LEHIGH UNIVERSITY

# Reflections on the NSF CAREER Proposal Preparation Process

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# Conflict of Interest Disclosures

Disclosures Current as of: 25-Mar-2020

1 – Royalties: No
2 – Speakers Bureau: No
3a – Paid Employee: No
3b – Paid Consultant: No
3c – Unpaid Consultant: Yes, OrthoXel, DAC
4 – Stock or Stock Options: Yes, OrthoXel, DAC
5 – Research or Institutional Support: Yes (institutional and former), OrthoXel, DAC
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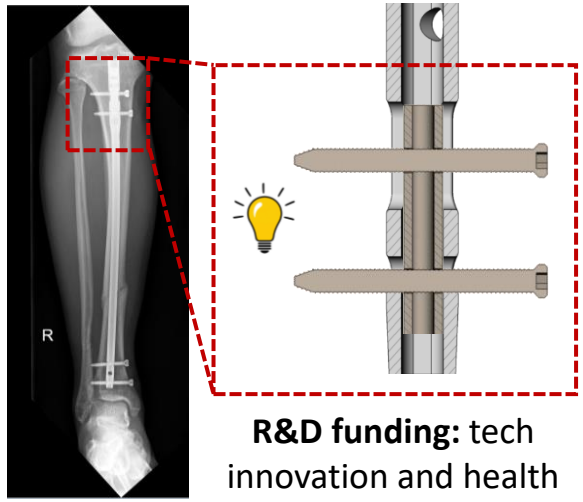
8 – Serve on Editorial or Governing Board: No
9 – Serve on Board of Directors/Committee: Yes, ORS ISFR Communications Committee Chair

# Background and Research Interests

post-doc focused on **orthopaedic technology development**

**evidence-based idea:** bone fractures heal more quickly with axial micromotion

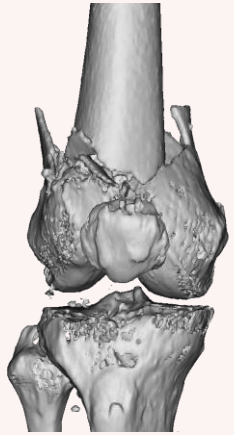


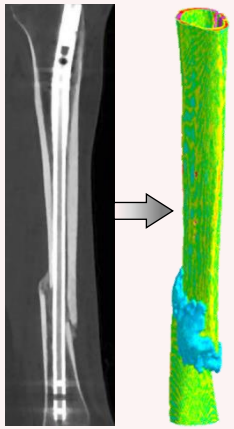
**R&D funding:** tech innovation and health research grants

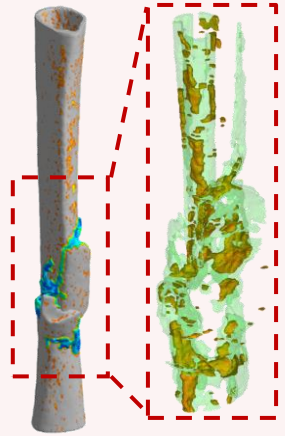
**assistant professor** of mechanical engineering & mechanics at **Lehigh University** (Bethlehem, PA)

## Dailey Lab Unique Research Value Proposition

innovative **structural mechanics approaches** to studying **bone fracture and healing** using rich **imaging data sets** with research questions and methods informed by **industry experience** and **clinical partnerships**

