

Why I'm writing this chapter

The PhD finish line is full of triumphs: a published paper that will be used to inform the world of your research, a final defense for you to showcase and explain that research, and the recognition as an expert in your field. These accomplishments are the fruits of intense labor and rigorous mental fortitude, but often research is presented without mentioning this mental toll and the strain on life that it took to succeed. I've been pretty fortunate on my graduate school journey. My family is relatively healthy, I have friends willing to catch up with me when I am able to make the time, and my professors and lab mates have been exactly the type of support I've needed. But even being fortunate, I've still had to miss out on holidays with family and friends, weddings and other important moments in the lives of those around me. I've willingly put myself through this experience because of how big this opportunity feels to me: I'll be the first person in my family to receive a PhD, in a field as prestigious as science, an opportunity to become another minority in a field that is still growing in diversity.

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 that I never thought I would have the opportunity to take, and I hope it gives you some perspective on the process of becoming an expert in learning.

The rest of the thesis is research and work, but when I saw the opportunity to write a chapter about "the parts of the story of science that don't get told in scientific publication", I felt compelled. My PhD journey wasn't straight forward. Like many other students before me, I've struggled mightily with my mental and physical health, and it felt like a necessary addition to my PhD thesis to share a transparent view of my graduate school experience.

10 years from now, I'm not sure how I'll feel about graduate school. 7 whole years. Over 1/4th of my life. A project that brought me deeper into the niches of science than I ever thought I could go. What is van der Waals packing anyways? This miniscule attractive force that relies on the periphery of atoms in space. Investigating subatomic interactions within both theoretical and physical experimentation, and making sense of the results. And here, finally at the end, realizing that my thesis is a translation of my findings that this superficially nanoscopic (it's actually smaller) force has on membrane protein folding and association. Discovery and novelty are extremely difficult to quantify. So what does it mean to become an arbiter of this seemingly immeasurable and imponderable academic knowledge?

I don't have the answer right now, but I do have the lessons I've learned along the way. And by preserving my experiences in writing, I'll have the opportunity to reflect on these thoughts while considering the answer to that question in the future.

Thanks again for reading, and best of luck on whatever journey you are currently facing. Sending love and good vibes your way :D.

Glossary

Sonder – realization that everyone has a life as real and full as one's own

Protein – molecules important for many important biological function: supporting cells, building immunity, sensing changes in environment

Membrane protein – proteins found in the cell membrane; important for helping cells adapt and react to change

Associate/Association – when two proteins stick together

Computational model – way to visualize what a protein looks like

Van der Waals packing – “static” like attraction between proteins in close contact

Algorithm – sequence of instructions that I made to build models of proteins with different amounts of “static”

Petrichor – the smell of rain

Gjetost – Scandinavian cheese that tastes like caramel

Tsundoku – the art of buying books and never reading them

Frisson – aesthetic chills, psychogenic shivers; commonly tingling of the skin when listening to music

Imposter Syndrome – internalized feeling of doubt in one's skill, talent, or intelligence; feeling like you don't deserve success and that much of it is attributed to things out of your control

Burnout – state of emotional, mental, and physical exhaustion brought on by prolonged or repeated stress

Etterath – the feeling of emptiness after a long and arduous process is complete

And some words that don't make it in but are fun anyways because I have the space:

Zarf – coffee sleeve

Leitmotif – short, recurring musical theme accompanying a person, place, or idea

[Spotify Link](#)



Sonder: Lessons from my PhD (Working Title)

"I do" 1

"It's so hard to swim against the tide" 2

"The world sayin' what you are because you're young and black, don't believe 'em" 3

"I don't belong here, let me start over, I wanna sleep so wake me up when I'm older" 4

"There will be mountains you won't move" 5

"You build it to a high to say goodbye because you're not the same as them" 6

"Where's my soul going?" 7

"Time has come, take it all in" 8

Into the Woods by Mree 9

"Why don't you leave if you wanna leave, if you wanna?" 10

"Cause is it really love if it don't tear you apart?" 11

"And we keep doing these things, not because they're guaranteed to make us feel good But because failing to do them? Guaranteed to make us feel bad" 12

"You don't cross my mind, you live in it" 13

"I don't wanna stand out" 14

“A letter always seemed to me like immortality because it is the mind alone without corporeal friend.”

— *Emily Dickinson*

"I do"*Flipside-postlude by Kid Quill*

Dear Reader,

April 2017

What do you want to be when you grow up?

I've answered different versions of this question over the years: What major are you going into? What's next after college? Do you want to go to medical school?

I'm a first-generation Haitian-Filipino American, and no one in my immediate family is a scientist. Yet the security of becoming a medical doctor to make money and have a reliable job was preached as the ideal route in the immigrant community I grew up in.

I chose to major in biology to assuage my curiosity for how life works. But I took most of the same classes and learned many of the concepts necessary for medical school. Deep down, I knew that the route I was taking could result in me becoming a doctor. It felt like I was too afraid to run away from the expectations that the adults I grew up around had for me.

So when my undergrad mentor told me that a PhD might be a good fit for me, I was befuddled yet elated. I'd been rejected from several research labs during college, and I didn't even know that PhD programs existed until junior year. But I think he saw my passionate curiosity to learn: this deep seeded interest in diving into subjects and a willingness to bang my head against a wall to understand. I applied, and I've recently been accepted to a program at the University of Wisconsin-Madison!

I'm not particularly gifted, I end up being average at everything I do, and although I wanted to help people from a young age, I couldn't see myself going to medical school at this stage in my life. But my fascination with how to learn and to apply knowledge between different areas of learning might actually fit well in a PhD. This potential route to become a doctor, despite it not being a "real" doctor, feels semi-validating, and for now soothes those immigrant expectations inside of me. College didn't prepare me for the real world, but I've acquired a passion for learning, and it seems that this PhD doctor is going to be an exciting journey for me!

