The SoP: Telling Your Science Story

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STEM Writing Specialist

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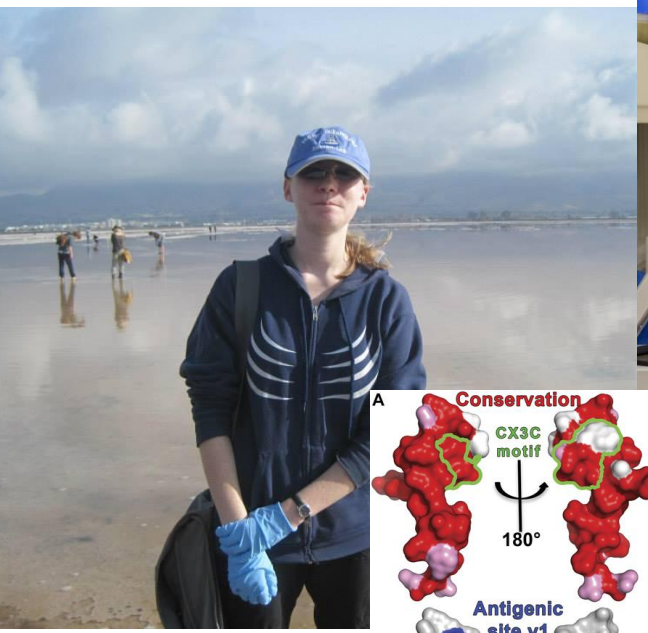
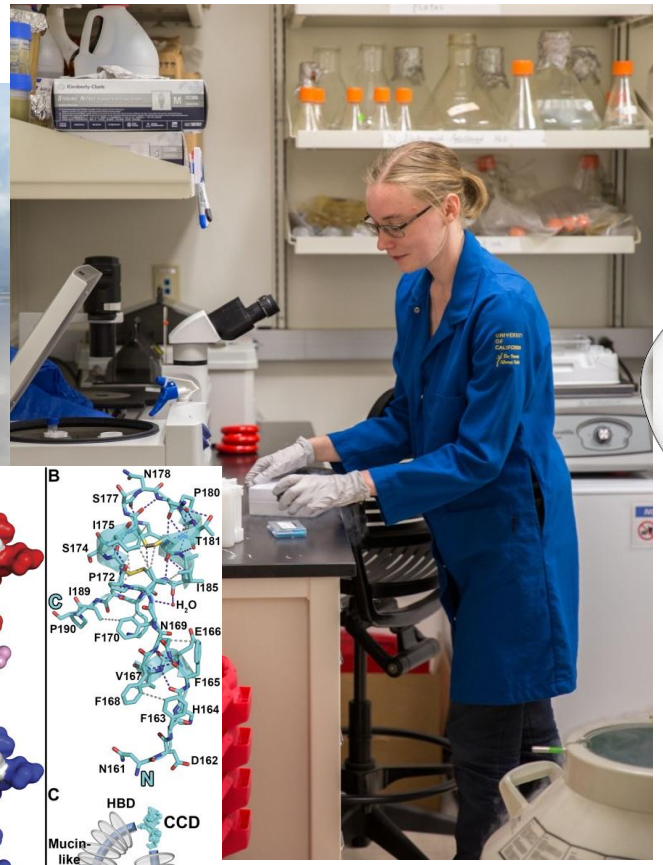
My grad school journey