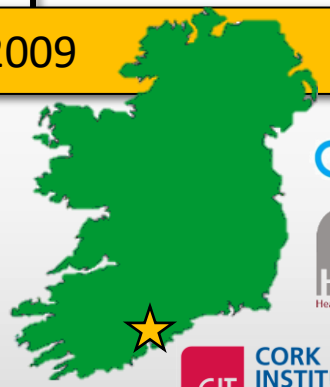






2009 — 2014 — 2015

BS-MS-PhD in **mechanical engineering**



ENTERPRISE IRELAND

HRB Health Research Board

CIT CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

ORTHOXEL www.orthoxel.com

**co-founder and chief scientific officer** of a company to commercialize trauma implants with micromotion technology

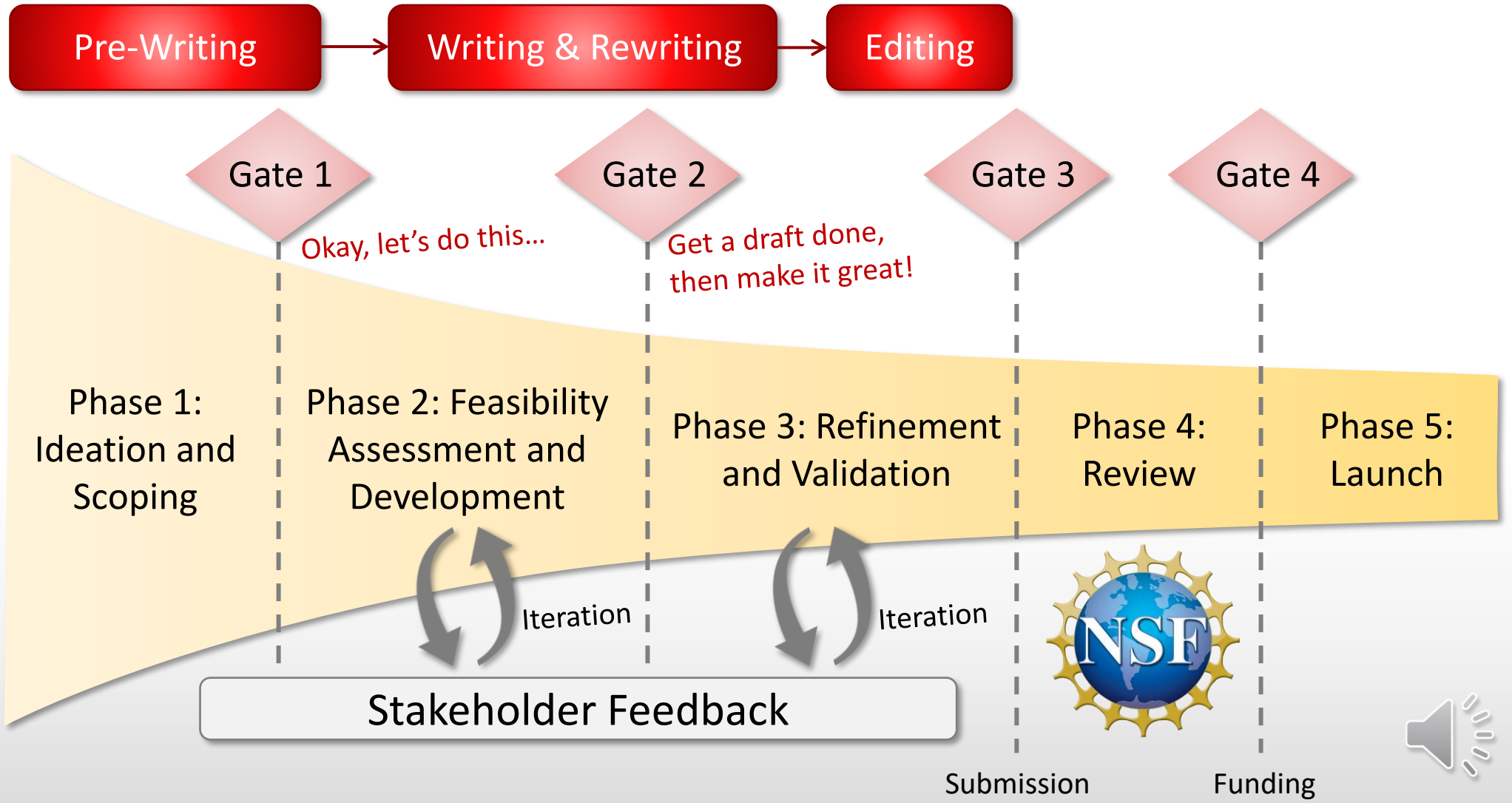
successful first-time FDA 510(k) and CE Mark **regulatory clearances** for the Apex Tibial and Femoral Nailing Systems and ongoing **human use**

