

Naval Nostalgia & Racial Memory in the United States, United Kingdom, & the Netherlands

Peter Odell Campbell, English
GSWS & Cultural Studies Programs and
the European Studies Center
Pitt Faculty Organizing Committee

Exigence

- Naval nostalgia culture in the United States, United Kingdom, and the Netherlands helps promote incomplete public memory about histories of enslavement, and ongoing oceanic settler colonialism (Na'puti)
- Intimate (Lowe) naval memory connections among these empires remains understudied in scholarship and obscured in popular naval culture

Project Description

- Seeks a comprehensive account of *naval nostalgia rhetoric* (language techniques for re-enacting idealized pasts through representations of watery warfare) across the histories and geographies of these three maritime empires
- Combines field-observation of the situated and physical arrangement of naval nostalgia with analyses of naval memory in popular culture, including painting, cinema, & historical novels

Context

- How do naval memory practices on the U.S. Pacific Coast, and occupied islands in Pacific archipelagoes, work together with naval memory sites on the U.S., Canadian, English, and Dutch Atlantic seaboard?
- This is a new attempt to elucidate connections among English and Dutch naval sites in the Atlantic, and present U.S. naval colonies (e.g. Oahu, Hawai`i)
- A physically situated understanding of how discourses of racial apology and amnesia are co-composed across these empires might provide resources for cultural literacy in the role the U.S. Navy plays in its ongoing and deadly settler colonial activities in Pacific archipelagoes

How is naval nostalgia physically arranged—in museums, battlefield monuments, active operations—across English, Dutch, and U.S. settler histories?

Background image: replica of the VOC East Indiamen ship Amsterdam, Scheepvaartmuseum, Amsterdam, NL. Photo by the author.

Project Goals

- Seeding funds enable field research toward completion of scholarly works including essays and a monograph-in-progress
- Field research will enable methodologies grounded in listening to Indigenous and other anti-racist decolonial activism as both primary and secondary sources
- Seeding funds will enable further application for external fellowships in anti-racist studies of maritime history
- Research for this project will contribute to movements in rhetorical and cultural studies toward better literacy about popular imperial nostalgia texts (Hasian)

Academic Impact

- Rhetorical studies help build—and better understand—discursive techniques for human interaction and memory building
- U.S. rhetorical studies of imperial war monuments focus on collaboration and solidarity among European empires—“Naval Nostalgia & Racial Memory” tries to show how interconnected naval memory sites play active roles in violent conquest and settlement

- *Supported by the Special Initiative to Promote Scholarly Activity in the Humanities & the European Studies Center Faculty Grant for Research on Europe*
- *For further reading see: Lisa Lowe, **The Intimacies of Four Continents** (Durham: Duke University Press, 2015); Marouf Hasian Jr., “Skyfall, James Bond’s Resurrection, and 21st-Century Anglo-American Imperial Nostalgia,” *Communication Quarterly* 62, no. 5 (2014); Tiara R. Na’puti, “Archipelagic Rhetoric: Remapping the Marianas and Challenging Militarization from ‘A Stirring Place,’” *Communication and Critical/Cultural Studies* 16, no. 1 (2019); Kyle Kajihiro and Terrilee Keko`olani, “The Hawai`i DeTour Project: Demilitarizing Sites and Sights on Oahu,” in *Detours*, ed. Aikau and Vicuña Gonzalez (Duke University Press, 2019)*



Remediating the Past: Silent Film and Contemporary Performance

Charles Exley, EALL
Lynn Kawaratani, ASC
Neepa Majumdar, English
Kun Qian, EALL
Seung-hwan Shin, EALL
Kirsten Strayer, ASC

Motivation

- Today, we have seen a renewed interest in silent film narrators (benshi and pyeonsa) and orchestral silent film performance.
- How can we understand such projects: these new, remediated works and the “reframing” that occurs when we combine older works with contemporary interpretations?
- What are the implications for performance, historical scholarship, and contemporary film viewing?

Context

- Contemporary film scholarship has begun to reconsider the relationship between the viewer and the mode of viewing, particularly about early film and silent works.
- Today, artists are revisiting and remediating older texts, adding new material, changing the mode of viewership (from a Nickelodeon to an art theater, for example), the format (often, from 35mm to a digital restoration), and other crucial elements.
- Additionally, archivists and scholars are finding and reviving older silent film-era performance recordings.

This project reconsiders silent Asian film exhibition of the early 20th century and the remediation of those performance practices today.



Illustration of a silent film/benshi performance.



Photoplay theater district with film advertisements.



Contemporary benshi performer Ichiro Kataoka.

Project Description

This project will

- Feature three silent film performance events over the three semesters.
- Record and interview the performers.
- Bring in scholars to discuss the attributes and effects of these contemporary performances.

Project Deliverables

- After 1 year, the group will have staged performances and amassed recordings.
- Over the course of 2 years, we will host a larger roundtable to discuss scholarly implications and establish a digital framework for a repository of recordings and scholarship.
- We will measure success qualitatively and quantitatively, in terms of events held, recordings taken, and the quality of the scholarly implications.

Potential Impact

- The research will create a digital repository for recordings and interviews.
- These events will become catalysts for scholarly inquiry, working both as a reflection on the past as an archeology of older media forms and an examination of the present through the lens of contemporary film.
- The project will experiment with ways to use digital media to reconceptualize past performances.

Images

From left to right

- Archival image
- http://www.taito-culture.jp/customs/engei_hall/english/page_03.html
- <https://www.hollywoodsoapbox.com/benshi-ichiro-kataoka-set-for-passing-fancy-screening-in-nyc/>



Transatlantic Dialogues: Sectarian Violence and Popular Performance in Nineteenth Century Belfast

Michelle Granshaw, Associate Professor,
Department of Theatre Arts

Motivation

- To examine how the transatlantic circulation of performance intersected with and intervened in the intensifying sectarian violence in nineteenth-century Belfast
- To explore how theatre, as one of the city's only public secular spaces, operated within the increasingly segregated city

Project Description

- This project examines how transatlantic circulations of performance negotiated the city's intensifying sectarian conflict through its imagining of Ireland's history and future. Occurring in one of the only public secular spaces in the city, these performances intervened in and created a potentially safe space for debates about Belfast's present and future, as a city, part of Ireland, and a commercial jewel in the British Empire. As industry boomed and migrants within and outside of Ireland helped make the city temporarily Ireland's largest, popular performance provided an opportunity to imagine competing notions of Irishness. These performances reveal nuanced patterns of exchange and influence and demonstrate how the discourses surrounding emerging sectarian violence were embodied.

Context

- Much of Irish theatre history is dominated by ideas of modernity that situate W.B. Yeats and the Irish Literary Theatre as the 'beginning' of Irish theatre. These narratives often exclude theatre in the north and non-text based performances that did not serve middle class audiences. Irish theatre historians have challenged these narratives, but common characterizations of nineteenth-century Belfast performance still represent it as collapsed or virtually absent. This project builds on the work of scholars, such as Mark Phelan, to consider how these ignored, usually non-literary performance spaces rewrite Irish performance historiography and suggest a crucial cultural role for performance in navigating political, economic, and social conflict.

Transatlantic Dialogues examines how **transatlantic circulations of performance** negotiated nineteenth-century Belfast's intensifying **sectarian conflict**.

Project Deliverables

- During the 2020-1 academic year, I will work on completing the archival research for the project in Belfast and London
- This research will contribute to the writing of a scholarly monograph over the next several years.

Potential Impact

- Speaking to theatre, performance, religious, and Irish studies, this research suggests a rethinking of patterns of cultural exchange through transatlantic cultural circulation and offers a model of theatre's flexibility and response to crises.
- Placing these secular theatrical performances spaces into dialogue with broader political and religious factors illustrates how these spaces of engagement, exchange, and embodiment operated as vital local and transatlantic nodes in negotiating emerging sectarian tensions and violence.
- Building on recent Irish theatre scholarship, this project considers how placing non-literary and northern Irish performances back into the scholarly conversation rewrites prominent narratives in Irish theatre historiography.



Closed Circuit Electronic Playground

Zachary Horton

Assistant Professor of English and Media Studies

Motivation

- Fill in the missing gaps in gaming history: 1940s – 1972
- Re-examine computational media history in this early period in relation to the development of game systems.
- Challenge the linear narrative of video game history, which places a primary focus on progressive technical advancement, equating it with game sophistication.
- Explore the effects of early home gaming on gender and media dynamics within domestic space in the early 1970's.

Project Details

- Period: 1940-1972
- Conceptual history from cybernetics to game theory to second order cybernetics and media theory.
- Technical and social history.
- Focus on individual games and what they reveal about forms of play, social dynamics, ideology, and interactions with computational media systems.
- Reproduction and emulation of lost game systems. Actual play is vital to the recovery of historical media contexts.

Context

- Most game studies scholarship neglects video game history before the mid 1970s.
- Computational history tends to relegate game history to “footnote status,” assuming that it was derivative of computational developments rather than a primary driver of them.
- Early game hardware had a huge impact on media history, but was rare and is now either inaccessible (lost or in special collections) or difficult to obtain and even more difficult to repair/operationalize.
- Early video games are rarely contextualized as being in dialog with analog game forms, such as board games.



Early video game development (1940-1972) drove **digital media culture**, yet remains inaccessible to academics. **This project recovers that history.**



Project Deliverables

- Completed archival research throughout US, UK, and Germany.
- Obtaining of historical artifacts for study.
- Reconstruction of lost game systems and prototypes (interdisciplinary collaboration at Pitt, including student-driven work and public showcases).
- Complete outline and plan for monograph.
- Initial article for publication.

Potential Impact

- A deeper understanding of the relationships between early digital computer development and game development, both technically and conceptually.
- A more robust understanding of early video game cultures and potentials, revealing alternatives to game cultures that solidified later.
- A better appreciation of the ideological contexts of video game history.
- Inspiration for game designers to explore forgotten possibilities of gaming, including deeper levels of player interaction and hybrid media forms that combine screen and tabletop modalities.
- Theoretical models to better conceptualize human-machine interaction and the relationship between machine-mediated interaction and the interwoven scales of media assemblages.

WE CROSSED THE RIVER

a multimedia artwork about detained children

Angie Cruz, novelist

Associate Professor, English Writing Program

Eric Moe, composer

Andrew W. Mellon Professor of Music

Aaron Henderson, video artist

Associate Professor, Studio Arts

Cynthia Croot, director

Associate Professor, Theater Arts

Description

WE CROSSED THE RIVER is a semi-staged work of concert music with video projection. Performers include two singer/actors and a compact group of instrumental musicians.

Motivation

WCTR is an artistic response to the detention of children in camps at the U.S. border. Our goal is to incite compassion by placing the wrenching eye-witness accounts of victims in an artistic setting.

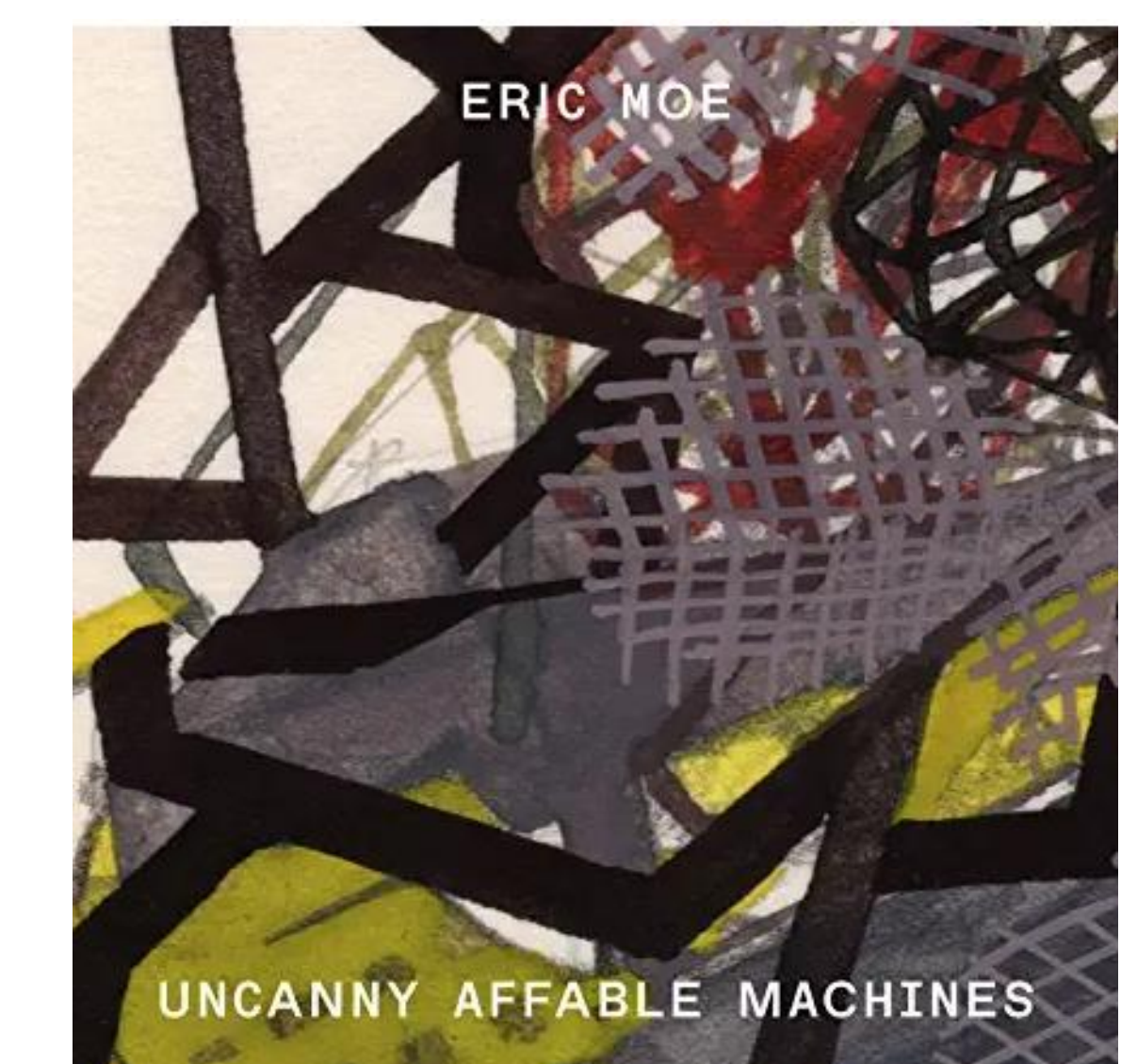
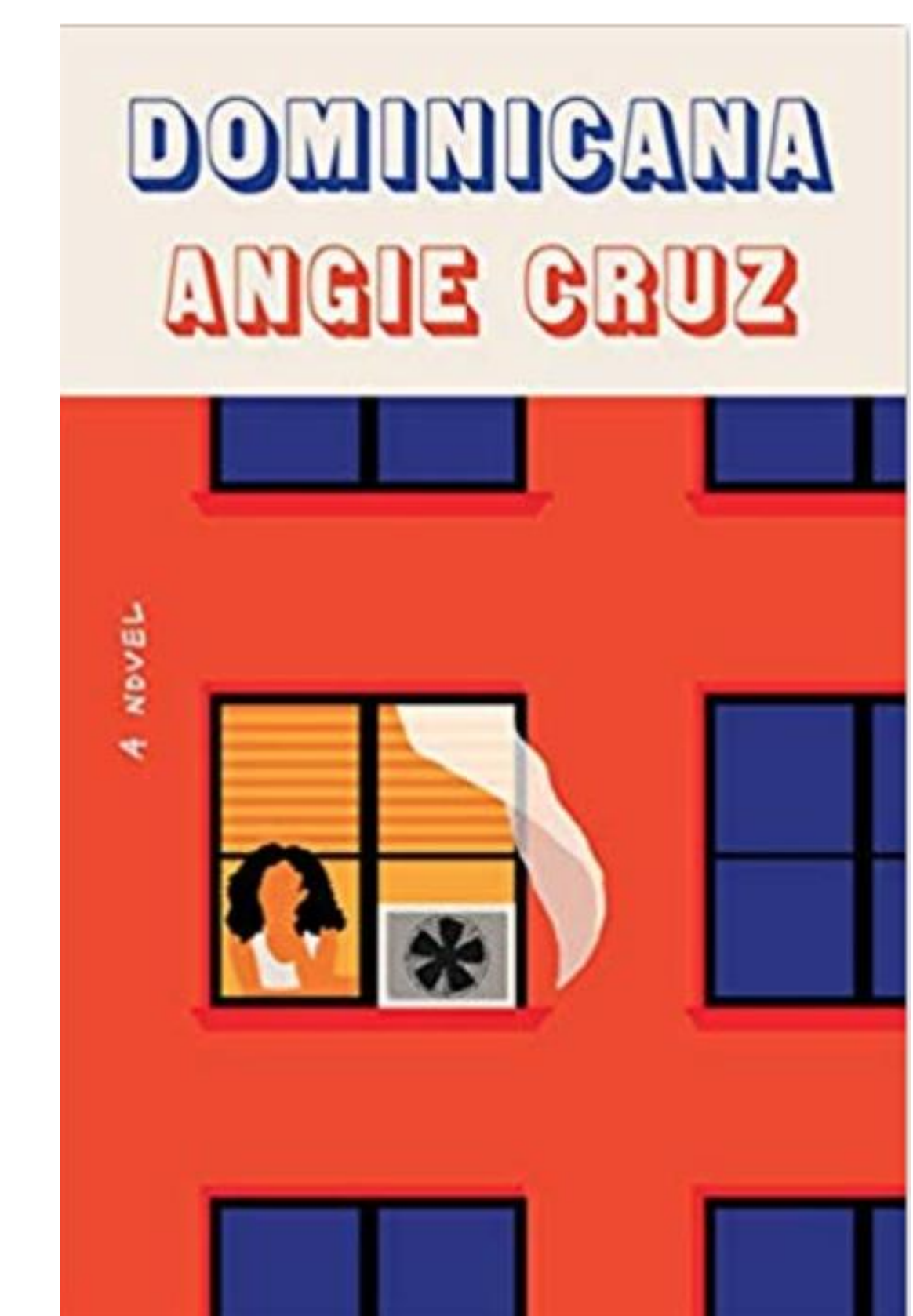
WE CROSSED THE RIVER

a multimedia artwork about detained children



Schedule

- Preview performance in Pittsburgh April 2020
- Performance with full instrumentation in NYC spring 2021 by the New York New Music Ensemble
- Performances in other cities 2022



Supporters include:

MAP Fund (Multi-Arts Production Fund)
NYSCA (New York State Council on the Arts)

Photo credit © ACLU



Russian Sovereign, Islamic Dynast

James Pickett, Assistant Professor, History Department

Motivation

- This project is at once *comparative* and *transregional*.
 - As indirectly ruled territories of the British and Russian empires respectively, Hyderabad and Bukhara were structurally similar political entities
 - They were also enmeshed in a culture of Islamic documentation, stretching from the Balkans to India.
- Who were the winners and losers of indirect colonialism, and how was it different from “pure” colonialism?

Project Description

- Deciphering and comparing two of the very few surviving Persian-language bureaucratic archives.
- Field work in Uzbekistan, Russia, Tajikistan, and India.
- Using *digital humanities* analyze texts in aggregate and conceptually map the region.

Context

- Few pre-20th century Islamic bureaucratic documents survive anywhere in the world.
- Layered sovereignty is alive and well in today's world:
 - Puerto Rico, Taiwan, northern Syria
- The state-building processes at the heart of this study shaped modern countries in Central and South Asia.



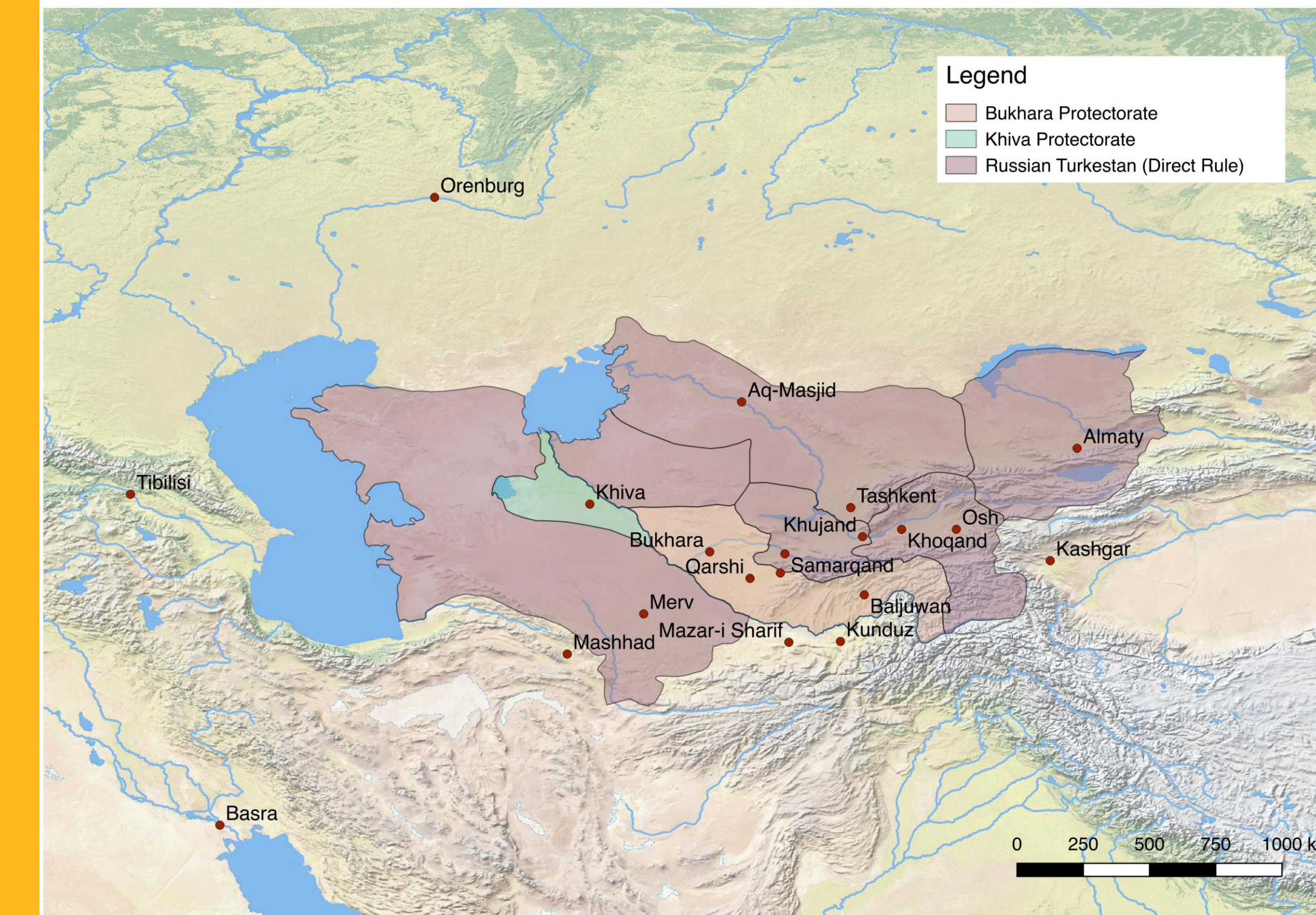
The Chahar Minar (“four minarets”) is an architectural form found only in Bukhara and Hyderabad. It serves as an apt metaphor for the deep connections historical connections between the two protectorates.