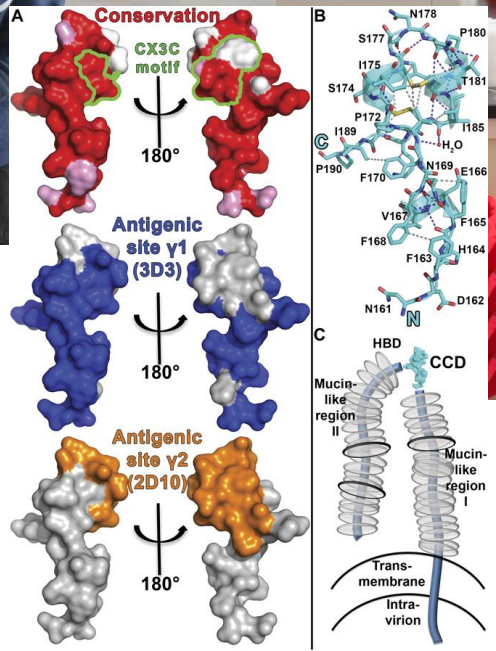
UNDERGRAD: UC SANTA CRUZ

Molecular, Cell, and Developmental Biology

Earth Sciences





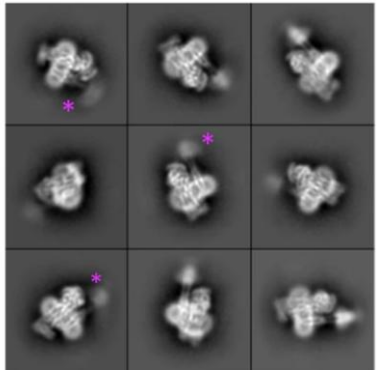


UC SANTA CRUZ – DUBOIS LAB

2 years as an undergrad

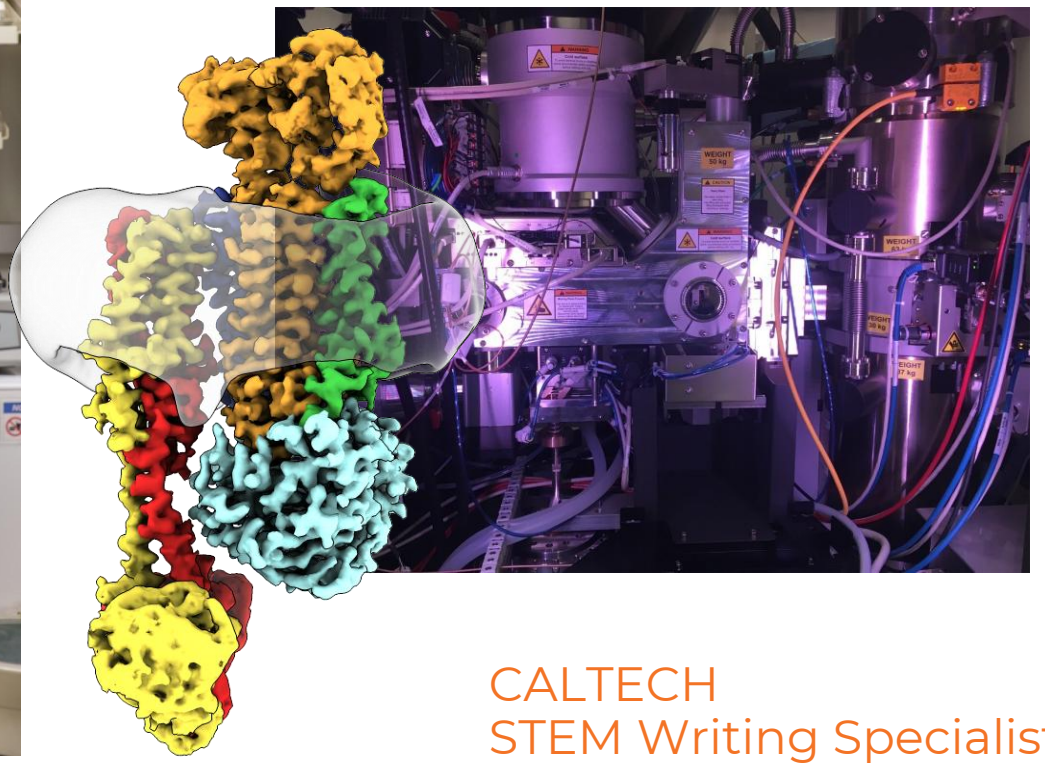
3 years post undergrad

grit
GRADUATE RECRUITMENT INITIATIVE TEAM



MICHIGAN STATE