Gilbert

P.S. Have you ever experienced frisson?

[Frisson](#): The aesthetic chills from the layering of instruments, the tingling up your spine from hypnotic harmony, engulfing you in tantalizing bliss. When I close my eyes and just listen to music, I feel those sounds pouring into my being, as if my body is literally resonating with sound.

P.P.S. Some of these letters might be convoluted. But I hope you'll understand my feelings by listening to the music.

P.P.P.S. This song is about wanting to be heard. About having bold ideas and passions, wanting to share. I'm hoping that a PhD will allow me to cultivate ideas, determine my strengths in learning, and allow me to confidently share something that I'm passionate about with the world.

"It's so hard to swim against the tide"

Swim Against the Tide by The Japanese House

Dear Reader,

October 2017

Graduate school classes have a conversation like feel. Instead of lectures where professors talk about a subject for an hour, classes are focused on maximizing time to discuss what we as students are most curious about.

Recently, one professor posed a personal question: What are your goals with your graduate education?

"Gilbert, what about you?"

"I'm not sure." I've never been good with public speaking, I never raise my hand in class, and being called on is *extremely* uncomfortable.

"That's okay, just say anything that feels right"

With that little bit of encouragement, I used my avoidant gaze, stared at the ceiling, and thought. *What could I do?*

"I want to find a way to replace PowerPoint."

"Okay! Why is that?"

"I feel like there are some weaknesses in how it communicates concepts and I think there would be some benefits to having something better."

In biochemistry, there's a technique called polymerase chain reaction, or PCR. Using our knowledge of how DNA replicates in cells, we're able to effectively replicate DNA with PCR! But how did we come up with something that is now so fundamental in scientific research and important in forensics to identify people by any trace left behind? Kary Mullis, the inventor of PCR said it best: "I was looking for something else...PCR was the possible outcome of a solution to a hypothetical problem that didn't really exist."

The best science comes from harnessing creativity, trying to see things that haven't been imagined, and discovering questions that haven't yet been answered.

How does van der Waals packing impact membrane protein association?

Research doesn't look for a specific answer, instead focusing on why things are as they are. My mind is racing, questioning what I know about my project, striving to delve deeper into membrane protein research. What sticks with me is that my professor gave me the opportunity to share an idea of an idea. I was encouraged, allowing my mind to drift towards something creative and fantastical. Asking "why" helped me to feel comfortable in a situation that I otherwise wouldn't enjoy. It helped me grow. And although it currently feels impossible, this journey into the unknown reaches of science is beginning to feel a little more comfortable.

Gilbert

P.S. How often do you go outside of your comfort zone?

P.P.S. Grad school is showing me that personal growth is enhanced when outside of your comfort zone. Whether it's getting called out in a class and answering with something that sounds outlandish, or moving to a state where sometimes the temperatures reach an unimaginable -40 degrees (which is the same in both Fahrenheit and Celsius!), there are a variety of ways to get outside of your comfort zone to grow! Why does Gjetost exist, why does it taste like caramel, and why the heck does it taste so delicious? By harnessing creativity and learning when to ask why, I'm hoping to find my stride on this journey for discovering knowledge.



“The world sayin’ what you are because you’re young and black, don’t believe ‘em”

Outside by Childish Gambino

Dear Reader,

September 2018

I was chatting with someone recently about TV shows. They were surprised that I had never watched *How I Met Your Mother* and *Arrested Development*.

“Why not?”

“Honestly, there are too many white people in them.”

A couple of days later, they recounted the conversation: “I looked up the demographics in those shows, and they don’t skew too far from the US population.” They didn’t understand that those shows aren’t likely to portray experiences I can relate to. Why didn’t they just ask me to clarify?

As a person of mixed descent, I’ve found it difficult to figure out how I belong, how to fit in, when I can be myself. In spite of this, I love listening to others with little judgment, sharing culture and perspectives. So why do I feel like an outsider?

In science I’ve often felt the same. Entering a biochemistry program after majoring in biology, my transition has been a bit more arduous than expected. I’m finding it difficult to communicate how I understand science with the wording and depth that people need to understand it. *What am I missing in my knowledge? Do I have the ability to navigate the field of biochemistry? Do I even belong here?*

Impostor syndrome: a persistent, unjustified feeling that one’s success is fraudulent. Because I know how the world perceives me by the color of my skin, I can quickly spiral into a mix of other negatives: *I’m a token minority for my program to look good, people don’t understand me because I’m just not smart enough to be understood, if I wasn’t a minority I wouldn’t have been accepted, I don’t deserve to be here.*



In both my personal and professional life, I feel like an outsider.

Does that feeling ever go away?

Gilbert

P.S. When was the last time you felt insecure because of your identity or personality? Because of who you are?

P.P.S. I thought coming here I would feel more comfortable because I’d find more people who questioned things, who want to learn by asking questions and developing insights into other people’s unique experiences. So why does it often feel like I have to conform to what other people expect of me rather than being given the chance to share my own identity?

"I don't belong here, let me start over, I wanna sleep so wake me up when I'm older"

atlas by Keshi

Reader,

May 2019

Today I had my preliminary exam, or prelim for short. It's the most unique exam I've taken: After a year of conducting independent research and reading a copious number of academic papers to learn as much information as I can about my project, I prepared a presentation detailing how I'm going to successfully complete my research.

I was put into a room with my mentors, 5 professors who I've asked to supervise my progress during my PhD. I explained a carefully thought-out research proposal to these professors who have *many* scientific publications to each of their names. I stood in front of them talking about the beginnings of my project, sharing my ideas to bring this research to completion. They asked me detailed questions, expecting me to think on my feet and to come up with reasonable answers.

"What's the definition of van der Waals? What will you do if your experiments don't work as you expect? If a tree falls in a forest and no one is around to hear it, does it make a sound?" After an hour and a half, I left the room to allow my advisors to discuss.