What does indirect rule in colonial empires reveal about sovereignty, Islamic authority, and the rise of the modern state?



Map of Colonial Central Asia



Project Deliverables

- First article and eventual book chapter: 1892 cholera outbreak
 - The cholera outbreak was reflected both in Russian and Bukharan documents.
 - Russian-mandated quarantine measures consolidated colonial power in the protectorate.
- Five-months of archival research in Uzbekistan, leading to “write-up” fellowship
- Long-term product: monograph comparing Bukhara and Hyderabad

Potential Impact

- Better understand the nature of *indirect* colonial rule.
- Delimitate where did Persian bureaucratic practices began and colonial ones ended.
- Assess what made new institutional practices “modern” in the eyes of locals.

References

- Early research findings:
 - James Pickett, “Written into Submission: Reassessing Sovereignty through a Forgotten Eurasian Dynasty,” *The American Historical Review* 123, no. 3 (June 0, 2018): 817–45.
 - James Pickett and Paolo Sartori, “From the Archetypical Archive to Cultures of Documentation,” *Journal of the Economic and Social History of the Orient* 62, no. 5–6 (0, 2019): 773–98.
- For more information, visit jamespickett.info

Acknowledgements

- Social Science Research Council Transregional Research Junior Scholar Fellowship: InterAsian Contexts and Connections Short-term Residency Grant (January - December 2020) and Transregional Research Junior Scholar Fellowship (2017-2018)
- Special Initiative to Promote Scholarly Activities in the Humanities (2018-2019)
- University of Pittsburgh Humanities Center Faculty Fellowship (2017-2018)

Killing “Nicely”

Elizabeth A. Pitts
Assistant Professor of English

Motivation

- I’m interested in how scientists and conservationists think about the notion of genetically engineering entire populations.
- Conservationists have long argued that diverse species should be protected for their own sake, rather than for their utility to humans. But genetic engineering approaches organisms as tools to be adapted for human purposes. How might these value systems intersect?
- What would it mean to create a mammal that functions as its own extermination device? What, if any, obligations would humans owe to such a creature?

Project Description

- I’m investigating the Genetic Biocontrol of Invasive Rodents (GBIRD) project, which aims to conserve endangered birds by eliminating populations of rodents that threaten them.
- Rather than killing the rodents, GBIRD would introduce a gene that makes it impossible for them to bear female offspring.
- I will interview the scientists developing GBIRD and the conservationists and regulators responding to it to refine the focus of a longer term study.

Context

- I forged personal connections with people developing and advocating for this technology while pursuing interdisciplinary doctoral studies.
- Popular accounts of genetic biocontrol liken it to birth control, but early analysis shows its logics also resemble those of eugenics. I want to draw on my relationships with the people involved with GBIRD to offer a more sophisticated account.

What would it mean to use genetic engineering to eliminate unwanted species? This project investigates the uncomfortable pairing of conservation and genetic engineering.



Project Deliverables

- Short term: conference presentations, mentorship opportunities for graduate and undergraduate students, an academic article, defined plans for a longer-term study, a strategy to solicit outside funding
- Longer term: a book that speaks to both academic and public audiences

Potential Impact

- I want to bring to light perspectives that could otherwise be overlooked. For instance, scientists involved in this project have expressed concerns that field trial plans might not adequately account for the agency of the mice.
- This research will appeal to humanities scholars and social scientists who want to move beyond anthropocentrism.
- Findings will also be relevant to policymakers in the United States, New Zealand, and Australia, which may serve as initial test sites for genetic biocontrol.

Selected References and Acknowledgements

- Leitschuh, C. M., Kanavy, D., Backus, G. A., Valdez, R. X., Serr, M., Pitts, E. A., Threadgill, D., & Godwin, J. (2018). Developing gene drive technologies to eradicate invasive rodents from islands. *Journal of Responsible Innovation*, 5(sup1), S121–S138. <https://doi.org/10.1080/23299460.2017.1365232>
- Valdez, R. X., Peterson, M. N., Pitts, E. A., & Delborne, J. A. (2019). International news media framing of invasive rodent eradications. *Biological Invasions*. <https://doi.org/10.1007/s10530-018-01911-9>
- This project builds on an Interdisciplinary Graduate Education Research Traineeship that I was awarded by the US National Science Foundation (NSF Award Number 1068676) in collaboration with the Genetic Engineering and Society Center at North Carolina State University.

Title

The Bonn *Lancelot-Grail* Manuscript and its Illustrations, Bonn, LUB MS 526

By Alison Stones, Prof. Emerita, Dept. of History of Art and Architecture

Motivation

I want to compare the illustrations in Bonn LUB 526 with the rest of the Lancelot-Grail manuscript tradition in order to find out what patrons and/or makers found interesting and important in this copy which, unusually, is signed by the scribe Arnulfus de Kayo in 1286. This will tell us what place these stories and this manuscript held in the value system of 13th century culture.

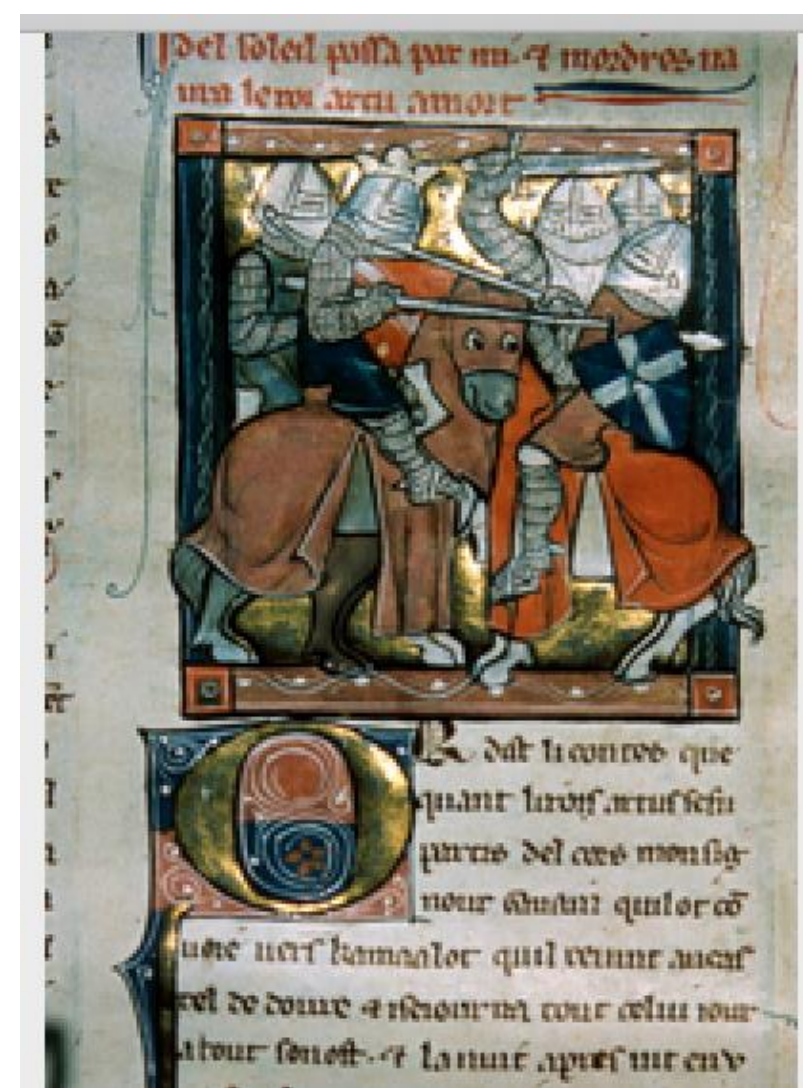
Project Description

I will go to the LUB in Bonn and assist in the photography of the manuscript to be executed by a professional photographer from the Digital Image Archive of Medieval Music (Oxford) with whom I have worked on other projects. Then I will make a page to add to my *Lancelot-Grail* web site and I will write the text for an analytical study to be published as part of the series *Manuscripta Illuminata* which I edit with Brepols in Turnhout, Belgium.

Context

The *Lancelot-Grail* Romance was one of the most popular tales of the Middle Ages, surviving in hundreds of copies, most of them illustrated. The pictures tell us what aspects of the story people liked the most. The text is about chivalry, adventure, military prowess, friendship, love, and the search for spiritual purity exemplified by the Holy Grail. But it is also about treachery and betrayal, defeat and humiliation, adultery (of Lancelot and Guinevere) and loss of friends, wounding, sickness, and death (it ends with the death of King Arthur and the disintegration of his court of the Round Table. All human emotions are there, and people loved it.

The Bonn manuscript is special because it is signed and dated and is a focal point for any study. It was the basis for the most recent edition of the text—but nothing is said there about the illustrations! They have never been studied in the detail they deserve. My project will correct that situation by making the manuscript available on the web and also in print.



Project Deliverables

- I expect to have completed the photography of the manuscript
- To have manipulated the images
- To have completed the web pages
- To have a book in draft
- In a year I should have completed the book

- By mid-term the photography should be complete
- By the end the web page should be complete and the book in draft

Potential Impact

- It should fill a gap in our knowledge of how medieval literature in illustrated manuscripts was created and received at the time.
- The proof lies in the manuscript itself which my project will make available on the web.

Acknowledgements:

I acknowledge the participation of the Digital Image Archive of Medieval Music (DIAMM), Oxford University, and the colleagues and students who worked on the Lancelot-Grail Project at Pitt.

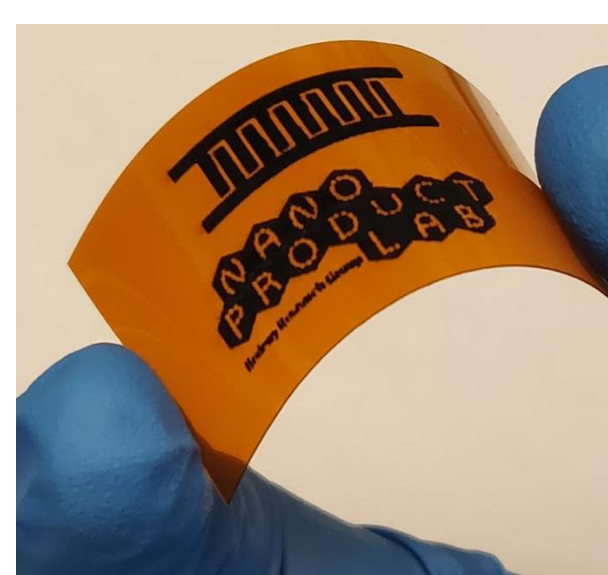
Reference:

A. Stones, *Studies in Arthurian Manuscripts*, 2 vols. London: Pindar Press, 2019.

Laser-induced formation of nanocarbons with tunable morphology directly on polymers

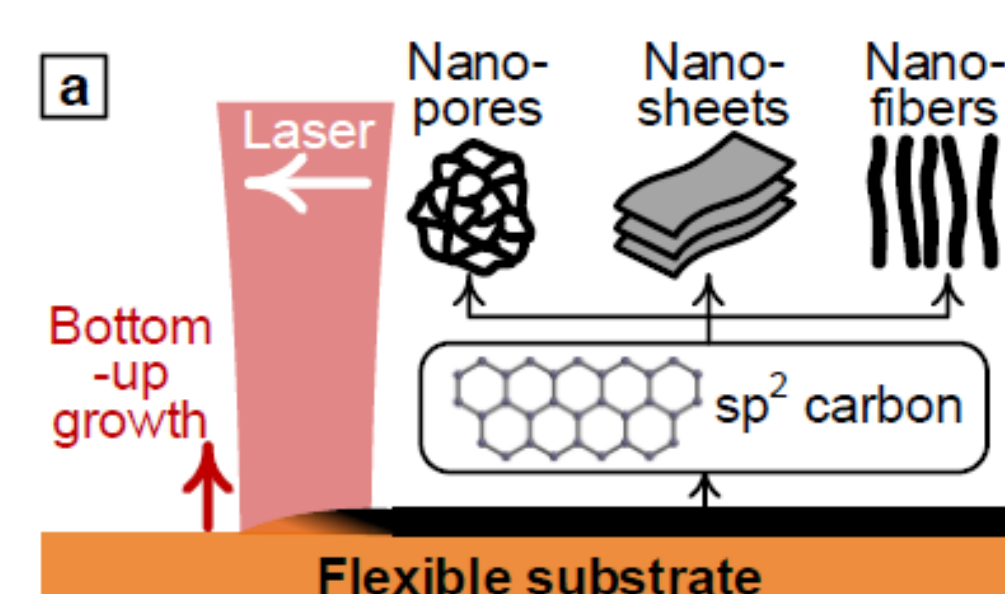
Mostafa Bedewy

Assistant Professor, Industrial Engineering, Chemical & Petroleum Engineering (secondary), and Mechanical Engineering & Materials Science (secondary), University of Pittsburgh



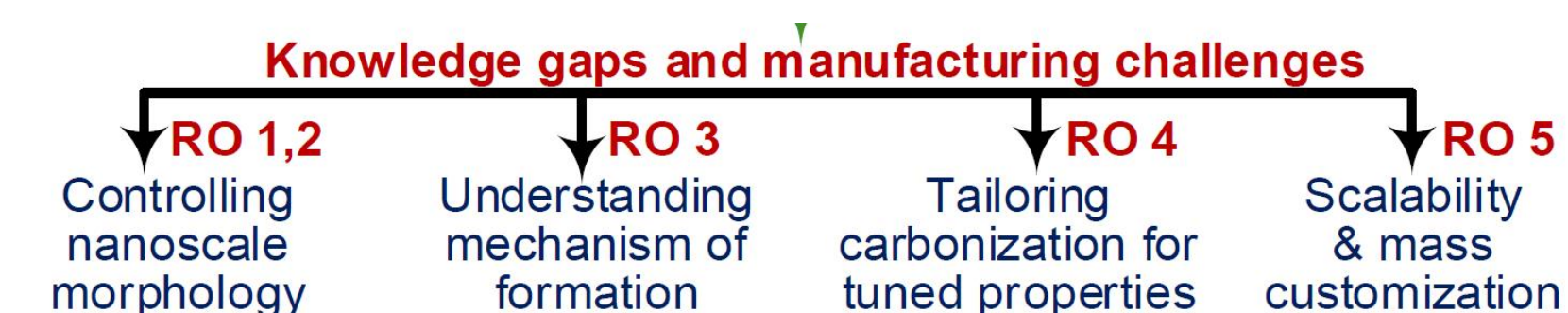
Motivation

- The challenge in flexible device manufacturing: Commercial top-down micro- and nanofabrication technologies were developed largely by/for the semiconductor industry. Hence, they are based on rigid substrates, such as silicon wafers. However, the recent shift toward flexible devices, such as wearable electronics, implantable medical devices, and lab-on-a-chip diagnostics created a global need for new manufacturing processes that are inherently compatible with flexible polymeric substrates that are temperature-limited.



Project Description

- We aim to understand the underlying fundamentals of process of the in **Laser-Induced NanoCarbon (LINC)** formation and develop its process-structure-property relationships
- Investigating the effect of beam intensity and width on the atomic structure, nanoscale and properties.
- Correlating beam parameters to temperature and heating kinetics using multiphysics simulations.
- Demonstrate tunability of functionality electrodes



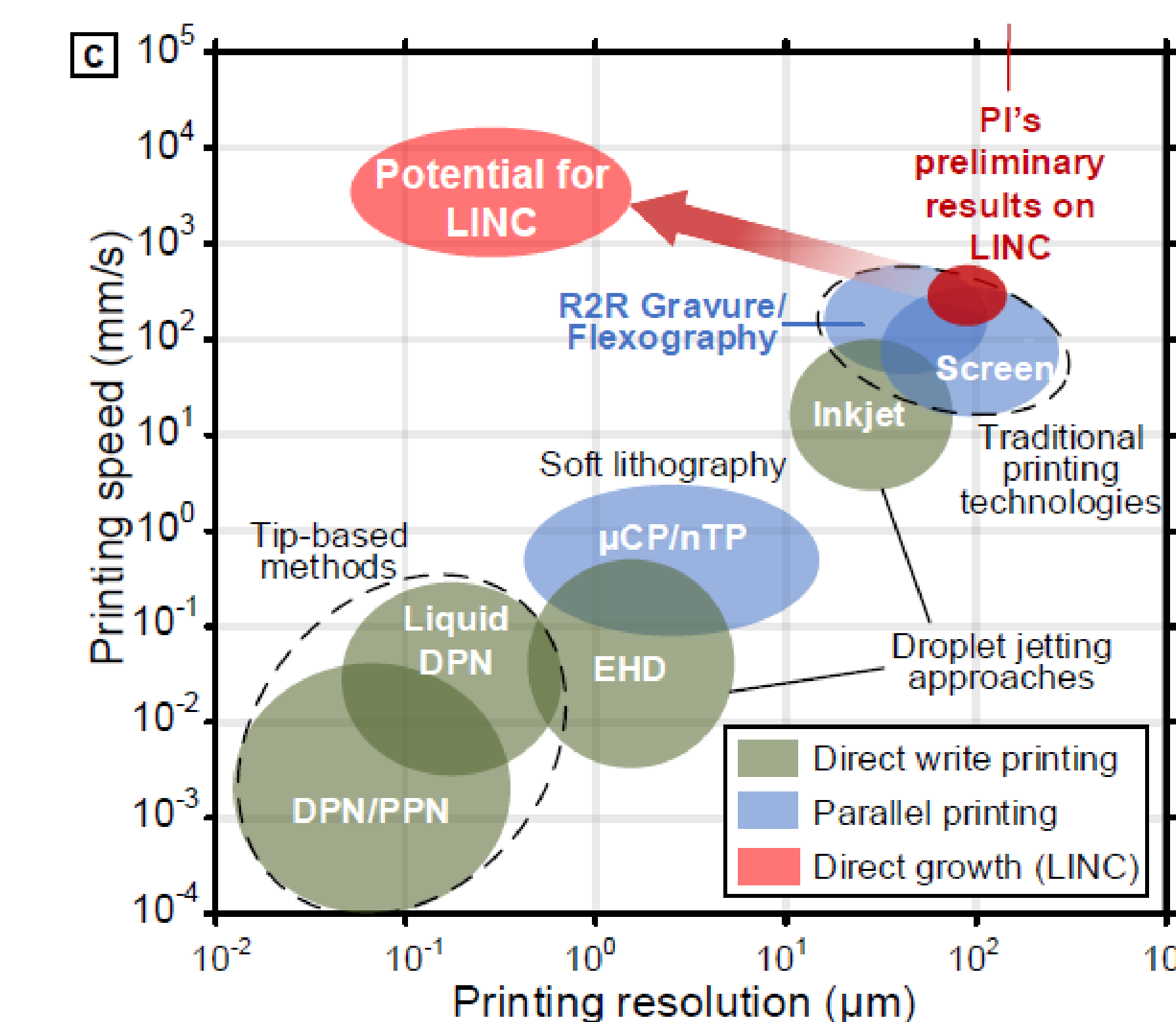
Context

- Today, a slew of either direct-write or parallel printing methods are used for fabricating nanocarbon-based structures on flexible substrates.
- Juxtaposition of all these technologies reveals a clear tradeoff between throughput and resolution. The fundamental reason behind this tradeoff is that all printing technologies are based on the transfer of material onto the substrate. Thus submicron resolution requires deposition of femto- to pico-litter volumes with accurate placement.

