

# How to expand your research profile

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Cornell Tech  
@2plus2make5

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CS 6006: Succeeding in the Graduate Environment  
August 28, 2023

# Outline

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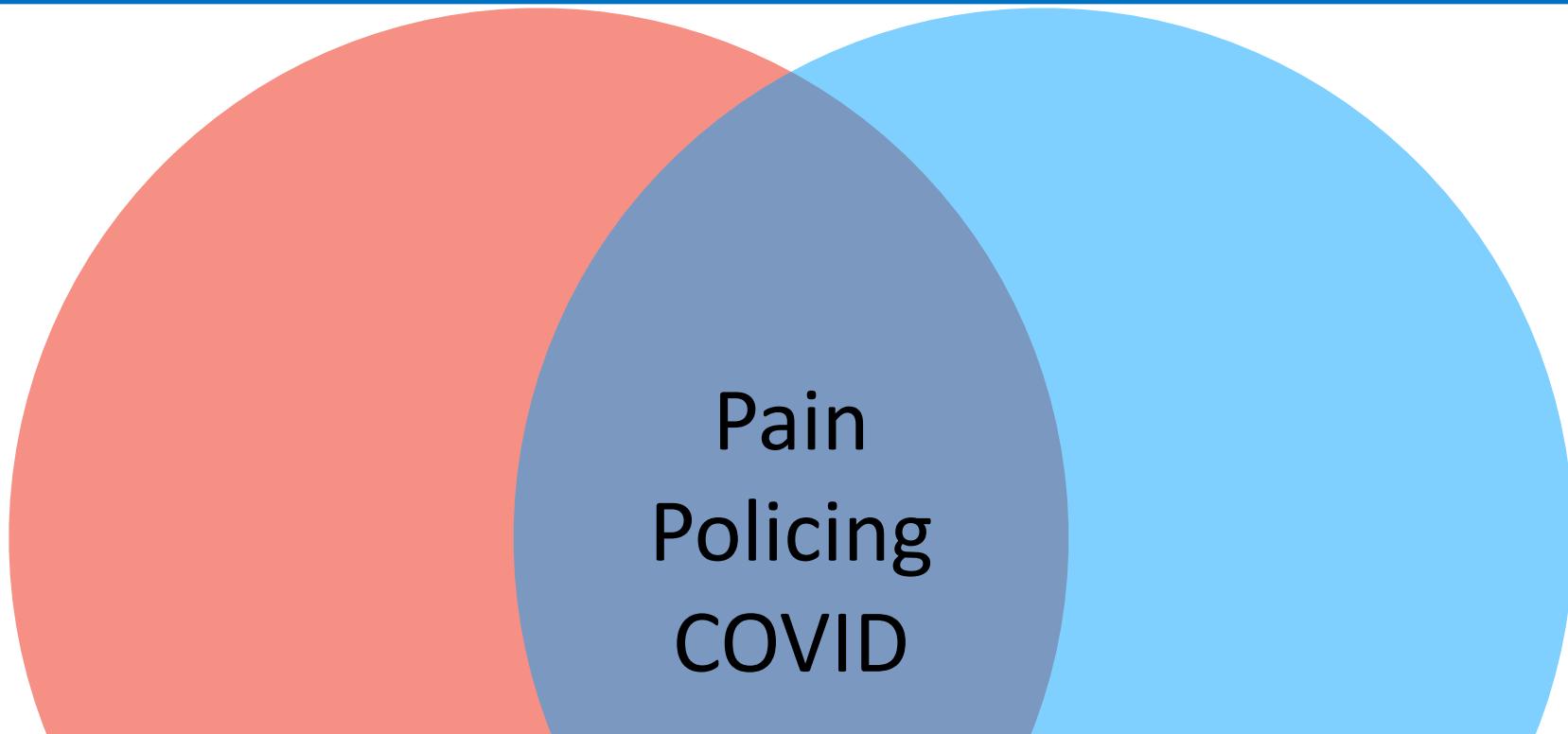
- **Context:** how I got here
- **People tips:** how to find (and work with) interdisciplinary collaborators (and yourself)
- **Research tips:** generating research ideas