Deflated, exasperated, mind afloat, I remembered to breathe.

"Did you just finish your prelim?" I nodded to the student passing by in the hall. "Congrats, the worst part is over."

27 minutes of sitting on the floor later, I'm called back into the room.

"Gilbert, we'd like to thank you for the presentation, but we can't give you a pass. There are some weaknesses..."

But I tuned the rest out. They didn't say the word, but I knew what it meant. *i failed.*

"...however, you're making progress and we look forward to seeing you have another opportunity next year."

I cried for an hour in that windowless, dimly lit room. I didn't want to exist.

- 1. For many prelim failures, there is no second chance. You're given a master's degree and asked to leave.**
- 2. I have a year to move on from this heartbreaking moment to do it over again, hoping for a different result.**
- 3. I'm one of the few black people in my research program.**

I'm insecure about my ability to communicate and my identity. But I want to leave Wisconsin on my terms, and to do that I have to figure out why I didn't learn enough this time and what I can do to help me pass next year.

But for now, I'm going to lay in bed and cry. Is it still crying if your eyes no longer have tears left to shed?

Gilbert

P.S. When was the last time you felt you didn't belong?

P.P.S. I think this song fits how I'm feeling: strained by feeling constantly overwhelmed with a hint of wanting to be better. These lyrics have been constantly pulsing through my head. *i don't want to fail, i don't want to feel like i just have a second chance because i'm a minority, i don't want to feel like a token student in this very white state. i just want to do science and learn, i want to discover knowledge and support other minorities, do i have to live with these feelings of failure forever, am i okay with that when will i be okay with that should i be okay with that? will they go away after i pass, i hate myself, will i always feel like a failure no matter what i do in my life, am i worth anything other than my work? if i place all my value in work then what could i even do, what's the point, why am i here?*

“There will be mountains you won’t move”

Godspeed by Frank Ocean

Dear Reader,

In a previous letter, I mentioned my feelings of imposter syndrome and reflected on feeling like an outsider during an interaction about TV shows. But I didn’t get to share some of the TV and media that I do enjoy!

We all deserve to have opportunities to share our thoughts and feelings, likes and dislikes. So before getting too much deeper into some of the mental anguishes of grad school, below in no particular order are some of the media that helped me think and reflect on my journey throughout grad school.

TV	Movies	Animation	Video Games
Euphoria	Waves	Bojack Horseman	NBA 2K
House MD	The Fallout	Sousou no Frieren	Nier: Automata
Atlanta	Interstellar	Plastic Memories	Persona 5
Dave	Soul	The Dragon Prince	Zelda Tears of the Kingdom
Devs	The Farewell	Inside Job	Fire Emblem 3 Houses
Ted Lasso	Portrait of a Woman on Fire	Scavengers Reign	Animal Crossing
The 100	Lady Vengeance	Girls Last Tour	Journey
Pen15	Sorry to Bother You	Cyberpunk	
Heartstopper	BlacKkKlansman	Edgerunners	
Sex Education	Nimona		

Tsundoku: the art of buying books and never reading them. I didn’t get to read anything really other than scientific journal articles...but hopefully I’ll get to books eventually!

Hope you’re well and taking time to take care of yourself!

Gilbert

P.S. If a friend asked you to give them something so they could know you better, what would you give and why?

...Need to work on thinking of a format for this letter...

Trigger Warning: mental health, suicidal ideation. I sincerely hope that this letter finds you in a good space, and that no burden in your life is too heavy to bear. Please take care of yourself.

“You build it to a high to say goodbye because you’re not the same as them”

I Always Wanna Die (Sometimes) by The 1975

My Dear Reader,

October 2019

A few months ago, I had a dark notion. As I was waiting for the bus, my head felt heavy and everything went black. My eyes were open, yet things looked motionless, greyscale. Intrusive thoughts flitted in and out of my head.

You’re tired. What if you just stopped trying?

But wouldn’t my family and friends be disappointed in me?

Nah, no one would care. Stop now, give up, what’s the point.

I want to end this on my own terms.

You still can. Just walk forward. Don’t think. Move.

Walk into the middle of the street?

It won’t take longer than a second.

Thankfully the bus arrived. I’ve had bouts with depression in the past, but never to the extent that my inner suicidal ideations were so evidently clear.

Then one day as I was preparing to start my day with a walk through the farmers market, I found myself unable to move. My mind was awake, eyes were open, and my inner voice told me to move. But my body wouldn’t listen. Literally petrifying: to think “Move”, “get up”, “go over there” while my body lay unresponsive.

I lost joy in time with friends, stopped eating, and my mental health continued to fade. My therapist couldn’t fix my movement issues, but she helped me state my feelings, rationalize and reflect on my thoughts, and helped me realize that my worst days were an **8** on this suicidal ideations chart. She gave me actionable ways to improve, helping me recover from a shell of myself. My journey back to myself began with her advice: “Take risks”.

I find it ironically comical that risking my mental health is the motivation to keep me here to pass my prelim because that feels riskier than just leaving. But I’m alive. And it’s time to put in the work to learn some science.

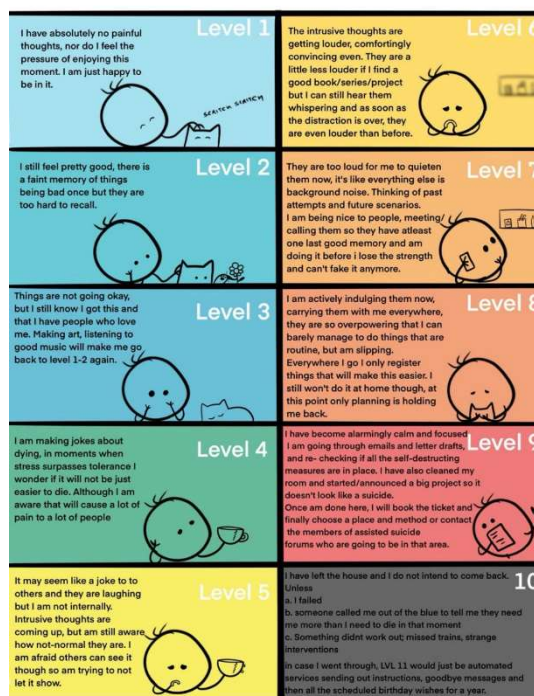
Gilbert

P.S. What’s the riskiest thing you did in the past year?

