t just ignoring all of those facets of life that … instead, it’s accepting that you’re not perfect. It’s realizing that even through a lot of hard work, you may still fail. Overcoming failure is the ability to accept your shortcomings and look deeper at yourself to determine how to address them…example of an introspective situation…taking past to present

…

Some ways to approach telling my project to the ley

My project is …:

* Understanding membrane protein folding
* Determining the strength of forces in the membrane
* Finding out how strong a force is…

Support from lab mates…advisors…mentors…true friends…

I thank my lab mates for helping me through what could have been the worst time of my life…

I began to realize that the thing I was missing wasn’t as much hard work as it was …love…

…

You go back into that room: the same one where you were told you failed the first time. With the same people, but each of them smiling, listening, hearing you out. You answer questions flawlessly, or are able to build a discussion around them… The chat feels fluid. After 20 minutes they tell you to leave the room again. But this time around, you’ve passed.

…

Love of science and my project and learning

…

How has this shaped me as a person: complaining without a purpose means nothing

I’ve been pushed to my limit as a student and I’ve come out alive.

I went into graduate school thinking it would be a challenge, but never expecting it to 1. Be this fucking hard. 2. To change my life in such a profound way.

A PhD is a realization that I have the tools to learn about anything that I’m interested in. It’s about objectively asking questions, knowing that they won’t all be the right questions, and quickly moving on to the next one once you realize they’re not. It’s about not getting frustrated that you haven’t figured something out, but rather being fascinated by why you haven’t and thinking of new ways to discover the extent of your own learning. It’s pushed me into new avenues: the beginnings of a podcast, music production, using machine learning to project basketball players…, things I would have never even thought of trying …

How long should this be? Check how long other people wrote their own.

The actual project:

**What is protein?**

Proteins are very small complexes that are used by our body to facilitate and manage many of the ways that we function. You often hear that people are able to get the correct amount of protein by eating protein rich foods like meat and dairy products. This idea actually sparked one of my first interests in proteins: when I became a vegetarian, I began to think of ways to properly maintain the amount of protein in my diet. Would I have to drink more milk or eat more yogurt? How much protein do vegetables contain? How do vegans get enough protein in their diet?

Long story short, proteins are found everywhere in daily life. As a vegetarian, I’ve found many protein rich substitutes including tofu, tempeh, and mushrooms. \*Do these contain different types of protein than meat? How do I get to the idea that there are many different types of proteins? Is this too in the details? Can I show some way to compare what we think of proteins and what they actually are: the structure of whey versus proteins that are actually in our bodies?

… to the point that we eat a lot of protein, but don’t

So why is consuming these smaller proteins so important for our body?

… is that too in the weeds too: I’d be breaking down the kind of processing that is necessary for proteins to be made: which is important, but kind of long: can I do it in a nice small figure

Image: protein eaten through mouth, digested by stomach into building blocks (how does this actually happen?), passes into … (does anything else have to happen to proteins before getting to be… processed into different cells, attached to new proteins being made in our body as old proteins are … (broken down?)

I specifically work with a subset of proteins called membrane proteins. Membrane proteins are fascinating molecules: they are found within the protective membrane structures that separate our cells from the outer environment. Figure: cell membrane with proteins in it, proteins floating inside cell (soluble) and outside environment. These are the proteins that help to facilitate interactions between our cells and the outside environment, for processes including cellular uptake (image) and responses (same image). Because membrane proteins act as the main players (?) in contacting cells from the outside, they are essential in regulating cellular responses to anything happening in our body, from … to …. And if something goes wrong with these regulatory proteins, it typically leads to diseases including …, and cancer.

So yes, technically my work is related to somehow studying how proteins are involved in these disease states and my work could be somewhat applicable to understanding preventing them. But I’d be remiss to say this is the main point of my research and the quest for understanding how these proteins work. The main point of my research has been to get better at understanding and asking the questions that could be important in a variety of areas…Being able to focus intently on what I find interesting and discovering the extent that I can pursue and achieve something I’m focused on (this sentence doesn’t really make sense right now)

So again, yes I’m trying to determine how these miniscule forces known as van der Waals impact membrane protein folding and association. But I’m also exploring the impact that I myself can have in a certain area of learning and knowledge, pushing the boundaries of my own personal learning to do so. It’s a journey I never expected to take, and one with many drawbacks including lost friendships, long work days, and stresses that take you … (analogy, ends of the earth? Maybe a dodie quote?).

…

**Limbo**

A quick way to summarize 3 years of my research: I wrote an algorithm that simulates protein dimerization and then tested this protein dimerization in cells. TOXGREEN… here in layman’s terms. BUT simulating protein dimerization is quite difficult and my first test on these proteins didn’t work well: proteins that I expected to be poor dimers were better than expected. So I reconfigured my algorithm. Below are the basics of how my algorithm changed from version 1 to version 2:

Quick scheme image: controlled positions, Gly only in one region, controlled geometries (will have to talk about this above; maybe in the prelim section about the data that I was able to present and pass with?)

* Design sequences
  + Sort-Seq
* Design sequences
  + Sort-Seq
* A process that takes months to complete and feels like no progress is being made…
  + Talk about how I’ve reached a point of low progress. Although I learned how to code, the journey and the path to becoming proficient enough to do my work was fun and came quick, but then I hit a wall where progress on my journey began to plateau (metaphor here)

Something about the above following repetition: I can talk about the process of learning protein design in the first place, having to scrutinize the way I did it, and continue to think critically about how to do it again in a more elegant way

Feels like limbo because I’m doing the same thing, but maybe at a slightly lower limbo level. Can probably equate it something to trying to limbo and the difficulty of things just getting slightly higher. You can feel yourself improving, but at the same time it feels like there’s no end. The stick just keeps getting closer to the ground, and you somehow keep finding a way to do what feels impossible, squish yourself under, and keep going.

**Something Comforting by Porter Robinson**

**Hallelujah by Oh Wonder**

**Data**

**Nothing Revealed/Everything Denied by The 1975** (to encompass the feeling that yes something seems to be working, and published, and succeeded, but it still feels wrong)

Conclusion: something here about failure

I think one of the most eery things about failure is that a lot of people know that it exists, but it’s failed to be spoken about. (Highlight Alessandro, Gladys, Samantha; encouragement from my other lab mates)

Every journey has a beginning. I wouldn’t be the same person, the same scientist, without having failed my exam. I would have never reached these heights of my learning ability without it…and I would never have known that there is so much more for me to still do.

I’m planning on pursuing my own independence in the future. I want to do something that I love without feeling like the consequences of them are going to misshape the way I think of myself. I plan to put forward myself in a way that allows me to continue my love of learning.

**Can van der Waals packing act as a driving force in membrane protein association and folding?**