PhD Microbiology Molecular Genetics



CALTECH

STEM Writing Specialist ☺

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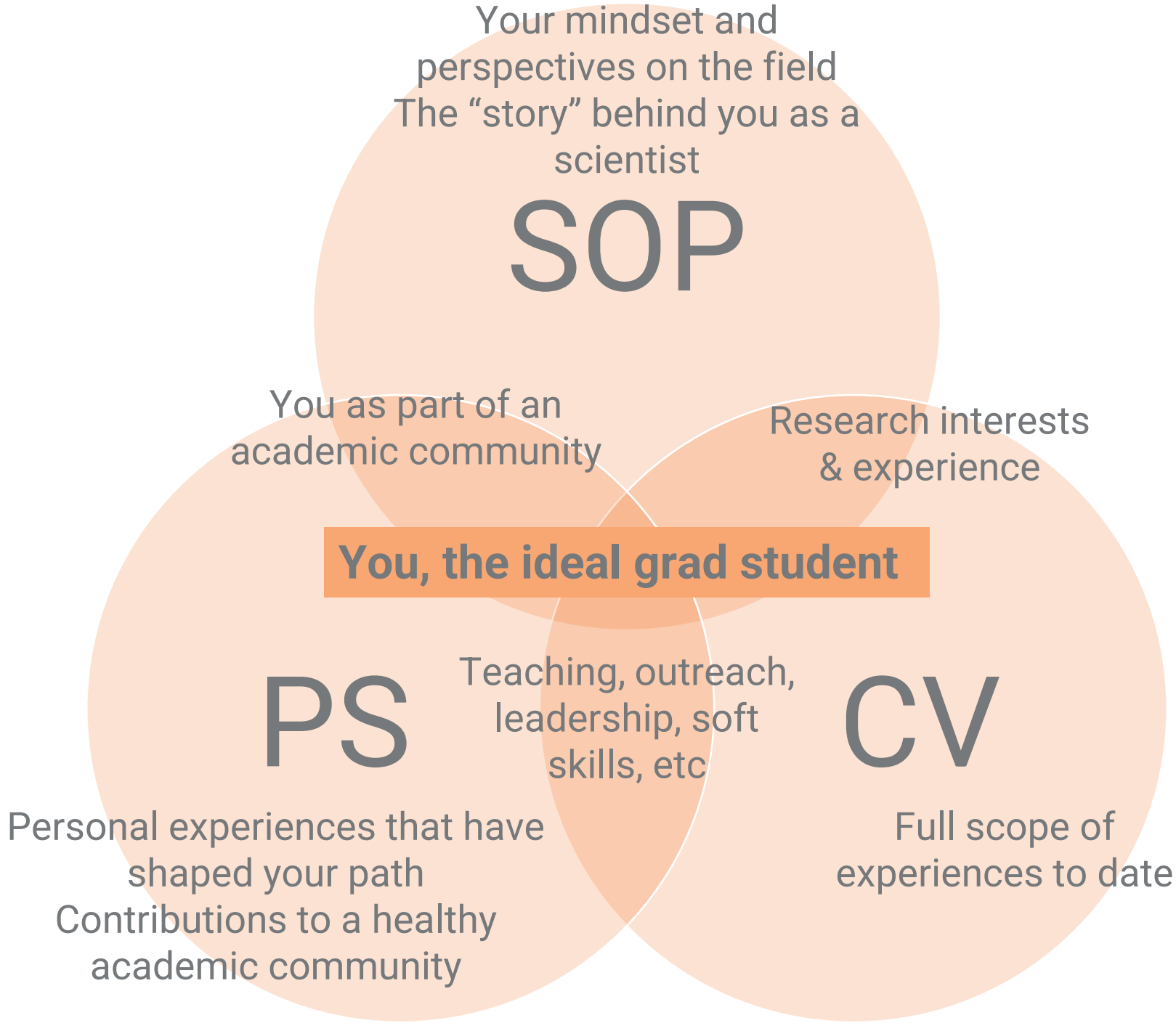

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Your application is read by humans (faculty in the department)

AKA your future teachers, mentors, committee members, collaborators, and co-developers of projects.

