RUTGERS UNIVERSITY
Interdisciplinary Job Opportunities for Biomedical Scientists

A SYSTEMATIC APPROACH TO SCIENTIFIC WRITING

The unofficial motto of academia is “publish or perish”. But a good research agenda always has more to explore. How do we know when to put down the pipette and pick up the pen? This workshop examines the process of scientific writing: how to start and sustain an effective proves, manage its various stages, and translate a project into a scientific story.

Friday
Nov 14, 2025
12:30-2:30pm

Ardon Shorr teaches science communication for graduate students and postdocs at Princeton University. He holds a Ph.D. in biology, and is a fellow with the national science foundation. He’s taught workshops at Harvard, Stanford, South by Southwest, TEDx, the CDC, and the EPA.
Deb Levy is a cognitive neuroscientist and educator specializing in the neural bases of language. She is passionate about brains, words, the human experience, and helping students get excited about their work.

A systematic approach to scientific writing

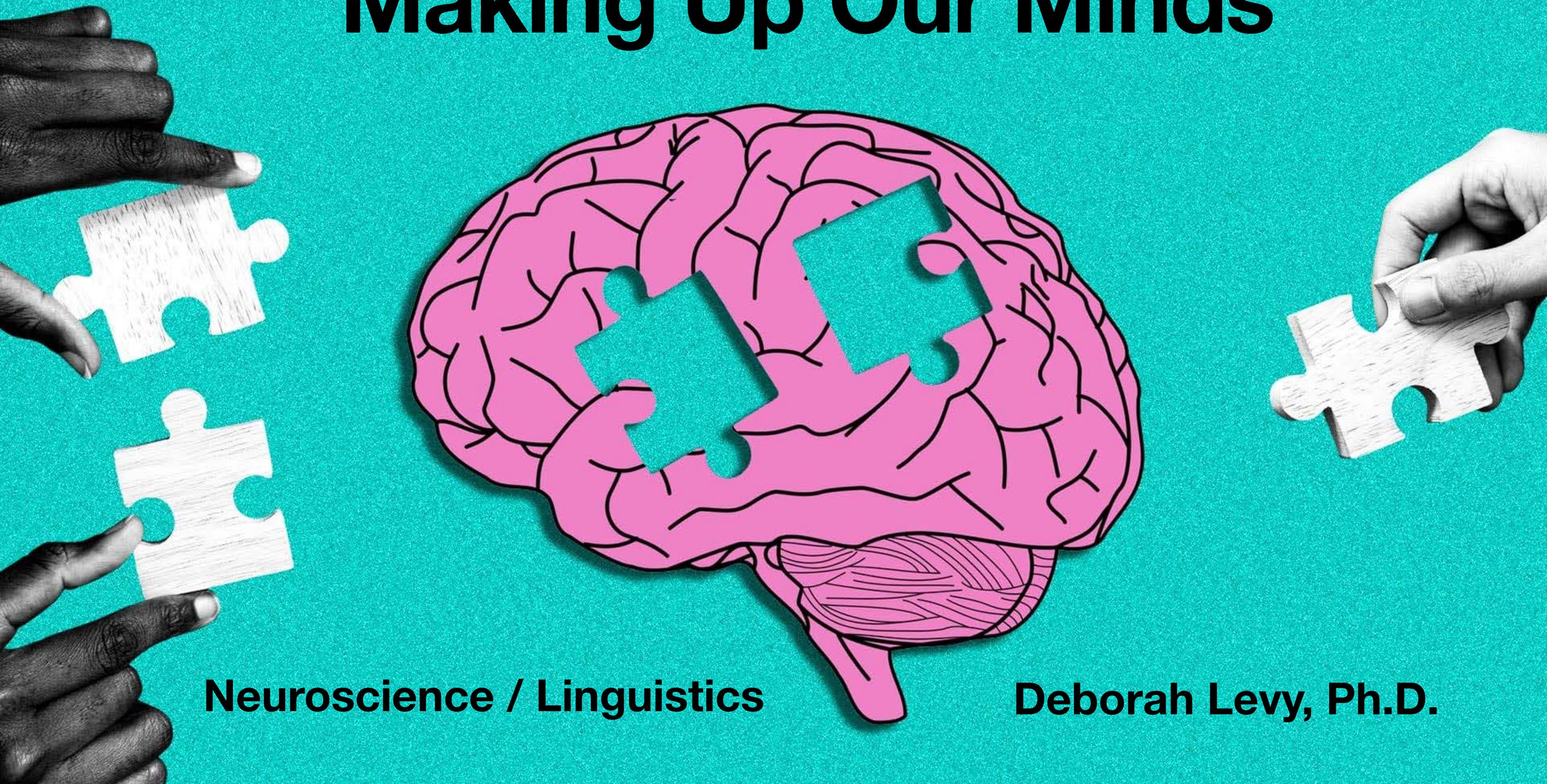
Liora Selinger
Deborah Levy
Ardon Shorr

PRINCETON WRITING PROGRAM

Judy Swan, Ph.D.

