

# Graduate school: Why, What, & How?

+ Supplement Info (email)

## **Today's Presenter (3<sup>rd</sup> version)**

Jason Halloran, Ph.D.  
Assistant Professor, Mechanical Engineering  
Cleveland State University  
Cleveland, OH 44115

## **1<sup>st</sup> version**

Valli Sarveswaran, Ph.D.  
Director of the McNair Scholars Program  
Cleveland State University  
Cleveland, OH 44115

## **2<sup>nd</sup> version**

Christopher Wirth, Ph.D.  
Assistant Professor, Chemical and Biomedical  
Engineering  
Cleveland State University  
Cleveland, OH 44115

# *Questions?*

- How many of you are considering pursuing a PhD?
- How many of you are considering pursuing a MS?
- How many of you are considering some other grad degree – MD, JD, etc?
- How many plan to join the workforce following BS?

# *Comments on today's seminar*

- Focused on students who go from BS/MS to PhD, but remember there are other paths to a PhD.
- Seminar has facts mixed with thoughts from previous presenters, which also includes my own (*in italics*)
  - **Caveat:** may be at odds with other advice you have received!
  - **Takeaway:** talk to others! (especially at programs of interest)

# ***Outcomes of*** BS vs. MS vs. PhD

# *Outcomes of* BS vs. MS vs. PhD

- An individual holding a Ph.D. will typically make 20% more than someone with a master's degree.
- The unemployment rate for of Ph.D. holders is less than 3%;
  - Similar for other types of professional degrees (MD, JD, etc.).
- There are limited opportunities for jobs in college instruction, or in research, for people lacking Ph.Ds in their field.
- A Ph.D. can lead to preferential treatment with regards to promotion and project assignment.
  - *My experience: it can also make you “over-qualified” for some industries*
- A Ph.D. enables its holder to work in academia, to work in an industry related to their field, or even to begin their own business.

# ***Outcomes of*** BS vs. MS vs. PhD

- An advanced degree (MS & PhD) typically puts you in a position to generate and execute ideas that **create knowledge**.
- A BS may put you in a position of conducting research, but **typically working for someone** with a MS or PhD.
  - *Unless you work in an industry that does not “value” an advanced degree!*
- A PhD allows **you to set the course** of a research lab!
- *All of the above requires ambition and independent thinking!*

# *Outcomes of* BS vs. MS vs. PhD

- **Corporate research and development** (**7 of 9** in Dr. Wirth's class, **2 of 4** out of my graduate lab)
  - Exxon, PPG, DOW, Intel, AkzoNobel, Lockheed Martin, DePuy Orthopedics....all hired PhDs to develop new technologies.
  - Sherwin Williams, PPG, Lubrizol, PolyOne all in Cleveland - more in Akron.
- National Laboratory (**1 of 9** in Dr. Wirth's class - EPA)
- Consulting practices
- Academic job (**1 of 9** in Dr. Wirth's class (@CSU) - this is typical, even coming from "best" institutions, **2 of 4** in my graduate lab(@CSU & NJIT))
- Entrepreneurial endeavors
- Policy jobs
- Think tanks
- High-level administrative positions (Typically later in career)
- Academic publishing

# *Applying for a* MS & *PhD* *program*



# *Applying for a* MS & *PhD* *program*

- **PLAN AHEAD**

- Most STEM programs do not require MS degrees prior to applying for PhD program (this is called **direct entry**).

# *Applying for a* MS & *PhD* program

## **Academic evidence**

- **Transcript**, GRE
- **Recommendation letters**
- Portfolio

## **Research experience**

- Resume
- **Recommendation letters**
- Publications

## **Demonstrated potential**

- **Evidence of leadership**
  - **Reach out to labs that may interest you!**
- Other experiences and extracurricular activities

## **Ability to collaborate or work with others**

- **Recommendation letters**
- Statement of purpose and/or a personal statement
- Interview questions

## **Ability to multi-task**

## **Creativity, writing ability**

- Writing sample
- Statement of purpose and/or a personal statement
- Portfolio

# ***Applying for a* MS & *PhD* program:** Research Experience

- **A research experience is just as much for you as it is for your PhD application.**
- This is a very important qualification, particularly in STEM disciplines.
- Showcase your research *no matter what it may be*.
- Your research experience should ideally involve more than simple clerical or technical work.
- If you have had the opportunity for longer research, it is more advantageous to mention 1-2 semester(s) of research than to mention 8 weeks of research over the summer.
- If you are interested in graduate school, *do not* take summer classes *unless you were not able to find any research opportunities*. If you did not get any offers, you probably did not try hard enough.