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# Context

# I use AI and data science to

## Reduce inequality   Improve healthcare

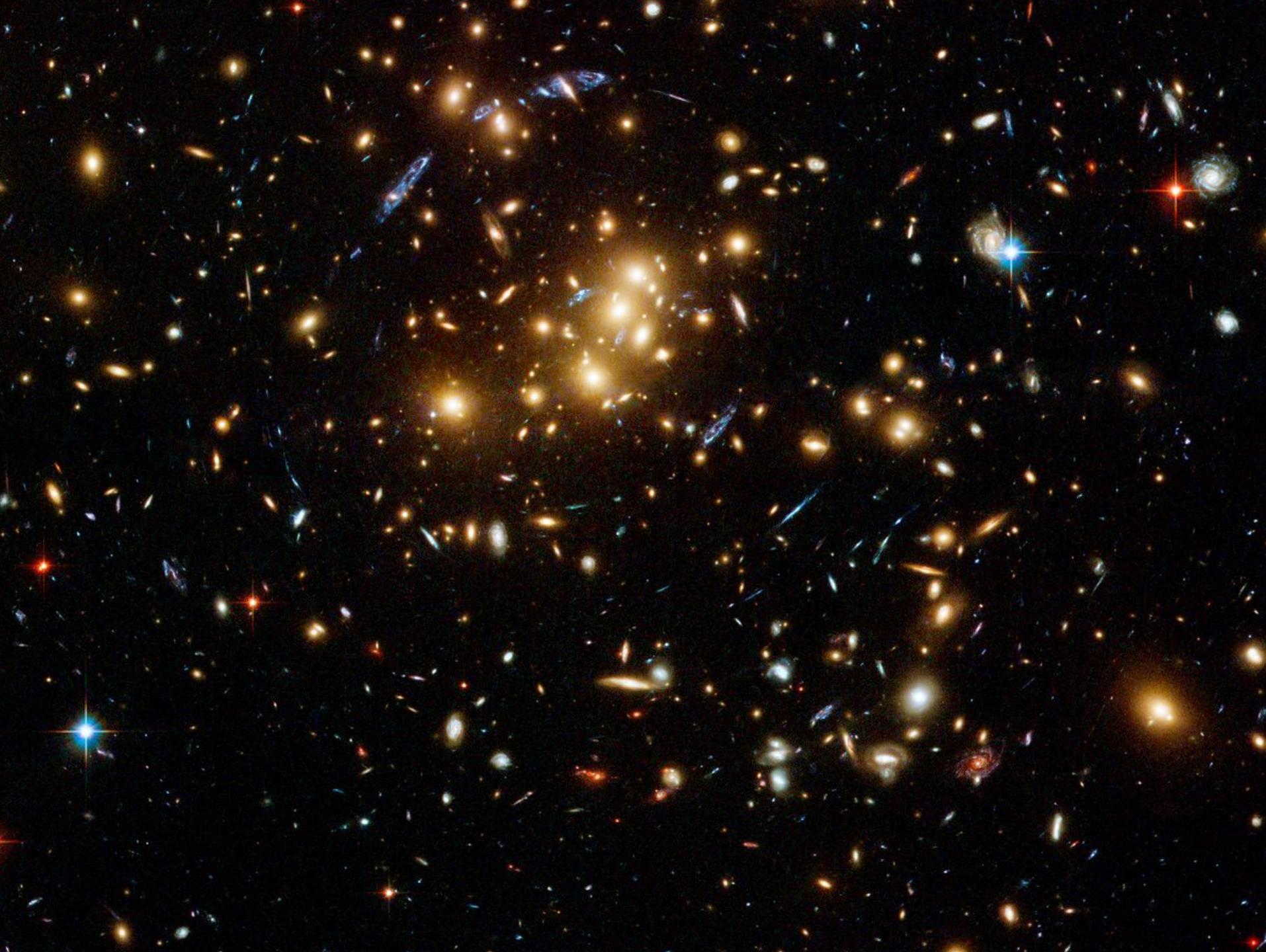


[1] **Pierson**, Cutler, Leskovec, Mullainathan, and Obermeyer. An algorithmic approach to reducing unexplained pain disparities in underserved populations. *Nature Medicine*, 2021.

[2] **Pierson**, Simoiu, Overgoor, Corbett-Davies, Jenson, Shoemaker, Ramachandran, Barghouty, Phillips, Shroff, and Goel. *Nature Human Behaviour*, 2020.

[3] Chang\*, **Pierson\***, Koh\*, Gerardin, Redbird, Grusky, and Leskovec. Mobility network modeling explains higher SARS-CoV-2 infection rates among disadvantaged groups and informs reopening strategies. *Nature*, 2021.





**CONFIDENTIAL**



**Multisite 3 BRACAnalysis®**

**Three Mutation BRCA1 and BRCA2 Analysis for Ashkenazi Individuals**

**MYRIAD®**

**PHYSICIAN**

**SPECIMEN**

Specimen Type: **Buccal Wash**  
Draw Date: **Nov 22, 2011**  
Accession Date: **Nov 25, 2011**  
Report Date: **Dec 01, 2011**

**PATIENT**

Name: **Pierson, Emma**  
Date of Birth:  
Patient ID:  
Gender:  
Accession #:  
Requisition #:

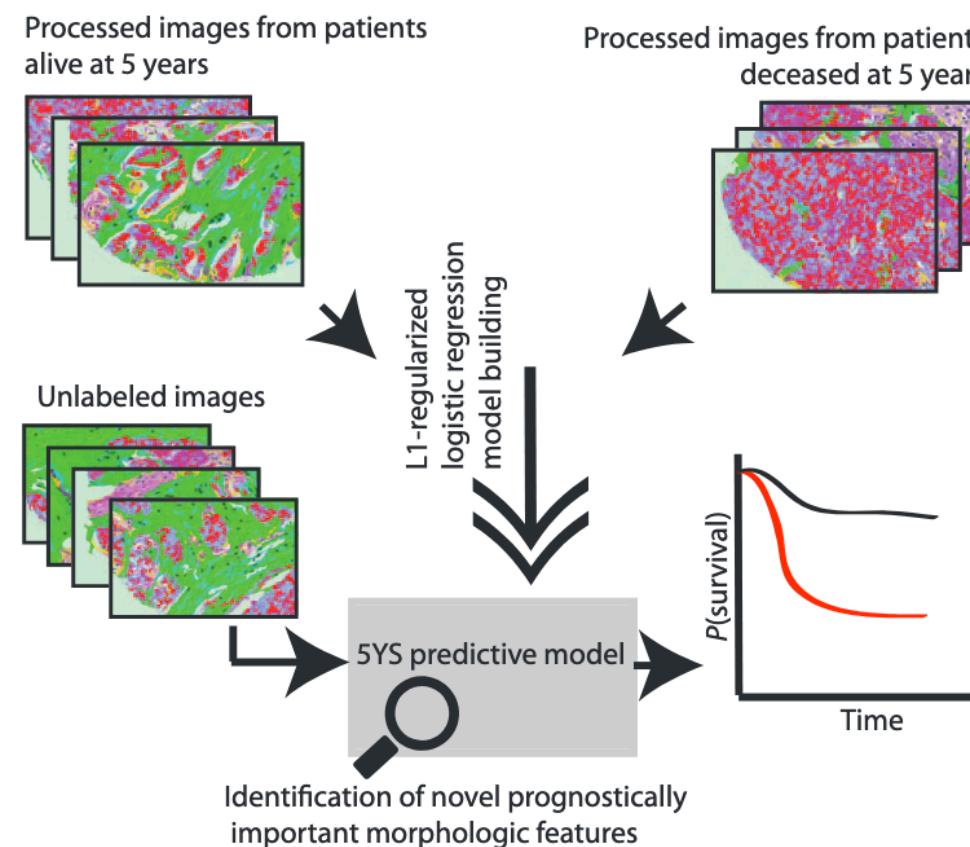
**Test Results and Interpretation**

**POSITIVE FOR A DELETERIOUS MUTATION**

## IMAGING

# Systematic Analysis of Breast Cancer Morphology Uncovers Stromal Features Associated with Survival

Andrew H. Beck,<sup>1,2\*</sup> Ankur R. Sangoi,<sup>1,3</sup> Samuel Leung,<sup>4</sup> Robert J. Marinelli,<sup>5</sup> Torsten O. Nielsen,<sup>4</sup> Marc J. van de Vijver,<sup>6</sup> Robert B. West,<sup>1</sup> Matt van de Rijn,<sup>1</sup> Daphne Koller<sup>7†</sup>





## Frustrated U.S. FDA Issues Warning to 23andMe



By [Kelly Servick](#) | Nov. 25, 2013 , 5:30 PM