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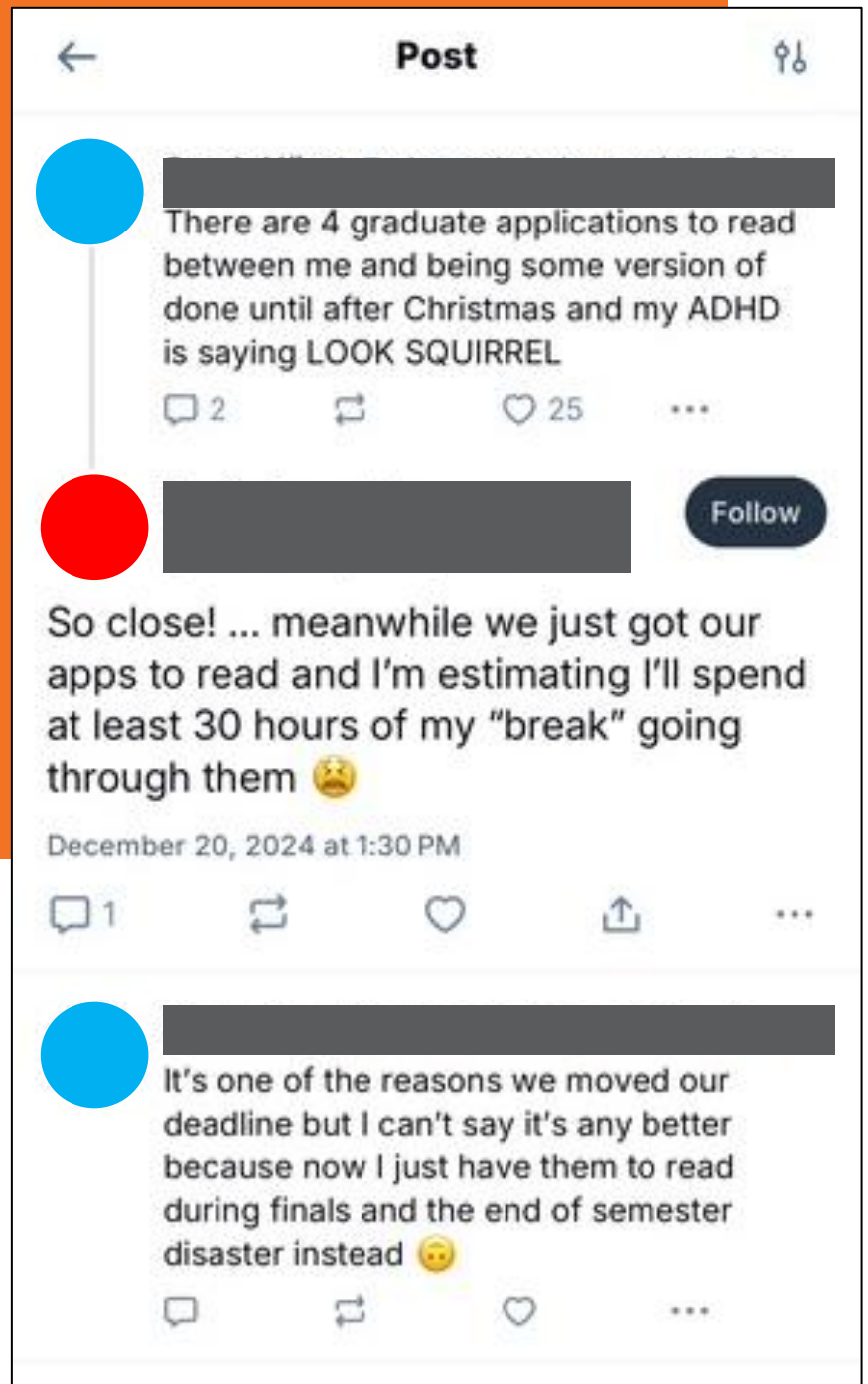

Your readers might be tired, busy, stressed, distracted, and juggling work at the end of the term, just like you.

They have limited time to spend per application, but want to be sure they are accepting **capable, motivated and resilient students**. They also care about having a diverse department full of **people who make the scientific community better for everyone.**

More than just picking students, they are choosing their future colleagues!

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Application reviewers are selecting new members of their academic community, not statistics

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Do you have transferrable skills and attitudes that will help you as a researcher?

Are you motivated and deliberate in your decision-making about your future?

Are you passionate and (independently) thoughtful about the field?

Do you have the scientific understanding and experience to thrive in grad school?

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MOST SOPs Can Be Divided Into Three Parts

1. Introductory Paragraph

Provide a story, background information, or direct statement of interest to put your experiences in context.

2. Body Paragraphs: Your experiences, qualifications, interests, etc

Address the prompt and build up a vivid picture of you as a researcher

3. Program Paragraph: why this program, and why you?

Show why your skills/experience are a good fit with the program, highlight things that excite you about the program/department/school, and mention specific professors you might like to work with.

Don’t overthink the introduction

Straight to the point, or tell a story – just give the reader some context to who you are, what motivates you, or what shaped your choices

Cliché isn’t a good use of space – look for what is uniquely true about you:

- Can you distill your research values and interests into a phrase?
- Do you have a unique or interdisciplinary background?
- Can you paint a vivid picture of the moment that inspired you?