Retired Associate Director of
Princeton Writing Program

Making Up Our Minds

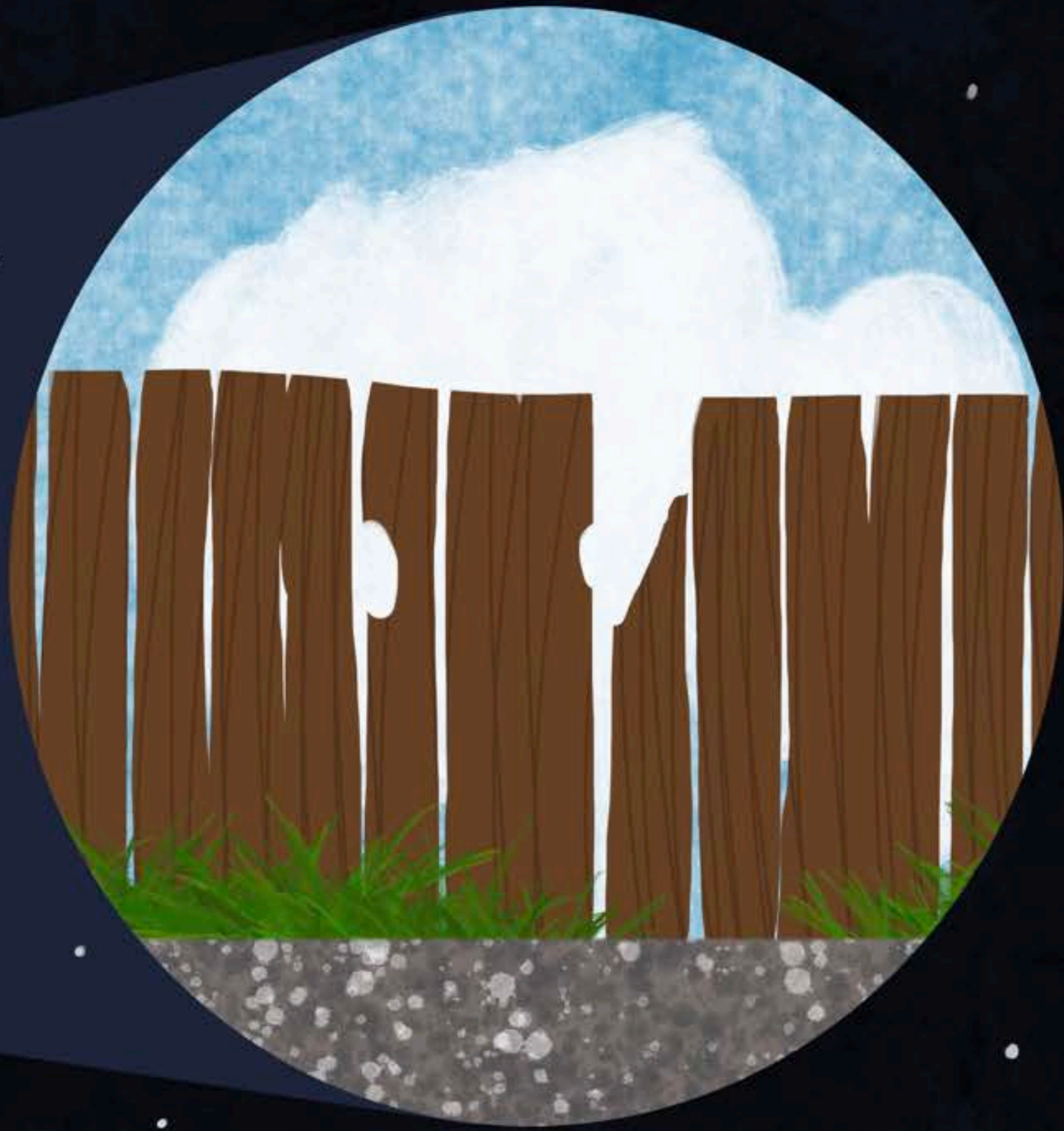


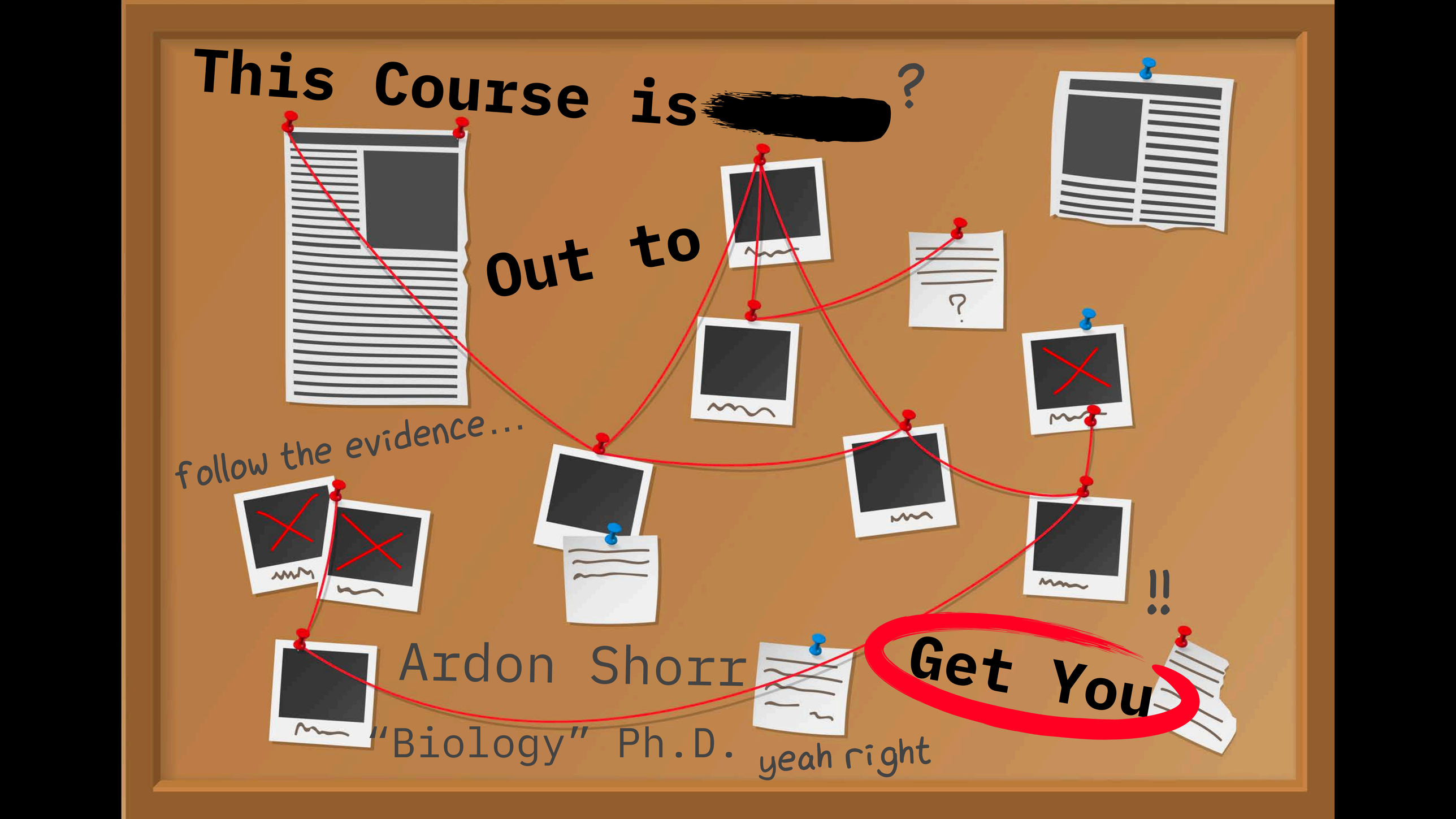
Neuroscience / Linguistics

Deborah Levy, Ph.D.

Curiosity

Liora Selinger, Ph.D.
English Literature




This Course is [redacted] ?
Out to
follow the evidence...
Ardon Shorr
"Biology" Ph.D.
yeah right
Get You
!!

Where do we learn scientific writing?