P.P.S. My body stopped listening to my inner voice. Although my mind contemplated feelings of wanting to disappear, something within me felt that it wasn’t right and resulted in outright rejections of simple thoughts of movement.

P.P.P.S. My limits are being tested here, mentally, physically, emotionally. But I’m still here. I’ve never acted on my intrusive thoughts, but the risk is there. Outside of the song title and lyrics alluding to suicide, the sounds of this song really resonate with me. The strings fill me with hopeful melancholy, accentuated by the strain in the singer’s voice. As if things will get better with time, even though it doesn’t feel that way right now.

Suicidal Ideations Chart



“Where’s my soul going?”

WELCOME TO SOUL, PRESENT by Q

Dear Reader,

February 2020

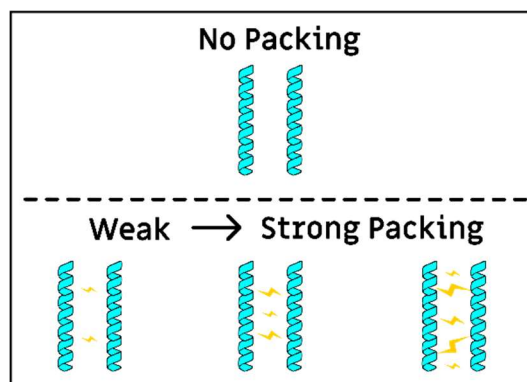
I have a few more months before my second chance to pass prelim and I’m anxious. I think not understanding how to communicate my project properly was a glaring weakness during my first prelim. I need to learn how to speak confidently about my science if I’m going to be successful in this pursuit of knowledge.

How does van der Waals packing impact membrane protein association?

The focus of my research is to further humanities understanding of how proteins found within cell membranes, or membrane proteins, interact.

Membrane proteins are complex structures that help our cells adapt to stimuli. From helping us recover from cuts and bruises to signaling to our brain that something feels hot or cold, membrane proteins are responsible for a multitude of our body’s natural responses to the environment.

The membrane proteins I work with are tiny, helix-like structures. These proteins naturally like to stick together, or associate. I’m trying to discover if different amounts of van der Waals packing changes how well proteins associate.



Van der Waals packing is like the “static” that comes from rubbing a balloon against hair: it’s a weak attraction between things in close contact, sticking them together. This “static” does make proteins associate, and we have the tools to predict the static strength in between proteins. But no one knows how strong it causes membrane proteins to be stuck together. Is it more like the lid of a jar before or after asking someone to open it: Impossible to twist or so loose that it’s open in 3 seconds?

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My current goal is to develop a computational algorithm to build, or design, proteins with different amounts of packing. By using software developed by my lab, I can create models of proteins. We know that protein shape affects the amount of “static”, so I’m currently working on creating a way to design proteins with different shapes.

My second goal is to test these designed proteins with experiments to see if my predictions agree with the data. But that comes after prelim. If my computation and experiments are similar, then I’ll be able to design membrane protein targeting drugs to prevent numerous viral infections and diseases.

Wouldn’t that be a story, researcher at UW-Madison develops the cure for Alzheimer’s, cystic fibrosis, or cancer.

But that’s MUCH farther away, tens of graduate students of research after me. For now, my research will have the potential to be a “possible outcome of a solution” that impacts humanity.

I’m feeling a smidge more confident in communicating my research. But this burden to pass to prove myself as a scientist still feels heavy. *if i don’t pass, then did i never have potential in science anyway? why does it vaguely feel like my failure would reflect poorly on not just myself, but other minorities in science?*

Gilbert

P.S. When was the last time that you were proud of yourself?

P.P.S. An electronic/disco like vibe felt fitting for this “static” attraction between proteins. Have you ever felt indebted to those who gave you an opportunity? So much so that you feel like what you do reflects on them? I’ve been given this chance, but I feel like if I fail, I’ll just be an example of why there aren’t many minorities in these upper-level degree programs. I want to set a good example, but will I lose myself on the way?

"Time has come, take it all in"

5 Year Plan by Chance the Rapper

My Dear Reader,

June 2020

Have you ever thought of how you could impact humanity?

With the world currently entrenched in a global pandemic, with minorities being abused and killed in a time of global strife, why is understanding how proteins interact important?

If we could further our understanding of how membrane proteins structures interact, could we design and engineer proteins that disrupt an interaction from happening?

It's bizarre to know that I'm living through this piece of history. For anyone studying virology in this time, they can see the applicability of their research in real time. But for a biochemist like me trying to understand the forces that impact membrane protein folding, could my research ever help anyone?

But how do you engineer proteins to prevent this? Well, you'd need a really deep understanding of how van der Waals packing helps these proteins stick together.

Maybe those thoughts are what I needed to really be zoned in to take my prelim. I've learned to question what I don't know about a subject, reading papers critically by marking any paragraph, sentence, word that I can't fully comprehend in my brain. I find that information, usually with more things I don't know, and continue to go deeper, peeling away layer after layer until I reach the core bit of knowledge I need to understand.

If we can simulate and predict how viral proteins interact with our cell membrane proteins and then support that predicted data with an experiment, we could design drugs to combat viral infections!

Know what you don't know. With this credo in the back of my mind, I joined my advisors on a zoom call, pitched my research to them, and after 40 minutes of defending my research my prelim exam was over.