Body paragraphs: telling your research story

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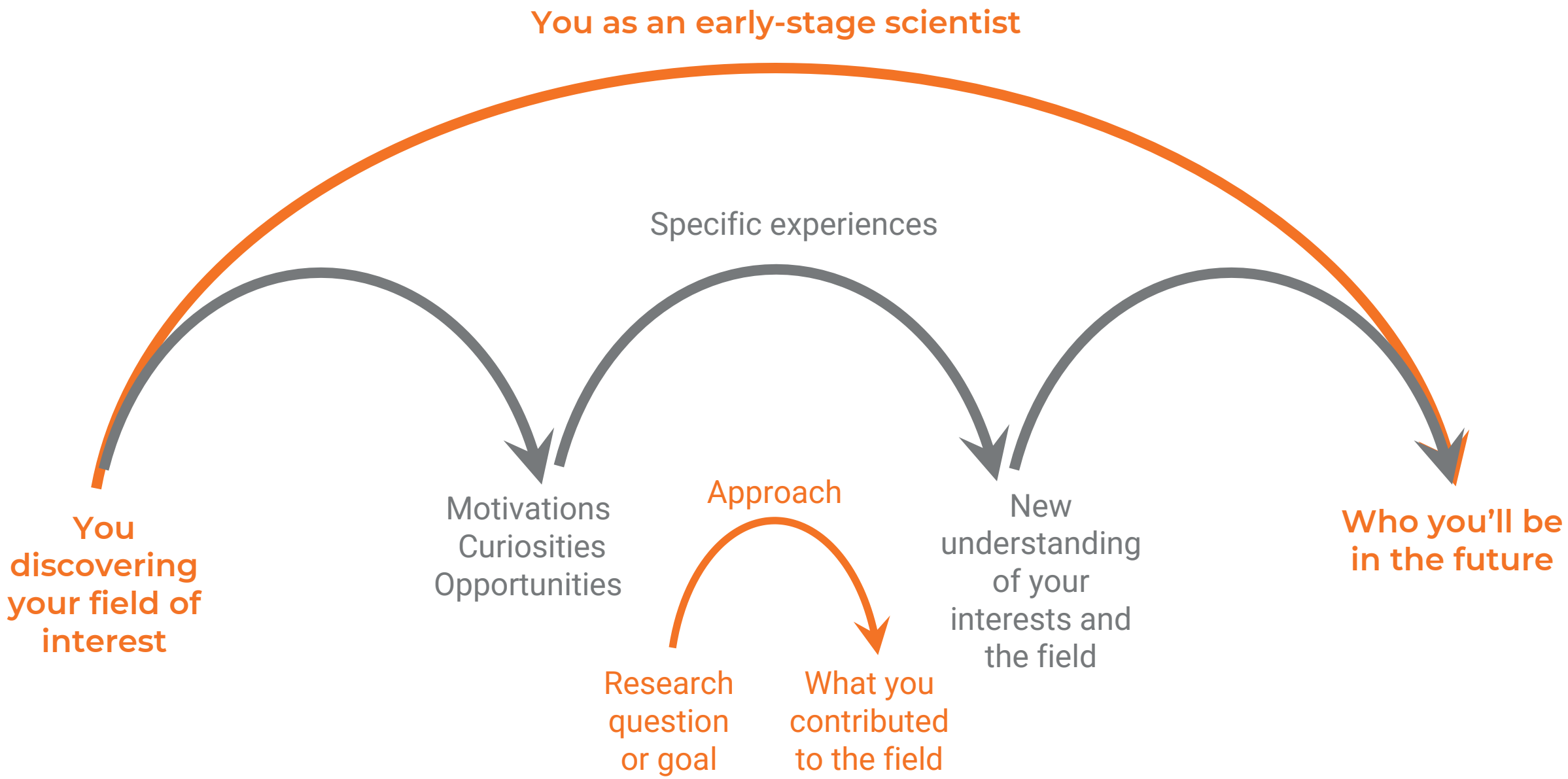
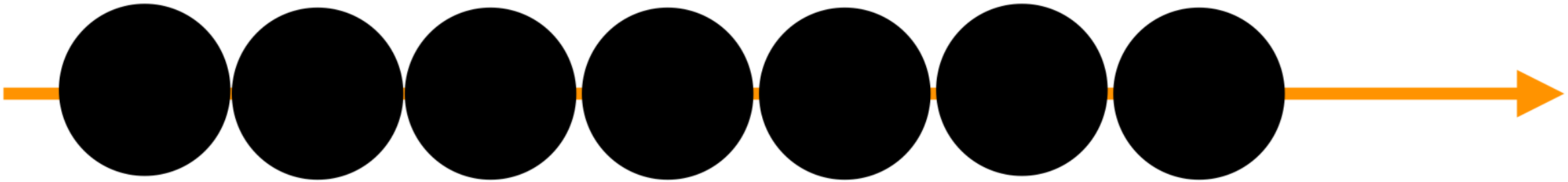
Illustration: Ally Jaye Reeves

