Graduate Studies in the Sciences and Engineering: Opportunities in the United States

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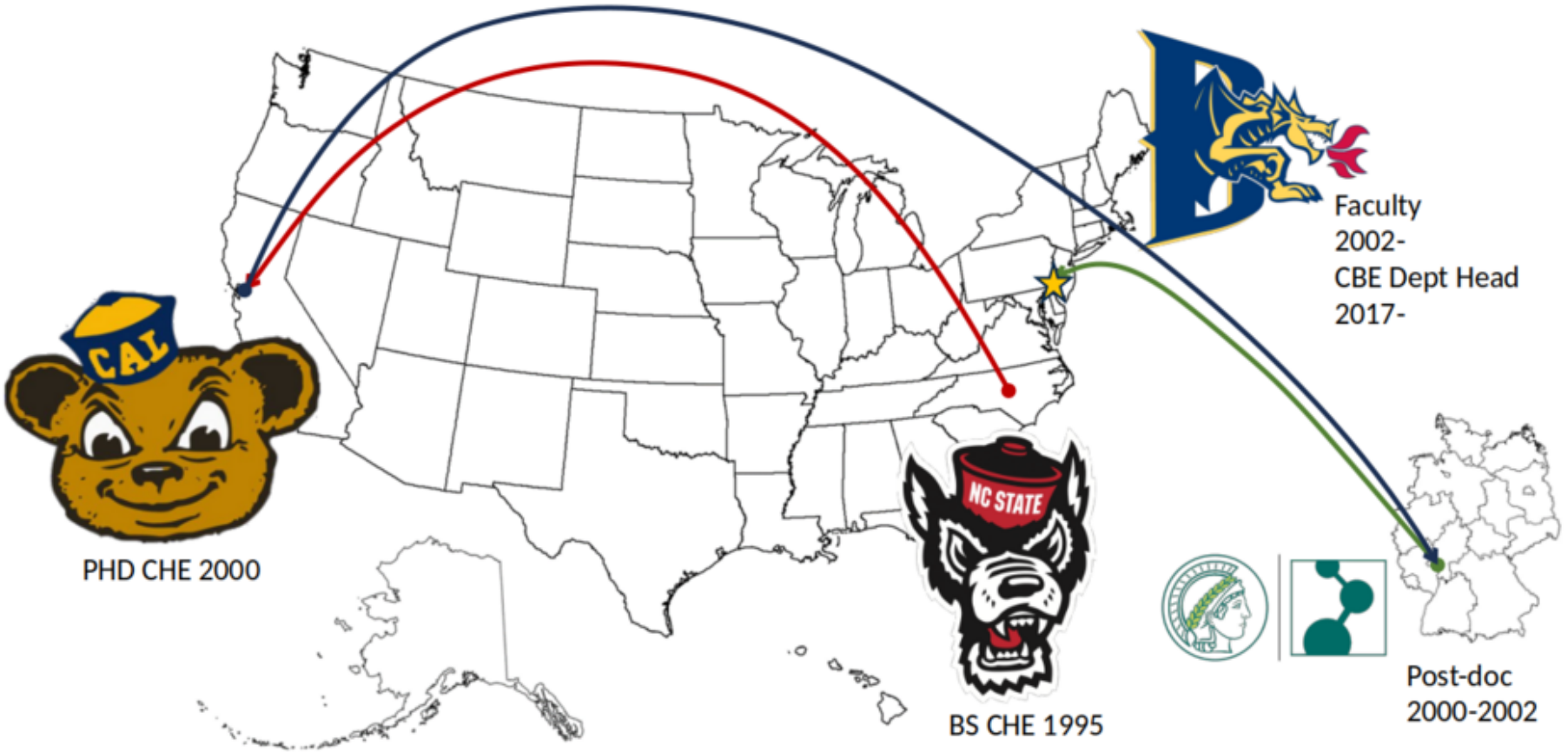
Outline

About me


CAL
PHD CHE 2000
NC STATE
BS CHE 1995
Faculty
2002-
CBE Dept Head
2017-
Post-doc
2000-2002