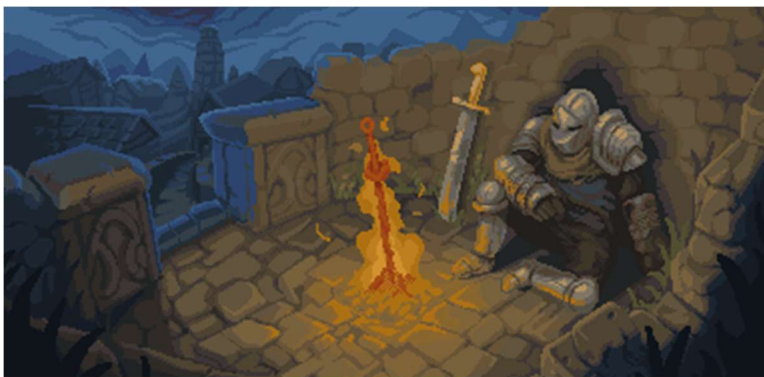
I passed...*but did I really do that much better? was I that much more prepared?* Yes and yes. But unfortunately, all this deep learning has taught me to search for more questions: *What don't I know?* With the police brutality and empowerment of the Black Lives Matter movement happening right now, *did I pass because it would look bad if one of the few black people in the program gets kicked out for failure?*

Gilbert

P.S. What are 5 things you're excited to do in the next 5 years?

P.P.S. A PhD is usually 5 years, but who can plan for failing a prelim OR for a global pandemic. The chords in this song remind me of a sunshower: a sprinkle of refracted sunlight, dancing on your skin amidst the soothing petrichor. It's like a prescription of hope for the future. And when Randy Newman sings these lyrics, it resonates nostalgia. Even if a plan doesn't work out completely, even if you can't exactly predict how things will go, you can still appreciate what happened because you're alive. It makes me feel optimistic for a future in which I'll feel nostalgic about the present.

P.P.P.S. My feelings of my identity driving my success still weigh heavily on me. There are a lot of things that I still don't understand about my project, but I'm now trusted to take it to completion, and that's what I'm going to focus on despite my internal doubts. My research likely isn't going to be used for anything impactful. But just the fact that it'll be a small bubble on the expansion of human knowledge is enough for me for now.



Rest here traveler,

I appreciate you taking the time to share these bits of my journey with me and thought this would be a nice place for a break. Graduate school has been quite a pensive and emotional journey: I've been broken down, survived mental anguish, and learned to think critically while finding comfort in the unknown.

Into the Woods by Mree

Through it all, I've found myself closing my eyes and finding respite in listening to this song on repeat. To me it channels both the fear of traversing the unknown as well as the excitement of the discovery waiting ahead. Whether you've read through and identify with me in some way, are just curious and wanted to understand one person's graduate school experience, or if you're a random person reading this for entertainment, thanks for being here now. I hope that wherever you are on your own journey that you're able to find solace and happiness.

You've made it to the middle stages of my journey. The next few years of graduate school blurred together. It's like the pandemic slowed everything down for me while I was in grad school. And then as if no time passed, stores began to open up, mask mandates ended, and people started to gather again.

3 years of anguish and struggle, filled with more anxiety and all consuming focus on my research.

I'm still insecure, it still takes me longer than I would like to feel confident that I know enough about a subject to talk about it, and I will forever feel like an imposter. But I've continued this journey and I'm nearing what it means to find knowledge, to ascertain truth, to discover. And with it, ever so close to graduation. The triumph is coming! But there are still a few more lessons to learn along the way.

Thanks for reading, sending much love and support your way! I hope you enjoy the rest of these letters.

Gilbert

P.S. If you're still not convinced that my research could be helpful to humanity, another group doing similar research was able to use protein design to combat Coronavirus during the pandemic. Their research is involved in the [SKYCovione](#) vaccine (cite)!

"Why don't you leave if you wanna leave, if you wanna?"

Leave If You Wanna by Overcoats

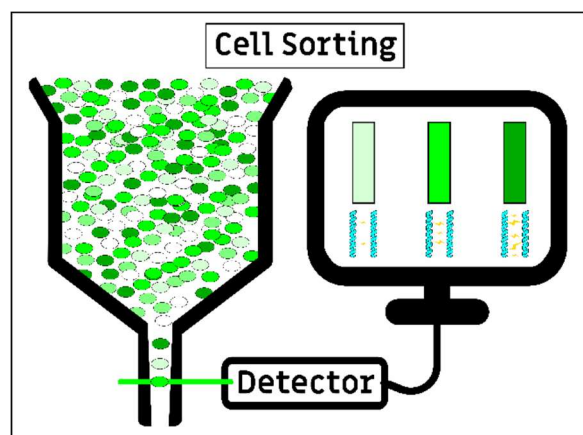
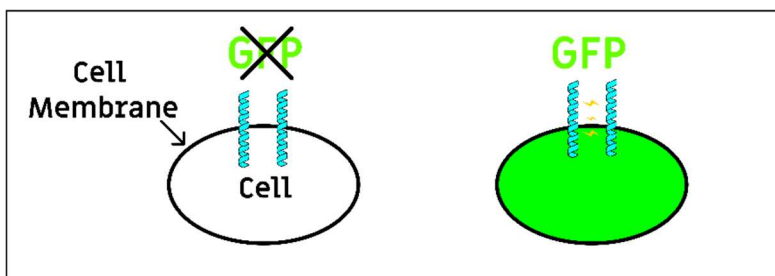
Dear Friend,

July 2023

Sometimes I feel robotic.

I've fine-tuned my algorithm over the last few years, testing my designed proteins in small experiments, and seeing many failures. My protein design algorithm can do three things: 1) build 1000s of proteins with unique shapes, 2) predict how well the proteins stick together (associate), and 3) estimate the amount of packing ("static").

