How to Design an Effective Chalk Talk

Erik Lee Snapp, Ph.D.
Janelia Research Campus of HHMI

snappe@janelia.hhmi.org

email snappe@janelia.hhmi.org

for free copy of my eBook

Strategies for Obtaining a Faculty Position in the Biomedical Sciences: Views from Both Sides of the Job Search Process

and Today's Slides

Also, download Snapp E. 2019 Mol Biol Cell. 30:1575-1577

Take home messages for easily distracted and caffeine-deprived individuals

1. **Your chalk talk is EXTREMELY IMPORTANT. Job offers typically come down to chalk talks.**

2. **Preparation needs to begin well in advance of interview invitations.**

3. **Make your program clear to a broad audience.**

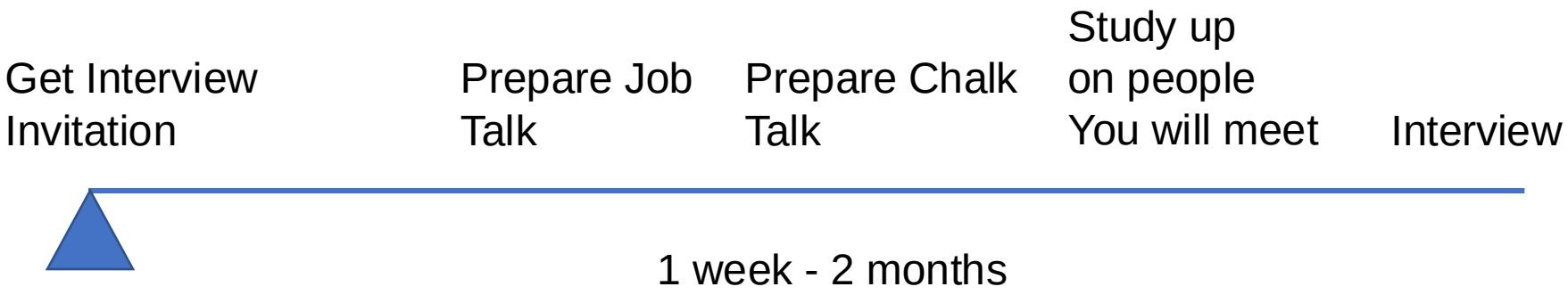
4. **Must be something worth doing and investing in.**
   Articulate concrete unambiguous outcomes from your research vision

5. **Get constructive feedback from people that have served on search committees.**

Disclaimer: This presentation is similar to getting a manual on how to ride a bike.
Chalk talks require effort, practice, and help!

Preparing for the Interview

“Typical” Timeline



Preparing for the Interview

“Typical” Timeline

Get Interview Invitation | Prepare Job Talk | Prepare Chalk Talk | Study up on people You will meet | Interview

1 week - 2 months

The Prepared Timeline

Prepare Chalk Talk | Prepare Job Talk | Get Interview Invitation | Study up on people You will meet | Interview

At least 1 - 2 months
Even better before submitting application materials

1 week - 2 months

Chalk Talk Goals

1. Make the case for an institution to make a substantial investment in your research program.

Chalk Talk Goals

1. Make the case for an institution to make a substantial investment in your research program.

2. Describe your research vision for next 6-10 years
   (usually not your first big grant, but department may ask for that)

Chalk Talk Goals

1. Make the case for an institution to make a substantial investment in your research program.

2. Describe your research vision for next 6-10 years
   (usually not your first big grant, but department may ask for that)

3. Generate excitement for your proposed research program

4. Demonstrate your ability to teach

Chalk Talk Goals

1. Make the case for an institution to make a substantial investment in your research program.

2. Describe your research vision for next 6-10 years
(usually not your first big grant, but department may ask for that)

3. Generate excitement for your proposed research program

4. Demonstrate your ability to teach

5. Make department members select you as a colleague for years to come.

Chalk Talk Parameters

30-60 min to pitch your research vision (~10 min uninterrupted, focus of this talk)

White board with markers

May/may not have time to draw/write before the start of talk.

Evaluators of varying levels of expertise

Audience can include: department members, search committee members from other departments, grad students, postdocs, deans, etc.

Your talk should be understandable by everyone.

Chalk Talk Structure

Overview (10 minutes uninterrupted)- arguably the most important part of the talk

Background/Set up (5 minutes)

Goals (20-25 minutes)

Questions (30 minutes, but throughout the talk)

Intro for Chalk Talk Version 1.0

I'm working on **wolf resistant houses (WRHs)**.
I'm going to develop a comprehensive understanding of WRHs in 3 Aims.

1. Identify most wolf resistant house type by building different houses in a wolf-filled forest.
   - HTScreen the Home Depot catalog of stick, brick, etc. building materials.
   - HTScreen grass varieties for straw house enhancement.
   - Test if house isoforms are resistant to all wolves.
   - Focus on role of beams and ts31 nails, galvanized plates, adobe vs. red bricks
   - My studies will have implications for pig therapies

2. MS/MS composition of WRHs. tSNE analysis of resistant and nonresistant features.

3. Super resolution imaging of GFP-expressing wolves attempting destruction of WRHs vs nonresistant houses.

Are you ready to hire this person?

Why or why not?