# About Lehigh University


- Private, founded 1865
- Today: 5,000 undergraduate and 2,000 graduate students
- Mechanical Engineering is the largest undergrad major, grad program, and faculty at Lehigh

# Writing Your CAREER Proposal: A Project Management Perspective

Modified Phase-Gate Model of Project Management for CAREER Proposals



# My CAREER Proposal Preparation Timeline

on-campus CAREER workshop

reading and brainstorming

phone call with CMMI-BMMB PD Michele Grimm

joined on-campus CAREER proposal writing group

pitched partnership to first-choice outreach organization

completed first draft, discussed in writing group

on-campus mock panel feedback on revised draft

panelist for standard proposals

submitted

February | March | April | May | June | July

solicited advice, got copies of successful CAREER proposals

lit review focused on outreach, requested institutional data

discussed development plans with chair and senior colleagues

completed budget, biosketch, letters

draft feedback from colleagues

Tips by Phase

Phase 1: Ideation

Phase 2: Development

Phase 3: Refinement

# What Worked [for me]

Translatable strategies by project stage:

**Phase 1:** Ideation and Scoping

**Phase 2:** Feasibility Assessment and Development

**Phase 3:** Refinement and Validation

- Choosing the right project/scope
- Building the unique value proposition
- Evidence and distinctiveness in outreach

# Choosing a Project

## SWOT Analysis (for research proposals)

### Strengths

- Why am I passionate about what I'm doing?
- What is the exciting potential payoff?

### Weaknesses

- Limitations as discussed in my published papers (obvious holes)
- Limitations I haven't had to address yet (strategic advantage)

### Opportunities

- Top down – lit review shows everyone has the same problem(s), "solutions" are dated or missing
- Bottom up – unique selling points (technical capabilities, data sets, access to distinctive resources, etc.)

### Threats

- Competitive landscape (other researchers, what's hot)
- Time and readiness (Am I ready to do this?)

# Brainstorming

Phase 1 Ideation → Phase 2 Refinement

Narrow the focus (How much can I realistically accomplish in 5 years?) by developing a formal project plan.

- Read papers, look for opportunities
- One idea per Post-It
  - Topics / questions
  - Techniques
  - Applications
- Start unstructured
- Organize into themes
- Look for connections, sequential steps
- Include education/outreach
- Vertical and horizontal integration
- Cut ideas that don't integrate well, save for "beyond the CAREER"

# Unique Value Proposition (UVP)

I am **uniquely well-qualified** to carry out this work because _____.

## Person

What is my story?
How did I get here?

skills / knowledge
perspective / experience

What makes me different, surprising, believable?

## Project

Why does this problem urgently need to be solved?

Is the potential payoff transformative?

How will success lead to what comes next?

## Environment

What resources do I have that nobody else does?

Can I show that I am ready to pull this off?