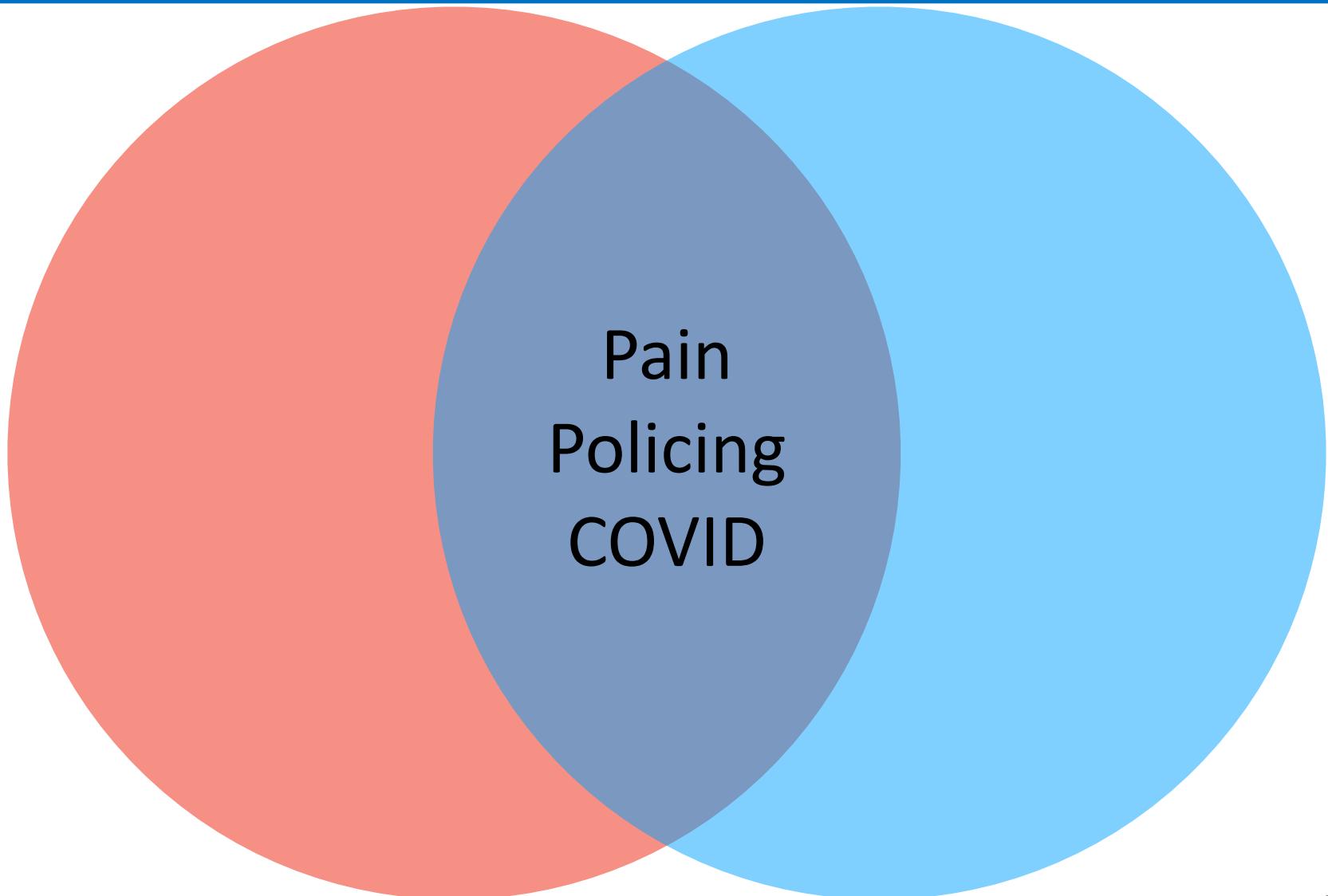
The U.S. Food and Drug Administration (FDA) is cracking down on DNA testing company 23andMe for the marketing of its Personal Genome Service (PGS). In a 22 November [warning letter](#) addressed to CEO Anne Wojcicki, FDA demanded that the Mountain View, California-based company stop selling its \$99 testing kit, which uses a sample of a buyer's saliva to identify genetic variants linked to more than 240 "health conditions and traits," until it receives FDA authorization.