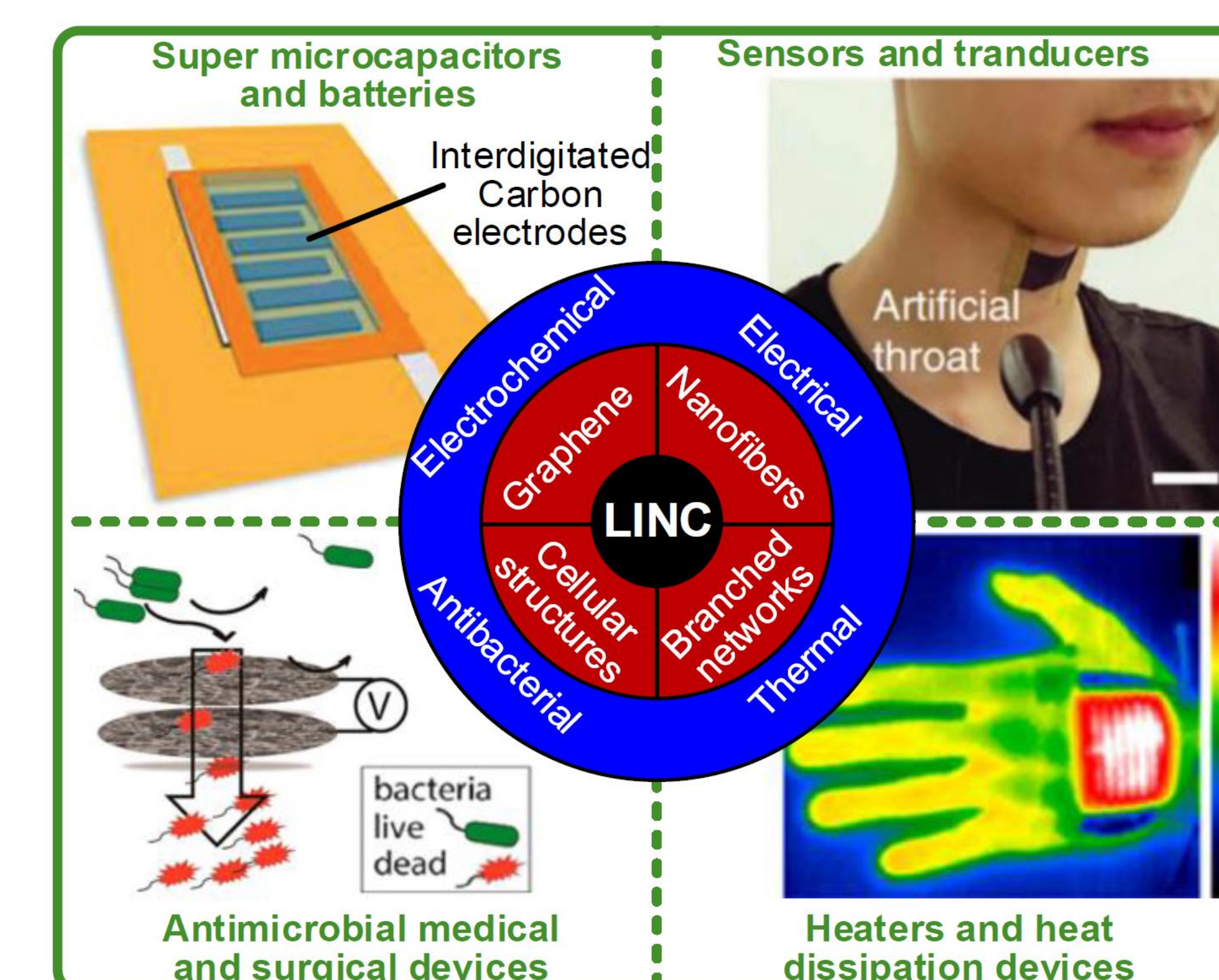
Laser-based bottom-up growth of nanocarbons on polymer films for flexible device manufacturing: An attractive alternative to printing

Potential Impact

- LINC process has the potential to disrupt flexible device manufacturing by replacing printing
- Unique combination of high rate and small resolution



- The proposed research can potentially break the limitations of printing by LINC's potential for on-demand control of the atomic structure/properties at specific substrate locations, enabling functionally graded patterns for different applications.



Project Deliverables

- Milestone 1: Submitting one journal article on experimental parametric study (5/1/20 - 9/1/20)
- Milestone 2: Generating multiphysics modeling results (9/1/20 - 12/1/20)
- Milestone 3: Submitting one proposal to NSF (12/1/20 - 2/1/21)
- Milestone 4: Submitting a second journal article with integrated experimental and modeling (2/1/21 - 5/1/21)
- Milestone 5: Submitting NSF CAREER proposal (5/1/21 - 7/15/21)

Acknowledgements

- PhD student Moataz Abdulhafez



Chemistries for Targeted Delivery of Agrochemicals: Development and Feasibility Testing

Leanne M. Gilbertson, Department of Civil and Environmental Engineering

Motivation

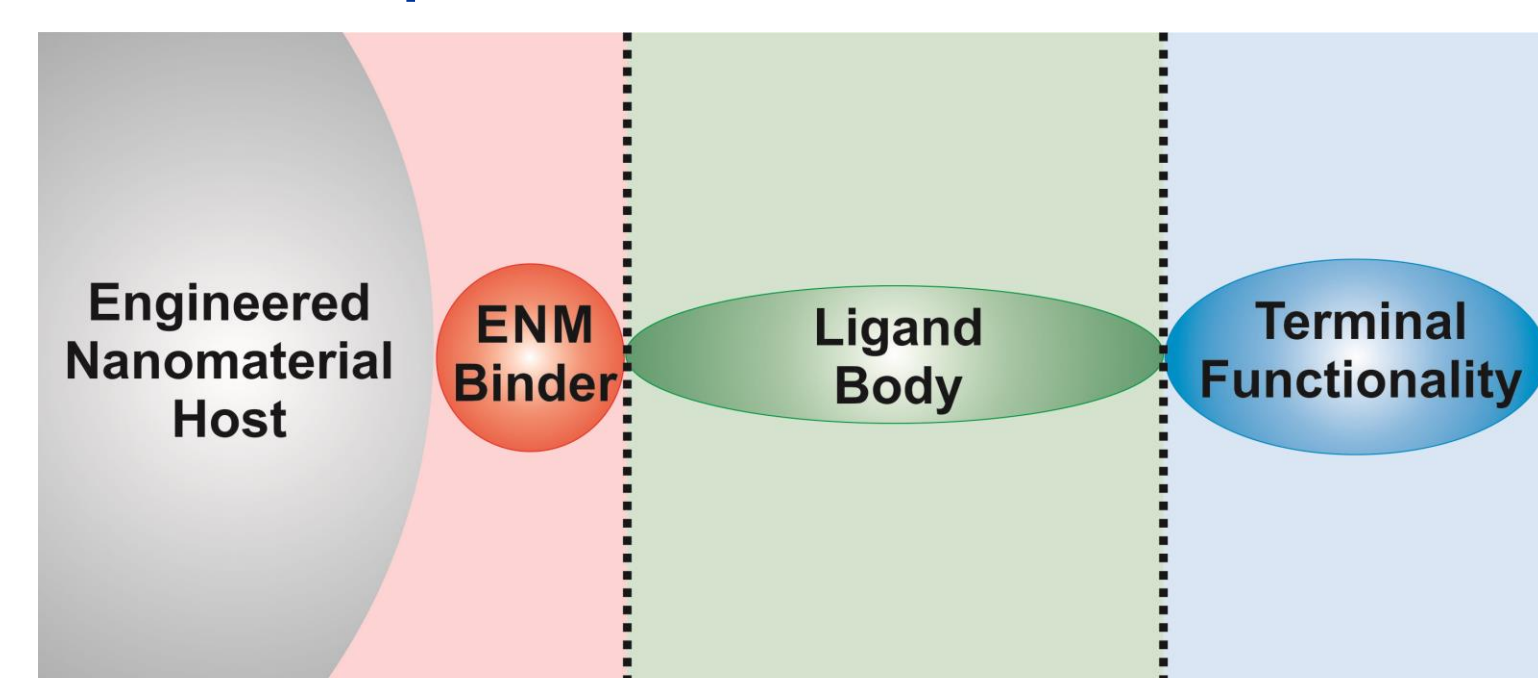
- 187 million metric tons of fertilizer and 4 million tons of pesticides are used globally each year to produce crops.^{1,2}
- The average utilization efficiency of N is 50%, P is 20%, and pesticides is 20%.
- The agrochemical fraction that is not taken up by the plant leads to incredible waste and ecosystem degradation, for example:
 - 158 PJ wasted annually based on U.S. ammonia consumption³
 - Over 37,000 km² of eutrophic waters⁴ and persistent pollutants in drinking water sources⁵

Project Description

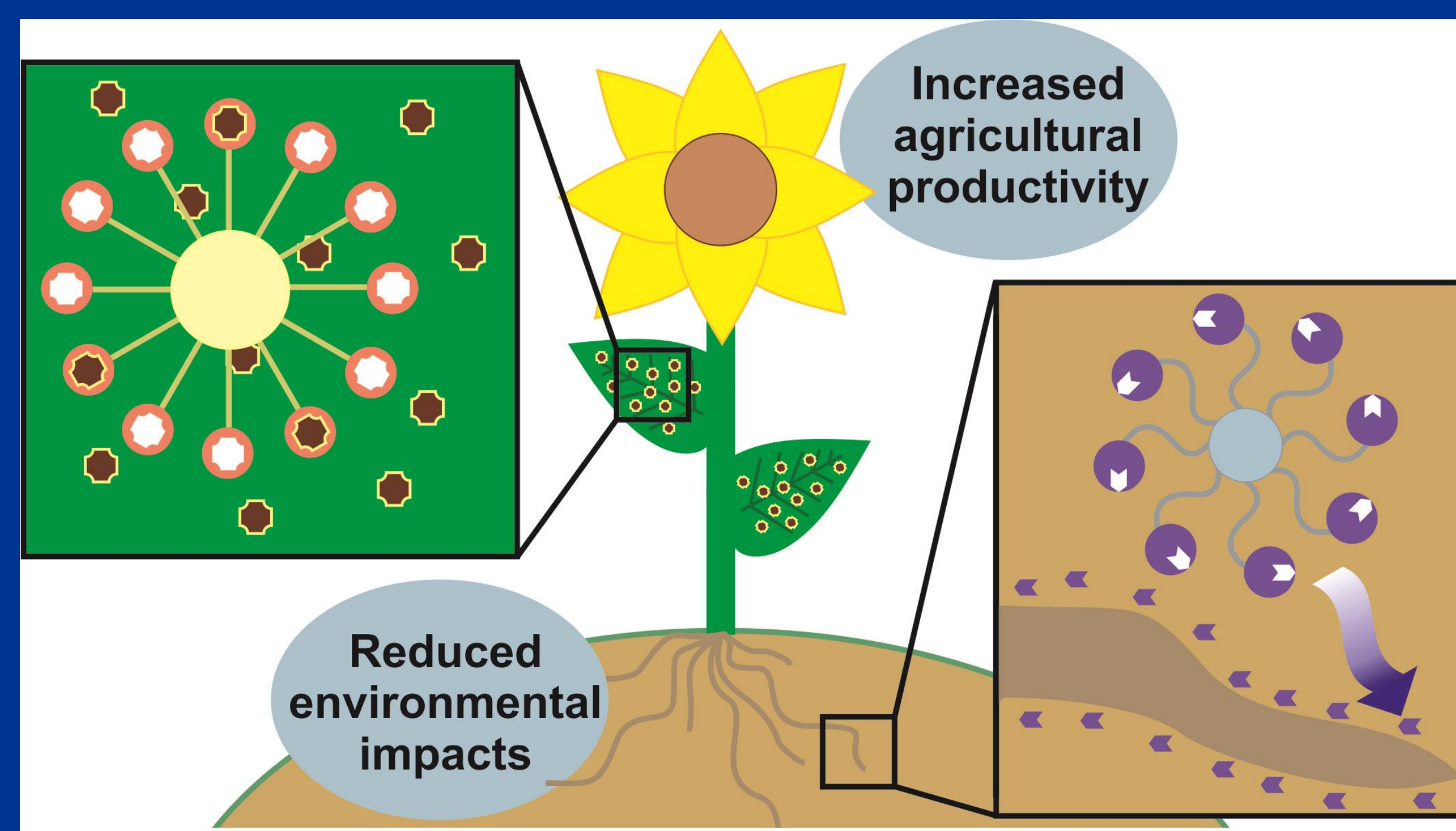
- My **long-term goal** is to demonstrate – at field scale – more efficient delivery of agrochemicals to crops through adaptable, targeted agrochemical carriers.
- **This seeding grant** will be the first step towards pursuing my goal by (i) identifying unique target compounds in/near the root, leaf surface, and internal plant cells, and (ii) demonstrating the preferred interaction of candidate terminal functionalities.

Context

- Best management practices have been around for decades, yet cannot solve this grand challenge
- Nanotechnology is one proposed approach that promises to enhance crop production while reducing agrochemical inputs by leveraging unique properties that emerge from the nano length scale (10⁻⁹ m)^{6,7,8}
- I propose that additional opportunities exist in the design and development of terminal surface chemistries that can target specific components of the crop.



Advance sustainable agriculture and rebalance critical nutrient cycles through the development of chemistries that target the delivery of agrochemicals to plants.

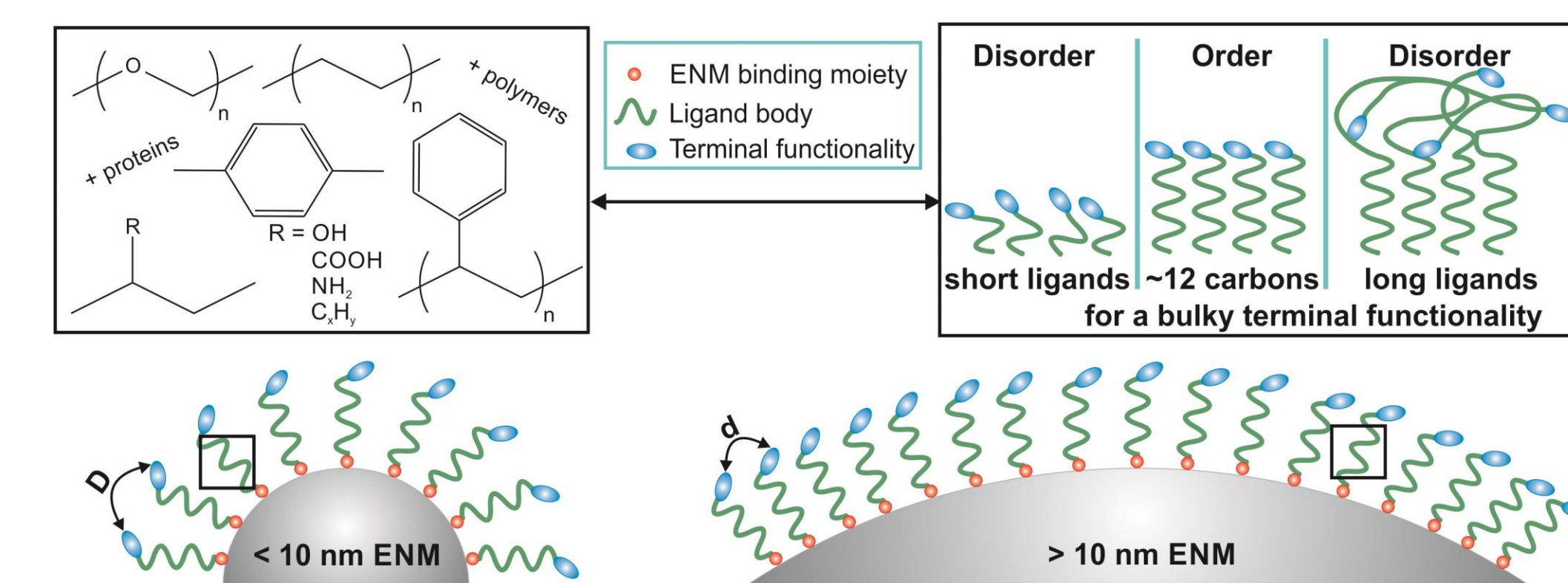


Project Deliverables

- At the end of the 1-year funding period, we will have identified targets and targeting chemistries (expanding the following table⁹) as well as demonstrated their binding affinity through existing and novel assays.

Location	Target compound	Targeting moiety	Type of interaction	Active ingredient class of interest
Rhizosphere	Glucose	Lectin from pea ³⁸ , Synthetic lectin ³⁹	CH- π and polar interactions	Fertilizers
Rhizosphere (under stress)	Flavonoids	Bovine serum albumin (BSA) ⁴⁰	Protein-ligand interaction	Fertilizers
Leaf	1° and 2° alcohols	Poly-L-proline (homopolymer) ⁴¹	H-bonding	Pesticides
Leaf with Karnal bunt	Phenols	Bovine serum albumin (BSA) ⁴²	Protein-ligand interaction	Fungicides (e.g., propiconazol or mancozeb)
	Trimethylamine	Casein ⁴³		

- Results from this seed project will lay the foundation for future work to develop the platforms – connecting the identified terminal chemistries to an agrochemical carrier (e.g., below⁹) – and demonstration of success in plant systems.



Potential Impact

- Crop production has a massive impact on our environment and global well being. It also suffers from extreme inefficiencies that can be addressed with innovative approaches to rebalancing critical resource cycles.
- If successful, this work has the potential to preserve finite resources, reestablish aquatic ecosystems and the economies and communities that depend on them, and protect drinking water sources; collectively advancing agriculture, sustainably.

References and Acknowledgements

- [1] Zhang, W. *PNAS* 2018, 8(1), 1-27 [2] Food and Agriculture Organization of the United Nations. *World Fertilizer Trends and Outlook 2020*, 2017 [3] USDA ERS. Fertilizer Use and Prices database [4] Rabalais, N. N.; et al. *ICES J. Mar. Sci.* 2009, 66(7), 1528-1537. [5] Klarich, K. L.; et al. *ES&T Lett.* 2017, 4(5), 168-173 [6] Kah, M.; et al. *Nat. Nanotechnol.* 2019, 14(6), 532. [7] Giraldo, J. P.; et al. *Nat. Nanotechnol.* 2019, 14(6), 541 [8] Lowry, G.V.; Gilbertson, L. M.; et al. *Nat. Nanotechnol.* 2019, 14(6), 517. [9] Smith, A. M. and Gilbertson, L. M. *ACS Sus. Chem. Eng.* 2018, 6, 13599
- LMG would like to thank the U. Pitt Momentum Funds for supporting this idea through their seed grant program.

Fuel recycling at copper catalysts

Rahman, M.A.; Allen, T.H.; Hernández Sánchez, R.

Motivation

- Recycle combustion waste products, CO₂ and CO.
- Develop the fundamental understanding of how to regenerate fuels from these waste products.
- Turn our everyday linear vicious use of hydrocarbons into a cycle, where the end products, CO₂ and CO, are treated chemically and used again as the fuels they once were.

Project Description

- Synthesize novel metal-based catalysts with potential to enforce the chemical regeneration of fuels starting from CO₂/CO.

Context

- Currently this transformation is known to occur in copper metal surfaces, shown below.¹
- In copper surfaces, products such as ethanol (the holy grail end product) have been observed.
- There are no homogeneous systems to carry out this transformation. Thus, much of the fundamental steps *en route* to fuels remain unknown.

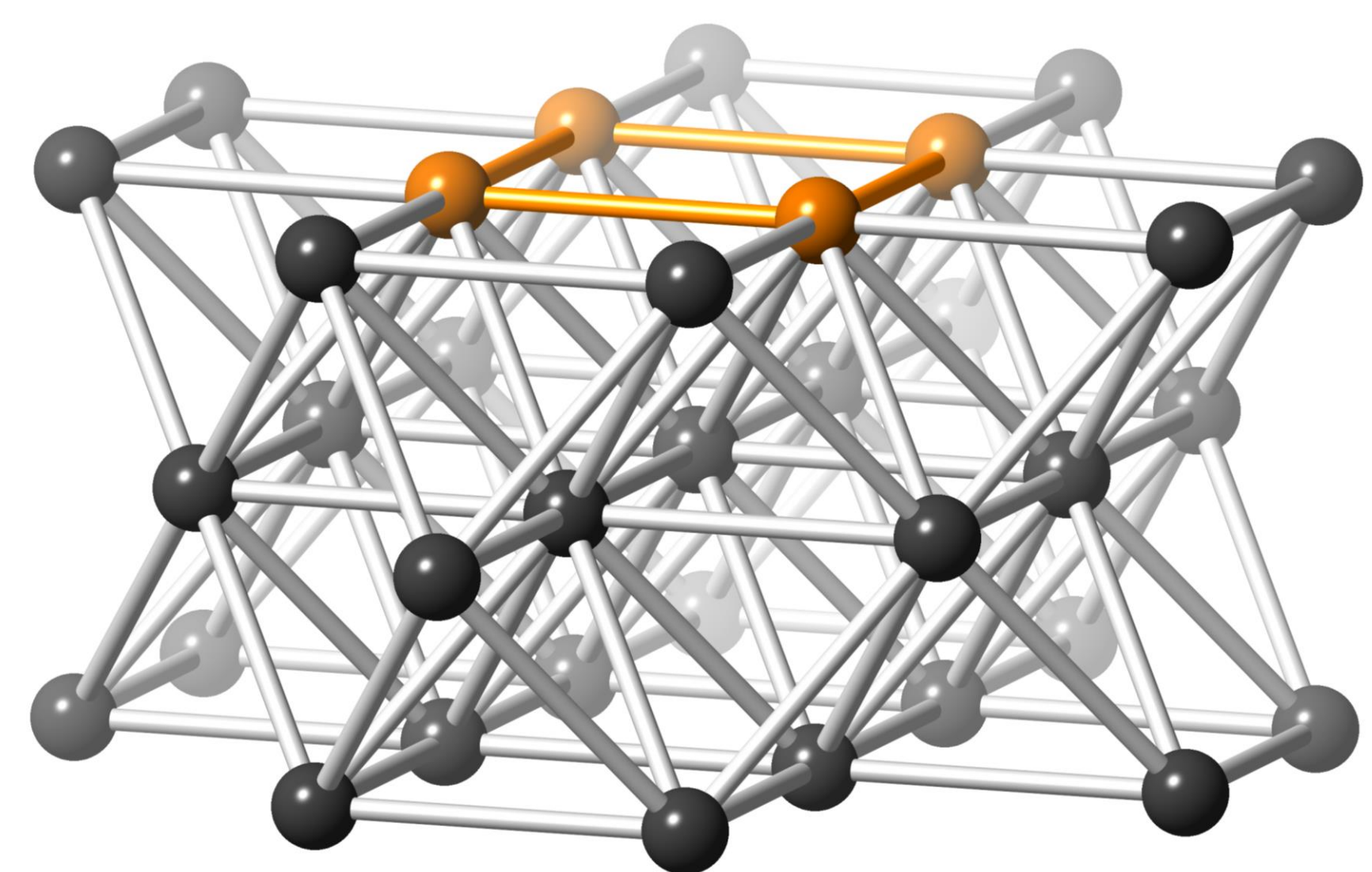
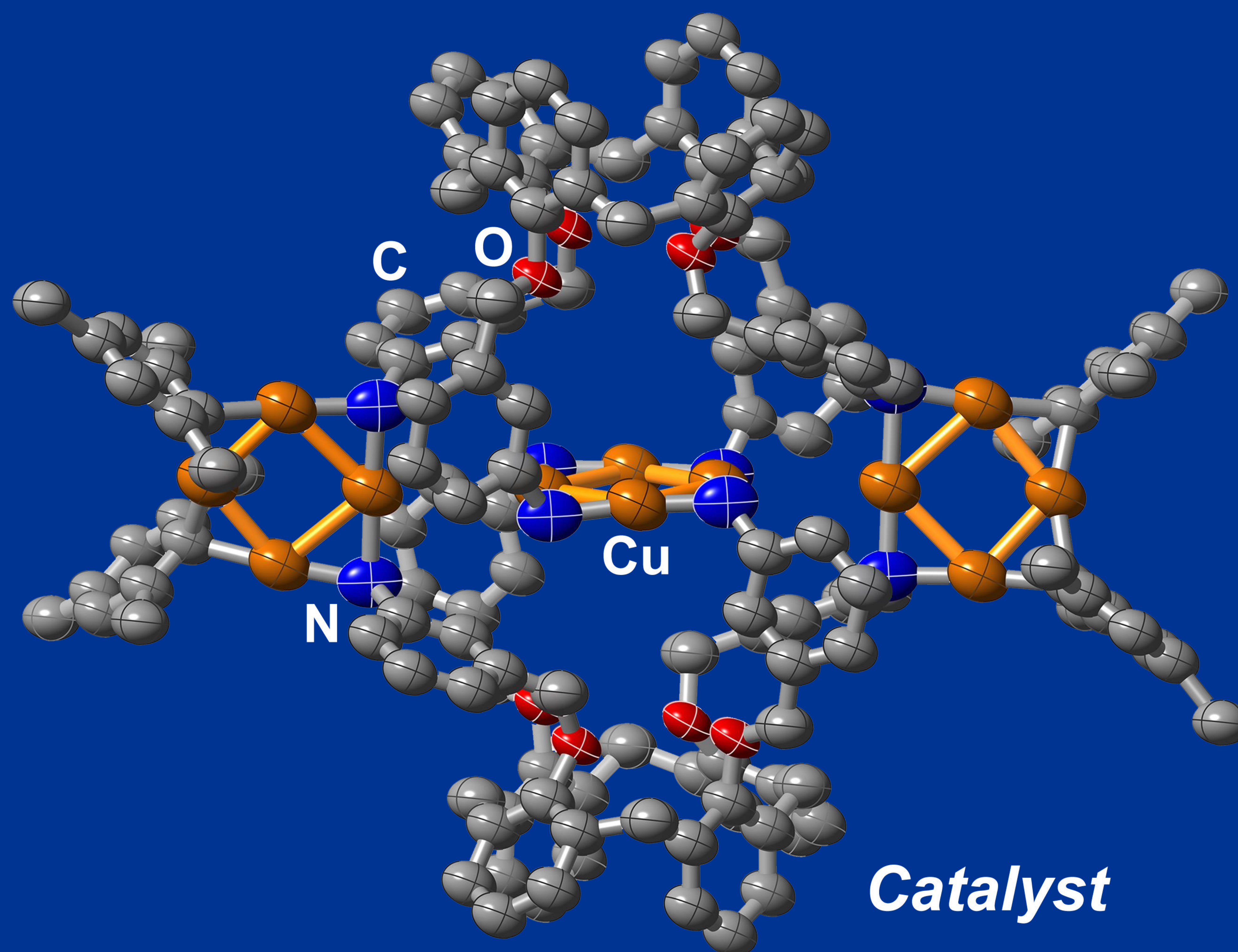