track record – publications, preliminary data

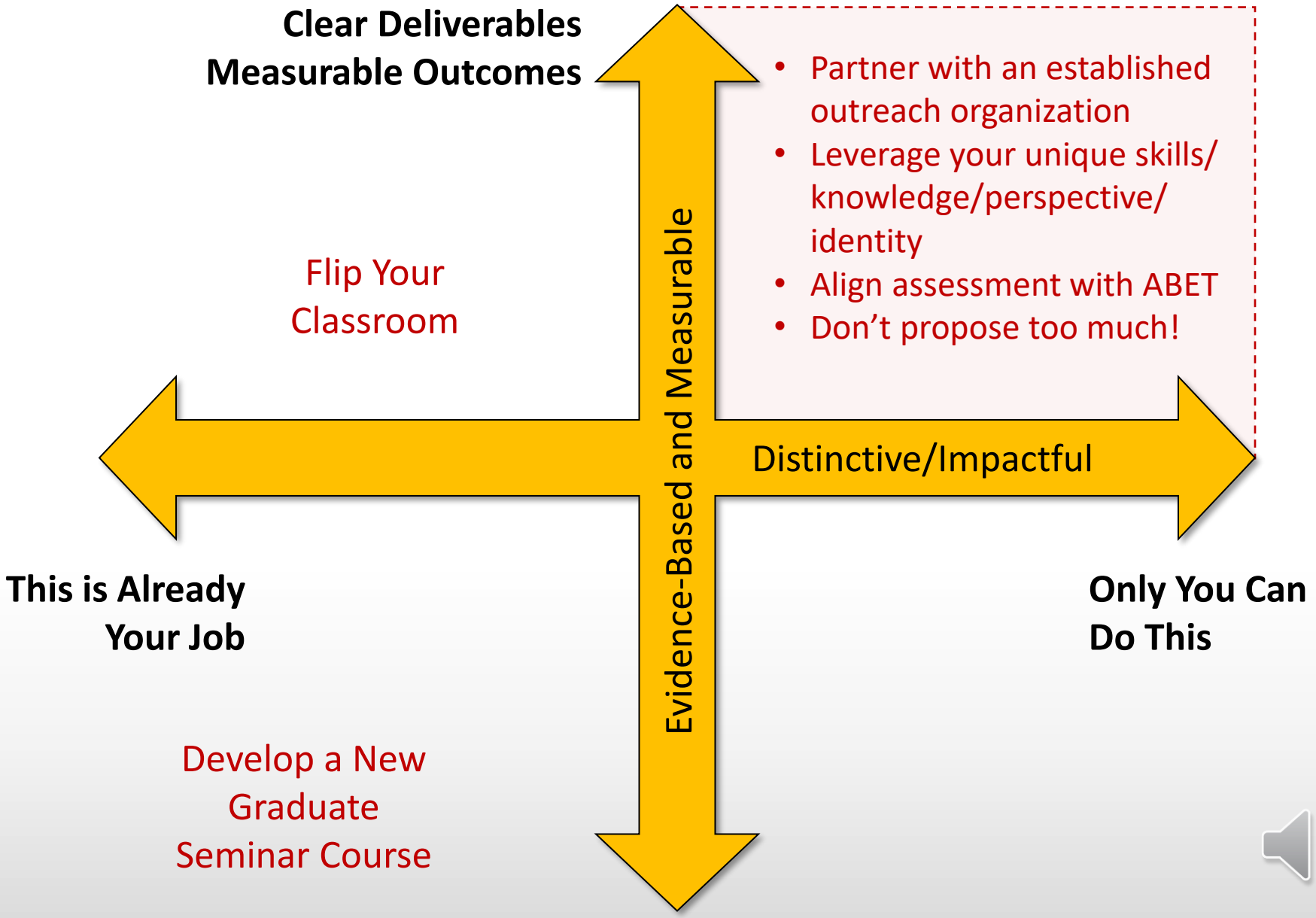
# Vetting Education & Outreach Ideas

**Step 1:** Use data to <u>define the problem</u>

**Step 2:** Read the literature before you try to <u>propose a solution</u>

**Step 3:** Look for translation from your research themes

**Step 4:** Think about how an intervention addresses the problem and how you will <u>assess whether it worked</u>



# Vetting Education & Outreach Ideas

**Step 1:** Use data to define the problem

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**Step 4:** Think about how an intervention addresses the problem and how you will assess whether it worked

**Problem:** Evidence-based drivers of persistent under-representation of women in mechanical engineering:

- Masculine cultures that lower the sense of belonging
- Lack of early experiences and role models
- Gender gaps in self-efficacy