A Good Statement Has Story Arcs:



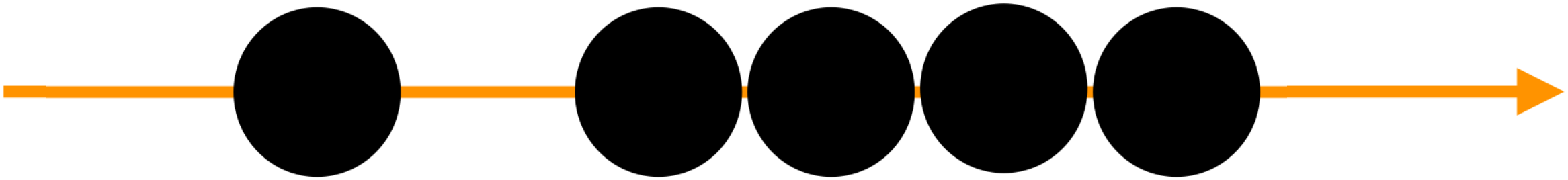
SOP MYTH #1: I NEED TO INCLUDE EVERYTHING

Your SOP is not your CV!
Make sure each document fills a unique role in your application packet.



Too much content can feel disorganized, unfocused, and shallow.

SOP MYTH #1: I NEED TO INCLUDE EVERYTHING



Focus on the most interesting or formative experiences you've had and take the time to share them fully and *explain how they influenced your scientific journey/career goals.*

SOP MYTH #2: I HAVEN'T DONE ENOUGH TO BE COMPETITIVE

Things I've heard again and again:

I would rather take a student who had only had four weeks of research experience where they had developed a great understanding of what it meant to think like a scientist than a student who had dozens of opportunities but couldn't explain what the projects were about.

(shared by a graduate program director)

You can teach anybody a new research technique, but it's much harder to teach passion, creativity, dedication, etc.

(faculty perspective)

Which experiences show the development of your interests and demonstrate how you "think like a scientist?"

When have you had to solve problems?

When did you let your curiosity guide your research decisions?

When did you have to design, analyze, collaborate, etc to get a project done?

When did you discover something you're passionate about? What inspired you to pursue this field?