Figure 1. Copper (100) crystallographic plane known to effect the CO₂/CO transformation into small hydrocarbons, i.e. ethanol. Shown in orange is the proposed catalytic active sites.

This research plan will develop metal-based *catalysts* to transform inert greenhouse gases, i.e. carbon monoxide and carbon dioxide, into fuels.



Greenhouse gases $\xrightarrow{\text{[catalyst]}}$ Hydrocarbons (fuels)



Project Deliverables

- This research plan will deliver a family of catalysts with the appropriate geometry to test the reduction of CO₂/CO into short hydrocarbons.

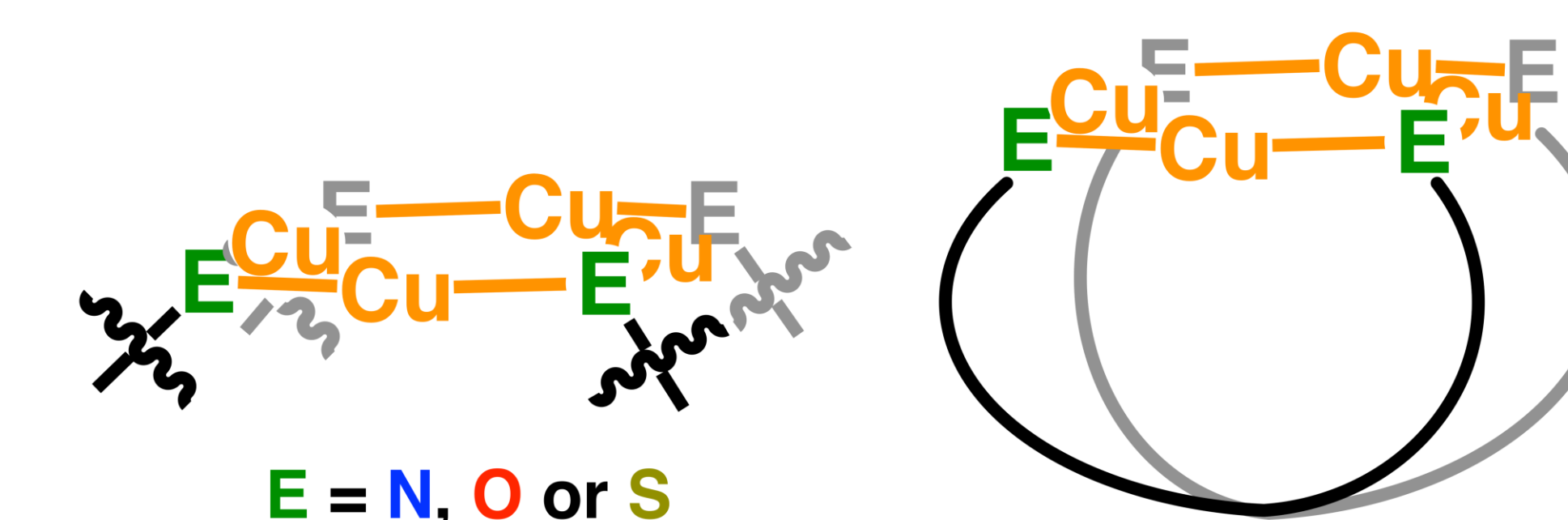


Figure 2. Ligand design concept.

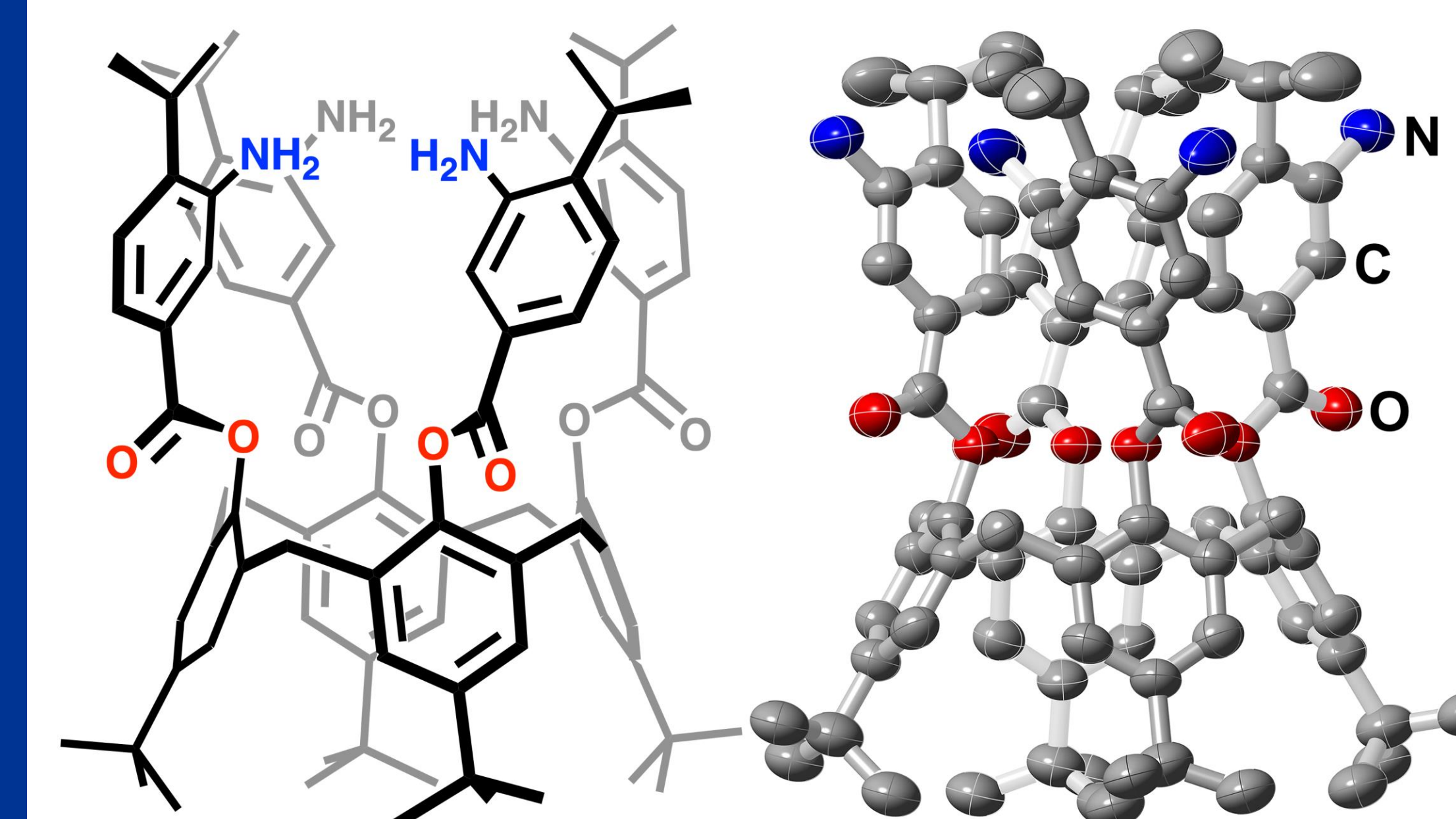


Figure 3. Example of ligand synthesized in the HSG. Shown on the right hand side is the crystal structure of this ligand.

- This funding will allow us to investigate an unexplored landscape of polynuclear copper homogeneous catalysis.
- Data collected throughout the upcoming year will serve as the basis to a major NSF and/or DOE grant application.

Potential Impact

- Success of this research will provide a guideline to develop catalytic systems to reintroduce carbon-based waste products into our energy-thirsty society.
- These catalysts promise to unveil the chemicals steps to guide society to *sustainability*.

References and Acknowledgements

- ¹(a) K. P. Kuhl; E. R. Cave; D. N. Abram; T. F. Jaramillo. "New Insights into the electrochemical reduction of carbon dioxide on metallic copper surfaces". *Energy Environ. Sci.* **2012**, *5*, 7050; (b) C. W. Li; J. Ciston; M. W. Kanan. "Electroreduction of carbon monoxide to liquid fuel on oxide-derived nanocrystalline copper". *Nature* **2014**, *508*, 504.

Identifying regulators of cell morphology.

Jeffrey D. Hildebrand PhD
Department of Biological Sciences, Kenneth P. Dietrich School of Arts and Sciences.

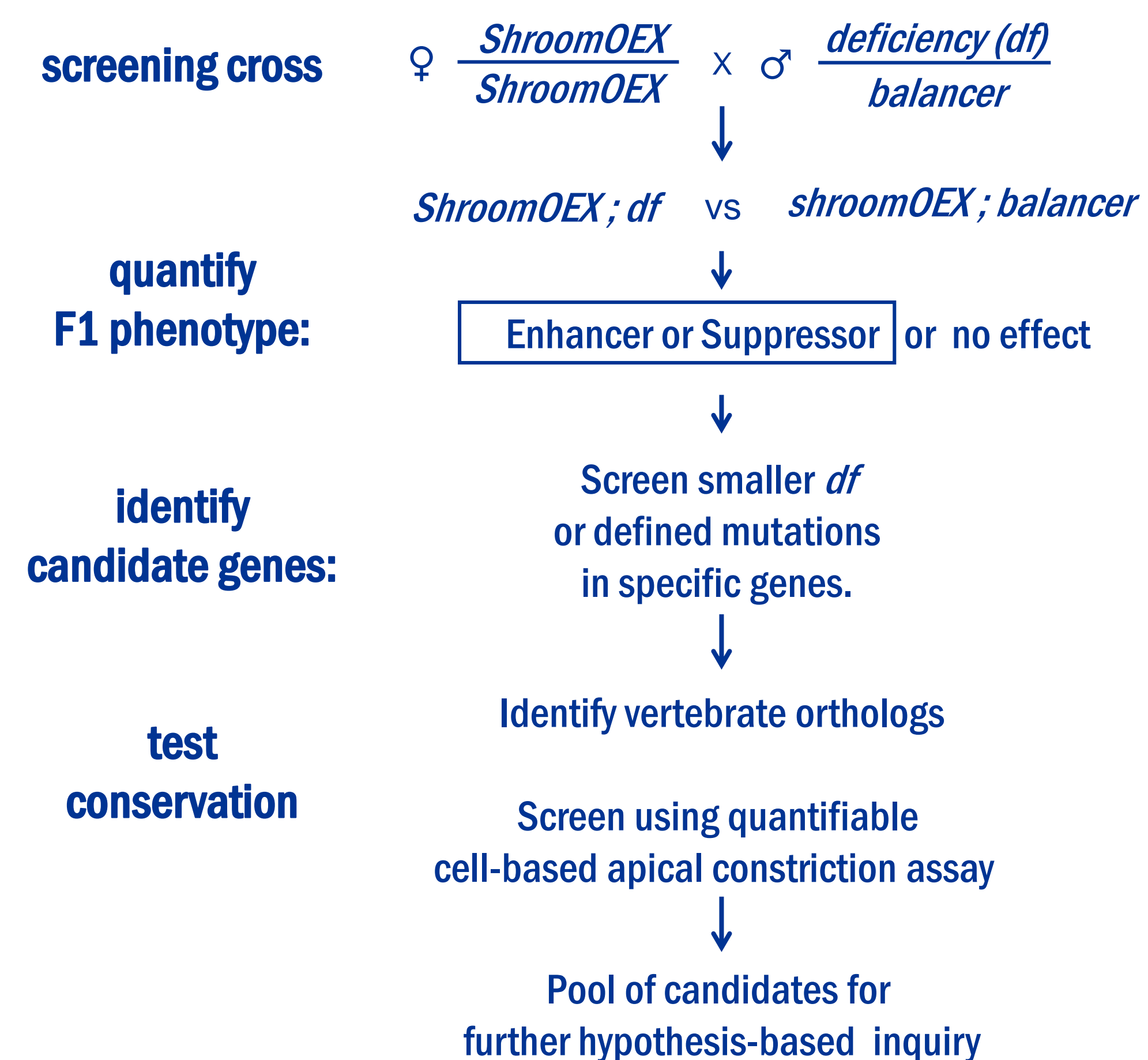
Objectives

While the Shroom3-Rock-myosin II signaling module is essential for proper tissue morphogenesis in vertebrates, we hypothesize that other cellular pathways work with Shroom to form tissues of the correct morphology. The following aims will be used to test this hypothesis:

Aim 1: Complete a genome-scale genetic screen in *Drosophila* to identify proteins and pathways that work with Shroom to control tissue architecture.

Aim 2: Determine the functional conservation of the identified pathways using mammalian models of cell morphology.

Project Description



Context

Previous efforts to identify new pathway components in mammalian systems are limited by redundancy and methodology.

These issues can be circumvented in *Drosophila* as they have a simple genome and defects in cell architecture in the embryo/larva are easily observed in adult tissues.

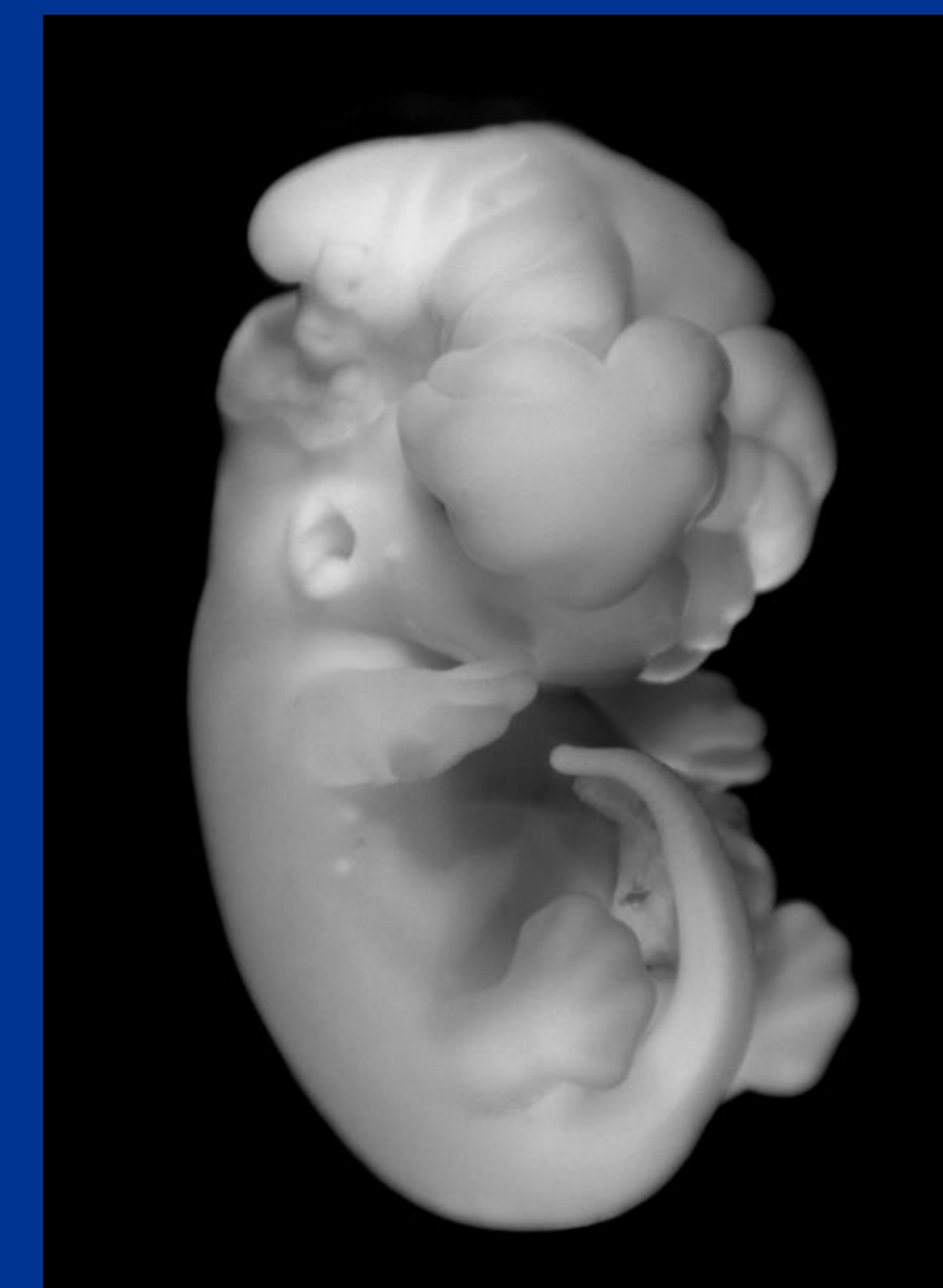


Identifying the determinants of cell architecture as a method to understand the mechanisms of tissue morphology and function.