**Evidence-Based Solutions:**

- Hands-on experiences (freshman, ME ugrad) clearly connected to the research
- Partnership to design orthopaedic implants for the Perry Initiative
- Curriculum planning leadership: medical device concentration for MEs

- Uniquely me
- Evidence-based
- Integrated
- Nationwide reach
- Career trajectory

# What Worked [for me]

Translatable strategies by project stage:

**Phase 1:** Ideation and Scoping

- Choosing the right project/scope
- Building the unique value proposition
- Evidence and distinctiveness in outreach

**Phase 2:** Feasibility Assessment and Development

- Formal project planning
- Long-term vision

**Phase 3:** Refinement and Validation

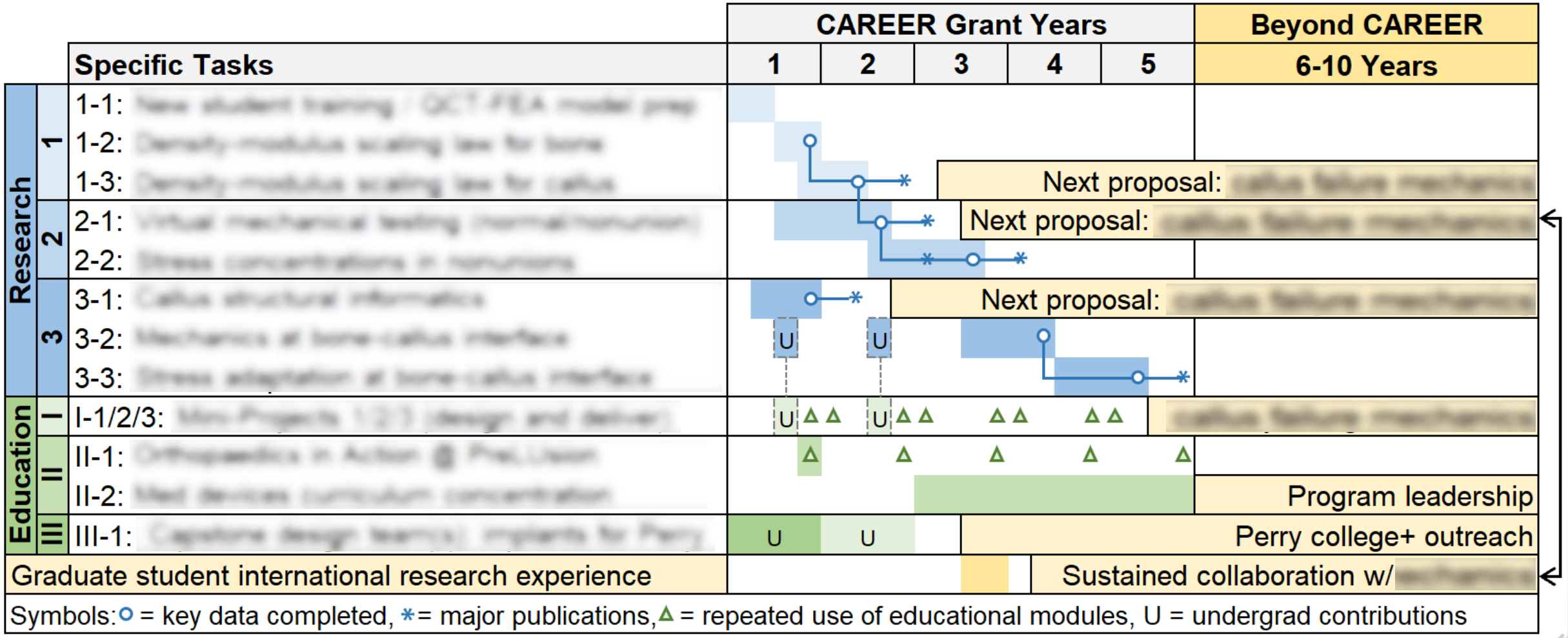
# Formal Project Planning

## Process Overview

- Rough timeline from Post-Its
- Identify smaller projects (Technical Objectives) within the overall CAREER program
- Describe:
  - ✓ Tasks (bodies of work)
  - ✓ Milestones (status goals)
  - ✓ Dependencies, critical path
- Lateral connections and temporal synergy – pacing the research/education/outreach