How many of you write about your work
once a year?
once a quarter?
once a month?
once a week?

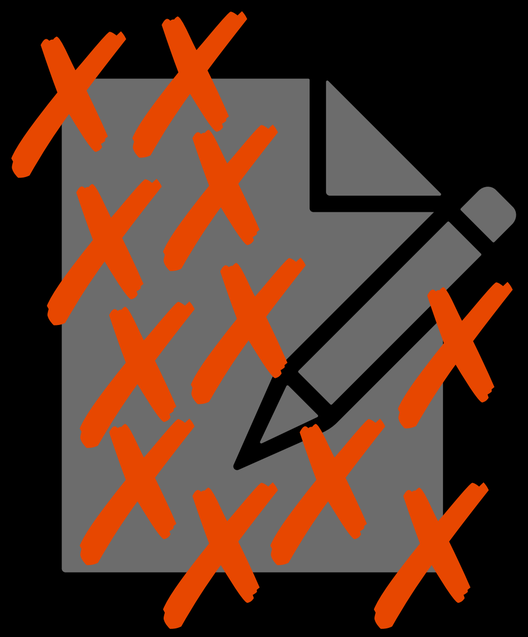
How many of your PI's write once a week?

Scientists are writers.
Writing is doing science.

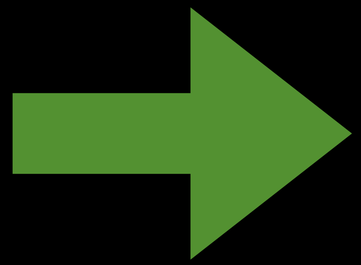
My data stayed the same but my results changed.

“I let the student loose
to draft the whole paper.

Sometimes it’s a mess,
and I just send it back
and say ‘Try again.’”