Emma Pierson. Seeking a cancer-free world. *The New York Times*, 2015.

# I use AI and data science to

## Reduce inequality   Improve healthcare



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# Finding and working with (interdisciplinary) collaborators

Being good technically is important.  
But non-technical skills are really important too.

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- Writing, speaking, listening, managing: the more senior you get, the more important these skills become
  - E.g., as a PhD student, the ability to concisely + precisely explain what you did, in a paper or a meeting, is invaluable (and difficult)

# It helps to have a common language

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- One reason I like working with economists: we both speak math, but slightly different math
- Philosophically, we share a focus on quantitative evidence
- Philosophically, I like the rigor with which they approach questions

# Be patient and curious

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- You are going to have trouble understanding each other
  - Spanish/Portuguese
  - Automatic cognitive load/  
slight headache of translation

# Be patient and curious

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- You will not know things they find basic (and vice versa)
- Key is to *not assume the other person is an idiot* when this happens
- Stay open, stay curious
- Focus on what they know that you don't

# Asking dumb questions is a fast way to learn

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- But power dynamics affect who can ask dumb questions!

# Keep incentives in mind

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- Compared to, say, economists, computer scientists (mostly) don't write hundred page papers
- Nor do we take 5 years to publish them
- We also have different authorship norms
- How can everyone win?

# Work with nice people

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- #1 thing I wish I had done earlier
- Particularly true if they're going to have power over you
- If a friend, colleague, or supervisor makes you feel systematically bad about yourself, get away from them

# 6 tips for working with nice people

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- 1. No one is so brilliant they're indispensable
- 2. Work with the same people repeatedly (less risky, become friends, encourages repeated-game behavior)
- 3. To the extent possible, privately vet people before giving them long-term power over you
- 4. (If you are a minority) Pay attention to whether someone collaborates repeatedly + successfully with members of your group
- 5. Value good mentors! (And let them know their mentorship matters)
- 6. Pay attention to vibes in initial meeting.