Some terminology

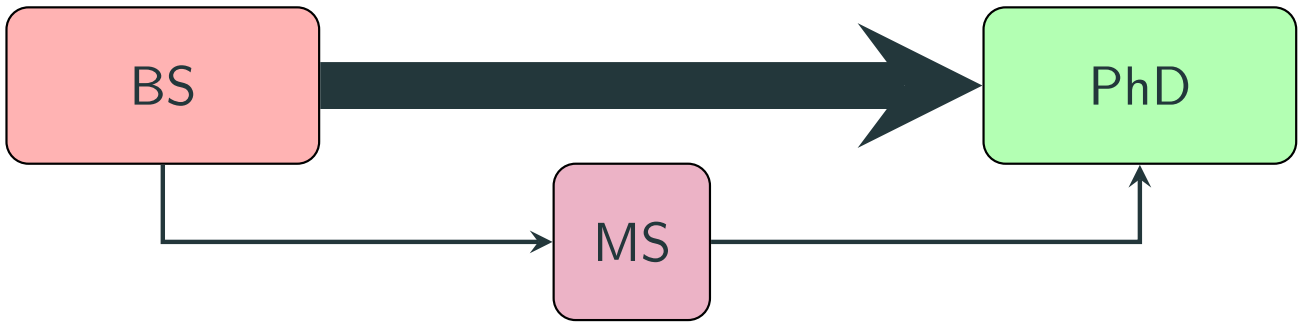
- **STEM**: Science, technology, engineering, mathematics
- **BS**: Bachelor of Science degree (Licenciatura)
- **MS**: Master of Science degree (Maestría)
- **PhD**: Doctor of Philosophy degree (Doctorado)
- **ScD**: Doctor of Science degree (uncommon)

Introduction

Why am I talking to you?

- The world needs more STEM PhDs (except from computer science)
- Hundreds of STEM PhD programs in the US depend on a steady supply of well-prepared and talented students
- STEM undergraduates from Latin America are usually exceptionally well-trained and well-qualified for graduate school
- Latin Americans are underrepresented among international students in the US (since 90% of international students are from China and India)
- Argentines are underrepresented among non-US students from South America
    - Fun fact: As a share of national populations, Brazil has 12% more international students in the US than Argentina (BRA 73 ppm - ARG 68 ppm), but only 2% more head-to-head goals (BRA 166 - ARG 162) (includes unofficial matches)
- We would love to see more applicants to US PhD programs from Argentina