| Pros | Cons |
| --- | --- |
| Assurance that the work is doable for N student(s) over 5 years | Can be perceived as pedantic, measured, less “Visionary” |
| Defining tasks helps with resource planning and output pacing (conferences, papers) | Less flexible, locked-in writing process |
| | Time consuming |
| Defining milestones helps identify and mitigate risks | Harder for earlier-stage faculty with less preliminary data |

# My Formal Project Plan (GANTT Chart)



# Long-Term Vision Beyond the CAREER

If I/we can answer/solve _____, that will unlock _____, _____, and _____ exciting payoffs or new directions for this research.

Can you convince the reviewer that successful completion of the proposed CAREER program will set you up for success in the next 5 years beyond the award?

# What Worked [for me]

Translatable strategies by project stage:

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**Phase 2:** Feasibility Assessment and Development

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- Long-term vision

**Phase 3:** Refinement and Validation

- Critical first/last pages: write Picasso's bull
- Visual design for the reader, not yourself
- Coco Chanel Rule
- Mindset matters – banish the imposter

# Anatomy of My CAREER Proposal

**INTRODUCTION**

**Overview of CAREER Development Plan**

Motivation for the Proposed Research Program

BACKGROUND & PRELIMINARY DATA

PROPOSED RESEARCH STRATEGY

Opportunities for Innovation

RESEARCH PLAN

Technical Objectives

Hypotheses
Tasks (including outputs: planned papers)
Expected Results & Criteria for Success
Feasibility, Potential Pitfalls, Alternative Approaches

INTEGRATED EDUCATIONAL & OUTREACH ACTIVITIES

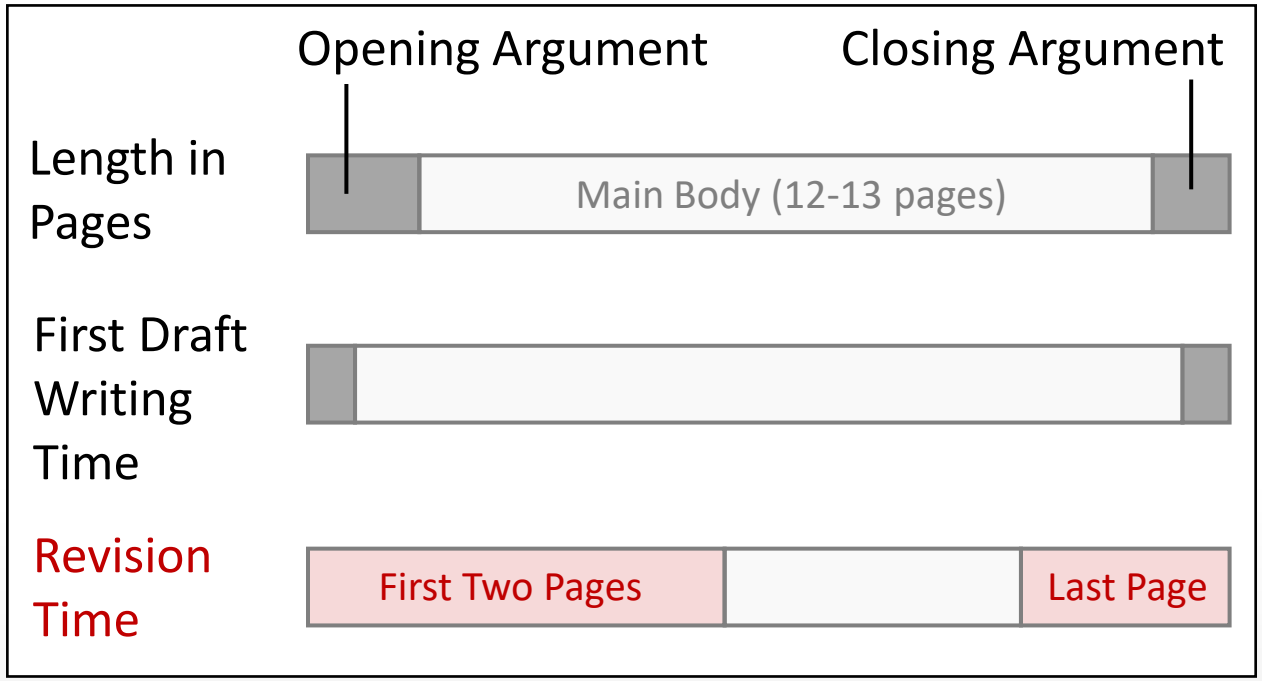
Motivation for the Education & Outreach Plan