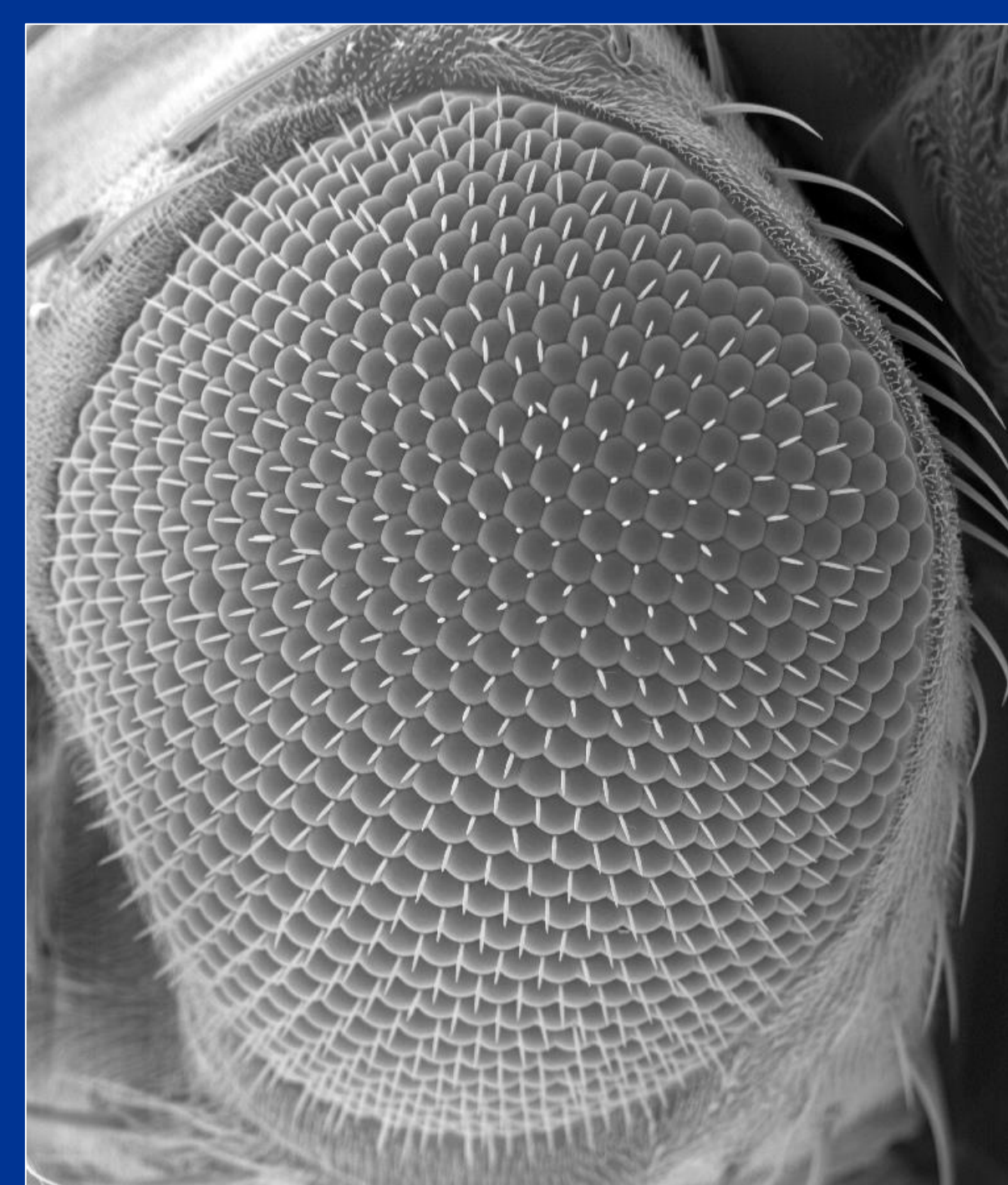
wildtype



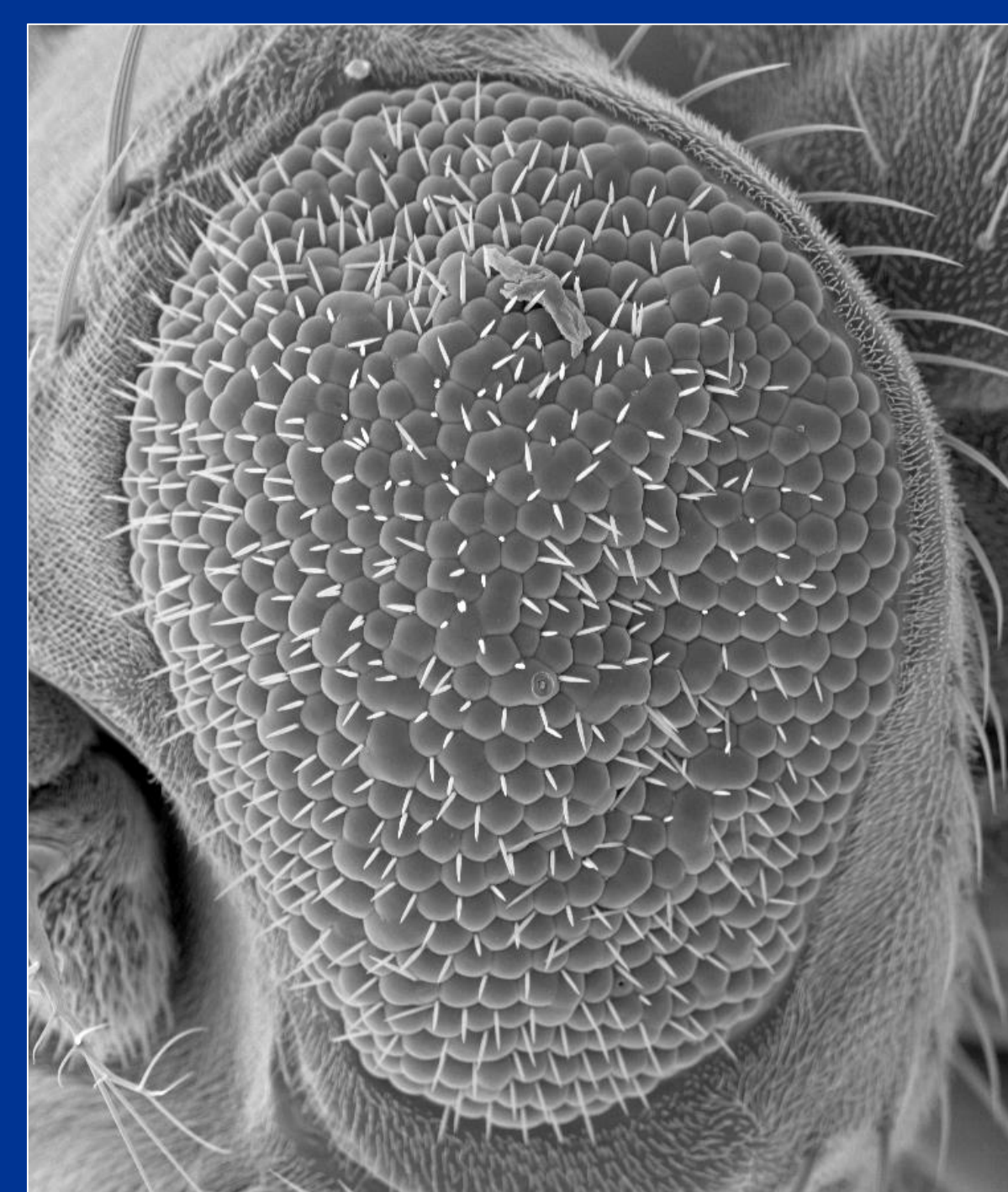
Shroom3 mutant



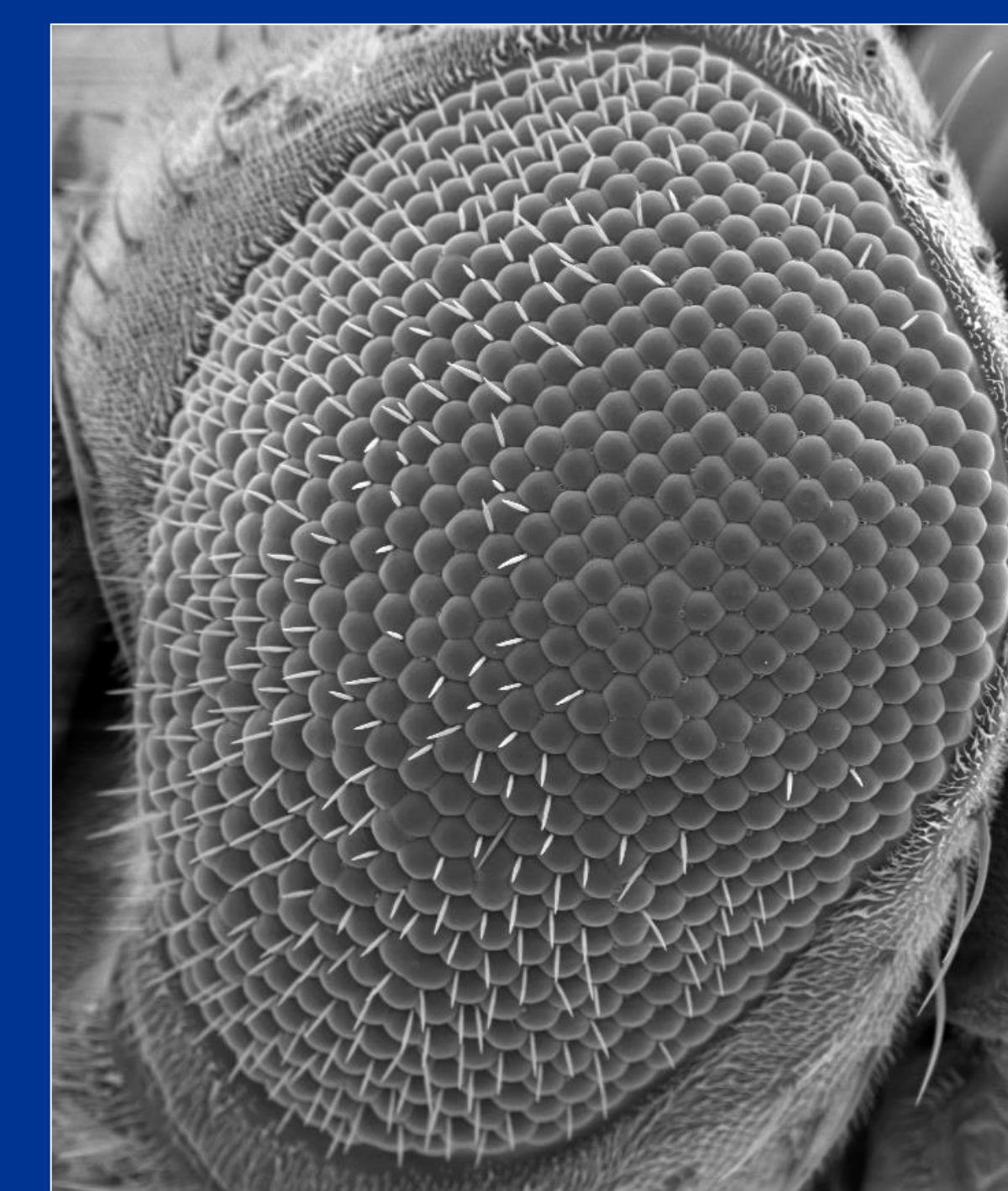
wildtype



↑ Shroom



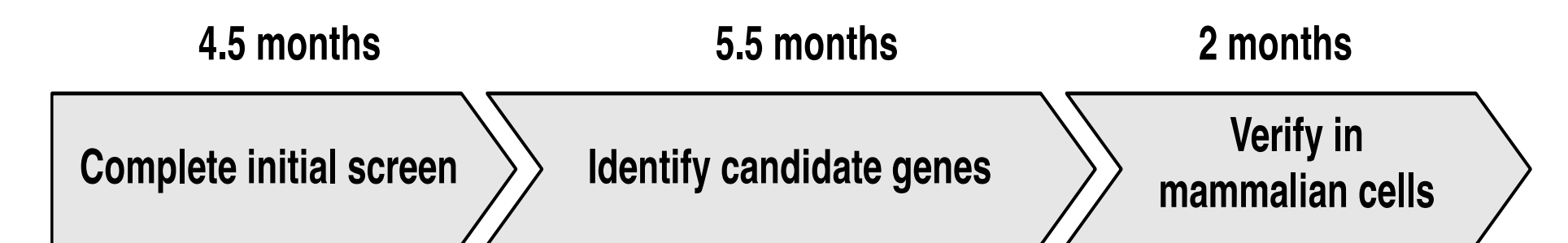
↑ Shroom ↓ MyoII



Project Deliverables

This research plan can be divided into three phases, each representing a project milestone, with a timeline below.

- Initial screening
- gene identification
- verification of functional conservation in mammalian cells



This work should provide a comprehensive network of proteins and pathways that participate in regulating cell architecture. This will allow for hypothesis-driven approaches to understanding the molecular and mechanical basis for tissue morphogenesis.

This work will be foundational for applications external funding agencies. These will focus on understanding how the Shroom pathway and other pathways may be integrated to control tissue morphology. This collaborative research would utilize cell biology, biochemistry, and biophysics to specifically define how proteins in these pathways may interact and would focus to elucidate protein-protein interactions, subcellular distributions, and combined influences on cell behaviors.

Significance and Justification

The importance of cell mechanics in human disease has only recently come to light. Shroom3 was one of the first proteins shown to regulate a mammalian developmental process by controlling cell contractility. The ability of cells in tissues to control their individual and collective architecture is a fundamental property of embryonic development and adult homeostasis, and errors in these processes result in birth defects and disease. Understanding how cells interpret intercellular cues to execute changes in cell architecture could be a way to prevent such defects and disease. In addition, the ability to harness these pathways could benefit the areas of tissue engineering and stem cell biology. This project leverages the power of large-scale genetic analysis to identify the pathways that cells use to control tissue morphogenesis during development and employs methods that allow for the transition into mammalian model systems to verify relevance to human disease.

References

- Hildebrand, J.D. and P. Soriano Cell, 1999. 99(9): p. 486-497.
- Hildebrand, J.D., J Cell Sci, 2005. 118(Pt 22): p. 5191-203.
- Bolinger, C., et al., Dev Dyn, 2010. 239(7): p. 2078-93.



Realtime Object Detection for 4K and 8K Endoscopes

Jingtong Hu
Electrical and Computer Engineering

Motivation

- Achieve better abnormal tissue detection with Ultra High Definition (UHD) 4K and 8K endoscopes.
- Reduce miss diagnoses with machine learning algorithms
- Accelerating the machine learning computation for UHD images with FPGA

Project Description

- Task 1: Develop a Novel Hybrid Deep Neural Network (DNN) Architecture
- Task 2: FPGA Acceleration with Dynamic Attention Evaluation and Combining Structured Weights and Group Convolution
- Task 3: Training Data Augmentation for Tissue Images

Context

- Most of existing colonoscopes are based on low resolution images. With such a resolution, diverse tissues are easily confused.
- We will develop machine learning algorithms to detect abnormal tissues for UHD images
- Current algorithms can only process 2-6 fps

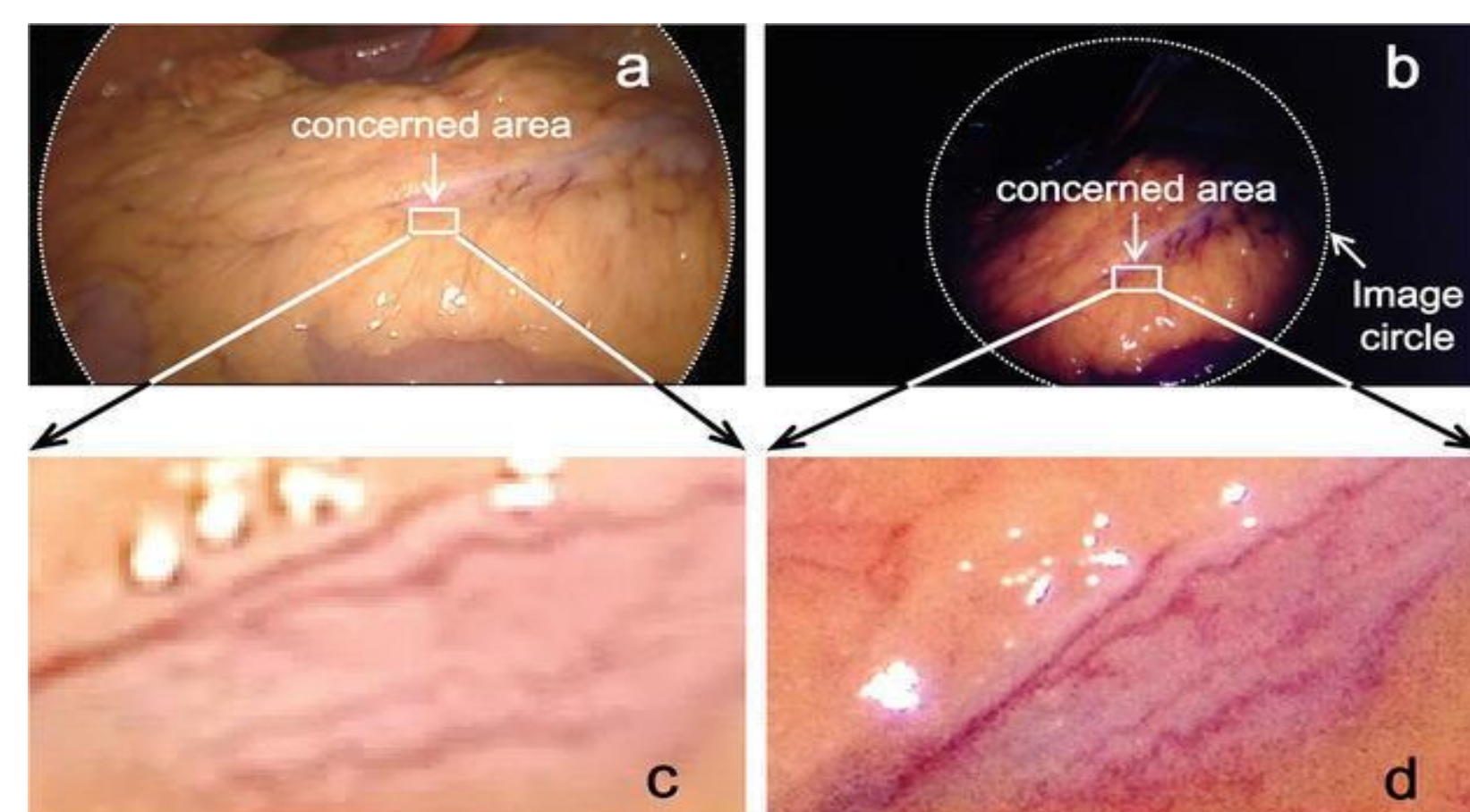


Fig 1. Comparison between 2K and 8K endoscopic images

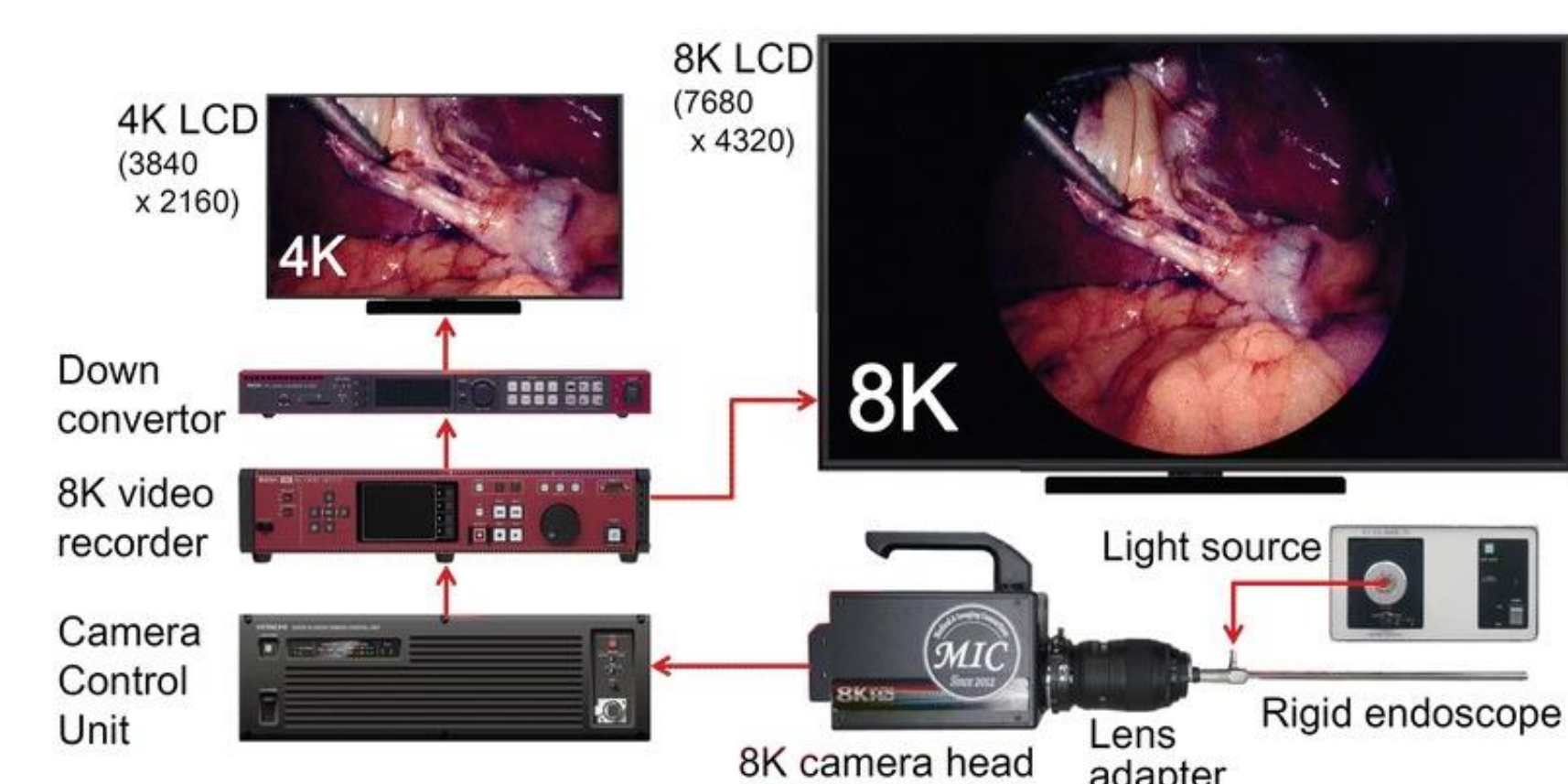


Fig 2. System Configuration for 8K UHD endoscope

Achieve Realtime Abnormal Tissue Detection for Ultra High Definition (UHD) endoscopes with Machine Learning Algorithms and FPGA Computation Acceleration

Project Deliverables

- Software: Novel Hybrid deep neural network for fast abnormal tissue detection in 4K/8K images
- Hardware: A FPGA-based system that can process UHD images in real time (25-30 fps)
- Tight collaboration with medical school
- Seek external funding support (NSF, NIH)
- The outcome of this project includes three items: the new hybrid DNN architecture, its optimized implementation in FPGA, and augmented training data set of tissue images.