Typical STEM Degree Pathways in the US

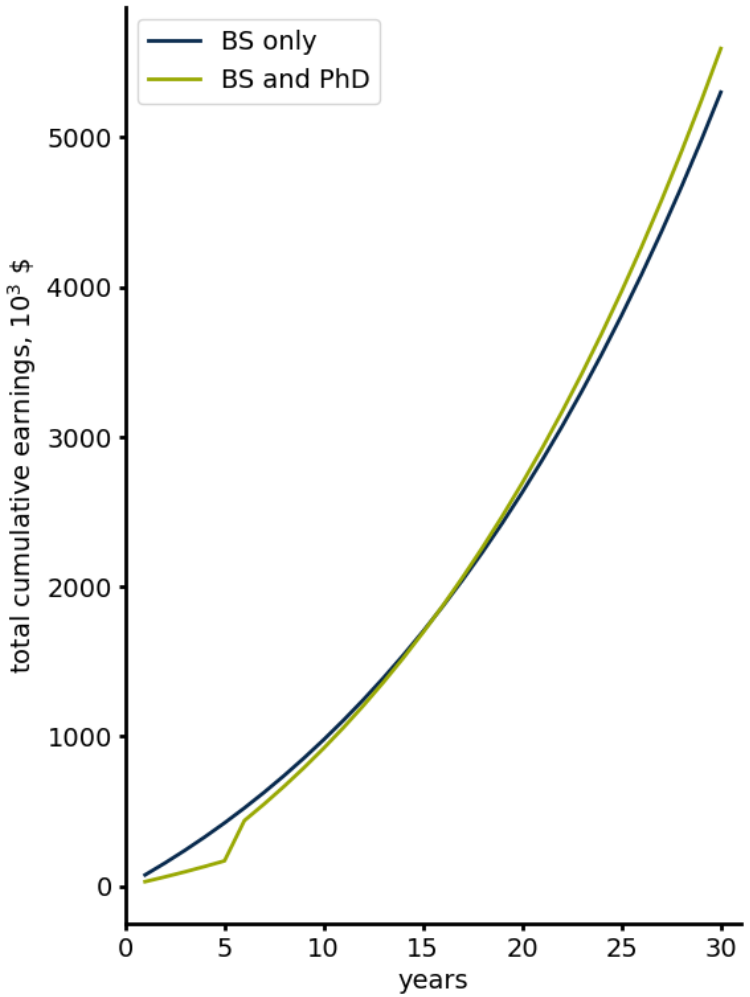


- Most applicants to PhD programs come straight from the BS
- Most PhD students never earn an MS
- Some programs offer the MS as a "consolation prize" for PhD students who fail to progress in research
- Applying with an MS can be advantageous if you received it directly and not as a consolation prize from another program

MS vs PhD: An Incomplete Comparative Analysis

	MS (w/o thesis)	MS (w/thesis)	PhD
Duration	1-2 y	1-3 y	4-6 y
Who pays who?	You pay institution	You pay institution	Institution pays you
What are you trained for?	Not much	Help w/ existing research project	Conduct your own independent research
Why do it?	A bit more pay	Try research (& more pay)	Advance humanity's knowledge

Why earn a PhD? It is NOT all about the money



Assumptions

- BS starting salary $75,000
- PhD starting salary $100,000
- PhD stipend $30,000
- Average interest rate 3%
- 30 y career

Things to know about the process

PhD Programs

- One typically applies directly to a "program"
- A "department" can have one or more programs
- A "college" or "school" typically comprises multiple departments
- A university has multiple colleges or schools
- A university will also typically have two special divisions:
  - a "graduate school" that
    - oversees all graduate education at a university;
    - handles all incoming applications;
    - determines what is required on applications; and
  - an "international students/scholars office" that handles all university immigration responsibilities

PhD Program Advisors and Committees

- Programs typically have one person in charge of PhD admissions; titles for such a person include
  - "graduate program advisor";
  - "graduate chair";
  - "associate department head for graduate studies";
  - "grad advisor"; or
  - "graduate recruiting advisor"
- Program advisors are responsible for setting the program's PhD enrollment target each year, based on open or pending positions in each professor's research group
- PhD applications are reviewed by a committee of 3-5 faculty chaired by the graduate program advisor
- It is a good idea to know who the graduate program advisor is for any program you apply to

Choosing a Program

- Choose programs based on the disciplinary home(s) of the research topics that interest you
- Most research topics "belong" to more than one program
- Faculty with primary appointment in a department that does not house a particular program can often advise students in that program (I can advise students in Biochemistry, for example)

PhD Program Requirements (Requisitos)

Most STEM PhD programs have a common set of requirements:

- "Core" courses
- Teaching assist (TA) duties; 1-4 courses in total
- Examinations
  - "Qualifying" exam: candidates demonstrate capability to ask an original research question and design a research program to answer it; usually in year 1 or 2
  - "Defense": candidate defends their dissertation

STEM PhD research advisors determine:

- Overall research directions
- Elective or concentration courses

PhD Application Fees

- Most universities require applicants to pay a fee to apply (US$10-100)
- Fee payment is usually the last checkpoint after which the university lets graduate program advisors "see" applications
- Many programs waive application fees; if it is not clear, then ask the grad program advisor!

PhD Program Application Management

- Most programs begin evaluating applications late in Fall terms (before December), even if their deadlines are much later
- Most offers are made between December 1 and April 30 for PhD positions beginning the following September
- Getting applications in early in this process is a good idea – try for October or November of your final undergraduate year
- Programs often reach out to international applicants for pre-decision interviews – this means they are very interested in you
- If you accept another offer, it is considered polite to inform other places you have applied so they stop bothering you

Preparing your application

PhD Application Major Components

- Transcript (your grades)
- Proof of Test of English as a Foreign Language (TOEFL)
- Personal Statement
- Letters of Recommendation

Some thoughts about transcripts

- Most applicants have very good transcripts, mostly A's
- B's or C's are not necessarily going to lead to a rejection; depends on
  - what courses they are in; if math, chemistry, physics, or major courses, this is somewhat concerning;
  - when they occur; early is OK, late is not so good
- Elective courses that show your interests can be a plus

TOEFL: Does it matter?