Problems

1. What is the question?
2. What is the significance of doing this work?
3. What will be done with all of the data? Why collect it?
4. What will be the impact if successful?
5. Is this the best candidate to execute the proposed study?
6. Is there anything novel about the question or approach?
7. What IS a “comprehensive understanding?”
8. So much jargon

Successful Chalk Talks need to convey

Context (Just the relevant details to tell your story)

What details are relevant to tell the story of Cinderella?

Disney Parks Photo
Illustration by Annie Leibovitz

Songs played at the Ball?
Species of pumpkin used for magic carriage?
Actual size of Cinderella's shoe?
Name of Cinderella's country?
Glass slipper?
Had to be home by midnight?
Fairy godmother helped Cinderella attend Ball?
Cinderella's stepmother and stepsisters were wicked?

Successful Chalk Talks need to convey

Context (just the relevant details to tell your story)

Big picture goal

Significance

The specific **knowledge gap** you're going to address

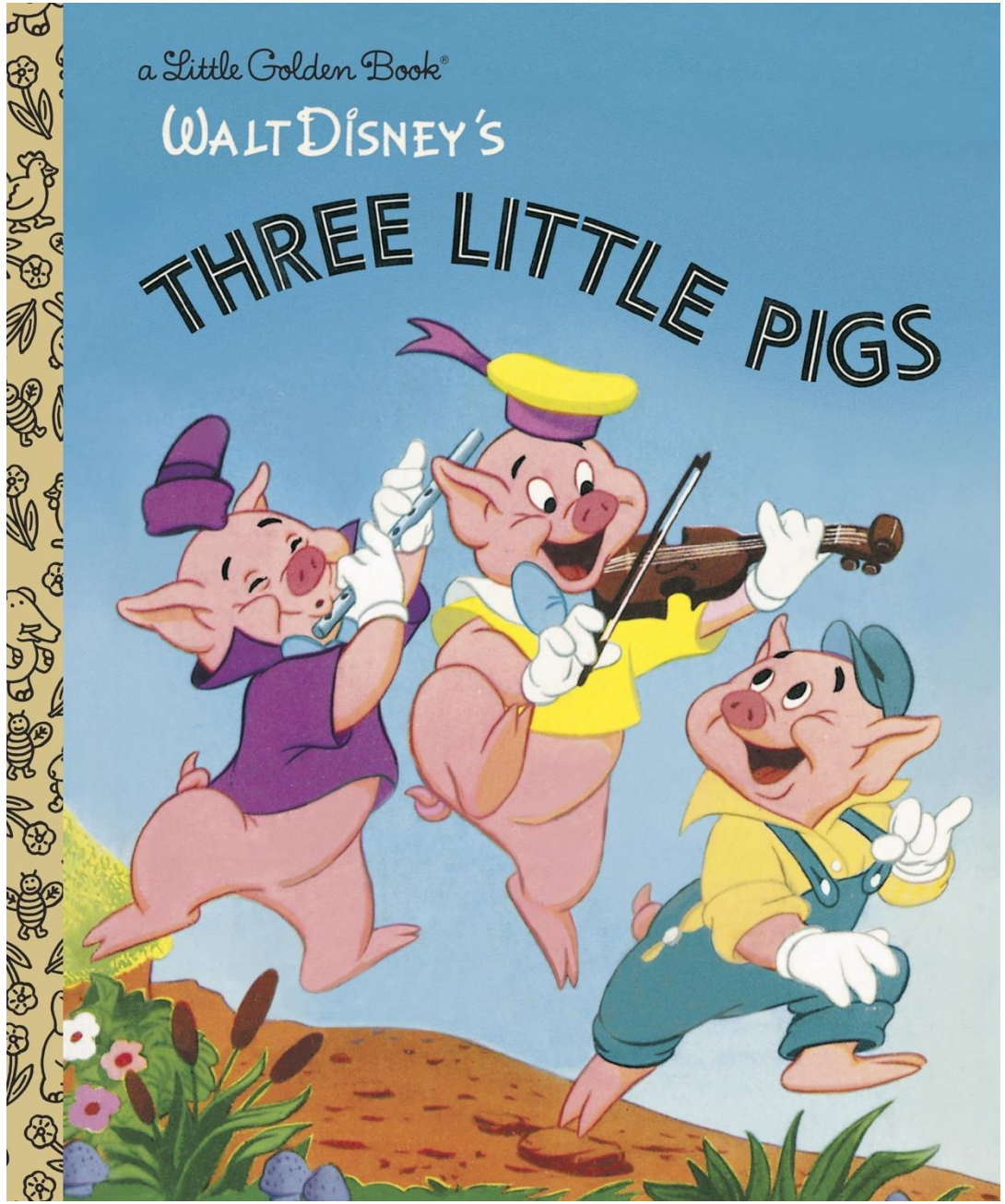
Why **you**?

What's the **payoff if you succeed**?

What are you actually going to do? Is it feasible? **Aims/Goals**

What does success look like?