A few years ago, my lab developed an experiment that I can use to test my proteins. We created a way for bacterial cells to produce our proteins alongside green fluorescent protein, or GFP. When the proteins associate stronger in the cell, more GFP is produced. We can't count exactly how much GFP is made, BUT the GFP makes cells light up green!



We can measure the green light for cells using a machine called a cell sorter. The machine passes bacterial cells through a detector that records the green light for each cell. This allows us to estimate how much GFP is produced per cell, effectively telling me how well our proteins stick together! I sorted billions of cells producing different proteins and calculated how well each protein sticks together from the data. And for once, it looks promising! My designed proteins associate as my algorithm predicts!

In my first 3 years of graduate school, no experiments worked, and I grew accustomed to failure. But I've finally reached the point in my graduate career where instead of

taking an hour to work up the mental bandwidth to do an experiment, I can plan 2 or 3 experiments around one another. My experiments work on the first or second try. I'm a well-trained, diligent grad student.

But the laboriousness of research is draining me. I know this is the best data I've discovered, so why do I feel so detached from my science? Where's my excitement? Why do I miss my family and friends so much?

Why is the only thing on my mind this desire to leave?

Gilbert

P.S. What was the last family/friend event that you regret missing?

P.P.S. After years of failure, I've finally found my stride in grad school. My project is taking shape, and the data I've discovered will ever so slightly push the boundary of membrane protein knowledge forward. I've learned to think on my feet, to dissect experimental data, and I've become a good scientist. But now with some success, I feel this sudden urge to leave. I'm realizing how much I've neglected my life outside of science. Missing events with family, not seeing close friends for years. Is science moving on from me? Am I losing my passion for research?

P.P.P.S. *Why am I still here?*

"Cause is it really love if it don't tear you apart?"

When You're Breaking My Heart by Gatlin

Dear Friend,

September 2023

It's been six years now, and my time here is finally coming to an end.

I was given the acknowledgement of my advisors that I'm close to finishing up: "We can see the story forming, and we think you'll be able to graduate next summer."

Do you remember the last time you had a mental spiral? One of those times where your thoughts begin in one place, start looping into another, and then another, and another, until it feels like an infinite abyss of issues, problems, conundrums that you need to work out in your head?

I really need to rest but I have to organize data for my thesis, but fine I guess I'll just do that this weekend, but if I do that then when do I get to reset and relax myself and do something fun? I still need to go grocery shopping, is eating even worth it this week, do I even have money to spend on food, is it worth living alone if I have to spend more money to do so, what am I going to do after I graduate, how will I make money to live, I have no marketable skills, I still don't know what I really want to do, is academia worth it? should I just sell out and join industry, potentially doing something insufferable like optimizing protocols only slightly more human relevant than grad school research but not really moving my desire or ambition to pursue something I love? am I even organized enough for industry?

What is even the point of this PhD?

Pensive, contemplative, unrelenting, my stream of consciousness spirals out: *what is my relationship with my PhD?*

I've built this intense relationship, where my research can do no wrong and I'm always at fault. Experiment after experiment, failure after failure, I attribute to myself. I do whatever I can to reach the needs of the science, give it all the time that I have at the detriment to myself, not allowing personal needs like hunger or sleeplessness to prevent me from focusing on the research. For the last 6 years, my project has been my life. But now that I'm getting close to the end, is it wrong that I can't even feel good about the fact that I'm finishing up?

Why does it feel like I'm being pushed away?

Gilbert

P.S. When was the last time you had your heart broken?

P.P.S. In this song, Gatlin realizes that she loved the chase of a relationship more than the person.

P.P.P.S. For a while now, I've stopped thinking about my future. I don't know if I want to teach, to support and mentor students, or even remain in science. I've been focused on chasing this PhD. *What do I love? Is there anything that I would be happy doing the rest of my life? The pursuit of finding knowledge is what kept me here, but do I even enjoy it?*



P.P.P.P.S. Those questions from years ago are ringing back and forth in my head: *Do I belong here?*

***“And we keep doing these things, not because they’re guaranteed to make us feel good
But because failing to do them? Guaranteed to make us feel bad”***

GOOD MORNING SUNSHINE by The Narcissist Cookbook

Dear Friend,

November 2023

I didn’t realize the end of this journey would lead to such an intense and paralyzing period of everlasting burnout.

Burnout: a state of emotional, mental, and physical exhaustion brought on by prolonged/repeated stress. My fierce zeal for science, to understand the auspicious beauty hidden within the intricate systems that naturally form life, feels like it’s nearing an end. I’m finally running out of the once seemingly infinite amount of kindling I had of patience, time, and willpower. That once unwavering fire and indelible passion inside me is gradually fading away.



It feels like I’ve already given a lifetime worth of energy to this endeavor called PhD. My body is perpetually tired, my mind incessantly ailing with doubt, anguish, distress. Another sleepless night. Hours pass and I continue to feel useless, thinking of all the things that I have to accomplish to graduate, yet being unable to do any of it. Everyday feels like I’m searching for something: *what’s the one thing that will pull me out of bed?*

Too many goals, temporary objectives, efforts to maintain content and find solace in the chase.

Today I’m going to analyze this set of data, I’m going to write this part of my thesis.

Insurmountable frustration begins to set in. The goals shrink as the hours pass, as does my willingness to do anything.

I’ll prepare for my presentation next week, maybe take out the trash, go grocery shopping, do laundry for the first time this month, clean the kitchen, wash dishes from the fried rice I made 2 weeks ago, feed my cat, eat SOMETHING, shower, brush my teeth.

This overwhelming feeling of powerlessness forces me to abandon that teeny glimmer of hope that I would make it to work today. Only one goal is left.

I just want to get up and leave the comfort of my bed

It’s 3 pm and I’m ready to start my day. I’m alive...*but am I well?*

Gilbert

P.S. Did you take the time to care of yourself during your last mental break/burnout?