- Most applicants from non-English-speaking countries have high TOEFL scores
- There is significant concern among most program advisors that there is inflation in these scores
- TOEFL is not typically used to rank applicants
- However: the TOEFL score is an absolute requirement for applicants from non-English-speaking countries.

Your Personal Statement: Some Guidance

- It is important! Put real time into writing it
- Describe
  - what motivates you to pursue a PhD (e.g., career goals and/or research)
  - what research topics you are particularly interested in and why;
  - what professors in the program look most interesting to you
- Try to keep it under one page, 11 pt font
- Don't worry if your English is not perfect; we are looking past English mistakes for clarity of expression
- Do not use ChatGPT or any other generative AI tool. We see this a lot and it is easy to spot (so far).
- Professors and mentors at your undergraduate institution should be happy to review drafts of your statement (I do this for every Drexel senior who asks)

Recommenders

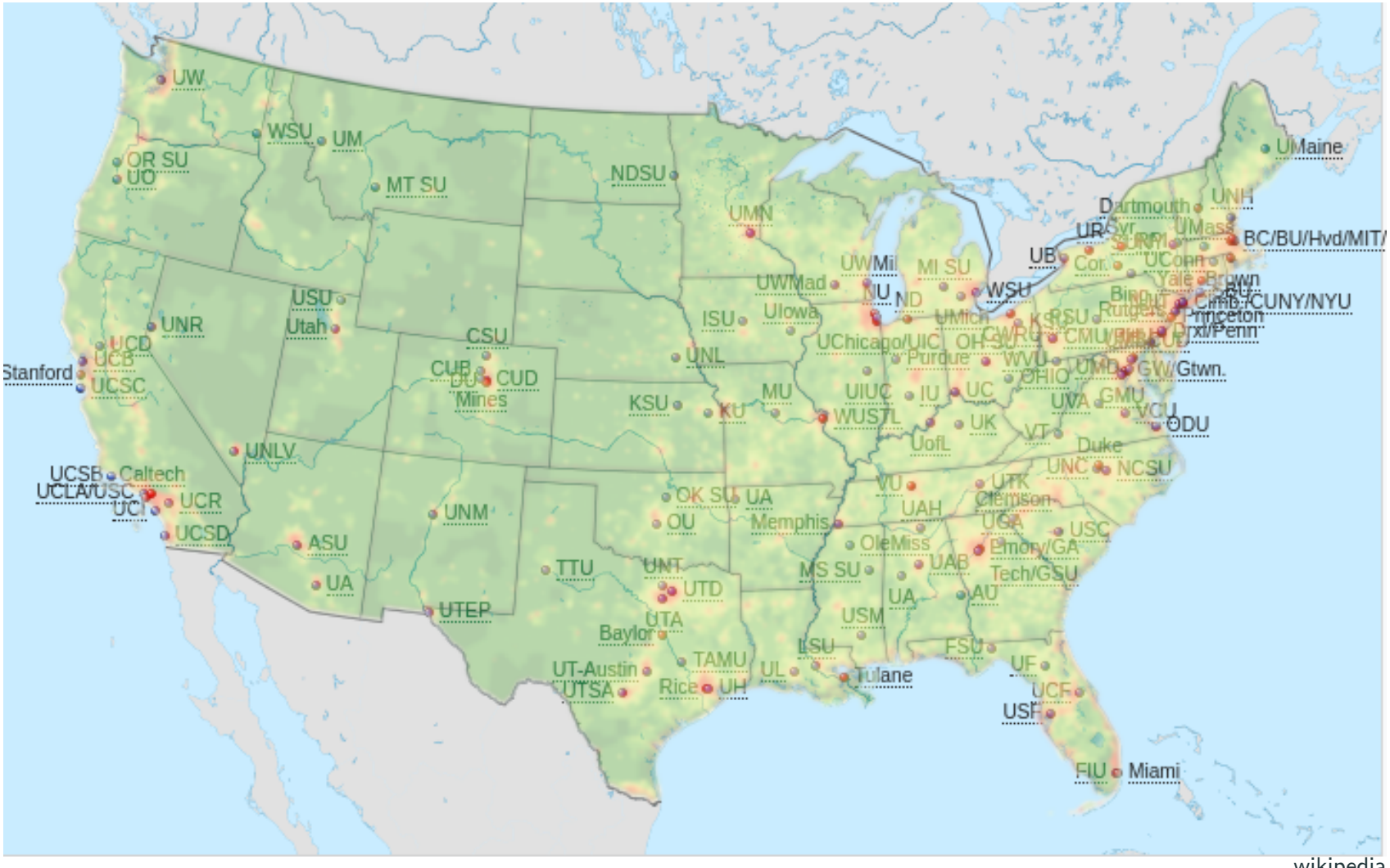
- Three to five professors who can say nice things about you
- You provide contact information and the application system makes the letter requests directly
- Be sure to ask each one if they are willing to be a recommender, and inform them of what programs you are applying to
- If possible, meet with each one specifically to discuss your application plans; they may have good advice.
- Avoid asking job supervisors, post-docs, grad students to be recommenders
- A letter from an undergraduate research advisor is highly recommended