The Stochastic Method



A Systematic Method

Faster graduation is associated with higher salaries

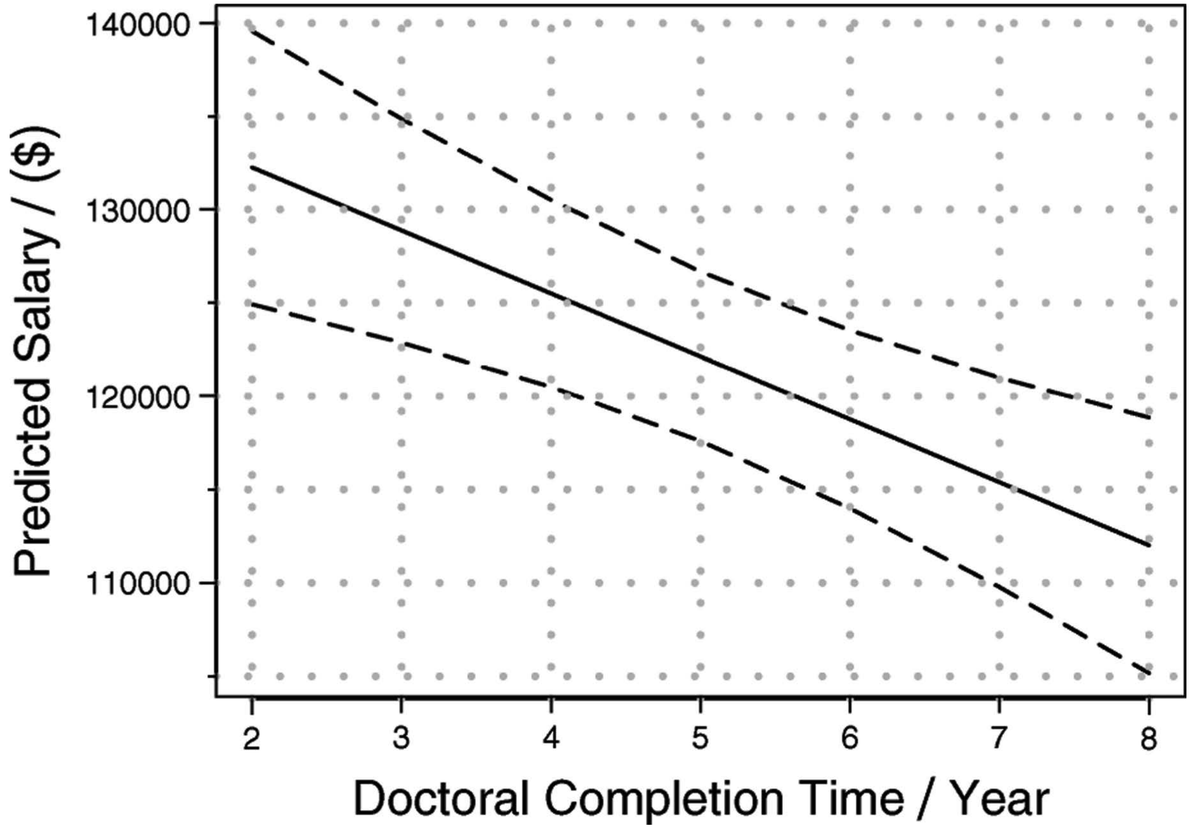


Figure 2. Predicted salary plotted with varying doctoral completion time. Confidence intervals (99%) are indicated by the dashed lines. All other factors appearing in Table 1 are held to their median values.

n=3,220

Potvin and Tai 2011

But grad school has gotten harder

Table 1. Scientific journal publications from UCSF graduate students

Graduation year	No. of students	Graduation time, y	Time to first-author paper, y	No. of first-author publications	First- plus second-author publications	First author C/N/S	First plus second author C/N/S
1979–89	71	5.7 ± 1.0	4.7 ± 2.3	2.2 ± 1.5	2.9 ± 1.8	0.52	0.80
Top 1979–1989	24	5.2 ± 0.9	3.4 ± 1.1	3.1 ± 1.2	4.5 ± 1.7	1.25	1.63
2012–2014	104	6.3 ± 0.9	6.0 ± 1.9	1.4 ± 0.9	2.1 ± 1.3	0.17	0.31
Top 2012–2014	34	5.9 ± 0.7	4.7 ± 1.4	2.4 ± 0.8	3.5 ± 1.1	0.53	0.94

Graduate degrees take longer

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Graduation year

Graduation time, y

1979–89

5.7 ± 1.0

Top 1979–1989

5.2 ± 0.9

2012–2014

6.3 ± 0.9

Top 2012–2014

5.9 ± 0.7

With fewer first-author publications

Graduation year	No. of first-author publications
1979–89	2.2 ± 1.5
Top 1979–1989	3.1 ± 1.2
2012–2014	1.4 ± 0.9
Top 2012–2014	2.4 ± 0.8

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It's *not* more prestigious publications

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First author C/N/S

1979–89 0.52

Top 1979–1989 1.25

2012–2014 0.17

Top 2012–2014 0.53

It's *not* more collaboration

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First- plus second-author publications

1979–89 2.9 ± 1.8

Top 1979–1989 4.5 ± 1.7

2012–2014 2.1 ± 1.3

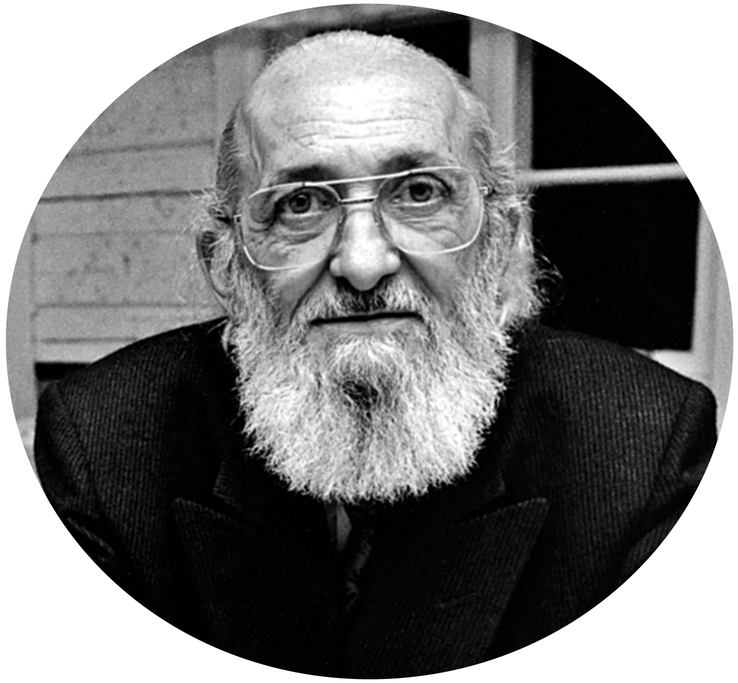
Top 2012–2014 3.5 ± 1.1

If publication is so important,
what's blocking us?

When you think about writing a paper, **how do you feel?**

"…*Negative Capability*, that is, when a man is capable of **being in uncertainties**, mysteries, doubts, **without any irritable reaching** after fact and reason."

John Keats, letter on "negative capability" 1817



There is always a relationship between fear and difficulty. But it is obvious that in this relationship the subject also figures, a subject who is fearful of what is difficult, who fears the storm, who fears loneliness, or who fears not being able to overcome the difficulty in understanding the text or not being able to produce some intelligence of it.

In this relationship between the *subject* who fears the situation or the object of that fear, there is yet another component, which is **the fearful subject's *insecurity* in facing the obstacle**.

This insecurity may be based on the subject's lack of physical strength, lack of emotional balance, or lack of scientific competence, real or imaginary.