Educational & Outreach Objectives

Lots of Variation!

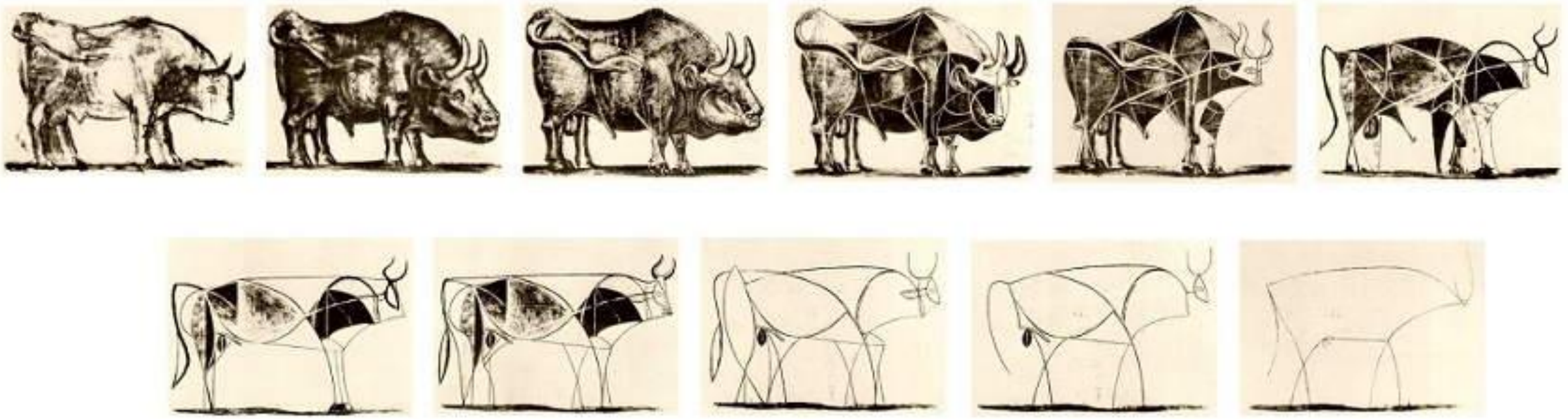
**PROJECT MANAGEMENT & LONG-TERM CAREER VISION**
**BROADER IMPACTS**
**RESULTS FROM PRIOR NSF SUPPORT (if applicable)**

Up to two pages
Include a large-format "Proposal in a Figure"
Clear paragraph on Intellectual Merit




Last page
Closing argument for yourself

# Picasso's Bull



Pablo Picasso, "The Bull", lithographs, 1945

**First two pages:** an **elegant, minimalist overview** of the proposal's research, education/outreach, and career development objectives

Convey the vision and essential ideas, intrigue the reader, save the details for later.