Potential Impact

- The National Polyp Study showed that 70%–90% of CRCs are preventable with regular colonoscopies and removal of polyps [1].
- It is estimated that 85% of these “interval cancers” are due to missed polyps or incompletely removed polyps during colonoscopy. These misses come from both equipment factors and human errors.
- A study [2] showed an 82% decrease in interval cancer rates among colonoscopists that improved their adenoma detection rate (ADR) to the top quintile.
- This research addresses current challenges with UHD endoscopes and machine learning algorithms

References

- [1] Winawer SJ, Zauber AG, Ho MN, et al. Prevention of colorectal cancer by colonoscopic polypectomy. N England J Med 1993;329:1977–1981. Type in or place your text here
- [2] Kaminski MF, Wieszczy P, Rupinski M, et al. “increased rate of adenoma detection associates with reduced risk of colorectal cancer and death.” Gastroenterology 2017; 153:98–105.



Dynamic Repositioning of Condition-Based Maintenance Resources

Lisa M. Maillart, University of Pittsburgh,
Department of Industrial Engineering

Motivation

- Recent advances in sensor technologies facilitate the implementation of adaptive, condition-based maintenance (CBM) policies
- In many CBM applications, the assets being maintained are geographically dispersed and the maintenance resources are limited; e.g.,
 - swimming robots used for maintaining subsea infrastructures
 - locomotive industry with assets distributed on a railroad network
 - large computer server centers maintained by robots
- Requires a novel maintenance optimization framework that integrates
 - condition monitoring
 - repositioning of maintenance resources

Project Description

- Establish a Markov decision process framework to explore this novel class of problems
 - resulting models will determine optimal actions (e.g., reposition, perform a repair, idle) for the maintenance resources to minimize total expected cost (e.g., downtime, travel, maintenance)
 - resulting policies prescribe actions as a function of the
 - conditions of the assets
 - locations of the maintenance resources
- Analyze the resulting policies numerically, analytically, and via simulation to answer open questions, e.g.,
 - How can the proximity of a maintenance resource to an asset location be exploited to perform opportunistic maintenance?
 - How can maintenance resources be repositioned in anticipation of asset degradation and maintenance needs?
 - Under what conditions is the optimal policy well-structured?
- Consider a suite of extensions to the base model
- Develop implementation-friendly heuristic policies

Context

- Existing work that considers mobile maintenance resources is limited by
 - considering only reactive or preventive maintenance
 - not allowing resources to idle at intermediate locations
- Our approach combines CBM, i.e., *predictive* maintenance, and more flexible control of mobile maintenance resources
- Promising preliminary results



Minimize cost by jointly optimizing the positions of maintenance resources and the timing of condition-based maintenance actions.



Project Deliverables

- Efficient and scalable coding of the base model that facilitates preliminary numerical results, e.g.,

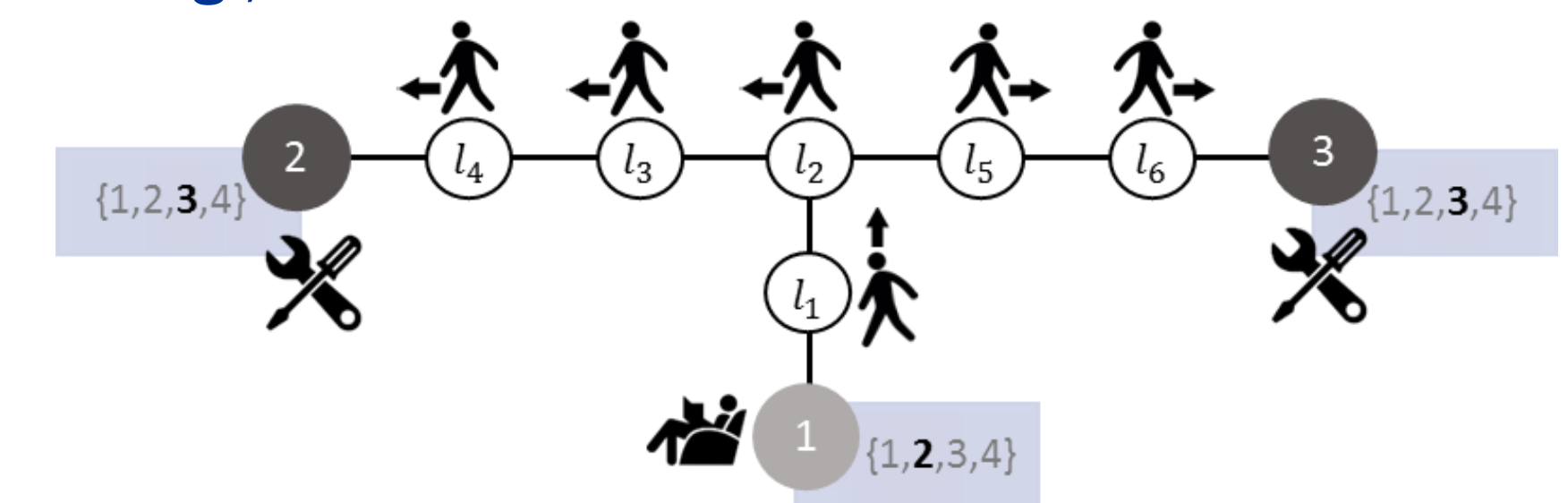


Figure 1. Policy schematic for a single maintenance resource on a graph with three assets denoted by and six auxiliary locations. Each asset has four possible degradation levels ranging from (1) as-good-as-new to (4) down or failed. The optimal actions are depicted by : travelling towards the indicated direction, : replacement, and, : idling.

- Submission of a 3-year NSF proposal by end of the funding period
- If funded, this grant will result in multiple peer-reviewed publications and conference presentations

Potential Impact

- Contribution of a novel class of problems to the maintenance optimization literature
- Generation of new managerial insights on the cost-effective use of mobile maintenance resources
- Reductions in maintenance expenditures
- Improvements in the safety and reliability of critical networks

Development of Real Gas Kinetic Chemistry at High Pressure

Shervin Sammak
Research Assistant Professor
Center for Research Computing
E-mail: shervin.sammak@pitt.edu

Motivation

- Lack of real gas models and their application to realistic combustion simulations
- Increase thermal efficiency of combustion
- Lower exhaust pollution
- Reducing fuel consumption

Project Description

- Investigate the effect of high pressure
- Develop kinetic chemistry for those conditions

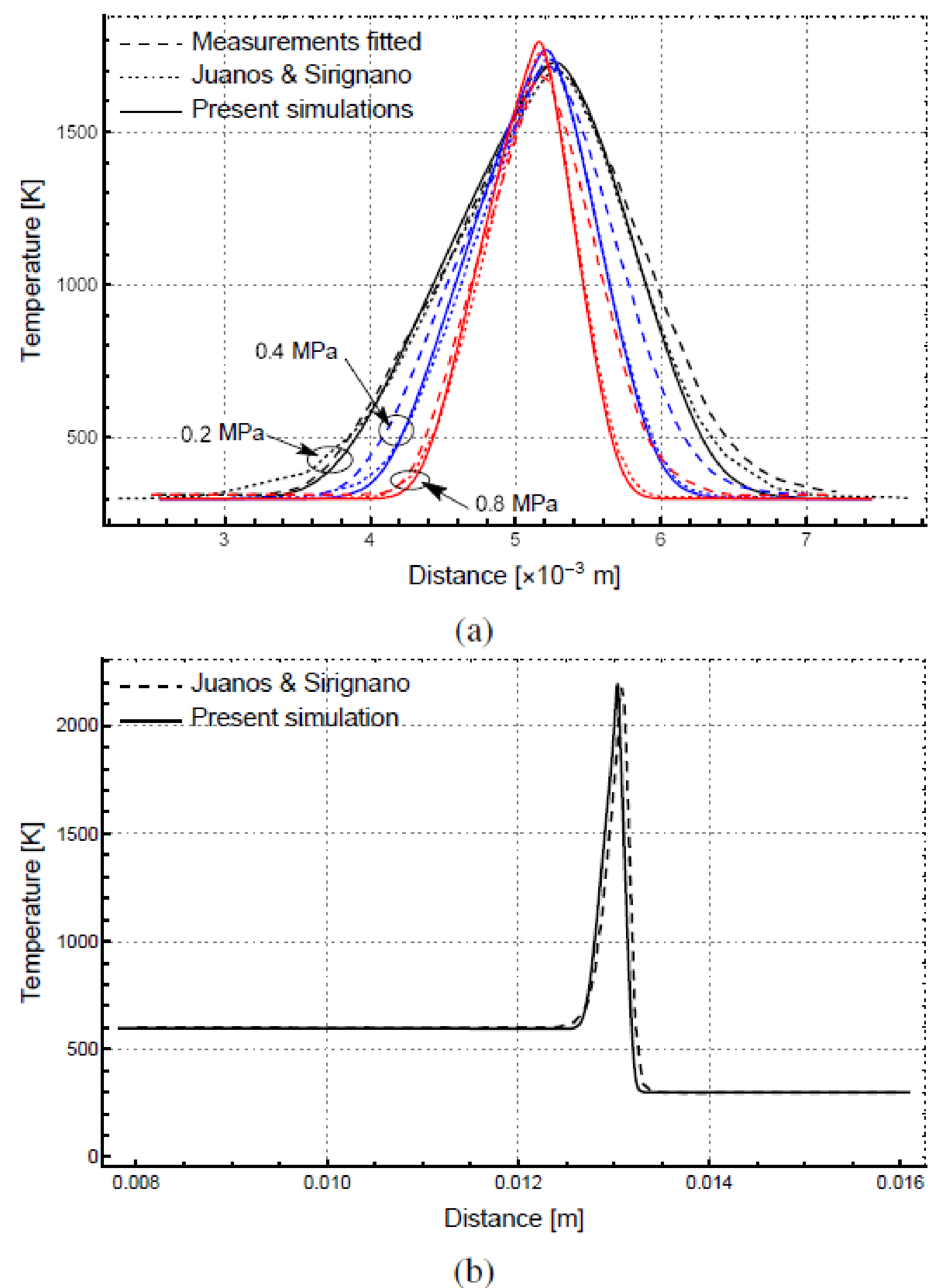


Figure 1: Temperature profile comparisons with experiment data [1] and simulation results [2]. (a) Pressure at 0.2, 0.4 and 0.8 MPa. (b) Pressure at 100 atm.

This encouraging agreement from preliminary results between the previous simulations and experiments with our methodology justifies the present methodology to predict the flammability limit of high pressure water-laden methane/air flame.



Primary project goal

Develop a real gas kinetic chemistry model for high pressure combustion and investigate the physics of the subject under such extreme conditions

Project Deliverables

Short term

- Coupling and assessment of the real gas effects for large scale kinetic reaction
- Implementation of efficient chemistry model for high pressure
- Simulation of laboratory flame mentioned in the previous section for validation and verification

Long term

- Advance the technologies in petroleum-fueled power generation systems
- Produce sufficient preliminary results to serve as the necessary basis for future collaborative proposal

Potential Impact

The significance of this research is also evident from the continuously growing interest of government agencies such as AFRL, DOD, DOE, NASA along with the commercial companies like Honeywell, GE and Boeing. That is due to the impact of this research on important issues such as **combustion efficiency, alternative fuel research and pollution control.**

References and Acknowledgements

[1]- Niemann, U., Seshadri, K., and Williams, F. A., *Combustion and Flame*, 161(1):138–146 (2014).

[2]- Juanos, A. J. and Sirignano, W. A., *Combustion and Flame*, 181:54–70 (2017).

Pitt Research

Center for Research Computing

Mascaro Center
for Sustainable Innovation



The evolutionary potential of the determinants of species coexistence

Martin M. Turcotte
University of Pittsburgh,
Dept. of Biological Sciences

Motivation

- Our understanding of biodiversity remains limited by a lack of studies that test interactions between ecological and evolutionary forces that dictate the creation and maintenance of biodiversity.
- Competition among species can cause them to evolve. Yet, we do not understand why this evolution sometimes promotes or sometimes hinders the coexistence of these species.

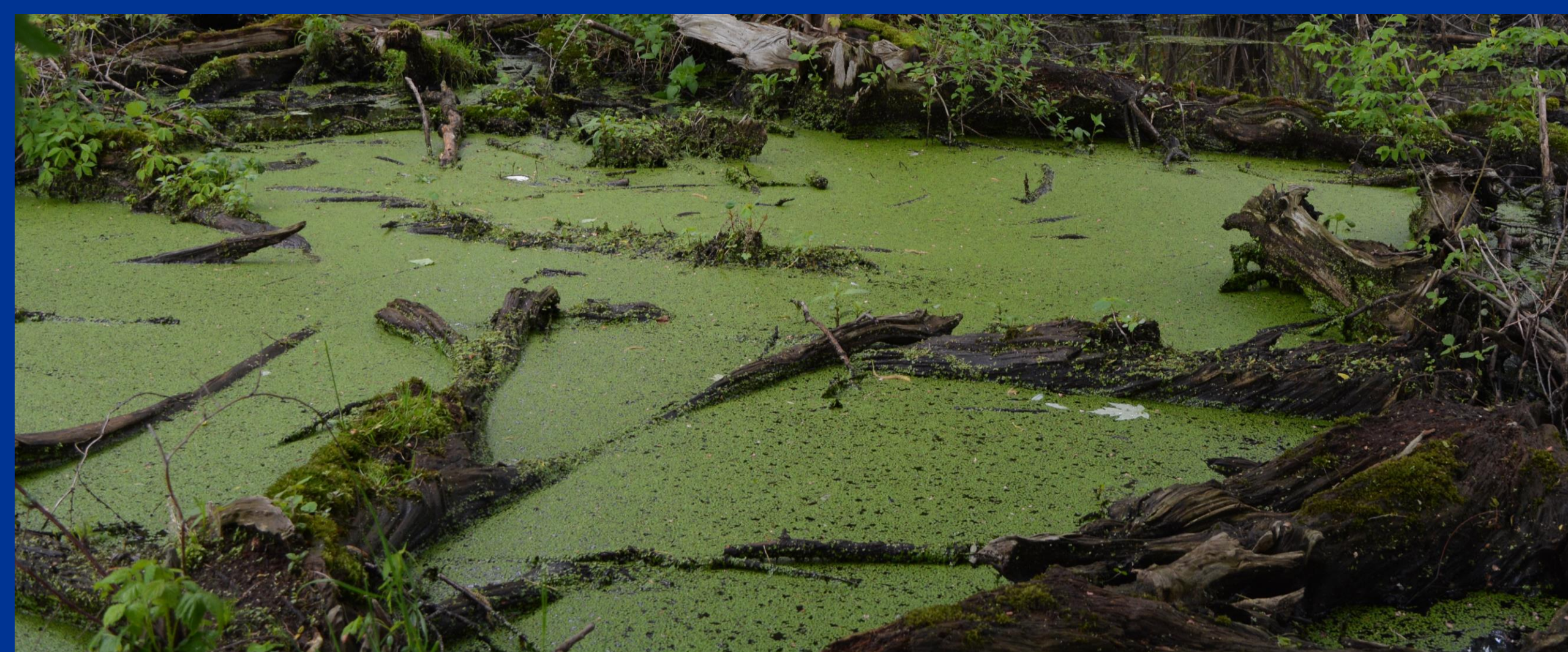
Context

- Most current research is retrospective, observational, and lacks rigorous evaluations of the impacts evolution on species coexistence.
- Using 2 species of duckweed, rapidly reproducing aquatic plants, we will conduct manipulative studies at large scales.

Project Description

- Quantify how natural populations differ in the determinants of species coexistence, and their evolutionary potential.
- Experimental evolution in the field to test how evolution alters the determinants of species coexistence
- Create synthetic populations to tease apart the mechanism driving evolution

Experimentally test why evolution in response to competition sometimes promotes or hinders species coexistence.



Spirodela polyrhiza

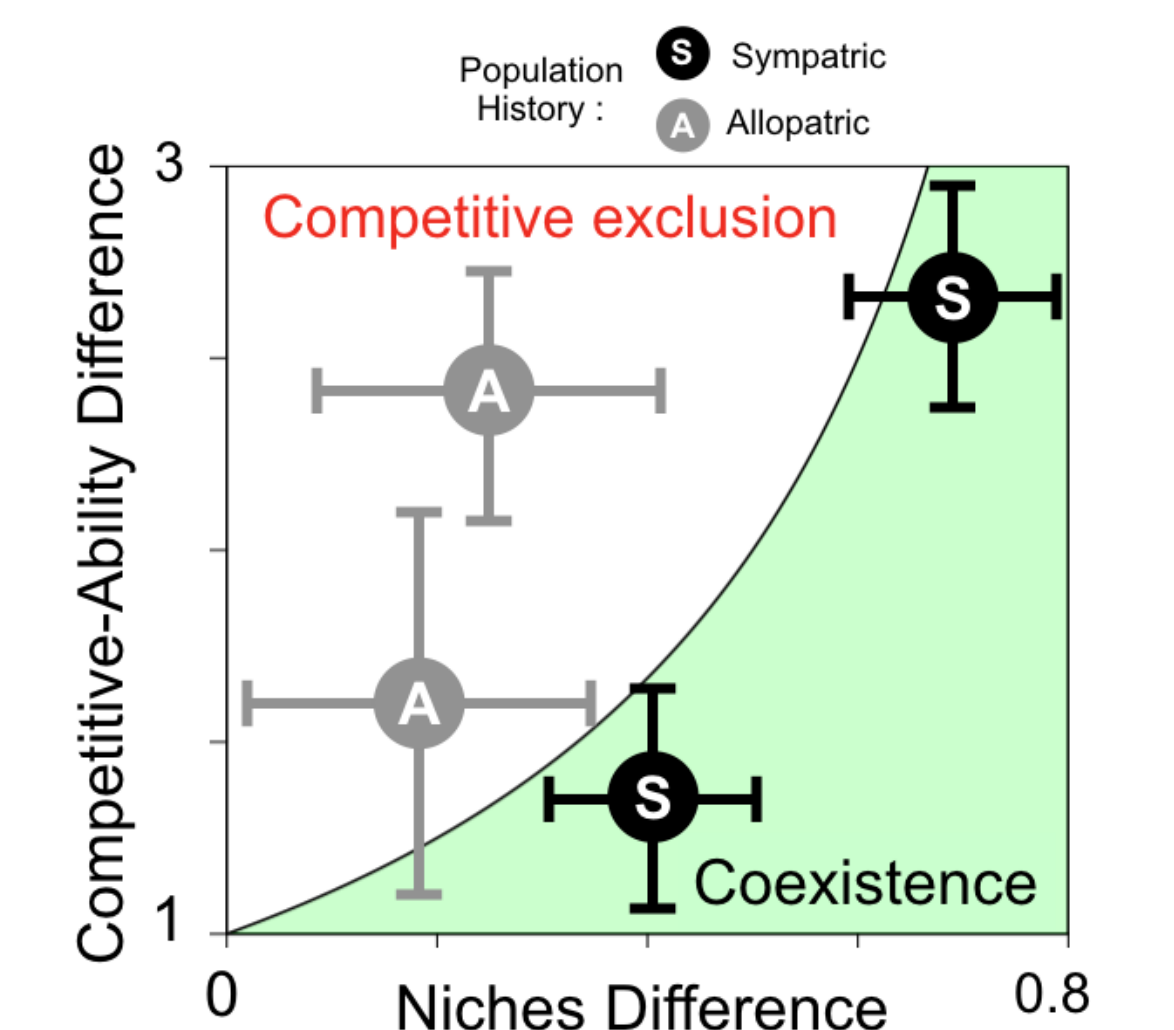
Lemna minor



Pitt's Pymatuning Lab of Ecology

Project Deliverables

Determinants of Species Coexistence



Populations with various competitive histories may differ in the key traits that favor or harm species coexistence as well as their evolutionary potential (error bars).

- Quantification of genotypic diversity among single and mixed species communities.
- Estimates of genetic variation in the determinants of species coexistence.
- Experimentally controlled and replicated tests of the impact of evolution on species coexistence.
- Relative importance of various ecological and evolutionary drivers in dictating why evolution harms or promotes coexistence.

Potential Impact

- Provides new understanding, and rare experimental tests, of the fundamental interactions between community and evolutionary ecology that together dictate the maintenance and creation of biological diversity.

References and/or Acknowledgements

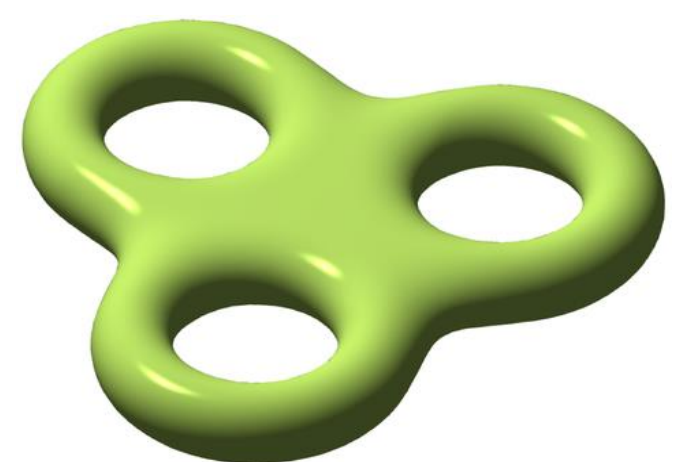
- Turcotte Lab
- Simon Hart
- Jonathan Levine
- Relevant manuscript: Hart, S. P., Turcotte, M. M., & Levine, J. M. (2019). Effects of rapid evolution on species coexistence. PNAS, 33, 201816298.

Polynomial equations and symmetries in numbers

Carl Wang-Erickson
Department of Mathematics
University of Pittsburgh

Motivation

- Since Diophantus in the 3rd century, humans have been seeking understanding how to solve polynomial equations like
$$y^2 = x^7 + 45x^3 - x + 1$$
with rational numbers.
- Today these efforts have developed into the mathematical field of “Diophantine geometry,” reflecting the fact that we use techniques and intuition from geometry in order to attack these problems.
- For example, a landmark theorem of Faltings (1983) links the number of holes in the surface made of the complex number solutions (x,y) of such equations to the number of rational solutions: if there are at least two holes, then there are finitely many solutions.
- The particular equation above gives rise to a surface of complex number solutions with three holes (see figure), so it has finitely many solutions!