Paulo Freire, 1997

“The issue here is **not denying fear** when the danger that generates it is fictitious. The fear itself is concrete. The issue is not allowing that fear to paralyze us, not allowing that fear to persuade us to quit, to face a challenging situation without an effort, without a fight.

When faced with fear of any kind, one must first **objectively ascertain** whether there are real reasons for that fear. Second, if those reasons do exist, one must **match them against the available possibilities for overcoming them** successfully. Third, if an obstacle cannot be overcome right away, one must **determine what steps to take toward becoming better capable of overcoming it tomorrow**.

…difficulty is always in direct relation to an individual’s **capacity to respond to it**.

Paulo Freire, 1997

We can map uncertainty

1. Where and how do you feel uncertainty?

Body

Restless
Listless
Tired
Sinking/ heavy
Short of breath
Tense

Mind

Brain tangle
Jumble of items
Aware of mountain to climb
Overwhelming Sea
Dread - Doom
Abyss

We can map uncertainty

2. Where is this feeling coming from?

Scope
Is this too big? Too narrow?

Self doubt
What if I’m wrong?

Social triggers
What will my colleagues think?

Need to research
Where do I look?

Need to think
How does this connect?

Need to sleep
Am I too tired right now?

We can map uncertainty

3. How might I respond?

Scope
Sketch the final product

Self doubt
Analyze evidence

Social triggers
Talk to a friend

Need to research
Consult librarian

Need to think
Mind map

Need to sleep
Schedule nap & work

Analyzing abstracts from the readers' perspective

What were we taught about abstracts?

As a reader, what are you trying to do with the abstract?

We know more as readers than we're aware of as writers

As a reader, what information do you need to make that decision?

1. Read the four abstracts
2. Rank them from best to worst
3. Compare rankings within your group
4. Discuss your evaluations using the criteria we developed

Which abstract was the worst?

Which elements are present?

Which elements are missing or incompletely developed?

How does this analysis account for your assessment and ranking?

Which abstract was the best?

Which elements are present?

Which elements are missing or incompletely developed?

How does this analysis account for your assessment and ranking?

We're also modeling a writing process

1. Reflect on what we already know
2. Brainstorm expansively: what might be important?
3. Prioritize criteria
4. Test our priorities against other texts and responses from other readers
5. Revise based on a deeper and clearer understanding

Disagreement is a feature of many minds

josh grubbs

@JoshuaGrubbsPhD

Peer review is wild. It's like if you took your car to mechanic and one mec said: "we noticed all your doors have rusted out, you should fix those" and another said: "LOVE THE RUSTED DOORS, but have you considered adding a flame thrower?" and a third said: "it's not a horse."

1:23 PM · 16 Oct 20 · Twitter Web App

We can think of these elements as the world *before* and *after* your paper

Before	Orienting	Why the need is important
	Motive	Why something needed to be done
	Task	What I did to address the need
	Thesis	What this document does
After	**Evidence**	What the work revealed
	Analysis	What the evidence mean for the reader
	Perspectives	What the future holds beyond this work

“Before” answers *Why*

Before	Orienting	Why now
	Motive	Why you
	Task	Why me
	Thesis	Why this document
After	**Evidence**	
	Analysis	
	Perspectives	

Based on Jean-luc Doumont’s
Trees, Maps, & Theorems

“After” answers *What*

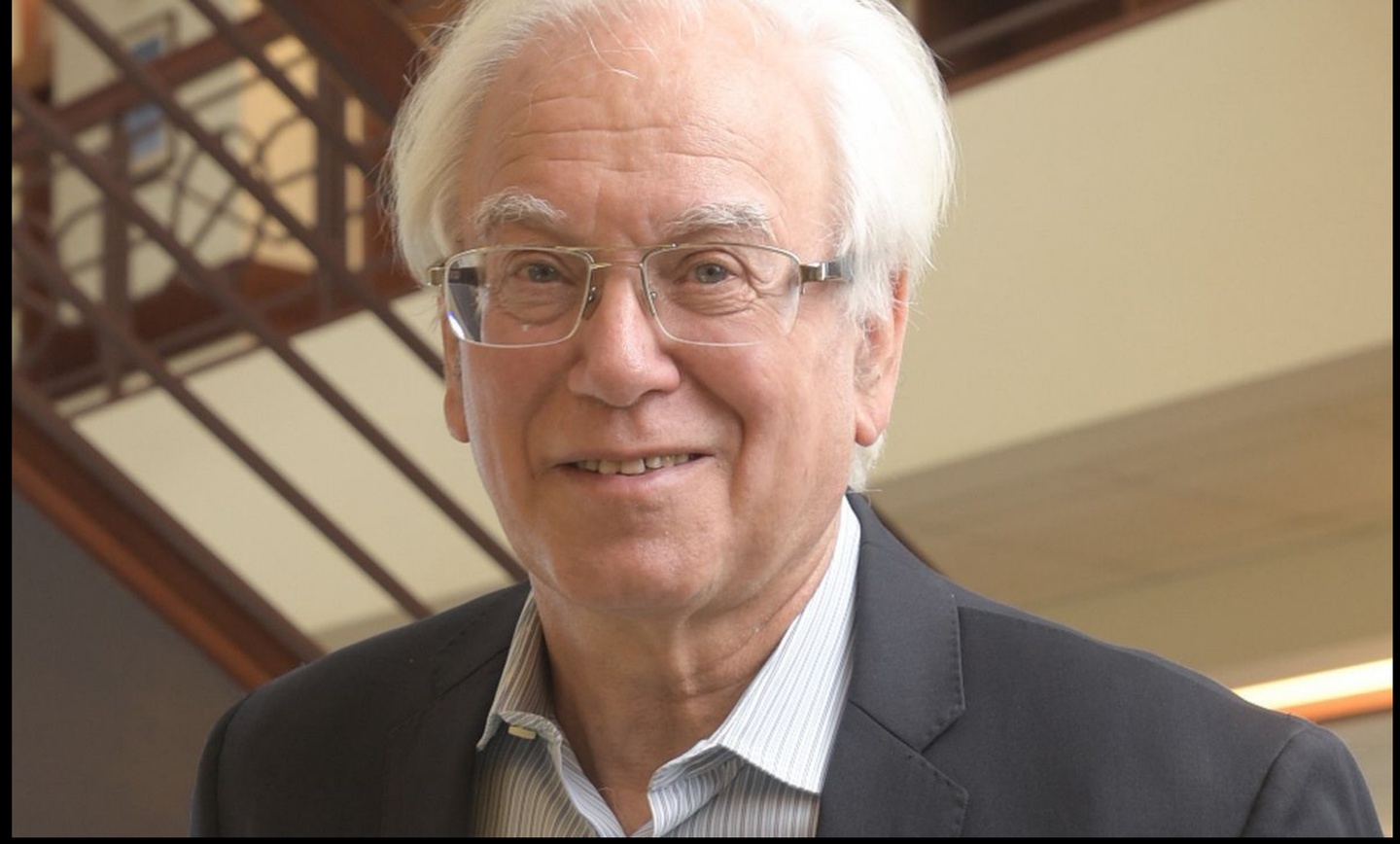
Before	Orienting	Why now
	Motive	Why you
	Task	Why me
	Thesis	Why this document
After	**Evidence**	What
	Analysis	So what
	Perspectives	Now what