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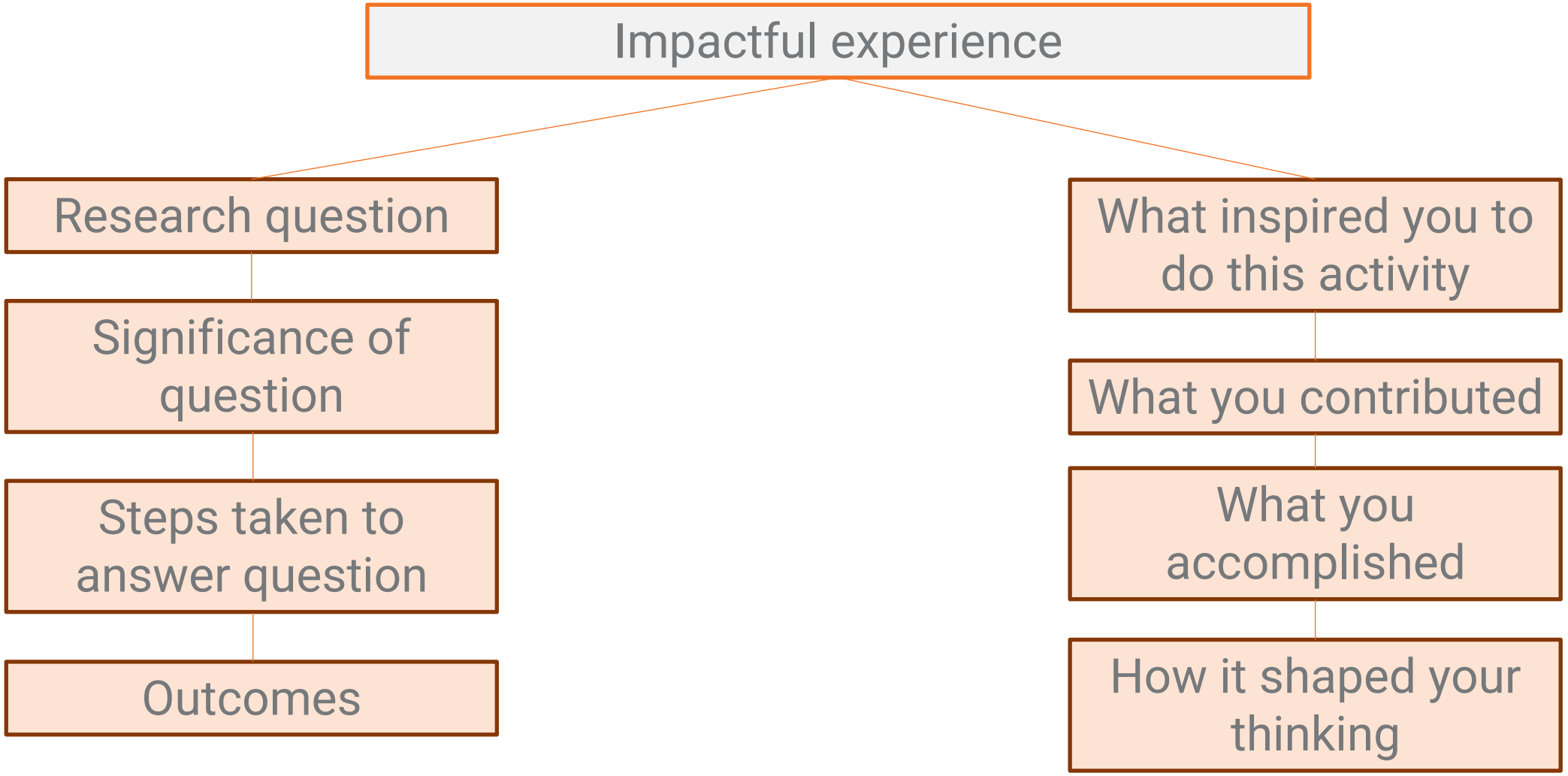
Show you can talk about research problems like a pro, as well as critically reflect on your experiences



"design" suggests autonomy on project

Project goal or question

Potential relevance of work on the field

How did the writer approach the research question?

Outcomes or future work

Impact on interests

The next summer, I designed a project with Dr. [redacted], to study inflation using galaxy clustering on ultra-large scales. Galaxy catalogs from future missions, including Euclid, will allow us to measure the parameter f_{NL}^{loc}, which gives us information about various inflationary models. I am studying new, optimal methods to construct the galaxy power spectrum from these catalogs, and thereby measure f_{NL}^{loc}. I have built a data analysis pipeline in C and Python, which first creates mock galaxy catalogs based on input values of f_{NL}^{loc}. I then use different methods to estimate the galaxy power spectrum from these catalogs and finally estimate the value of f_{NL}^{loc} that best fits this spectrum using an MCMC. Through this pipeline, we can compare the constraints on f_{NL}^{loc} obtained by different data analysis methods, including the traditional Feldman Kaiser Peacock estimator and an optimal quadratic estimator. This project has also developed into my senior thesis, and I plan to extend it to study pixel-based likelihood functions, and include general relativistic effects in my analysis. I will be giving a poster presentation on this work at the American Astronomical Society Winter Meeting in January 2018. My senior thesis work will also be an essential component of the proposal for SPHEREx, a NASA Medium Explorer mission which aims to measure f_{NL}^{loc}.

In the course of my cosmology research, my interests have gravitated towards the mathematical methods which we employ in the field. One of the primary challenges in cosmology today lies in extracting the maximum amount of information from individual measurements with large uncertainties. I have found this to be a common theme in all my past research experiences,

SOP MYTH #3: MY RESEARCH WASN'T SUCCESSFUL SO I CAN'T TALK ABOUT IT

"That's why they call it RE-search!"

Your readers know that science doesn't always go as planned!

Focus on what you LEARNED from the opportunity and think about how your experience could demonstrate tenacity, creativity, analytical thinking, problem-solving, etc...