The set up for mock chalk talk intro


a Little Golden Book®
WALT DISNEY'S
THREE LITTLE PIGS


Donald Duck
www.donaldduck.nl

3 Pig built house isoforms that differ in structure and composition

Pig built houses can protect pigs from wolves....
But not always, because huffing and puffing

Brick House Isoform appears to be wolf resistant

Warner Brothers Looney Tunes

Revised Chalk Talk Overview Opening, Version 2.0

Predatory wolves are lethal to pigs. New protective interventions to save pigs' lives are urgently needed.
Recently, novel pig-built structures termed "houses" have been described that can protect pigs from wolves.
Protection is modest. Only 33% of houses appear to be resistant to wolf respiratory-mediated destruction.
Principles of pig-built house structure and material composition are poorly understood.
In my future lab, I will develop a mechanistic model of how specific houses withstand wolves to develop ways to robustly protect pigs. My preliminary studies have identified multiple house isoforms of differing compositions, including straw, sticks, and bricks. Our working hypothesis is that both resistant house isoform composition and structure are required for wolf resistance. To test this hypothesis, I developed a novel functional assay, the BB Wolf 2000, which simulates wolf respiratory-mediated destruction. Employing this assay, we will build a mechanistic model of how pig-built houses protect pigs from wolves in three aims.

1. Solve the structures for straw, stick, and brick houses.

2. Define the necessary and sufficient house requirements for protection from wolves.

3. Determine the mechanism of wolf entry into respiratory-mediated destruction resistant houses.

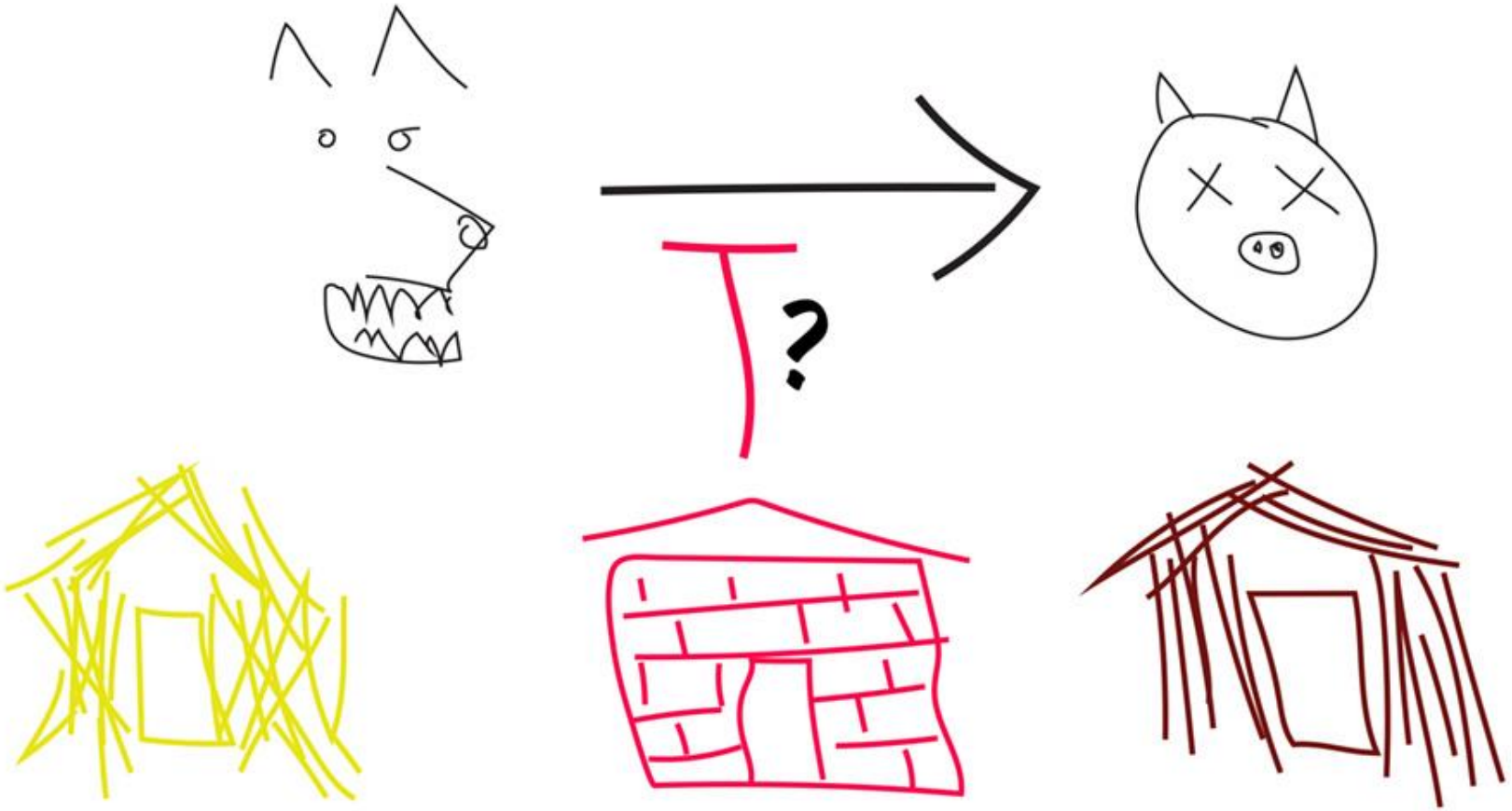
Our studies will establish a robust house model that can be used to create synthetic houses to protect pigs.