# Be nice yourself

- Not just for moral reasons; for *professional* reasons
- The world is small; life is long
- Collaboration is positive-sum
- PhDs are not competitive



Koh Pang Wei <koh.pangwei@gm... Sun, Jan 18, 2015, 5:02 PM

to me ▾

Hi Emma!

Somewhat random note, but...

I just read your article in the NYT from a couple of years ago on carrying the BRCA1 mutation. It was a really poignant read; thank you for sharing that part of yourself. I just wanted to send along good wishes and tell you that I found your piece powerfully moving. I hope you're doing well!



ISMB 2017



ICML 2020

AISTATS 2019

Nature 2020

KDD 2021

ICML 2021

# Be nice yourself

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# What does it mean to be “nice”, academically?

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- Examples:
  - If you like someone’s work, let them know
  - Make people feel like they have a right to be in the room
  - Be mindful of how much you/others are talking vs listening
  - Be gentle when people screw up. People are more fragile than they appear.
  - Be cautious on Twitter
  - Be generous with credit: err on the side of coauthorship, always discuss coauthorship with people
  - Be humble

# Be nice to yourself too!

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- You can survive and get a lot done if you are miserable, for a time
  - But in the long term you'll burn out
  - And it's very hard to do brilliant/creative work
  - And also, do you really want to live your one life miserable?
- While research sometimes entails doing things which conflict with your *short-term* happiness, I feel strongly that **it should not come at the expense of your long-term happiness**

# Be nice to yourself too!

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- PhD can be tremendously exciting, but it can also be stressful, volatile, and frustrating
  - Research is hard!
  - People are hard!
- Evidence shows high rates of depression and anxiety among PhD students

# Be nice to yourself too!

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- Pay attention to your feelings, and learn what you need to be happy/resilient (individual-specific)
  - Some people need deadlines, some people hate them
  - Some people like getting things done early, some go down to the wire
  - Some people work from 9-5, some people work from 2-10
  - Some people like working while listening to Taylor Swift, and some people are wrong
- It's ok/normal to have days or weeks where nothing gets done. The key is to NOT letting guilt about that lead to months where nothing gets done.

# Be nice to yourself too!

- Things I need to be happy:  
social connections (esp.  
partner/family), writing, cats,  
music, time in nature, work,  
managing essentials (sleep/  
food/exercise)
- Try to keep yourself happy  
while you work! I do often  
work on Sundays, but I do it  
with a mocktail



# Productivity tips

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- Work schedule: I work (at least a bit) 7 days a week, but not particularly long hours (probably 50-55 hours a week)
  - Know when you do your best thinking
  - Working when exhausted is very inefficient, sometimes worse than useless
- I don't work when I'm really tired
- I do not pull all nighters (including before paper deadlines)
- I frequently get distracted by messaging and social media
- I don't use productivity apps (I tried, they don't help me)

# Your family/friends can also be your colleagues



The New York Times

OPINION  
GUEST ESSAY

## Genetic Risks for Cancer Should Not Mean Financial Hardship

Nov. 26, 2021

By Leah Pierson and Emma Pierson

The Piersons are sisters with a family history of breast cancer.

# Colleagues/brain trust

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- You want brilliant colleagues/friends who will make you feel slow sometimes! They will make you better at what you do.
- You want them to bring diverse perspectives you haven't thought of
- Try to let go of any need to be “the smartest person in the room”

# Colleagues/brain trust

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- They tell me which ideas are worth pursuing
- They edit my writing
- They keep me from doing anything too stupid
- They guide me at professional turning points
- They give my guest lectures
- Overall, they do a lot of my thinking for me

# Mentors

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- Don't just have to be in your demographic group
- Don't just have to arise through formal mentorship programs
- Provide so many things! Advice, projects, data, jobs, opportunities, encouragement, introductions...
- Reach out if there's someone you admire.  
Not: “can you mentor me”. Just: “can we chat”.
- If someone has a reputation as a good mentor, value that.
- Let people know their mentorship matters.