# ***Applying for a MS & PhD program:*** **The GRE**

**If your GPA is low, you will *have* to address it in your cover letter and statement of purpose.**

- You may wish to focus on your GPA within your major.
- You may wish to focus on your “upper level GPA” (excludes your freshmen or freshmen and sophomore years) (***I remember doing this***).

**The following approaches may compensate a low GPA:**

- **Excellent reference letters**
- **Good research experience** (*Once more, showcase your research very well!*)
- A convincing statement of purpose
- A good GRE score, particularly a good Subject GRE score
- Research experience at the institution to which you are applying
  - ***Again, talk with professors where you may want to go!***

# *Applying for a* MS & *PhD program:* The GRE

## **General GRE**

- **Verbal reasoning:** Tests the ability to analyze and evaluate written materials and synthesize information obtained from them (Scored from 130-170 | 2 sections of 35 minutes each)
- **Quantitative reasoning (STEM):** Tests basic mathematical skills and the understanding of elementary mathematical concepts (Scored from 130-170 | 2 sections of 40 minutes each)
- **Analytical writing:** Tests critical thinking and analytical writing skills (Scored from 0-6 | 2 sections of 30 minutes each)

## **Subject GRE** (Available in 7 Different Areas)

- Biochemistry
- Biology
- Cell and Molecular Biology
- Chemistry
- English Literature
- Mathematics
- Physics
- Psychology

# ***Applying for a* MS & *PhD* program:** The GRE

- **You may take the computer-delivered test once every 21 days, up to five times within any continuous rolling 12-month period (365 days)**
- **Score reports**
  - **On test day (free for 4 reports)**
    - Not to send reports
    - Send
      - Most recent
      - All
  - **After test day (\$27 per score report)**
    - Most recent
    - All
    - Selected one
- **GRE scores are valid for 5 years**

# *Applying for a* MS & *PhD program:* The GRE

- Take the GRE in your junior or sophomore year. Imagine preparing for the GRE during your senior year...course work, undergraduate research, writing personal statements and preparing grad school applications.
- Take the diagnostic GRE as a ballpark indicator of your future scores
  - [www.review.com](http://www.review.com) & [www.kaplan.com](http://www.kaplan.com)
- Two bad GRE scores will indicate a trend; don't take the test a second time unless you are going to be better prepared than you were the first time.
- Let recruiters know if you plan on taking your GRE again.
- Ask recruiters about the GRE scores for their program (*this will tell you a lot*)
- Don't report unless it is good.
- A good Subject GRE score may help if you are changing disciplines, or if your GPA is not so good.
- A good GRE score in general will help if your GPA is not so good.

# ***Applying for a MS & PhD program:*** Your transcript

- Those reviewing your application will be examining your transcript's *trend*.
- You should do the same. If your GPA is low, you should be able to explain what drove it down and why.
- It will be even better if one of the faculty members writing on your behalf can address that issue in their letter.



# ***Applying for a MS & PhD program:*** **Letters of Recommendation**

***Note: This is considered the most important of all application materials***

- **Ideal Order of Preference:** Faculty member who has supervised your research > Supervisor who has seen your direct work with clients in practicum or internship experiences > Faculty member with Ph.D. > Faculty member > Anyone else
- Your Discipline Faculty Mentor (DFM) and Non-Discipline Faculty Mentor (NDFM) can be your references
- Professor who taught you classes, preferably upper level classes, may be other references.
- Letters from advisors, graduate assistants, teaching assistants, or research assistants *will not be considered seriously.*
- A letter from someone who directly supervised your undergraduate research is okay, but I would still ask the faculty supervisor to write a supporting letter.
- If you are applying to top schools, it is not a bad idea to ask the letter writers to attach their own CVs.
- Industry letters tend to be weak. You may have to let them know exactly what you would like them to highlight in the letter.
- Your McNair Director may serve as a third or fourth recommender.