Based on Jean-luc Doumont’s
Trees, Maps, & Theorems

You can help readers find what they're looking for with some version of a signal phrase

Orienting	*In previous work…*
Motive	*However,*
Task	*Here…*
Thesis	*We find that…*
Evidence	*This resulted in…*
Analysis	*This appears to be…*
Perspectives	*This implies…*

Capture



Edit

“Years ago, a colleague told me that breast milk contains urea (that we usually think of as excretion)—I was holding on to the idea until I had a post-doctoral fellow who was interested in exploring it—and now the project has sprouted many heads

Marty Blaser

Telling Science Stories

Goal, but **Obstacle**

is a series of parallel statements to connect your work into a big picture problem

We want [**Goal**], but [**obstacle**].

Solving the obstacle becomes the new goal

We want to [**solve obstacle**], but [**more detailed obstacle**].

Goal, but **Obstacle**

is a series of parallel statements to connect your work into a big picture problem

Approach Eventually, we find a new approach

Result That breaks through the obstacle

Benefit Which makes progress towards the goal


Google Earth

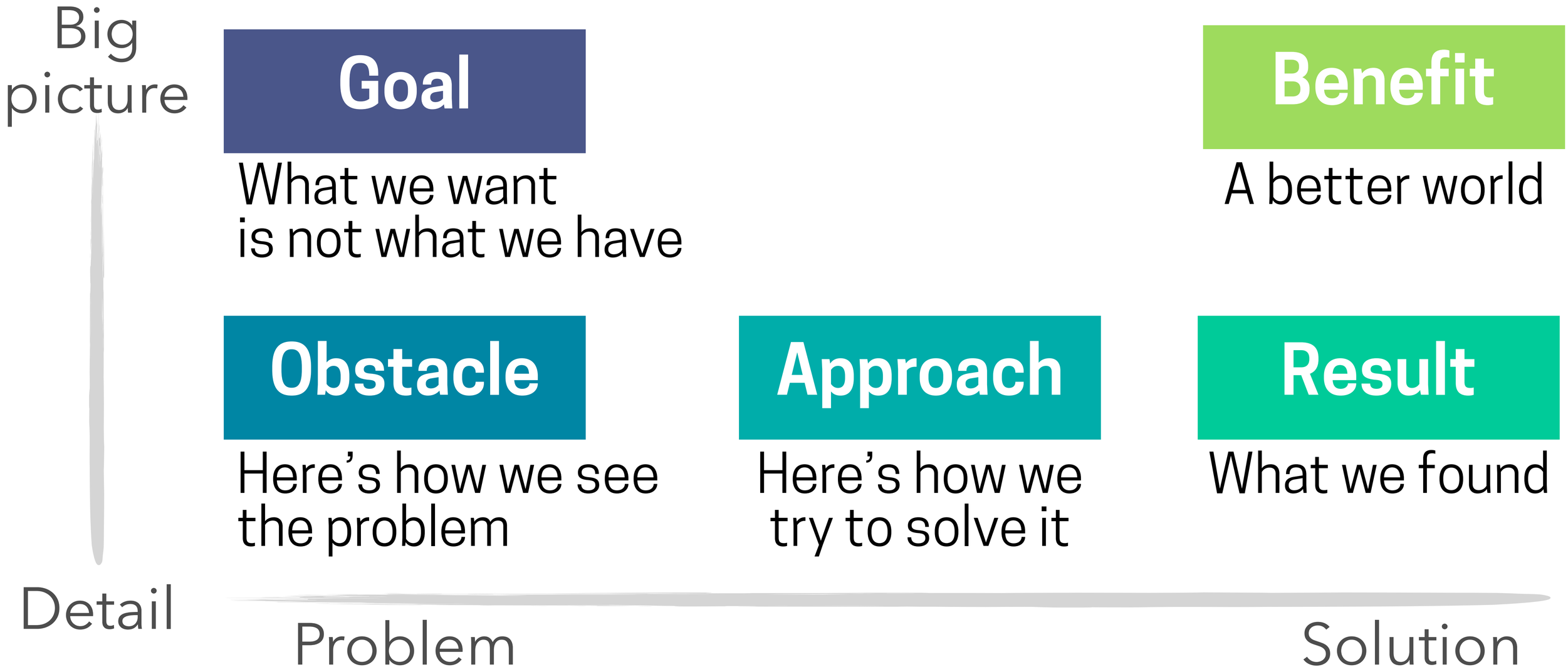
Radiolab establishes motivation with a series of increasingly specific obstacles

Goal	People didn't know how to feed a growing population.
Obstacle	We couldn't grow enough food because plants need nitrogen.
Obstacle	There's plenty of nitrogen in the air, but not in a usable form.
Obstacle	It's not usable because nitrogen clings tightly to itself
Approach	But Haber found a way using temperature and pressure…
Result	…to capture nitrogen gas into liquid ammonia.
Benefit	That discovery allowed the world to feed 7 billion people.