Project Description

- While Faltings’s theorem is powerful, it gives no way to find this finite set of rational solutions.
- In order to find these solutions, around 2010, Minhyong Kim introduced a new suite of techniques into Diophantine geometry, known as the “non-abelian Chabauty method.”
- Netan Dogra and I are producing a conceptual framework that incorporates and extends the existing ways of carrying out the computations used to implement the non-abelian Chabauty method.



Finding integer solutions to polynomial equations is known to be difficult: there is provably no completely general algorithm to do it.

We are contributing to a toolkit that will enable us to find solutions in new cases.



Context

- Dogra has been involved in recent field-leading projects that carry out the computations of the non-abelian Chabauty method in the “quadratic” or “order 2” case.
- Extending the scope of the method requires that we work orders 3 and higher.
- At order 2, it is straightforward to identify the right computations, but it becomes difficult at order 3 to even identify what to compute, much less carry it out.
- My expertise in Galois representations, which has to do with symmetries among numbers, complements Dogra’s as we develop a framework that incorporates all orders.

Project Deliverables

- In the next year, Dogra and I plan to complete a manuscript setting up this framework and demonstrating an application to finding solutions to a few equations of interest.
- I will organize a workshop at Pitt in May 2021 to bring together experts in the non-abelian Chabauty method and other new developments.
- The workshop will also be pitched at PhD students and junior researchers – both at Pitt and externally – who can benefit from the lectures.

Potential Impact

- My joint work with Dogra provides a useful framework to extend the applicability of the non-abelian Chabauty method.
- The workshop will hopefully spur on new developments linking Galois representations to Diophantine questions, as several ways of linking these will be featured.

Acknowledgements

- Pitt Momentum Funds
- Pitt Department of Mathematics
- Dr. Netan Dogra (University of Oxford)

Scalable Artificial Synapses with Tunable Temporal Dynamics

Feng Xiong, Electrical and Computer Department, Swanson School of Engineering, University of Pittsburgh

Motivation

- Improve energy efficiency and computing performance by mimicking the human brain
- Spiking neural network (SNN) mimics the biological neural network more closely by incorporating the temporal dynamics
- Need a dynamic synapse with a tunable temporal dynamics, high-precision, and low power

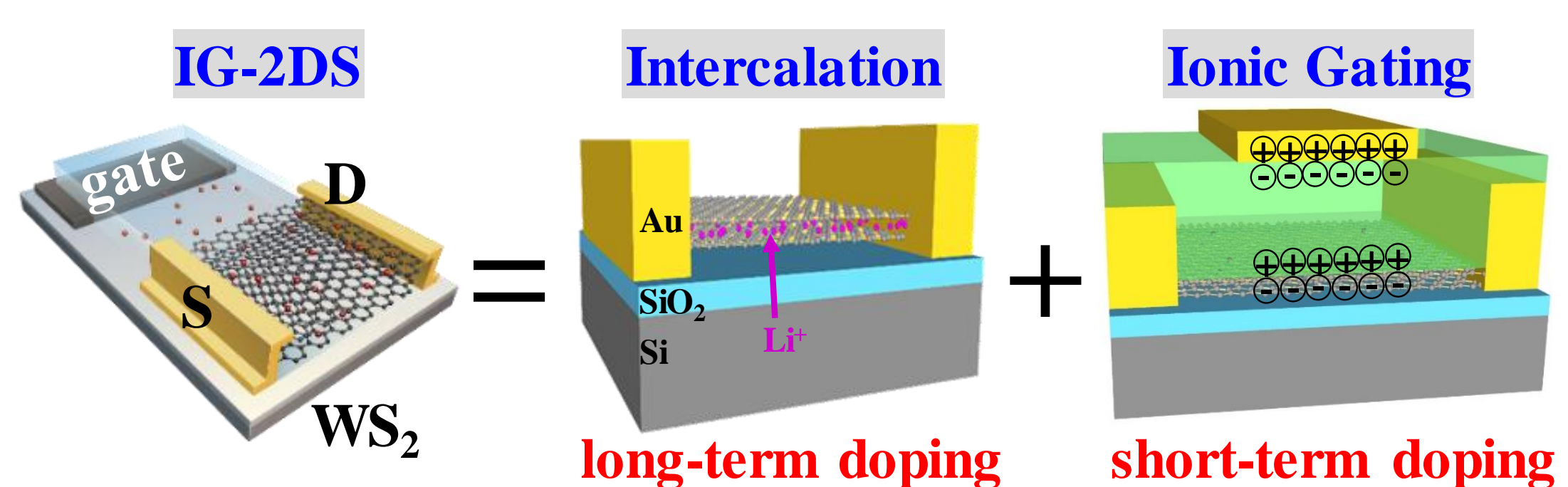
Project Description

- Task 1: elucidate short- and long-term doping mechanisms
- Task 2: demonstrate tunable spatio-temporal dynamics for SNNs

Context

- Existing approaches: digital CMOS devices or non-volatile memory devices
- Limitations: energy intensive, no temporal dynamics, digital (not analog)
- Proposed approach: electrochemical 2D devices where the channel conductance can be tuned reversibly to achieve temporal dynamics and high precision

Uniqueness: short- and long-term temporal dynamics due to intercalation and ionic gating



Build scalable synaptic arrays with programmable temporal dynamics, high-precision, and low power for the hardware implementation of spiking neural network.

Project Deliverables

- an in-depth understanding of the short- and long-term doping mechanisms in 2D synapses
- Control over both the amplitude and timing constants of the synaptic weight of 2D synapses
- Follow-up external funding strategy
 - Electronics, Photonics and Magnetic Devices program at NSF
 - Electronic Photonic Materials program at NSF
 - Quantum Electronics Solids program at Air Force Office of Scientific Research (AFOSR)
 - Semiconductor Research Corporations

Potential Impact

- Cognitive Computing
 - explainable AI models for logic inference
- Neuromorphic Vision System
 - event-based camera with high throughput and low power
 - For self-driving vehicle, robotics etc.
- Edge Computing
 - flexible and wearable electronics with low-power AI
- 2D Nanoelectronics
 - effective doping platform for 2D devices

References and/or Acknowledgements

- Sharbati, M. T.; Du, Y.; Torres, J.; Ardolino, N. D.; Yun, M.; Xiong, F., Low-power, electrochemically tunable graphene synapses for neuromorphic computing, *Adv Mater* 2018, 0, (0), 1802353
- Wan, Q.; Sharbati, M.; Erickson, J.; Du, Y.; Xiong, F., Emerging artificial synaptic devices for neuromorphic computing, *Advanced Materials Technologies* 2019
- Pitt Momentum Funds, University of Pittsburgh



Support of the UPJ Soil Judging Team

Mitzy L. Schaney, PhD
Soil Judging Team Coach
Assistant Professor and
Director of Environmental Studies at Pitt-Johnstown

- UPJ was invited to the 2019 Northeast Regional Soil Judging Competition.
- The Team pieced together funding and a minimum of equipment.
- This was such a valuable experiential learning opportunity – we can't wait to go back!



- Soil Judging competitions are an intensive, compact field courses in soil science, soil taxonomy, and soil profile descriptions.



Equipment and travel expenses for UPJ Soil Judging Team



- Geography and Environmental Studies Department offers a one-credit research course each fall for Team members to ensure a dedicated time for practice and preparation.
- The ability to describe and interpret soil profiles is a unique and valuable resume builder and career skill for future Environmental Scientists.



Design and Scale-Up of Photobioreactor

Shivkumar Bale and Ramesh Singh
Department of Chemical Engineering
University of Pittsburgh at Johnstown

Motivation

- The major challenge policy makers, government and scientists around the world currently tackle is the global warming.
- In the 21st century, the planet will become warmer with detrimental environmental effects on our lives, since the global average surface temperature has risen by 0.3 – 0.6 °C (0.5 – 1.1 °F) [1].
- For example, Indonesia will move its capital city as its current one is sinking, average wildlife populations have dropped by 60 percent in just over 40 years, and excessive heat exposure contributed to more than 8000 premature deaths in the United States from 1979 to 2003.
- Hence, to achieve a healthier and cleaner environment, the priority should be mitigating greenhouse gas (GHG), mainly CO₂, and use renewable sources for fuel.

Project Description

- Microalgae is considered as the most promising medium for renewable energy and GHG mitigation, mainly CO₂ [2].
- It can attain fast proliferation under several hours and it has over 3000 different strains. However, an efficient and cost-effective photobioreactor (PBR) for microalgae cultivation is required.
- Computer simulation, through its close interaction with experiments, has shown to be a useful tool in offering a fundamental knowledge of key aspects of many emerging technologies.
- Hence, our aim is to employ a customized approach to design an efficient and cost-effective photobioreactor.



Our Primary Goal Is To Develop An Efficient And Cost-Effective Photobioreactor



Context

- Design and scale-up are major issues in developing an efficient and cost-effective PBR.
- It is essential to conduct complete optimization study at laboratory scale prior to scale up [3]. Comprehensive optimization study has never been conducted.
- Our approach of combined numerical and experimental study provides various advantages, compared to other optimization methods, which are as follows: (i) reduced workload; (ii) low cost; and (iii) shorter design period.
- Hence, we believe we will achieve our goal.

Project Deliverables

- Pitt Momentum Fund will be utilized to build an experimental setup required for our research.
- We will have the experimental setup constructed and preliminary experiments conducted by the end of the 1-year funding period.
- Once the preliminary results are obtained, we will apply for NSF funding to further pursue our primary goal.
- The mid-term check for success would be the procurement of the required equipment, whereas the final check would be the working experimental setup.

Potential Impact

- The fund will help us launch towards our goal to develop an efficient and cost-effective PBR.
- If we achieve our primary goal, we will create a PBR, which provides a healthier and cleaner environment along with biomass as a by-product.

References

- [1] EPA., U.S., *Report on the 2013 U.S. Environmental Protection Agency (EPA)*
- [2] Shuba, E.S., et al., *Sustainable Energy Reviews*. 2018. **81**: p. 743-755.
- [3] Rawat, I., et al., *Applied Energy*. 2013. **103**: p. 444-467.

A powerful new Alzheimer's disease model

Karl Herrup, Professor of Neurobiology
Ryad Benosman, Professor of Ophthalmology

Motivation

- The last new drug for Alzheimer's was approved in 2003
- Dozens of clinical trials for new compounds have failed
- We badly need new disease models
 - To understand the biology
 - To link Alzheimer's to the aging process
 - To identify the targets for therapeutic intervention

Project Description

- The project combines the bioengineering expertise of the Benosman lab with the cell biological resources of the Herrup lab
 - Cortical neurons will be grown on multielectrode arrays to establish neuronal networks in a dish
 - A lenti virus will drive the expression of the Amyloid Precursor Protein (APP)
 - The response of the network to the changes in the axon initial segment will be monitored

Context

- The genetics of Alzheimer's identifies APP as a disease gene.
- The field has assumed that the genetics meant that the beta-amyloid fragment of APP was driving Alzheimer's disease
- We will test the alternative hypothesis that APP by way of its effect on the axon initial segment is the true driver of the disease

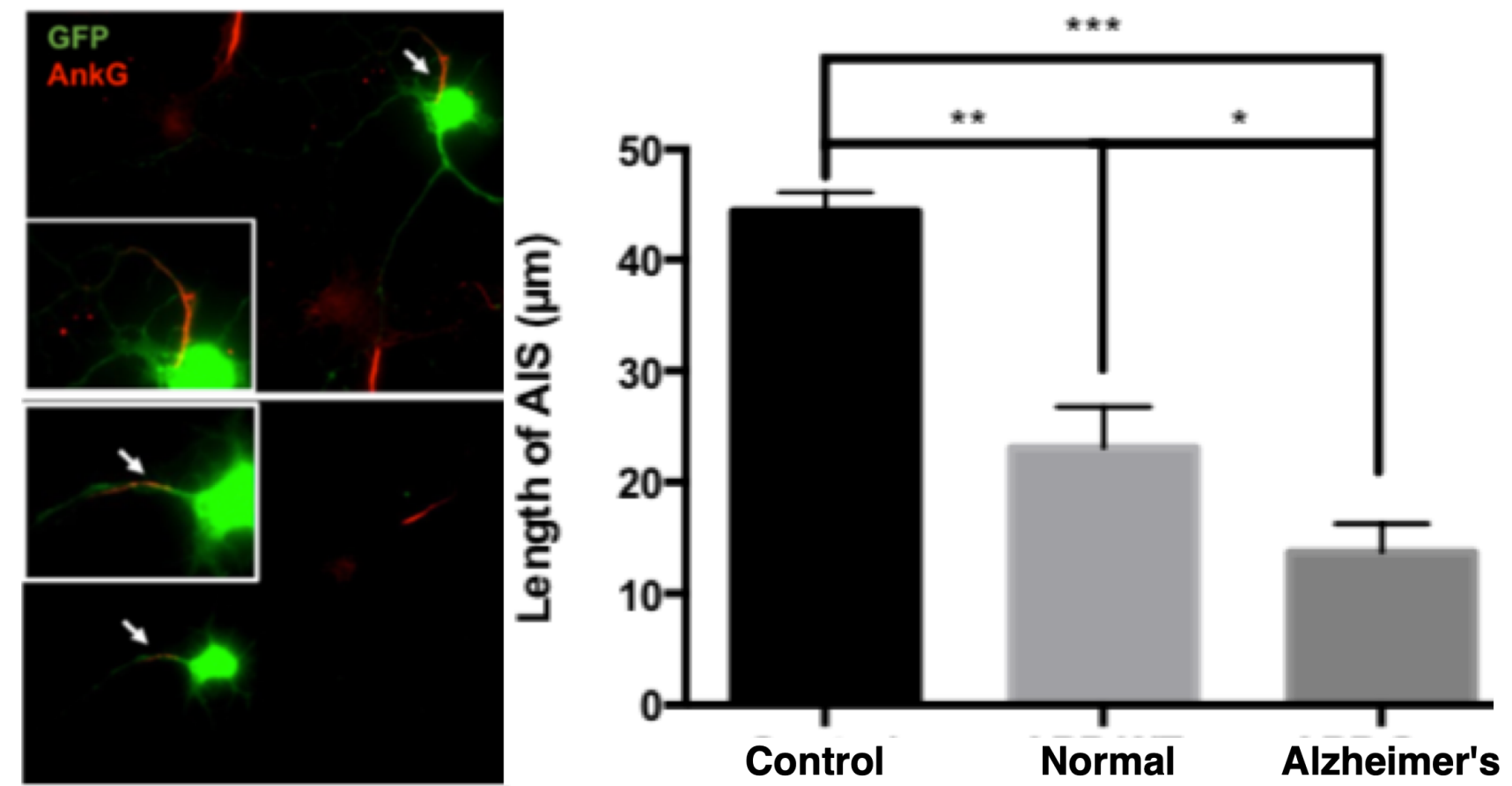


Figure. Elevated APP protein shortens the initial segment

The figure above shows the preliminary data supporting the shorten of the axon initial segment after APP expression. The change would be predicted to make the neuron harder to fire and thus reduce network activity.

We propose to use the network properties of cultured neurons to identify the forces driving the Alzheimer's disease process

Project Deliverables

- Establish conditions for culturing neurons on the microelectrode array.
- Define the ground state behavior of the neural networks
- Determine the effects of wild type and mutant APP expression on the network
- The preliminary data will be a springboard of preliminary data for competitive grant applications to NIH and NSF
 - The network properties will serve as an advanced drug screening platform
 - The network changes we observe will be validated in living animals
 - The predicted changes in the axon initial segment will be charted in human brain

Potential Impact

- Our disease models of Alzheimer's disease have proven to be nearly worthless in interpretive and predictive value
- Proving the validity of our new model of APP function will offer a fresh and useful area to target new drugs and therapies.

References and/or Acknowledgements

- Thanks are due to the work of two postdoctoral fellows: Dr. Fulin Ma in the Herrup Lab and Dr. Himanshu Akolkar in the Benosman Lab
- Support of the Depts. of Neurobiology and Ophthalmology is also gratefully acknowledged



Epigenetic Aging and Cognitive Health: A Pilot Study

Rebecca G. Reed,
Anna L. Marsland,
& Stephen B. Manuck

Department of Psychology,
Dietrich School of Arts & Sciences

Motivation

- People can be biologically older or younger than their chronological age (Fig 1), and this difference may predict important health outcomes, including cognition.
- Epigenetic biomarkers can be used to quantify biological age.

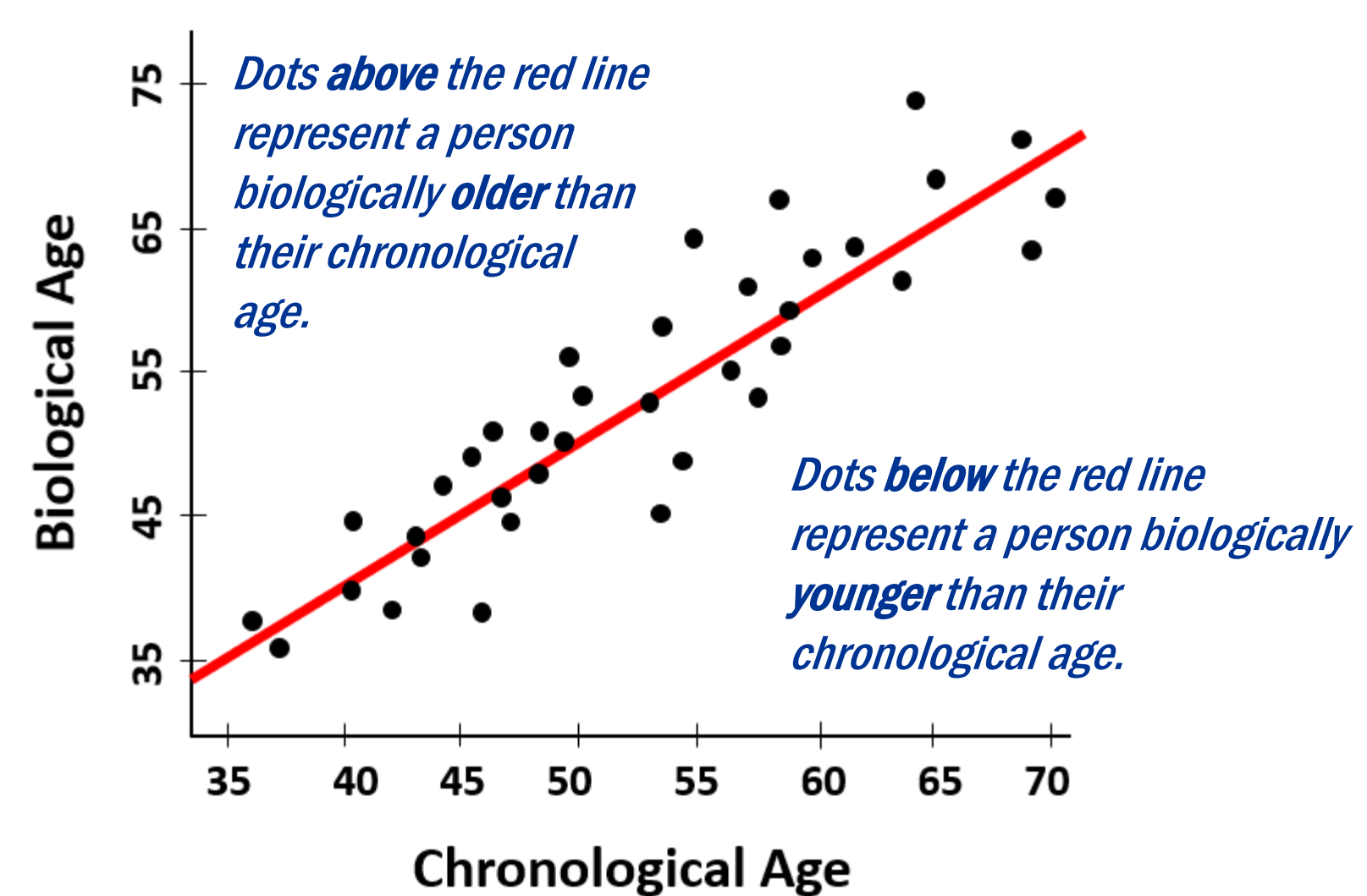
Project Description

- Leverage an existing longitudinal cohort of midlife adults (AHAB) with two waves of data collected 10-16 years apart.
- Establish whether and to what degree (1) cognitive function and (2) epigenetic age change over the length of the 10-16 year follow-up, and (3) provisionally test in a subset of adults whether changes in epigenetic age are associated with changes in cognitive function over the follow-up interval.

Context

- Previous investigations have been cross-sectional; primarily use “first-generation” clocks to estimate epigenetic age; and test a limited number of cognitive abilities.
- This study will use both first- and second-generation clocks to estimate epigenetic age and its effects on a range of cognitive functions in a longitudinal sample of middle-age adults.

Fig 1: Biological vs. Chronological Age



Does accelerated epigenetic aging over 10-16 years predict cognitive decline in middle-aged adults?

Project Deliverables

- By the end of the 1-year funding period, this pilot study will provide needed preliminary data for external NIH application, and will establish feasibility and key infrastructure for epigenetic age assays and calculation.
- Within 1-2 years after funding period has ended, pilot data will be used in future applications that investigate longitudinal links between accelerated biological aging and cognitive aging among midlife adults in the larger AHAB cohort.

Potential Impact

- Cognitive decline and dementia convey substantial health and financial costs, and individuals and their families place high value on maintaining cognitive functions as they age.
- Establishing epigenetic age as a biomarker of cognitive function in midlife can uncover **pre-clinical markers** that may identify individuals at increased risk for cognitive impairment and dementia in later life.

Acknowledgements

- This project leverages data from the Adult Health and Behavior (AHAB) cohort, which is supported by grants from the National Institutes of Health: R01-AG056043 (Manuck) and R01-DK110041 (Marsland).