Undergraduate Research Experience

- Most STEM PhD programs in the US highly value undergraduate research experience in applicants
- Meaningful undergraduate research experiences provide a lot of inspiration for personal statements
- Getting your name among the list of authors on a publication can be very valuable, but only if you can clearly describe how you contributed
- Undergraduate research can compensate for less than stellar grades on your transcript

Recommendations on where to apply

Carnegie "R1" Doctoral Universities



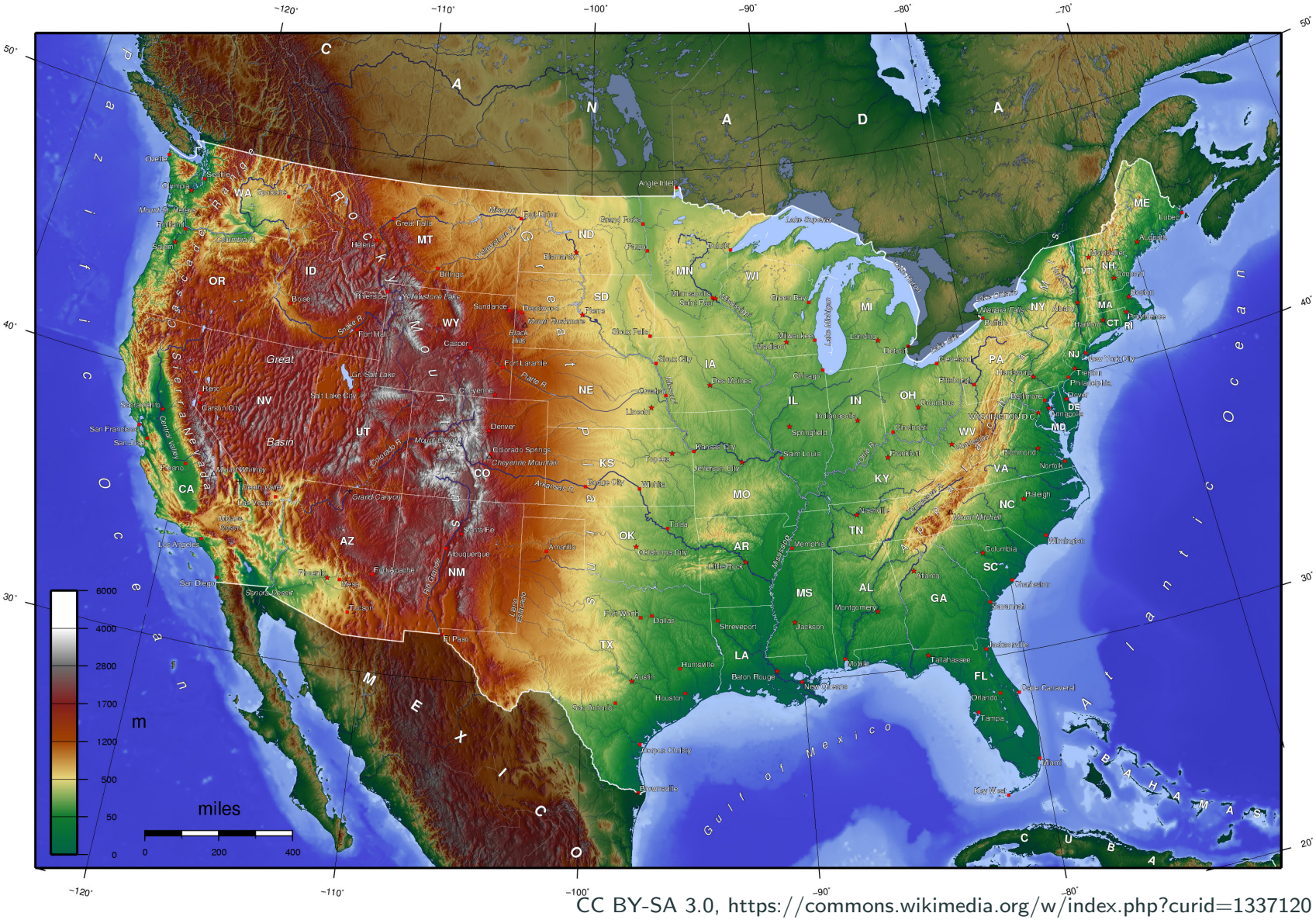
wikipedia

Google "list of US research universities"

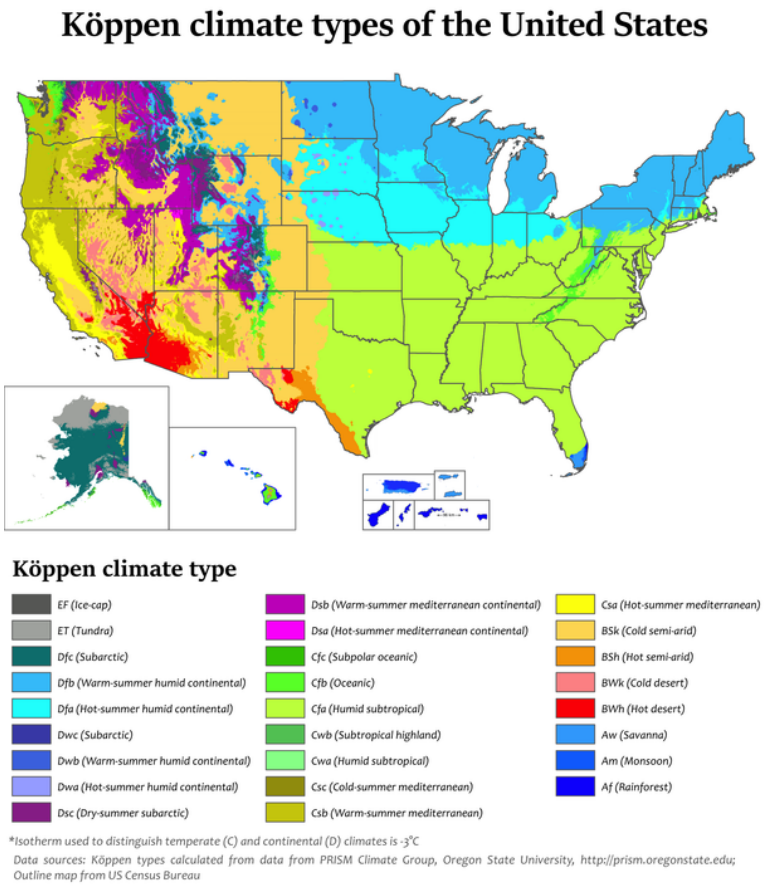
Make a List!

- Wikipedia: List of US Research Universities
  - There are 146 R1 universities in the US
  - Pick $\sim$10 based on location to investigate to see if they have a program for you
- Talk to your professors; they may have direct knowledge of US institutions and programs
- Log into online "open houses" from programs, departments, or colleges. Sometimes these are live and sometimes pre-recorded.
- Stay organized!