This same rhetorical technique is used in Porter 2011, NEJM

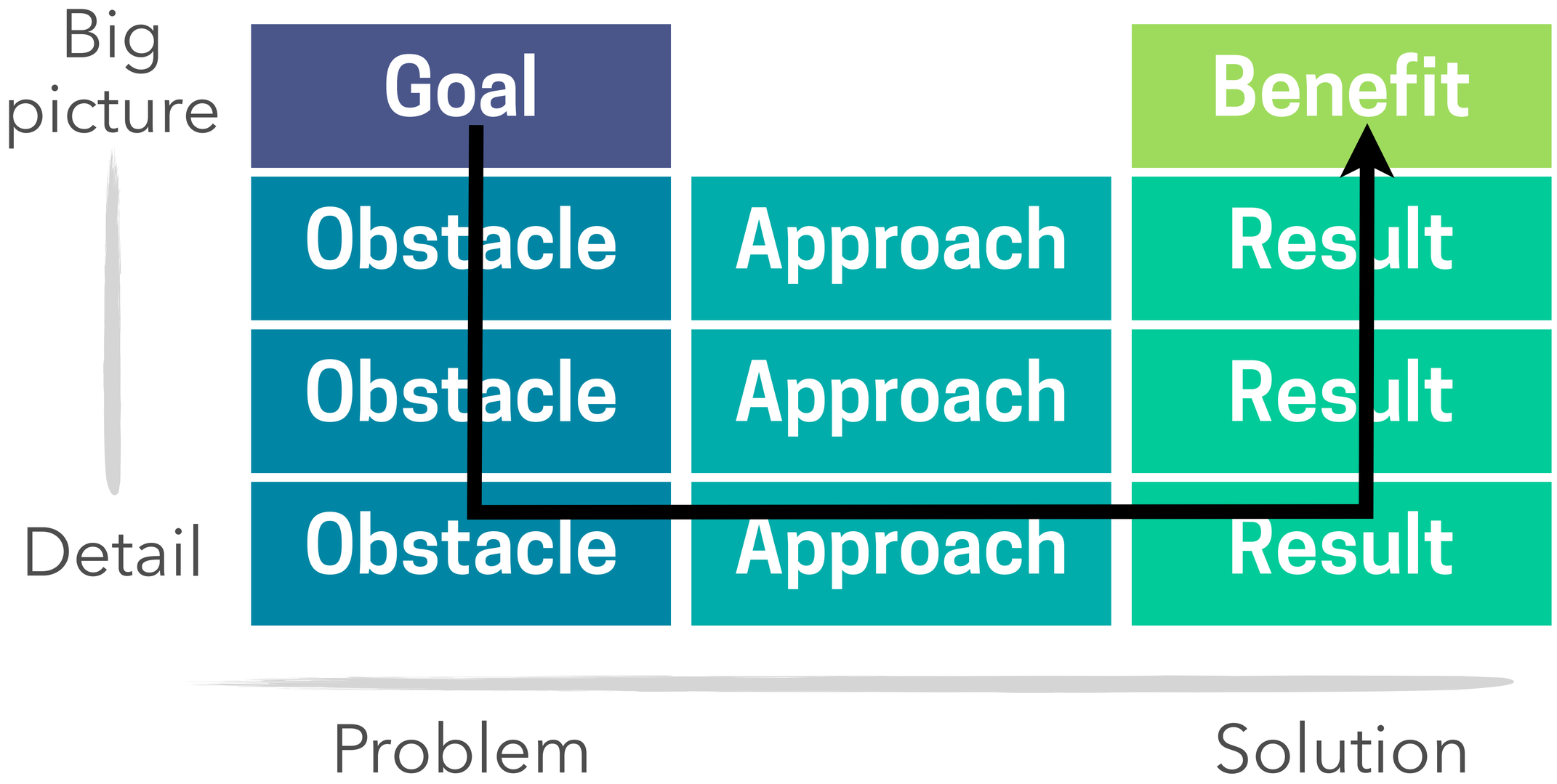
Goal	Killing cancer cells usually hurts the surrounding tissue.
Obstacle	Specifically targeting cancer cells is hard because cancer disguises immune signals.
Obstacle	We've tried to inject T-cells that recognize cancer, but these T-cells don't last very long in the body.
Approach	We found a new method
Result	to add persistent T-cells.
Benefit	This resulted in specifically killing leukemia tumors.