Mechanisms of Wolf-Resistant Houses

White board the intro

1. Solve structures of all house types
2. Define necessary and sufficient requirements of protection from wolves
3. Determine mechanism of wolf entry into respiratory-mediated destruction resistant houses

Long term goal: Model of WR House to develop synthetic houses to protect pigs.



Goal 1: Solve the structures of straw, stick, and brick houses.

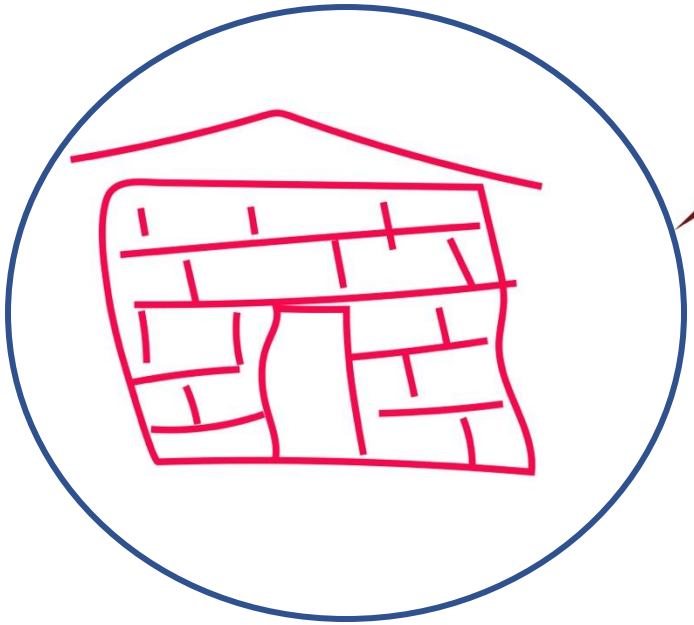
Is wolf resistance a structure or materials problem or both? How do the three most common house isoforms differ, if at all, in structure?

Predict brick houses will have greater component interconnection, reinforcement, and more aerodynamic structure.

- Use iPhone, pencils, autocad, and x-rays to solve structures of the 3 most common houses.
- Remove pieces of houses to analyze composition. Collaborate with a contractor, Bob Smith.
- Build straw and stick houses with same structure as brick houses and test for BB Wolf 2000 resistance.

Outcomes of this aim will establish whether cheaper materials can be used to make wolf resistant houses through improved design principles.