EXAMPLE: Talking about failure

My ability to multitask and enthusiasm for challenging projects resulted in a full-time job as a research specialist in the [redacted] lab after graduating in 2017. Curious how the respiratory syncytial virus G protein sabotages the immune response, which can result in dangerous illness in infants and the elderly, I initiated a new project to explore RSV G mimicry of the human chemokine CX3CL1. Solving structures of the viral and chemokine protein bound to their shared receptor should provide a blueprint for blocking RSV G interaction with CX3CR1, but the seven transmembrane region receptor and its flexible ligands are challenging to study with techniques typically used in the lab. I initially designed soluble mimics and fusion proteins to focus on the extracellular regions of the receptor, in hopes of solving structures of RSV G and CX3CL1 complexes with these proteins. When half a dozen different complexes failed to crystallize despite efforts at optimization, I took this as an opportunity to learn something new. Now I am employing several strategies in parallel to increase my odds of finding success, including NMR of ligand-receptor peptide complexes, solubilizing full length receptor from cell membranes or producing receptor in lipid nanodiscs, and using biolayer interferometry to probe the role of different fragments of the receptor in ligand binding. Through this combination of techniques, relentless searching for backup plans and improvements to methods, and a lot of patience, I am slowly piecing together an understanding of how and insight into how my two structurally dissimilar proteins use one receptor to produce unique immune responses.

What writing style should I use?

- Expert to (mostly) expert – your readers are experts in your general field but may not know the specifics of your work – can use technical language but be clear about project goals

- *Show don't tell* – rather than "I am a good problem-solver," tell a story that shows you in action!

- Be authentic – there is no magical formula for success and reviewers want to get to know YOU not what you think their idea of a "perfect" grad student is

Illustration: Beth Kobliner

CUSTOMIZING YOUR STATEMENT FOR DIFFERENT PROGRAMS

Usually, the last paragraph of the SOP addresses the question: why this program?

* Quick reminder of your interests & goals
* What faculty you'd be interested in working with
* Any unique facilities, programs, groups, etc that will be beneficial to you

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EXAMPLE: A tailored last paragraph

In the course of my cosmology research, my interests have gravitated towards the mathematical methods which we employ in the field. One of the primary challenges in cosmology today lies in extracting the maximum amount of information from individual measurements with large uncertainties. I have found this to be a common theme in all my past research experiences, and a PhD in [redacted] University would be the logical continuation of this trend. The [redacted] department would offer me the opportunity to work with both theoretical and observational cosmology research groups. This will allow me to become familiar with both the theories which we are trying to test, as well as the measurement techniques we use to test them. I would like to work between these two steps, by attempting to understand how we can efficiently and optimally make inferences about physical theories from raw data. I would like to work with Prof. [redacted] on data analysis methods for CMB S-4 experiments, particularly those that would allow us to search for primordial gravitational waves, such as CMB delensing. I am also interested in forecasting cosmological parameter constraints from WFIRST with Prof. [redacted] would enjoy working with Prof. [redacted] on constraining cosmological parameters using the large-scale distribution of galaxies. Pursuing a PhD at [redacted] University would give me the chance to study a number of applications of astrostatistics, due to [redacted] involvement in surveys like WFIRST, LSST and ACT. [redacted] will offer me an extremely well-rounded research experience, which will uniquely position me as a scientist in the advent of surveys which will present us with larger and more complex data sets. My work at [redacted] will prepare me to use these data sets to extract fundamental information about the workings of our universe.

How many statements do I have to write????

The goal of every SOP is similar: to demonstrate your potential as a grad student and your interest and understanding of the subject area you plan to study.

Body paragraphs are generally reusable, intro might be slightly adjusted and “tailoring paragraph” rewritten for each application.

Maximize the use of space! Avoid repeating content with other parts of the application.

Illustration: Ally Jaye Reeves

A QUICK NOTE ON GEN AI:

We find that GenAI tools like ChatGPT, Gemini, Grammarly, etc are NOT effective for application writing. Students who use these tools often end up with vague, cliché, or impersonal writing that can be extremely time-consuming to improve.

We STRONGLY encourage writers to avoid GenAI in preparing their applications.

Feedback from real people (mentors, friends, colleagues, etc) tends to be far more informative and representative of your actual audience

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Questions?

Illustration: pngwave