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# Generating and choosing research ideas

# It's okay to not know exactly what you're going to research right now

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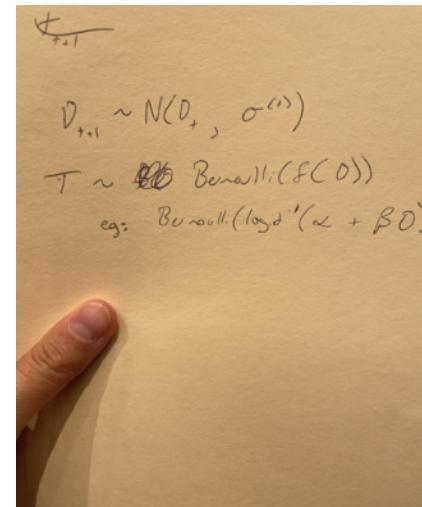
- You are not expected to know the grand narrative of your PhD (or your job talk) early in your PhD (and frankly I still feel like I'm faking it a lot of the time)
- If you keep working on things you're enthusiastic about, with some eye to coherence, a narrative will emerge
- You also do not have to do exactly what you did research on in undergrad
  - You know little relative to what you will learn
  - This sounds like a Yoda quote

# Passion/excitement helps

- A senior academic told me recently: it's very hard to do what we do at a really high level unless you're excited about it



I don't work (much)  
on deep learning interpretability  
cuz this guy just cares more than I do  
(Chris, not the frog)



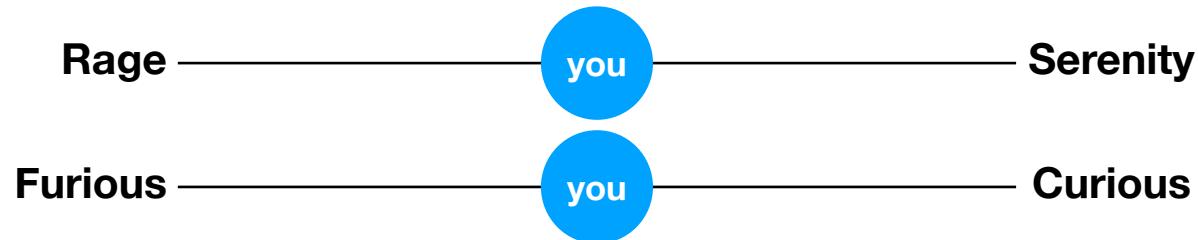
But I love writing down  
Bayesian models

# Passion/excitement helps

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- Heuristics:
  - What papers do you look forward to reading?
  - What problems does your mind obsess over?  
(Don't actually work all the time...but take signal from the things your mind naturally jumps to thinking about all the time)
- Caveat: sometimes data science (and publishing papers) involves a fair bit of annoying grunt work, even for worthy projects! You don't have to love what you're doing all the time.

# Another heuristic: the point between rage and serenity



# Another heuristic: the point between rage and serenity

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- Why do I study health?
  - **Rage**: “There are dozens of questions that have not been answered, have not EVEN BEEN RESEARCHED, and this hubris enrages me. I guess what I demand is that they, in their pristine white coats, should look down and see the blood on their hands, should feel some of the agonized ambivalence that I do.”
  - **Serenity**: a domain with high-dimensional, multimodal data which humans can’t parse but computers can

# Keep a curious and skeptical mind... and talk to people about your ideas

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Emma Pierson <emmap1@cs.stanford.edu>  
to [redacted]

Tue, Nov 16, 3:56 PM (3 days ago)   

Don't know if we can get this data, but I think would be cool to study disparities not just by patient race but also by income/education/occupation. Was just at the doctor and it's always striking to me how much more fully they explain things once they know you're a professor. Just a random thought.