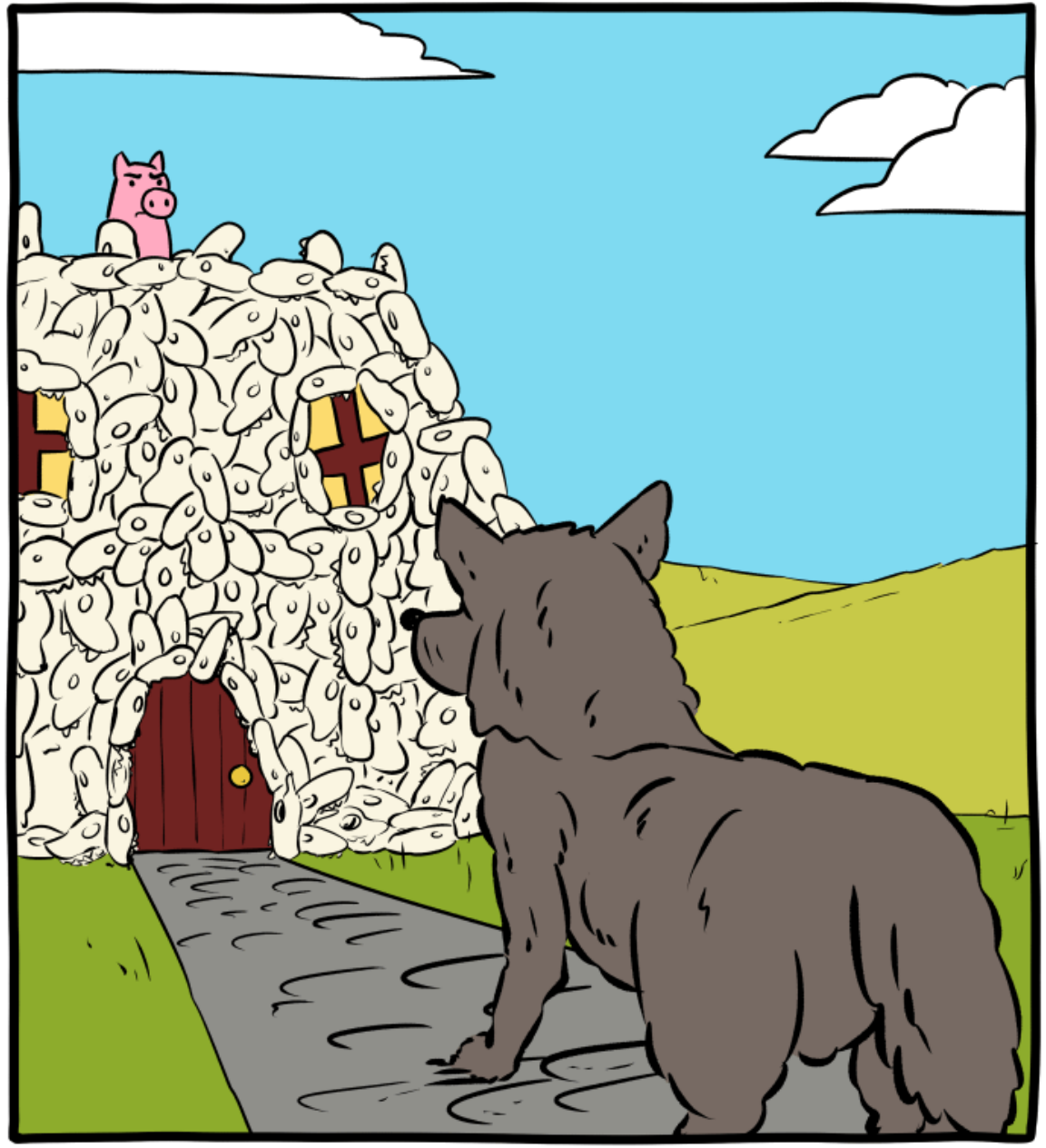
White board the aim



Structure? Materials? Both?

Predict: Brick houses have greater component interconnection, reinforcement, and more aerodynamic

- solve structures (iphones, x-rays, autocad)
- analyze composition (w/Bob Smith)
- Build straw and stick houses with brick house structure, test BB Wolf 2000 resistance



The fourth little pig's house was made of wolf skulls.
They aren't very sturdy, but they send a message.

Biggest challenges for Chalk Talk design

1. **Articulating the research problem**

Distinguish goals from process (techniques, experiments) and details.

Details by themselves are rarely as interesting as what the details can achieve

-20°C
24 cubic feet volume
Stainless steel surface
Energy efficient
4 shelves
Door can be placed on either side

Details by themselves are rarely as interesting as what the details can achieve

-20°C
24 cubic feet volume
Stainless steel surface
Energy efficient
4 shelves
Door can be placed on either side

You can have ice cream at home!!!!!!

1. Techniques vs. Goals: The Job You are applying for

The Department of Microbiology at University X invites applications for a **tenure track faculty position** in Microbial Systems Biology, at the level of Assistant Professor. We are especially interested in biologists who combine wet-bench experimentation with large-scale data **to address fundamental questions in microbiology**. Those questions may be related to inter-species community interactions, metabolic flexibility, antimicrobial targets, or pathogenic interactions.

Vs.

At University X, the **Research Core Facilities is looking for a motivated and skilled microscopist to lead the Microscopy Core**.
This role, specifically, will lead the core in providing technology and expertise to researchers in basic and translational science, giving them the ability to visualize structures within cells, tissues, and organs at a higher resolution than ever before.

This **position will be responsible for**:
Directing the day-to-day operations of the Microscopy Core
Assess and plan for future imaging needs across areas of service, by evaluating, and implementing new technology such as super-resolution microscopy
Consulting with investigators about experimental design, image analysis and the execution of projects using advanced imaging technology and resources
Working with vendors to negotiate equipment purchases and maintenance contracts
Developing and maintaining standard operating procedures

2. Engage first with questions, not the techniques or experiments.

I work on a high-speed collider, a machine that accelerates and collides protons at 13 TeV in a Compact Muon Solenoid to understand bosons.

vs.

I work on a machine that recreates the conditions of the early universe to learn what everything is made of and how everything sticks together. Essentially, particle physicists want to know, “what is matter?”

Techniques and experiments are things to do, NOT the question.

3. Techniques/Details vs. Mechanism/Questions

Techniques and experiments are things to do, NOT the question.

-super resolution SIM imaging
-CRISPR tagging
-MALDI-TOF mass spec
-RNAseq on AR42j cells to study the secretory pathway.
"***new insights and greater understanding"*** of the role of professional secretory cells in metastasis.