Stories move vertically in **detail**
And horizontally in **solving problems**

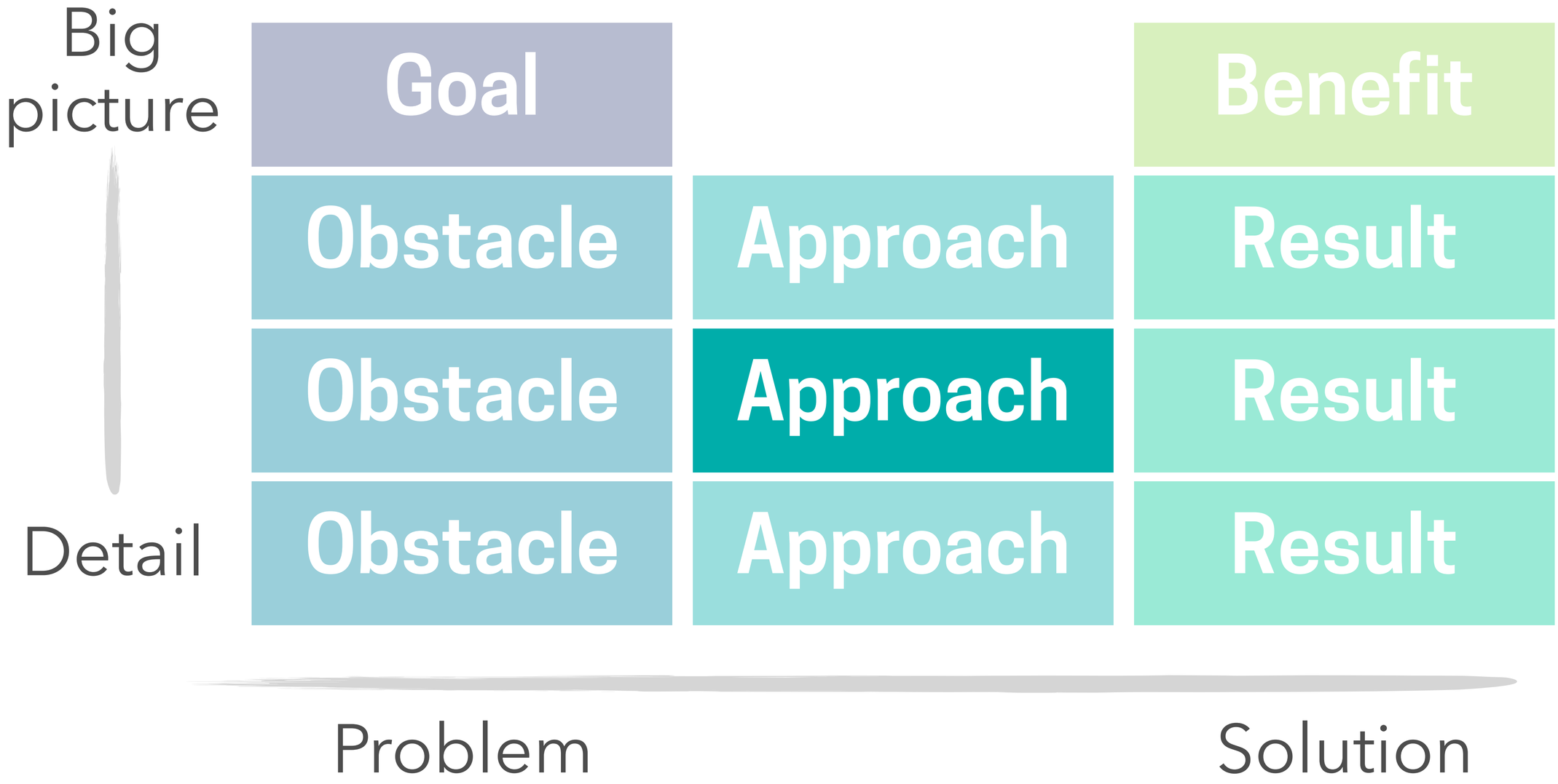


Craft the storymap from the *inside out*

Readers need a story in a U-shape



Readers need a story in a U-shape
But writers start from methods



To fill in the gaps, ask yourself questions:

Goal — “Why do you want to solve that problem?”

Obstacle — “Why is that hard? Why hasn’t it been done?”

Approach — “What problem does that solve?” / “What do you do?”

Result — “What happened when you did that?”

Benefit — “What are the benefits of that solution?”

Common moves for obstacles

D. No evidence for thick deposits of ice at the lunar south pole

Shackleton crater at the Moon’s south pole has been suggested as a possible site of concentrated deposits of water ice, on the basis of modeling of bi-static radar polarization properties and interpretations of earlier Earth-based radar images. This suggestion, and parallel assumptions about other topographic cold traps, is a significant element in planning for future lunar landings.

D. No evidence for thick deposits of ice at the lunar south pole

…earlier Earth-based radar data lack the resolution and coverage for detailed studies of the relationship between radar scattering properties, cold traps in permanently shadowed areas, and local terrain features such as the walls and ejecta of small craters.

Here we present new 20-m resolution, 13-cm-wavelength radar images

Internal motive

The field doesn’t know because…

Lack of data

Lack of resolution

Lack of consistency

Lack of accuracy

Lack of resources

Lack of theory

Defining the obstacle is your analysis of how you see the problem

Internal motive

Each of these implies a different solution

Lack of data
Lack of resolution
Lack of consistency
Lack of accuracy
Lack of resources
Lack of theory

Defining the obstacle is the process of justifying your methods

How happy would my advisor be if I scheduled a meeting with this agenda?

Known	Unknown	Approach	Results	Discuss

1. A sketch of figures capturing these five moves
2. …indicating progress so far
3. …and a timeline of steps to finish the rest
4. With an invitation: how do we get to publication?

Agenda for winning the advisor meeting

1. A sketch of figures capturing these five moves
2. …indicating progress so far
3. …and a timeline of steps to finish the rest
4. With an invitation: how do we get to publication?

5. Here are three journals I think we could target

6. …with author requirements, timeline for decision, and template

Summary

- Start writing as soon as you have results
- Start sketching figures of expected results
- Stories establish what we don’t know
- Submitting to journals: hurry up and wait
- Stories can help transition from pipette to pen
- Target journals based on fit

A systematic approach to scientific writing

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