# Use Visual Design for the Reviewer

- Look at the design (not content) of successful proposals
- Find a few design elements you like and use throughout
- Use visual queues to make the reviewer's job easy
  - Don't frustrate the reader
  - Leave some whitespace
  - Proposal structure and big ideas should be clear from the headings/subheadings
  - Make things easy to find during panel discussion

**MAIN SECTION HEADING**

**SUBHEADING**

***Subsection Heading***


# The Coco Chanel Rule

*"Before you leave the house, look in the mirror and remove one accessory."*

*- Coco Chanel*

Strip out all your **bold**, *italics*, underlines, ***bold italics***, *underline italics*, and all other formatting crutches…

Choose one emphasis style and deploy it sparingly for thoughts you really want to stick in reviewers' minds.

# Mindset Matters

Proposal reviews can be harsh…

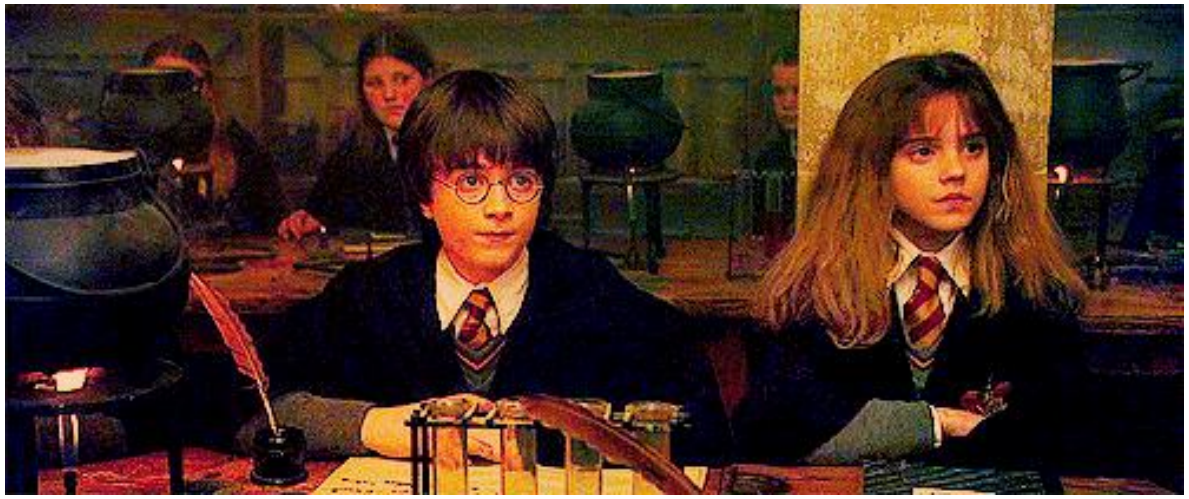
…and the more of them you accumulate, the more your writing can sound:

- Defensive
- Apologetic
- Weak
- Uncertain

…like a person who has been rejected many times

This is not a fundable mindset.

# Banish the Imposter – Write Like a Dude-Bro*



***dude-bro*.** Noun. (plural *dude*-bros) (slang)
A hypermasculine man, usually white, who is unaware of his own privilege

Of course my work is critically important, exciting, and fundable…why would I think otherwise?


*actual advice given to me by a female mentor

# Acknowledgements & Contacts

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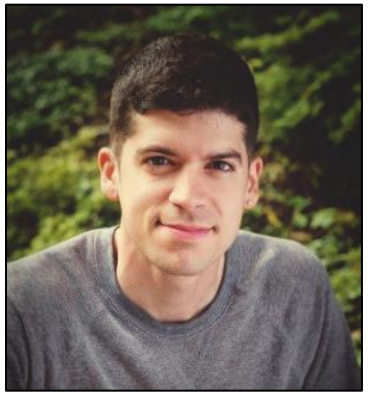
Peter Schwarzenberg



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