# ***Applying for a* MS & *PhD* program:** Letters of Recommendation

- Ask: “Would you be able to write me a strong recommendation letter?”
  - ***Personal experience: I have been asked by students for a letter, been honest with them about what I would say in the letter, and they ultimately decided to ask someone else. They didn’t bother to ask the above question!!***
- Provide your resume and a paper/project that the faculty recommender awarded you an A.
- It is not a bad idea to give them a little blurb about what you would like them to include
- Give your letter writers a folder of documents with a picture (*maybe not necessary*)
- Give your letter writers sufficient time to write (*the day before will not result in a strong letter*).
- Letter writers can talk about your low subject GRE or GPA.
- Do not send more than the maximum number letters!!!
- [www.interfolio.com](http://www.interfolio.com)
  - ***Hiring by committee is challenging!***

# ***Applying for a MS & PhD program:*** Statement of Purpose

- The first third of a statement of purpose should focus on your educational achievement and academic interests.
  - Mention your research experience.
  - Highlight your skills.
  - Explain your career goals.
  - Do not overemphasize the instrumentation.
  - ***Remember that the beginning of a SOP is very important!***

# ***Applying for a MS & PhD program:*** **Statement of Purpose**

- The second third of a statement of purpose is where you sell yourself.
  - What is impressive about you? You should mention that you are a first-generation low-income student (FGLI) and/or that you are from a group underrepresented in higher education (URM).
  - Explain any gaps or discrepancies in your academic records.
  - If you have worked a lot during your college years, explain this as well.
- The last third of a statement of purpose is your conclusion.
  - Outline your future plans.
  - **Mention faculty with whom you would like to work. (Have you met any faculty?)**
  - Explain why you like the institution to which you are applying.

# ***Applying for a MS & PhD program:*** **Statement of Purpose**

- **In your conclusion, make sure to incorporate your interest in research with that of the institution to which you are applying.**
- Address what *they* want in the statement of purpose; it can vary by program and by discipline.
- Mention topics that interest you, when you became interested in them, and why.
- Explain how have you learned about your field of interest (classes, reading, seminars, work, etc.)
- **Mention at least two research members at the institution to which you are applying. Do not say that you want to work with them. Say that you want to work with researchers like them. Strengthen your statement further by reading recent publications by these people and mentioning that you have read them.**
- It is okay not to have clear idea as what you want to do. *Do not make things up.*
- *Do not exceed the maximum length! Translation: applicant can't follow directions.*

***It is very important to customize this part of the SOP.***

# ***Choosing a PhD program:***

## Questions to ask on visitation (brainstorm)

- Talk to everyone – faculty, students, staff

# ***Applying for a MS & PhD program:*** **Your Resume**

- If you are making physical copies, use plain white paper.
- Use a 12 point, legible typeface, 1" margins, and 1½ spacing
- Do not use any contractions.
- *Carefully* check and double-check grammar, spelling, and punctuation; *do not rely on spell check.*
- Be aware that many Ph.D. programs will require a Curriculum Vitae (CV) as opposed to a resume.

***The CSU Writing Center will be happy to help you in preparing a resume.***

# ***Applying for a MS & PhD program:*** Your Portfolio

- Resume
- Research papers
- Projects
- Group projects
- Lab reports
- Other significant graded work
- A picture of yourself (either on the outside or inside of the cover)
  - ***I never did this, but it can't hurt.***

***Remember to make all the suggested corrections on your reports.***



# ***Applying for a MS & PhD program:*** Rankings Matter (kinda)

There is probably not much difference between the #3 program and #11 program – but there a difference between the #11 program and #45 program - Check US News and World Report and ***NRC Rankings. (counter: my school wasn't even ranked)***

Sites where students can generate their own rankings of graduate schools:

<https://www.phds.org>

<https://collegescorecard.ed.gov/>

<http://graduate-school.phds.org/>

<http://www.petersons.com/Default.asp?ShowTab=gr>

Apply, at minimum to 10 schools – ***CAST A WIDE NET (unless you know what you want):***

**Top 3:** Your miracle choices; do not self-select out of these

**Bottom 3:** Schools to which you don't want to go, but which you are prepared to accept

**Medium 4:** Solid choices to which you should gain admission. ***Your DFM may be a valuable resource (This was VERY important for both mine and Dr. Wirth's situation - more on that later).***

Your list ***should depend*** on your grades, your GRE score, and your ECA.