P.P.S. At a time when I just needed something, ANYTHING, to feel good about, I discovered this song that immediately resonated with me. Most days it’s hard to get out of bed, difficult to motivate myself to do even the most inconsequential things. I find ways to work through it as best as I can. Even with all these anxieties bogging down my mind, I find a way to tell myself that I’ve done enough each day. It gets me through, has kept me productive, and is bringing me closer to the end of grad school.

"You don't cross my mind, you live in it"

Off Day by Lyn Lapid

Dear Friend,

March 2024

Oftentimes I've found myself wondering what it means to live.

As I write this, I should be sleeping, resting, prepping my body and mind for the next day. But this incessant gnawing deep within the recesses of my brain continues to keep me awake. I close my eyes, but thoughts keep ringing around, drowning out my tinnitus. 12:19. I readjust, pull the sheets a little closer. I don't enjoy sleeping tight. It feels restrictive and reminds me of being unable to force my body to move. 3:13. I stare at my eyelids, no rest or reprieve. I firmly understand what it means to have a restless night.

During my 2nd prelim year, I found myself dreaming of the science. My subconscious was hard at work while I slept, envisioning how to design proteins to associate, imagining possible experimental results, coming up with reasonable explanations. I thought it was a superpower.

But now with fewer experiments and a deeper understanding of my research, the main thing left is to relay my findings. No more anxiety about redoing experiments or thinking of new ways to interpret data. I need to write, to put my thoughts into coherent words on paper. But how? Instead of dreaming, my mind continuously tells me *to work*. I'm constantly thinking about what and how to write, prioritizing work, and instead of dreaming of the science, it's preventing me from reaching any semblance of rest. I can't sleep because if I do, then I'm not working. But if I can't sleep, then I can't work efficiently, and I can't sleep. A delightful feedback loop at the end of my PhD.

A waking nightmare.

But on the 2AM drives in and out of lab when the traffic lights are blinking red and yellow, I'm able to recognize myself as one of the few living beings filling the halcyon silence. In the midst of insomnia and the existential crisis that I'll never be able to leave, I'm finding a deeper appreciation of the stillness, cherishing the freedom and fluidity of time in graduate school. From deciding to take advantage of my sleeplessness by working during unorthodox hours to remembering to breathe in the early glow of the sun as the brisk air fills with birdsong, I'm finding ways to appreciate life.

Gilbert

P.S. When was the last time you closed your eyes and just took a moment to pause, breathe, and take in life?

P.P.S. A few letters ago, I mentioned that I would miss the chase, miss the ways that I've been forced to push myself past my limits just to learn. But I'm beginning to realize that the enjoyment has been a bit more than just the chase. This environment has pushed me towards discovery: time to allow my brain to acclimate to the idea of working at the boundary of human knowledge, allowing me to excise biases in pursuit of truth. It reminds me of being a kid again, just staring at the sky, letting all thoughts freely flow in and out of mind. I feel like graduate school harnesses this latent ability, allowing for deeper exploration within our understanding of anything you find interesting.

P.P.P.S. This song feels like it bundles you up in a freshly washed blanket on a snowy day. A blend of tranquil and reassuring warmth amidst the frigid winter. I've questioned myself and my capabilities for the past 7 years, but I've finally made it to a place of what feels like mutual respect. Pushed to grow by finding comfort outside of my comfort zone. Pulled out of the ebbs of 36-hour water diets, to the flows of buying Babcock ice cream as a reward for accomplishing tiny goals I set for myself. Birther of my restless mind, bringer of appreciating the peaceful subtleties of the day. My PhD has been that warm blanket for me, and I never expected it to be so comfortable. Which means it's probably about time for me to move on.

"I don't wanna stand out"

Wallflower by mxmtoon

My Dear Friend,

July 2024

University of Wisconsin-Madison finds itself on an isthmus: a strip of land between the lakes Monona and Mendota. Comprised of about 50000 students and 25000 staff, 3 out of every 10 people in the city are affiliated with the school. I moved here 7 years ago, knowing just as much about Wisconsin as I did then about what it takes to do a PhD. I quickly learned to love cheese curds and spicy cheese bread, found joy on long walks around the farmer's market, and appreciated the amount of people biking through the city on even the chilliest, snow filled days.

When I first arrived here to interview for grad school, my hosts took us out for a night walk around the city. It was cold, quiet, the sides of streets filled with many tall piles of snow. We made our way to Monona Terrace, tiptoeing around the icy, slippery sidewalks. We had gone ice skating on a small lake earlier in the day, so I understood that Madison could get quite cold. But to see Lake Monona, 5 miles (13km) of water across, completely frozen over at least ... feet deep. I was astounded. We ignored the signs, the orange tape and traffic cones, and walked onto the lake. I stared into the darkness, then closed my eyes, the only visible difference being the chill against my eyeballs and the phosphenes on the backs of my eyelids.

A lot has changed in 7 years. This year, the lake froze for the least number of days (44) in the last 150 years. The temperatures haven't reached the same biting cold, and it's not safe enough for many of the winter activities of the past. I didn't get the opportunity to relive that moment on the lake, but that memory sticks out to me. Serenity, astonishment, bliss. A fitting introduction to the hellishness of a PhD.

From failing my prelim and questioning why I'm even alive to developing the computational skills to create an algorithm that builds protein structures. Feeling like an imposter and a failure because of my identity yet discovering my personal deficiencies in work life balance. From knowing basic biochemistry to becoming what many would consider an expert in my field.

***Beware of people that say that they know everything about a subject
Because, people that think that they know everything
Are the ones that know nothing***

Even If It's Lonely by Hazlett

Graduate school has taught me that I don't know much at all. I've learned to live life in this kind of neutral zone, experiencing new things like discoveries, looking with a non-judgmental eye, and interpreting what I can with the information given. I've poured so much mental energy into learning the intricacies of how membrane proteins fold and the biochemistry behind it, that I've learned how little I know about it.