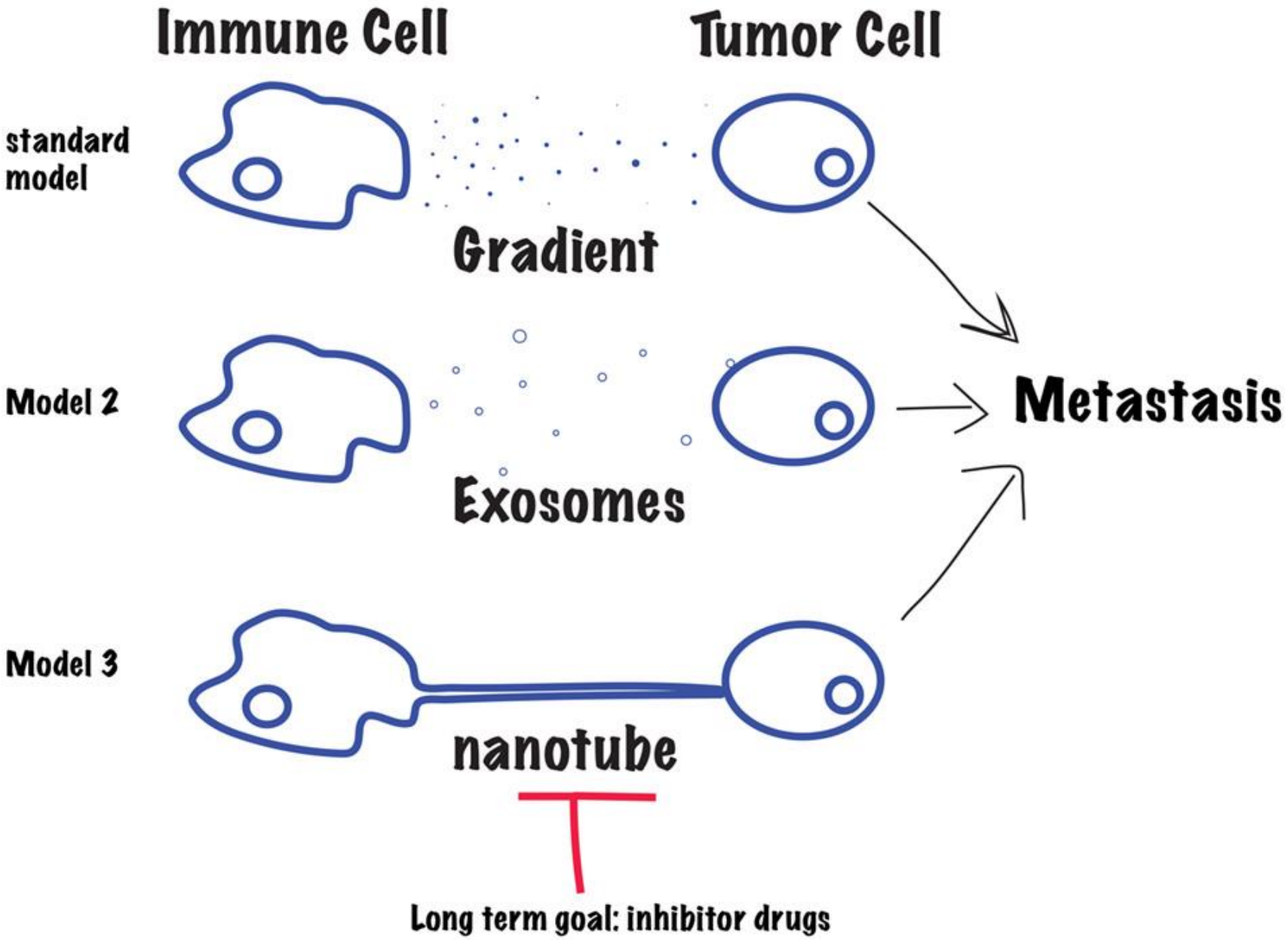
vs.

How do secretory immune cells stimulate tumor cells to break away from the main tumor?

Are molecules from secretory immune cells released freely, attached to long membrane projections or encapsulated in secreted vesicles?

Results of these studies will reveal potential targets for therapeutic interventions to disrupt secretory cell signaling.

White board the aim



Research Vision Goals

1. Describe a problem worth solving and how you will solve it.

2. Describe the elements that make you the ideal person to solve the problem.

3. Describe the likely impact of your success on the field and potentially broader.

The RV is what the chalk talk will try to sell. This requires a well-developed RV.

The Problem (a worksheet to develop your Research Vision)

What is the high-level question? ***What is the MYSTERY????***

What is the knowledge gap and why does it exist?
What is the specific question (not specific aim) that you will address?

Why now? (e.g., innovative problem or approach)

Why are you the right person to solve this problem? (technique, training, prelim data)

What will successfully resolving the knowledge gap look like?
Outcomes need to be concrete (not increased understanding) and answers.

What is the payoff if you are successful? How will the field be advanced?
What will it now be possible to do? What is the impact on field? Broader impact?

NOTE: Answer this list of questions, 2-3 sentences each.

Articulating the Research Problem

Distinguish goals from process (techniques, experiments) or details

High level version of your problem.
Minimize jargon.

How does sleep improve memory formation?

How does the brain recognize a face?

How is cell size regulated?

Research vision/problems are:

1. **Succinct problems**

2. **Relatable.**

3. **Timely and innovative.** Why this problem and why now?

4. More **Tractable** because of YOU.

Research vision/problems are not:

1. **A catalog of experiments.**

2. **Highly exploratory.** Yes, Science IS exploration,
   but research problems need a road map.

3. **Complicated to explain.**

Biggest challenges for Chalk Talk design

1. Articulating the research problem

2. **Telling a story**
   Path to resolve your identified knowledge gap.

3. Define mechanistic goals/aims.

Power of Stories

Create a storyline.
A path from Question to Resolution over 5-10 years.

Stories engage your listeners. Make them care.

-fMRI studies

-oxytocin release

If audience can imagine or visualize what you are describing, they can understand your problems and goals.

Biggest challenges for Chalk Talk design

1. Articulating the research problem

2. Telling a Story

3. **Define mechanistic goals/aims. The meat of your chalk talk/ Research proposal.**

How are YOU going to break open the field with an approach to a fundamentally important question?

Aims/Goals (how you will get to tenure)

~3-5 sentences:

Give aim an active title that clearly states the objective in relation to the hypothesis.

Brief summary of the experimental approach and ***anticipated outcomes*** for each aim.

Describe pay-off of each aim. Aim should sound valuable and testable,
not open ended or unclear outcome.

*** Some chalk talks expect you to describe your first R01 style grant proposal. Be prepared to talk about this proposal.*

Example Goal

What is the mechanism by which immune cells communicate with tumor cells to maladaptively induce metastasis?