Geography is (probably) important



Geography: Some Tips



- Where are you willing to live for 5 years?
- What is important to you outside of school?
- Outdoor activities?
- A vibrant urban culture?
- Peace and quiet?
- Never seeing a single snowflake?

Some Words about "Elite" PhD Programs

- US News and World Report ranks graduate programs based **solely** on reputation score (voting by department heads)
- For example, in 2024 the top 10 for Chemical Engineering are:
  1. MIT
  2. UC Berkeley, Caltech, Stanford (tied)
  5. Georgia Institute of Technology
  6. University of Minnesota
  7. University of Delaware, Princeton, University of Texas (tied)
  10. University of Michigan
- Non-US applicants are often overlooked by elite programs unless
  - A faculty member
    - has direct knowledge of an applicant's institution; and/ or
    - is from an applicant's country; or
  - There is history of strong students from an applicant's institution
- Elites essentially never waive application fees
- Elites often do not recognize credit in graduate courses from other institutions (no MS advantage)

After you apply

Application outcomes

The first outcome of every application you submit is one of three possibilities

- Rejection
- Waitlist placement
- Offer

We typically reject applications because:

- Missing some necessary component ("incompletes")
- Weak grades in important technical courses
- No undergraduate research experience
- No letter of recommendation even though there is research experience
- Poor quality personal statements
- Lack of good information on the applicant's home institution

The Waitlist

- Applications that are acceptable but rank below the topmost applicants in one or more metric
- Applications are ranked on the waitlist
- Any offer that comes back as not accepted opens up a slot for the next applicant on the waitlist
- Once the number of acceptances is met, the waitlist is dissolved and all applications on it are rejected
- An acceptance in one program is almost infinitely better than a waitlist placement at another, even if the waitlist institution is "better"

Offers

- First-round offer letters can go out as early as December
- Offer response deadline: 2 weeks (typical)
- Elements of offer:
  - Start date (usually Sept. 1)
  - Stipend level and stipend yearly increase rate
  - Description of health insurance benefits or options
  - (Maybe) Potential research advisor assignment
  - Any signing bonus, fellowship, or scholarship
  - Requirements to remain "in good standing"
  - Things that might get you kicked out

Offers can come out of sync!

- You may get an offer from one institution before you know your application status at another. What do you do? My personal recommendation:
  - Take the offer! You should not apply to a school whose offer you would not seriously consider
  - Let other place you have applied to know so they can drop your application

Competing Offers: What to do?

- Consider:
  - Availability of several potential research projects
  - Stipend level
  - Any bonuses or scholarships
  - Any contact you have had with faculty in the program
- Last and most important: if one of the competing offers is from Drexel, come to Drexel!

Some particulars about Drexel University

Drexel University

- Private R1 research university with strong programs in engineering and medicine
- 13,000 undergraduate students and 6,000 graduate students ($\approx$1,000 PhD students)
  - Large for a US private institution
  - Small compared to UNC and UTN!
- Located in the city of Philadelphia
  - 7th largest metro area in the US ($\approx$ 2,000,000 people)
  - 1 h from NYC, 2 h from Washington DC
  - Home to four major research universities (Drexel, UPenn, Temple, Thomas Jefferson; $\sim$ 87,000 total students)
  - Rapidly growing biotech sector

Drexel Chemical and Biological Engineering (CBE)

- 12 tenure-track faculty
- Cohorts of ≈6-10 PhD students per year
- Research strengths:
  - Electrochemistry (batteries, solar cells)
  - Materials
  - Molecular theory and simulation
  - Polymers
  - Immunoengineering
- CBE waives all PhD application fees
- Our faculty have courtesy appointments all over Drexel, including in chemistry, materials science, physics, biochemistry, biomedical engineering, and more

In conclusion...

Concluding Thoughts

- There are many opportunities for STEM PhD programs in the US
- Find out who the grad advisors are and ask them questions! (Drexel CBE: Prof. Joshua Snyder, jds43@drexel.edu)
- Argentine students will make very competitive applicants to most programs, especially students from UNC and UTN
- Did I miss something? Let me know: cfa22@drexel.edu