# Keep a curious and skeptical mind... and talk to people about your ideas

**Friend: expert on healthcare**

Says MSK is a good place to be treated  
because it's the top choice of many  
medical residents



**Friend: expert on  
matching markets**

so I am wondering, could we  
actually use this to do  
hospital rankings

Because if the best people  
go to MSK, I want to be  
treated at MSK too

Or at least, this feels  
informative

like basically the two-sided  
market can serve another  
function

# Keep a curious and skeptical mind... and talk to people about your ideas



[◀ All Medical Info](#)

## Test Results and Reports

You can now see imaging results (such as PET, MRI and CT scans) and most pathology results 2 business days after they are entered into our computer system. Screening mammography and screening breast ultrasound results will appear in MyMSK the same day or on the following business day.

If you're worried your results may be upsetting or confusing, you may choose to wait until your healthcare provider contacts you. You decide the best time to view your results.



WELL | Knowing You Carry a Cancer Gene

I know there are some things I do not want to know: which other girls my boyfriend finds attractive or the day and manner of my death. The truth can hurt in two ways. It can worsen your options: you can't live as happily with a significant other after learning of his infidelity. Or it can make you irrational: hearing about terrorists targeting airplanes may lead you to drive instead of fly, though planes remain much safer than cars.

# Keep a curious and skeptical mind... and talk to people about your ideas

To: Shengwu Li

so let  $X$  be your believed probability you have a disease

wait

and you get some psychic benefit/cost  $v(X)$

Is it the true binary state  
Or is it yr believed probability  
These are not the same thing

ah i am abusing notation badly

Yes you are

let  $X$  be the state and let  $p$  be the belief

$v(p)$

Ok. So  $x$  is binary  
And  $p \in [0, 1]$

$x$  is binary (though it doesn't matter)

$p$  is in  $[0, 1]$

and your 'news utility' is  $v(p)$ .

ok.

the thing is, whenever you get a signal and update your beliefs, when  $v$  is linear we have  $E[E[v(p) | \text{signal}]] = v(E[p]) = v(p)$ .

Oh I see sure.

# Reading papers to get ideas

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- Sources of papers (suggested by Nikhil Garg)
  - Twitter (but be intentional about whom you follow)
  - Subscribe to (relevant) mailing lists
  - Subscribe to specific people on Google scholar whose research you like
  - Skimming proceedings for relevant workshops
  - Skimming syllabus of relevant PhD classes
- Advice for reading papers:
  - Pranav Rajpurkar: <https://docs.google.com/document/d/15pnUpD47S6mAM-g4fwQvc2kIYlb-GKgWex1oOlmNjvg/edit>
  - Mert Sabuncu: <https://twitter.com/mertrory/status/1581348089847173120>

# “Academia is a max function”

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- In other words, people won't remember the 17th most important paper you wrote; they remember the 3 most important papers you wrote
- So you do want to work on at least *some* projects which could be high-impact if everything works out
- On the other hand, since these can be high-risk/high-reward, not everything should be like this

# Filtering ideas

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- **Are others excited about the idea?**
  - Technical experts?
  - Domain experts?
  - Laypeople?
- **Am I *viscerally* excited about the idea?**
  - “24-hour rule”
  - Have I had the idea for a long time?
- What’s the ceiling on the idea?
- Is there a path to real-world impact?
- Why would I do this better than others?
  - Do I have data they don’t?
  - Do I have technical comparative advantage?  
(Idea should “require a computer scientist”)

# If there's no downside but rejection, do it

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- No one sees your failures
- Many of my papers/essays have been rejected multiple times
- At this point it doesn't even sting most of the time
- Famous people are surprisingly willing to talk

# Consider blogging / writing for a mass audience

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- Longer topic, but a few reasons this is worth doing:
  - Forces you to generate your own ideas
  - Lighter-weight way to explore new ideas
  - Keeps you focused on things that might actually interest someone
  - A space to call your own
  - Keeps you sane
  - Improves your writing
  - Gets you better at starting things quickly...and actually finishing them

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Good luck!!!!