Tumor cells require a signal from immune cells to stimulate escape from the main tumor.
Immune cells are rarely closer than the length of a few cells.

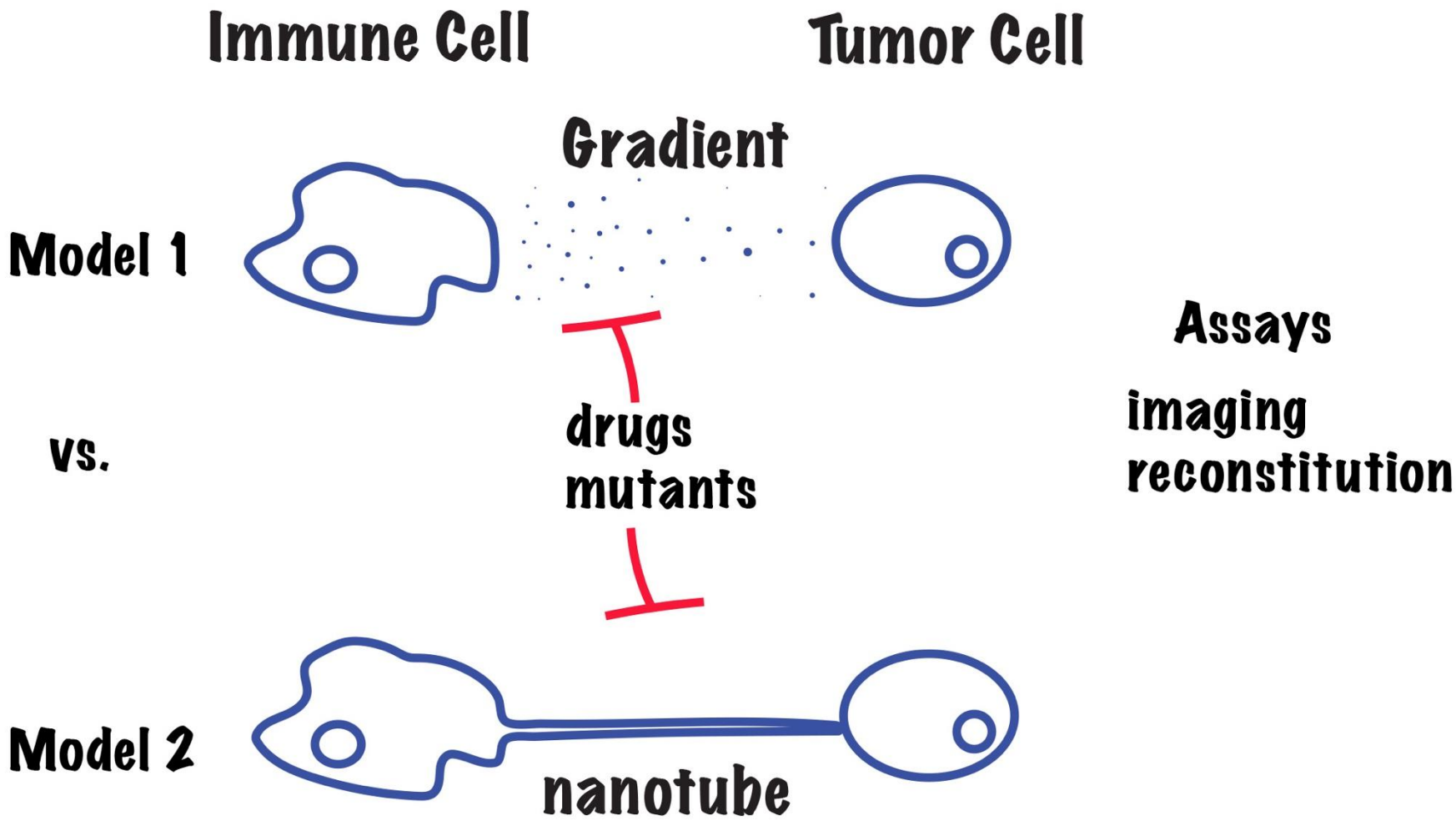
The **leading model** is that immune cells secrete molecules in a gradient that attracts tumor cells.

Our **preliminary data** suggest nanotubes (membrane protrusions
that can be several cell lengths long) on the immune cells deliver
a highly concentrated signal to tumor cells that they contact.

We will use live cell imaging, mutations, reconstitution experiments,
and nanotube and secretion disrupting drugs to
distinguish between the secretion and nanotube models.

Results of this aim will provide novel therapeutic targets
for disrupting cell-to-cell communication in cancer.

White board the aim



Assays

imaging
reconstitution

Impact: Determine drug target to disrupt cell-cell communication

Goals are not

1. Lists of stuff to collect (or collected data that are intended for others to use to answer questions)

2. Fuzzy and open ended

3. Interdependent

Bad Chalk Talk Goal Examples

- Titles longer than one line of text

- Screen X, Follow X, Image X, Characterize X, Describe X

- Collect most complete and detailed data set EVER!

- Overly ambitious. Could take one lab 10 years just for the one aim

- Unclear contribution to resolving knowledge gap, e.g. “yes/no/whether” questions are a red flag.