I don't see my PhD as making me an expert in biochemistry, but rather that I've become an expert in how to learn and discover things that I didn't know before. As I'm writing this, I haven't yet defended, the thesis isn't submitted, and I'm not even sure if my committee will award me my PhD. But I know that I've learned enough on this journey, and I'm ready to move on.

***Once I saw fire, and all I know is something happened
Did I let it go?***

Before the Line by dodie

One final reflection: If you could do it all again, as a bright eyed, younger version of your current self, would you make that big decision that led you to where you are today?

If you could do it all over again, would you still go to graduate school?

And my answer is yes.

I've been caught within the greyscale of science for so long. Crafting my contribution to the scientific community, developing my research to ascertain a nuanced glance into membrane protein association. Failed experiment after failed experiment, poorly written code after poorly written code, constantly banging my head against a seemingly unbreakable wall. But with flickering grit and tottering determination, my hardheadedness was enough to put a crack in it. I've gotten a glimpse into what it means, what it feels like to discover something.

Do you remember the first time you held a kaleidoscope? Not knowing what it is, you're encouraged to put one eye up to the tiny sliver of clear plastic. For those first few seconds of looking inside, you see a glistening, prismatic repeat of color and shapes so overwhelming that it seems unable to fit into the small toy in your hand. It's infinite. That fleeting moment of first revelation is probably something I've been chasing my entire life.

I've thoroughly enjoyed learning how to passionately search through the unknown for information, trekking through journal articles, learning the jargon that I need to synthesize my understanding of a subject. That childlike, innocent nonjudgemental curiosity on the search for deeper understanding. Becoming so enthused with that feeling of learning something new that it becomes more than a subject, but a passion, a love. When I look back at my time in graduate school, there are a lot of bad moments. But I guess you could say that my love for learning won out.

I could imagine myself doing the same thing forever. Research, teaching, mentoring. Searching for that same joy in discovery, that kaleidoscopic spark.

"I'd rather be free"

Escapism from Steven Universe

I've truly loved my time in graduate school. But my head is throbbing from banging against the wall of discovery.

For now, I've used up all my passion and determination.

Etterath: the feeling of emptiness after a long and arduous process is complete. Maybe this is what the end is supposed to feel like. Every time I've wanted to leave prior, I felt exhausted from the grind. But I gritted my teeth, continued the trek into discovery. Like finishing a great TV show or reaching the end of an awesome video game. Bittersweet, not exactly ready, but knowing that it's time to move on.

I don't know where I'll be 10 years from now. But whatever I end up doing with my life, ...(end)...

Gilbert

P.S. Thank you to SciFun, WISL, and WISL staff for the opportunity to write and share my reflections on my PhD! I'm extremely grateful to be able to reflect on these moments, and this wouldn't have been possible without their help!

P.P.S. To all my professors, friends, roommates, lab mates, communities (shoutout SciMed, CBI, and IPIB DEI), thank you for every little bit of support you gave me along the way. Whether it was chatting deeply and thoughtfully about science to discover my weaknesses, finding ways to develop a more supportive environment for students, or just discussing life and food and the mundane things, I truly appreciate every conversation, every moment of time that you've all given me. This PhD wouldn't be complete without it!

P.P.P.S. And to you reader, whether a friend old or new, thank you for sharing this journey with me! Academia isn't always the most vulnerable, and I wanted to create a transparent view to highlight my grad school experience. I hope that I succeeded! Best of luck on whatever journey you're currently facing, I'm supporting you from afar, and would happily support you if you reach out :D.

P.P.P.P.S. From someone who's been there: Even in the darkest of times, when it seems like there's no light at the end of the tunnel, I promise you there's light.

Other parts to potentially add in!

Can you imagine knowing that you loved something, and then wondering years later where the love went? Time is a fickle thing. Like any relationship, you need reminders about why you fell in love in the first place. Graduate school for me was a grueling experience. As I'm sure many former graduate students understand, the constant failure, trying an experiment again, failing, and learning to finally find an answer is extremely demoralizing. It takes a special kind of person to continue that journey. And right now, I don't know if I'm it.

My relationship with my PhD has me thinking about how to regain that kind of love: when will I be inspired again, not by some external force like graduation, but by an intense drive and passion to learn? I'm not yet sure what I'll be doing next, or if I'll even want to be in science. But I recall something my dad told me when I was a little boy: "If you put your mind to it, you can learn anything." Thank you, PhD, for teaching me how to learn at the highest level. I'm not the smartest or most brilliant person, and this journey wasn't anywhere near a perfect PhD. But it was perfect for me because it made me grow into the person that I am: a tryhard, a thinker, and someone who now knows I can make a difference somewhere, someday if I just put my mind to it to learn enough.

Becoming an expert in anything is daunting. This story is just one person's journey to it. I now know how much I don't know.

This comfortable and steady environment full of individuals searching for the unimaginable, using all their will power and energy to do the impossible and discover knowledge ...

Convey the fact that for a really long time I didn't think that I deserved anything. Whether it be getting to play games longer than my brother, or ... On feeling like I've been treated differently, when all I want is to be treated with respect.

Talk about how I seem to no longer enjoy the wins, but I still hate the losing?

Emphasize that you just can't feel relief anymore. The feeling that the rug could get pulled from under you at any moment is still with you.

"Academia can be toxic." When people say that I've always thought they were referring to the people, or the lack of minorities, or the slow-moving grind to find your own niche within the academic community. But the toxicity goes deeper than that. The mental anguish, the beating yourself down, the ... well you already know. Feel free to reread the other letters if you need a reminder :P.

Citations (in progress)

Kary Mullis quote: https://www.youtube.com/watch?v=xd4De47ldYs&ab_channel=NobelPrize

Reddit: u/nodubby (suicidal ideation chart)

The dictionary of obscure sorrows by John Koenig

Ways to cite all of the music, and the tv and video games and such if I have to?

Citing definitions for the glossary (probably mostly just merriam-webster.com)