# ***Acceptance to and Choosing a PhD program***

# ***Acceptance to a PhD program:*** **Offer Letter**

Most programs now will send out offer letters in December - February. The letter (hopefully) will contain **the amount** and **conditions of your stipend.** Engineering programs are typically in the ~\$20k - \$30k range. You will have until mid-April to make a decision on the offer.

# ***Choosing a PhD program***

This is one of the most important decisions that you will make (up to that point). For PhDs, your career is almost always dictated by ***where and/or for whom you did your PhD*** (unlike your BS).

***Graduate School Visitation***: Most departments (~top 30) now hold visitation weekends for all accepted students. ***If you can afford it, go!!!***

These weekends can be ***essential*** to choosing the right graduate program.

# ***Choosing a PhD program:*** Factors

- 1) **Number** and **Quality** of **potential advisors**  
determined from visitation weekend. May change if advisors are assigned prior to acceptance deadline.
- 2) Being comfortable with the culture and location – including the faculty, graduate students, and city.
- 3) Other resources, i.e. – how are other STEM programs ranked, how much collaboration is there?
- 4) Graduate placement
  - ***I come from a small school, but everyone out of my lab has a good job***

# ***Choosing a PhD program:*** **Advisor Selection**

- Pick someone that you could form a healthy working relationship with – this may not be someone that works exactly in the area that you thought you wanted – which is OK.
- How soon should you identify them? Seminars vs. Research rotations.
- Changing your advisor (not easy).
- Changing schools (not easy).
- Advisor's academic vs. personal reputations – **talk to students!**
- Future relationship with advisor.
- ***Personal: I picked my advisor over the school***

# *Choosing a PhD program:* Culture of Program

- You will more than likely be spending a majority of each day of your early and mid-20s in a single institution with similar people.
- **YOU NEED TO LIKE WHERE YOU ARE.**

# ***Choosing a PhD program:*** Other resources at University

- Academic resources – other programs in related fields, people that you could work with (but are not your advisor), core research facilities
- Professional resources – seminars, etc...
  - ***My school lacked these resources***
- Personal resources – Offices, campus facilities, **active graduate student associations**



# ***Choosing a PhD program:***

## Placement of Graduates

- Where do most graduates go to work? Certain programs have strong ties to corporate or academic labs – does this fit your plan?

## ***Choosing a PhD program:***

### Questions to ask on Visitation (Supplement Info)

- Talk to everyone – faculty, students, staff

# Doing a PhD:

## Dr. Wirth's story

- BS ChemE at SUNY Buffalo, Overall GPA ~3.78, Engineering GPA >3.9, Doesn't remember his GRE
- Multi-year research relationship with two well-known Colloid Scientists **(letters)**
- Very highly involved with student chapter of AIChE **(letter from dept. chair)**
- Internship as a researcher at local company
- Did not know what a PhD was until late in my junior year – **didn't really know where else to apply besides SUNY Buffalo.**

## My story

- BS ME at University of Denver, Overall GPA ~3.5, junior & senior year GPA >3.9, Don't remember my GRE (but it wasn't terribly high)
- Multi-year research relationship with an emerging biomechanics researcher **(letter)**
- Student athlete for two years
  - Multiple research projects after
- Internship at local orthopedics research company
- Did not know what a PhD was until my senior year
  - **Didn't decide to do a PhD until after my MS!**

# Doing a PhD:

## Dr. Wirth's story

- Applied to **Michigan, Princeton, Carnegie Mellon University, SUNY Buffalo, CWRU, MIT, Harvard Physics, UPenn.**
- (**Accepted & visited, Accepted & did not visit, Wait listed/rejected**)
- Probably should have applied to 3-4 more places – especially outside of my region.
- Picked the lowest ranked program (**of the 3 realistic options**) because he **felt CMU had the most options for potential advisors and he fit very well into the department's culture.**

## My story

- After my MS, I applied to **University of Denver & University of Washington,**
- (**Accepted & visited**)
- Probably should have applied to more places – especially outside of my comfort zone.
- Picked the lowest ranked program (**of the 2**) because **I knew I worked well with my advisor & thought I would have a better overall experience.**

# ***Doing a PhD:*** Questions?