Good Aims

Concise, clear rationale, minimal jargon, will produce an *interpretable* answer to a problem

1. Mechanistic/How or What ?s that address the overarching knowledge gap.

2. Focus on specific components for well justified reasons (e.g., preliminary data)

3. Have clearly defined likely outcomes that solve the problem

4. Address the overarching knowledge gap.

5. Contextual (e.g., appropriate for a department)

6. Make use of the appropriate technologies, controls, robust assays to address question.
   Be able to explain why you chose a particular approach, note any shortcomings, have more than one way to answer your question.

Sample Chalk Talk Structure (~30 minutes)

Highest level things that interest me/overview, relevant things I did as a postdoc/prelim data (5 minutes)

If everything goes great in 5-10 years, what I will accomplish (2 minutes)

Why is this exciting to me? (3 minutes)

Impact of my program (beyond immediate accomplishments)- benefits to other fields of study, create new field of study, new tools with applications beyond my lab (2 minutes)

Why this specific project/question and why now? (2 minutes)

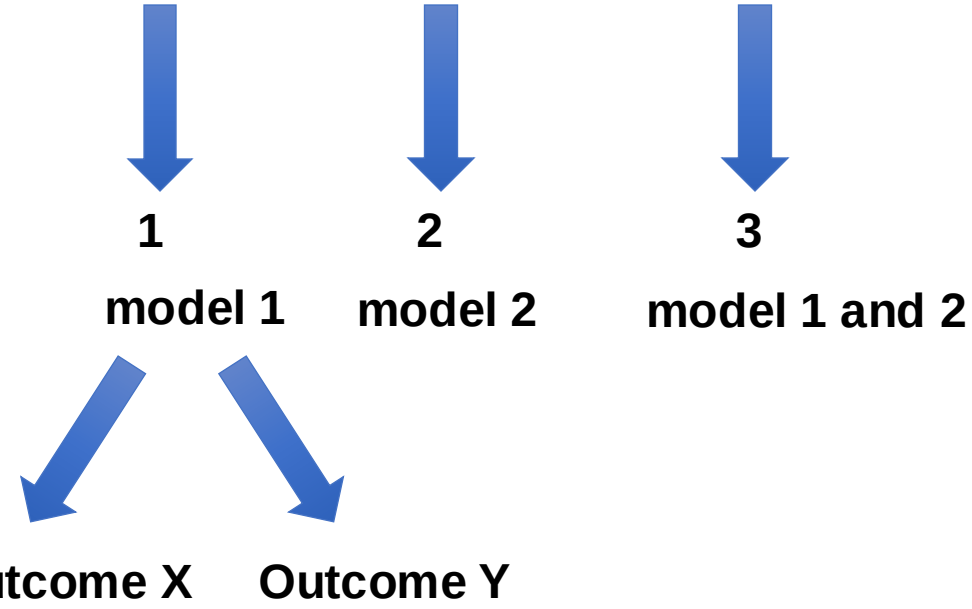
Why this institution/department and in turn, what will my contributions be? (2 minutes)

Summary of methods/key tools (5 minutes)

Example experiment/project in detail and why you are focusing on this (10 minutes) (prepare two)

Helpful Tip1. Outline your Research Plan with a Flow Chart

Model Experiment with 2-3 predictable outcomes



New tests to further establish or reject model 1

Helpful Tip 2. You don’t know how you or your problem “sound”

9Gag

Chalk Talk Tips

1. Practice drawing and writing in advance. It's easy to run out of space or draw things too small if you haven't practiced.

2. Practice your talk with faculty *that have been on search committees*. Do at least two practice talks. The first one will be terrible.

3. Practice with people outside of your own lab and even some outside of your field. You need to learn how to reach a diverse audience.

4. Consider the limitations of a 2D white board. Try 3D visual aids, e.g. 3D printed model or a toy. Or choreograph your model (think molecular motors).

5. Bring your own water and eat a light protein snack before your talk.

6. Bring your own NEW *erasable* markers.

Virtual Chalk Talk Guidance

1.Plug your computer directly into the ethernet.

2. Do the chalk talk in a **professional setting**. e.g., conference room.

3. **Choose your media well in advance and practice with it.**

4. Wear an interview outfit. e.g., business casual.

5. Ensure you hear/see and respond to questions from search committee.

6. Include a notepad for yourself and water to clear your throat.

7. Make **contact with the eyes of the viewer on their monitor**.

Real Potential Questions from the Search Committee

1. How will you distinguish yourself from your postdoctoral mentor's lab/show independence?
2. Can you describe another approach to solve this problem?
3. What if someone published a paper tomorrow that solves EVERYTHING in your proposal. What would you do?
4. What's the first experiment you will do your lab? Your top priority?
5. Our institution has a number of undergraduates that are seeking research experience. How will you incorporate them into your research program?
6. What will you do when your recent paper is shown to be one big artifact?
7. How will you compete against large well funded competitors?
8. How does your project relate to (fill in with questioner's favorite subject- evolution, fenestrae, etc.)?
9. Do you see any potential for collaborations with members of our department or institution?
10. Our institution offers you X resources. What will you bring to our institution?
11. What study section and funding agencies do you plan to submit your grants to?
12. You said you want to use GFP for your studies. Which GFP and why?
13. What will be the titles of your first two graduate students' theses?
14. What is your dream experiment and the anticipated result?