Evaluating Prescription Drug Subsidies for Diabetics

Eric Roberts, PhD¹

Inmaculada Hernandez, PharmD, PhD²

Alexandra Glynn¹

¹Department of Health Policy and Management, Graduate School of Public Health

²Department of Pharmacy and Therapeutics, School of Pharmacy

Motivation

- Rising drug prices are putting increased financial strain on individuals with chronic diseases such as diabetes
- Since 2006, out-of-pocket costs for insulin have doubled
- Rising out-of-pocket costs for prescription drugs may impede medication adherence and lead to poor health outcomes for diabetic patients

Policy Background

- Medicare's Part D Low-Income Subsidy (LIS) reduces drug co-pays and caps out-of-pocket costs for low-income beneficiaries
- The LIS has strict eligibility thresholds based on household income (135% and 150% of the Federal Poverty Level) and assets
- These thresholds generate sizable differences in expected out-of-pocket drug costs below vs. above 135% and 150% of FPL

Cost-sharing responsibilities per prescription for Medicare Part D enrollees by LIS status, 2019			
	Full LIS (≤135% FPL)	Partial LIS (136-150% FPL)	No LIS (>150% FPL)
Deductible	\$0	\$83	\$415
Coinsurance	\$1.25*-\$8.50**	15%	25%
Catastrophic	\$0	\$3.40*-\$8.50**	5%
Estimated out-of-pocket cost of filling a one-month prescription of Lantus insulin by LIS status, 2019			
	Full LIS (≤135% FPL)	Partial LIS (136-150% FPL)	No LIS (>150% FPL)
Deductible	\$0.00	\$143.45	\$432.75
Coinsurance	\$3.80	\$72.90	\$121.50
Catastrophic	\$0.00	\$8.50	\$24.30

*For generic drugs, \$1.25 with income below 100% FPL; \$3.40 above 100% FPL
 **For brand name drugs, \$3.80 with income below 100% FPL; \$8.50 above 100% FPL
 Notes: Coinsurance phase is when total spending that counts as out-of-pocket is between deductible amount and catastrophic threshold of \$5,100. We use estimated cost for Lantus of \$243 per vial, assuming two vials per one-month prescription filled at beginning of each phase. Assume Lantus is a brand-name drug. Source: SSA, 2019 and Health Care Cost Institute, 2019.

Prescription drug subsidies for low-income Medicare beneficiaries cap out-of-pocket costs for insulin and other drugs used by diabetics.

We will employ quasi-experimental methods to examine the effects of caps on out-of-pocket costs on beneficiaries' medication adherence and diabetes-related health outcomes.

Data and Methods

- Data from Health and Retirement Survey linked to Medicare claims (5 waves, 2006-2016)
- Regression discontinuity (RD) design:
 - Exploits abrupt reductions in subsidies at LIS thresholds among those who are otherwise minimally different
 - Mimics a "randomized trial" within the vicinity of LIS thresholds
 - Allows us isolate the effects of differences in out-of-pocket drug costs at these thresholds with patients' health outcomes

Outcomes and Analyses

- Primary outcomes:
 - Total out-of-pocket drug spending
 - Medication adherence
 - Cost-related medication non-adherence
 - Hospital admissions related to diabetes
- Separate analyses will be conducted for insulin and oral diabetes medications
- Secondary analysis will be conducted for beneficiaries with co-morbid hypertension and hyperlipidemia

Project Goals

- Publication in a peer-reviewed journal and presentation at scientific conferences
- Catalyze collaborative research program between researchers in Pitt's Schools of Pharmacy and Public Health
- Generate preliminary data for an R21 or R01 grant proposal
- Support research training opportunities for one PhD student and an undergraduate at Pitt

Potential Impact

- Our study will provide evidence to policymakers on the impact of high out-of-pocket drug costs for low-income diabetics
- This is relevant because several states and insurers are considering limits on out-of-pocket costs for insulin products
- The results will also demonstrate whether reforms to the LIS could improve medication outcomes among individuals most sensitive to rising drug costs

Locomotor Adaptability, Brain Integrity, and Mobility of Older Adults

Andrea Rosso, Department of Epidemiology
Gelsy Torres-Oviedo, Department of Bioengineering
Andrea Weinstein, Department of Psychiatry

Motivation

Restrictions in community mobility, the ability to move outside of one's home, are common in older adults and contribute to disability, institutionalization, and poor quality of life.

Successful community mobility requires the brain to quickly use information from the environment (e.g. surface quality, distances) to appropriately adapt gait to the current situation (locomotor adaptation).

Context

Locomotor adaptation can be induced in the laboratory by having an individual walk on a split belt treadmill on which each leg is moving at a different speed. Repeated exposure to split belt walking improves the rate of adaptation to the new situation.

The brain mechanisms of this adaptation are unknown in healthy older individuals. The impact of locomotor adaptability on mobility and fall risk are also unknown.

Project Deliverables

We plan to submit 1-2 manuscripts and an NIH R01 grant as a result of this preliminary study.

The R01 will be aimed at understanding how the proposed training for locomotor adaptability could improve brain control of walking, community mobility, and fall risk of older adults.

We anticipate finishing data collection by midterm and to have all data processed and analyzed with manuscript and grant drafts in progress by the end of the funding.

Does brain aging affect community mobility and fall risk in older adults through changes in walking adaptability?

Project Description

Our central hypothesis is that the ability to improve locomotor adaptability with repeated exposure to split belt walking is greater in those with better brain integrity, specifically the integrity of subcortical-prefrontal connections that contribute to the brain control of walking (gait automaticity).

We will test whether:

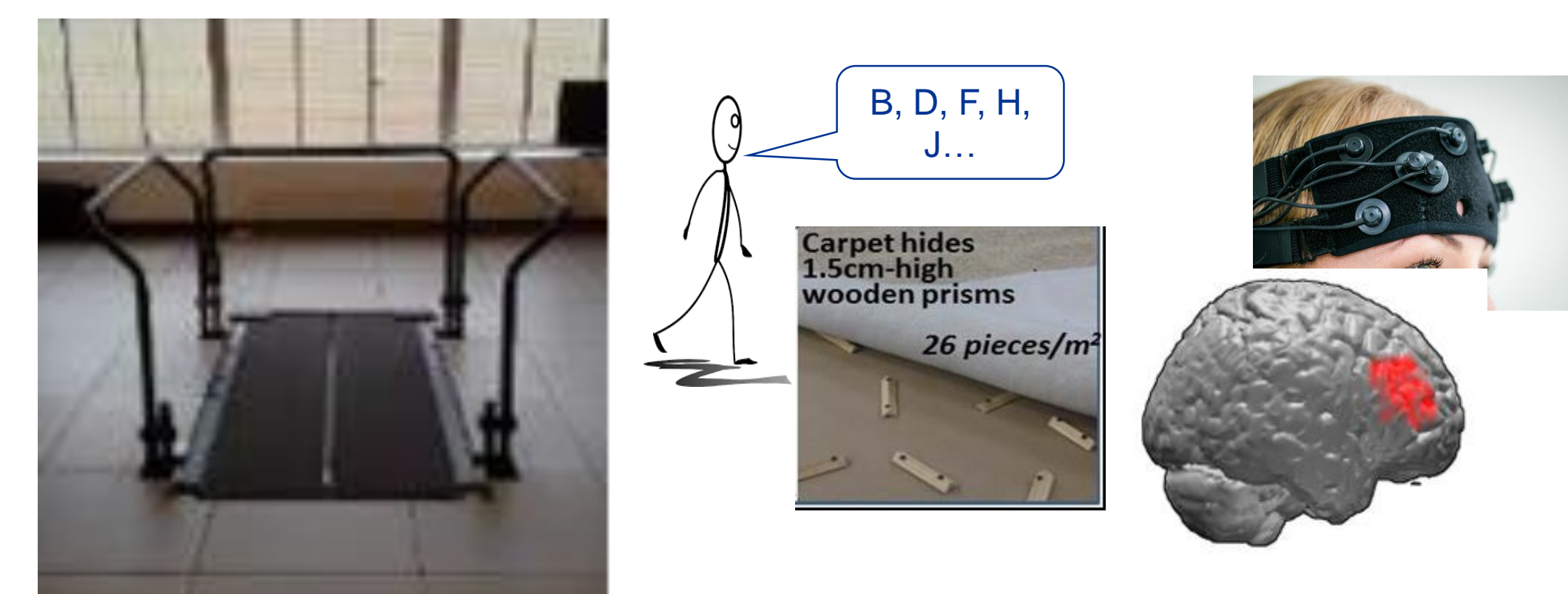
1. Brain integrity is related to locomotor adaptability
2. Better brain integrity predicts greater improvements in locomotor adaptability with repeated exposures
3. Improvements in locomotor adaptability are related to clinical measures of mobility and fall risk.

Our primary measures will be defined by:

Locomotor adaptation: Rate at which individuals adapt to a new walking situation when placed on a split belt treadmill and changes in adaptation rate after repeated exposure

Brain integrity (gait automaticity): The extent to which an individual relies on the prefrontal cortex rather than subcortical structures to walk under challenging conditions

Brain integrity (cognitive function): Neuropsychological battery to assess prefrontal-subcortical function



Potential Impact

Exposure to split-belt walking improves locomotor adaptation in older adults, but the underlying mechanisms and relevance to mobility and fall risk of these improvements are unknown. Gait automaticity and prefrontal-subcortical function may be important neural mechanisms of locomotor adaptability.

These results will identify novel contributors to loss of community mobility in older adults and could identify novel therapeutic targets for interventions that improve locomotor adaptation to prevent falls and enhance independence.



Druggable targets for Robinow Syndrome

Yong Wan¹, Nadine Robert¹, Brandi Lantz¹, Louis Rapkin², & Heather Szabo-Rogers¹

¹Center for Craniofacial Regeneration, Department of Oral Biology, School of Dental Medicine, ²Pediatric Oncology/Hematology, UPMC Children's Hospital of Pittsburgh

Motivation

- Robinow Syndrome is a rare genetic syndrome. The diagnostic features of Robinow Syndrome include shorter stature, a wider face and a prominent forehead.
- Some patients experience bone overgrowth that impinges on nerves and causes pain.
- The only treatment is neurosurgery to remove the bony overgrowths.

Project Description

- Using a mouse model (*Prickle1^{Beetlejuice}*) and patient cells we will determine if FDA-approved drugs can modify the disease.

Context

- The only treatment option to relieve pain for these patients is surgically excise the bone overgrowth.
- Often the patients require several surgeries.
- Our analysis of the mouse model suggests that two pathways have altered signaling in bone cells. These pathways have FDA-approved drugs to modulate them.
- By identifying and testing FDA-approved drugs in our *in vivo* and *in vitro* model systems we hypothesize that we will be able to halt bone growth.

Evaluating pharmaceutical treatments to replace surgery for bone overgrowth in Robinow Syndrome.

Project Deliverables

- Invention Disclosure filed with the Innovation Institute by 6 months.
- This project will provide the data for a competitive R01 application prior to the end of the funding period.
- Within 1-2 years, we expect to have submitted a high-impact paper with our results.

Potential Impact

- We hope to prevent the need for repeated neurosurgeries for patients with Robinow Syndrome.
- If the FDA-approved drugs modify the patient disease, then we will have identified a pharmaceutical treatment that can modify Robinow Syndrome.

Acknowledgements

- Wan et al Scientific Reports 2018.
- Funds from the School of Dental Medicine



Responses of gray treefrogs to acid mine drainage

Luis A. Bonachea
Pitt Johnstown, Natural Sciences

Motivation

- Amphibians are highly sensitive to environmental pollutants like AMD from coal mining.
- Amphibians play a crucial role in both aquatic and terrestrial ecosystems, so effects on their populations are widely felt.
- Just as their dual life cycle exposes most amphibians to both terrestrial and aquatic contaminants, the population level effects of those pollutants are then felt by both the terrestrial and aquatic communities that amphibians interact with.

Project Description

- The proposed funds will support broadly focused, integrated studies of the effects of acid mine drainage on the development, metabolism, stress physiology, and ecological interactions of gray tree frogs, *Hyla versicolor*.

Context

- Past work has focused narrowly on specific aspects of developmental toxicity or on population level effects
- Pitt Johnstown currently does not have a facility for housing vertebrate animals
- These funds will allow me to set up such a lab, providing year-round research opportunities for students



Fig 1: A male gray treefrog (*Hyla versicolor*), one of the most widespread and abundant amphibians in the state of Pennsylvania. Photo by Aaron Capouellez.

Assessing the impacts of acid mine drainage on the development, metabolism, and ecological interactions of gray treefrogs

Project Deliverables

- The short scale (within 2 years) publication plan is to produce three publications:
 - 1) A description of the developmental effects of AMD on larval development,
 - 2) A comparison of pre- and post-metamorphic metabolic rate of AMD exposed larvae, and
 - 3) A description of the effects of AMD exposure on corticosterone levels in larval, post-metamorphic, and adult frogs.

Potential Impact

- My ability to involve students in my own research has been largely limited by the lack of a facility to house live vertebrates and a short field season, most of which occurs in the summer when students are not available.
- My goal here is to establish a lab where 5-8 students can participate in research year-round and develop their own projects.
- This would greatly expand the research opportunities available to our students.

References and/or Acknowledgements

- I would like to thank Aaron Capouellez, an undergraduate student whose passion for amphibian conservation has been a major source of inspiration for this work



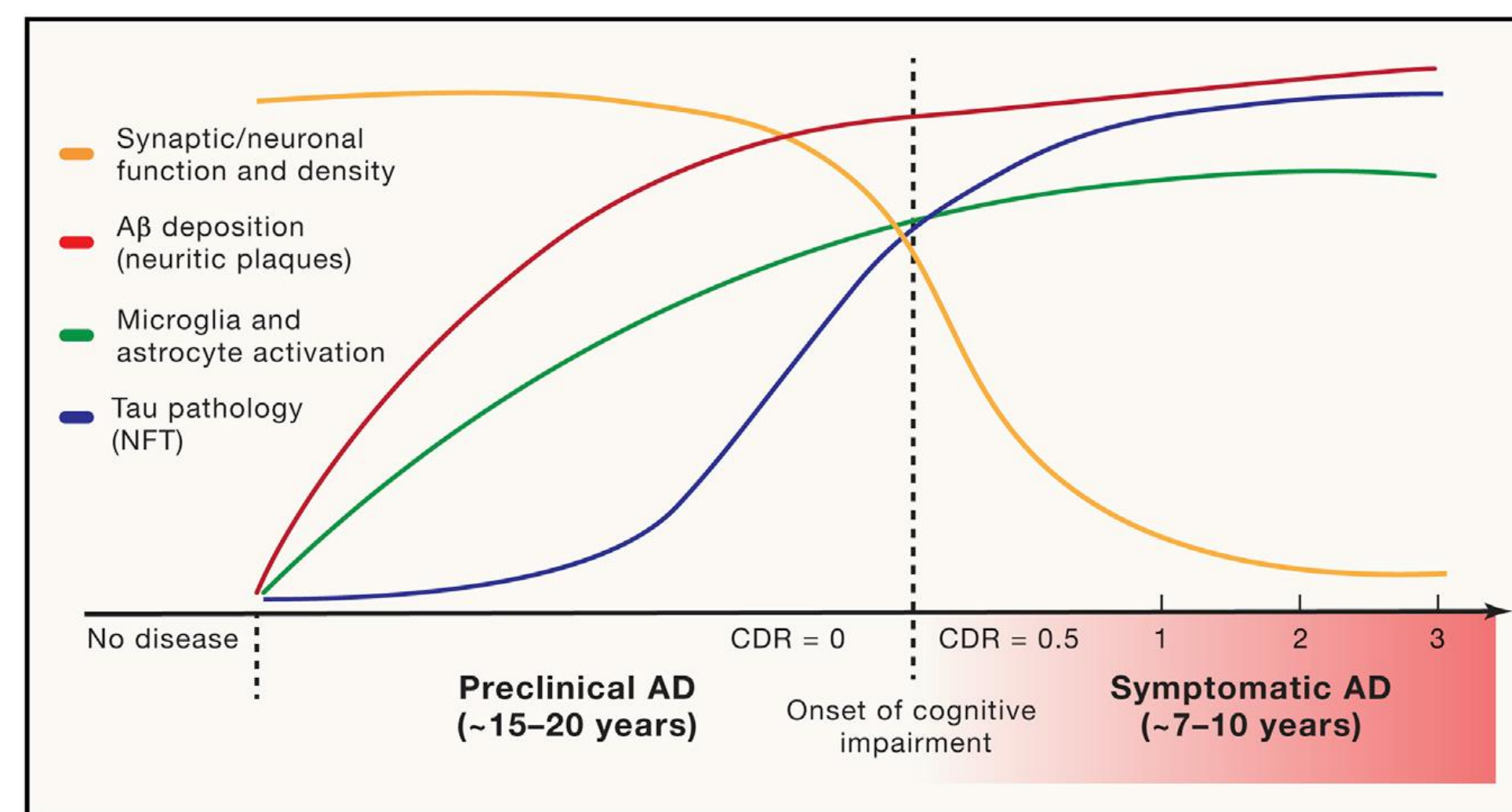
Identification of Factors Associated with Alzheimer's Disease Diagnosis Over Complex Large-scale Longitudinal Health Data

Beth Shaaban, Helmet Karim,
Scott Malec, Sanya Bathla Taneja, Maria Ly,
Jonathan C. Silverstein, Steven Albert, Paul Munro,
Richard D. Boyce

Motivation

Risk of Alzheimer's disease (AD) doubles every 5 years after age 65. An estimated 14 million Americans will have AD by 2050. With no disease modifying treatment or prevention in sight, we aim to:

- Identify factors associated with pre-clinical AD i.e. 10 or more years prior to disease diagnosis using electronic health records.
- Discover novel causal associations for AD using graphical causal methods.



Long JM, Holtzman DM. Cell 2019. doi: 10.1016/j.cell.2019.09.001

Project Description

- Cases - patients with ICD-10 AD diagnosis since 2016 and with UPMC visits 10+ years prior to their diagnosis.
- Controls (8 controls to 1 case) - patients matched on age, sex, and other factors who were not diagnosed with AD but do have UPMC visits 10+ years prior.
- Case-control & machine learning analyses to identify early markers of AD.
- Knowledge graphs and graphical causal methods to address confounding and suggest mechanisms.



We aim to discover novel clues in large-scale electronic health records (EHR) to prevent the onset of Alzheimer's disease.

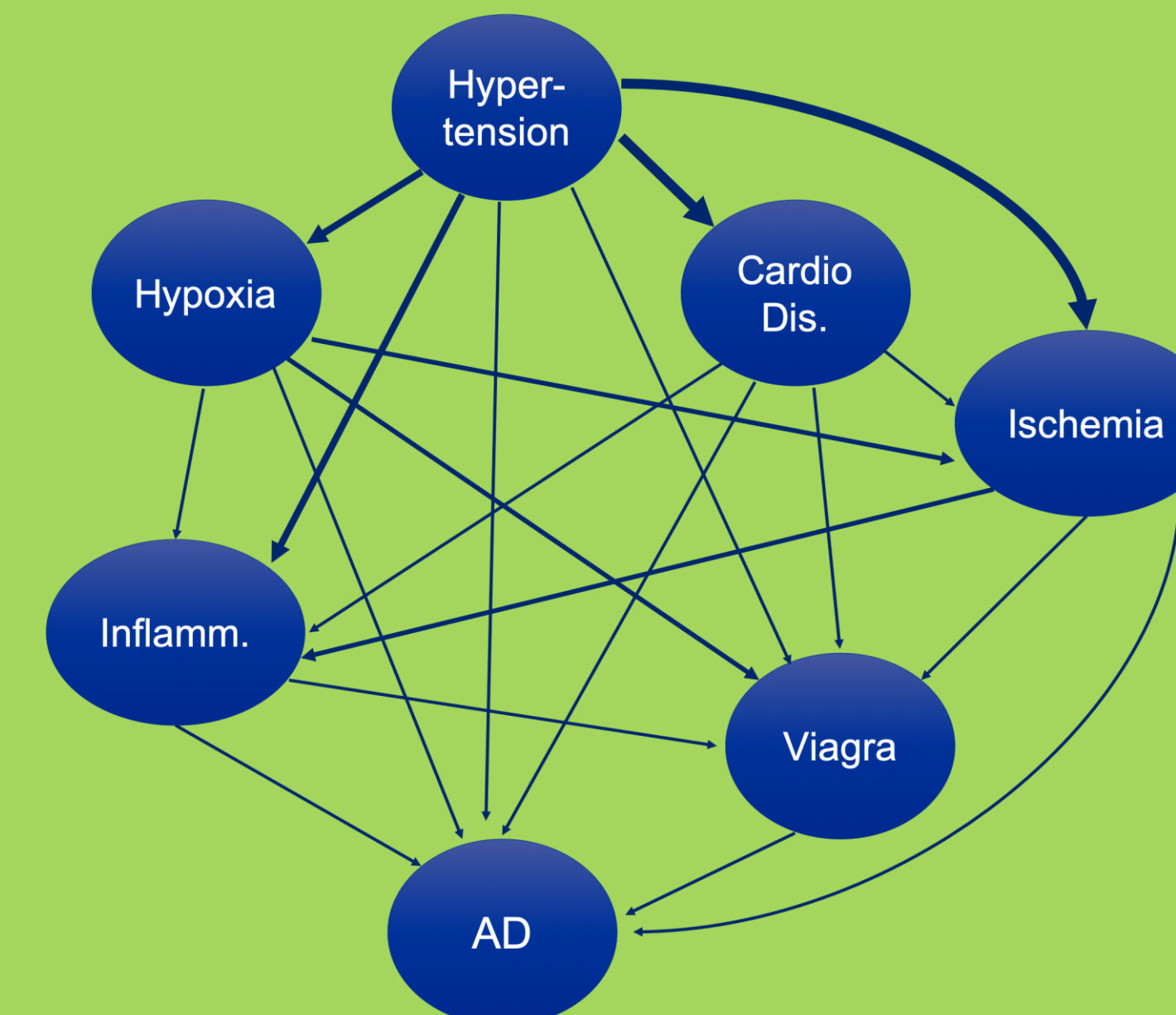
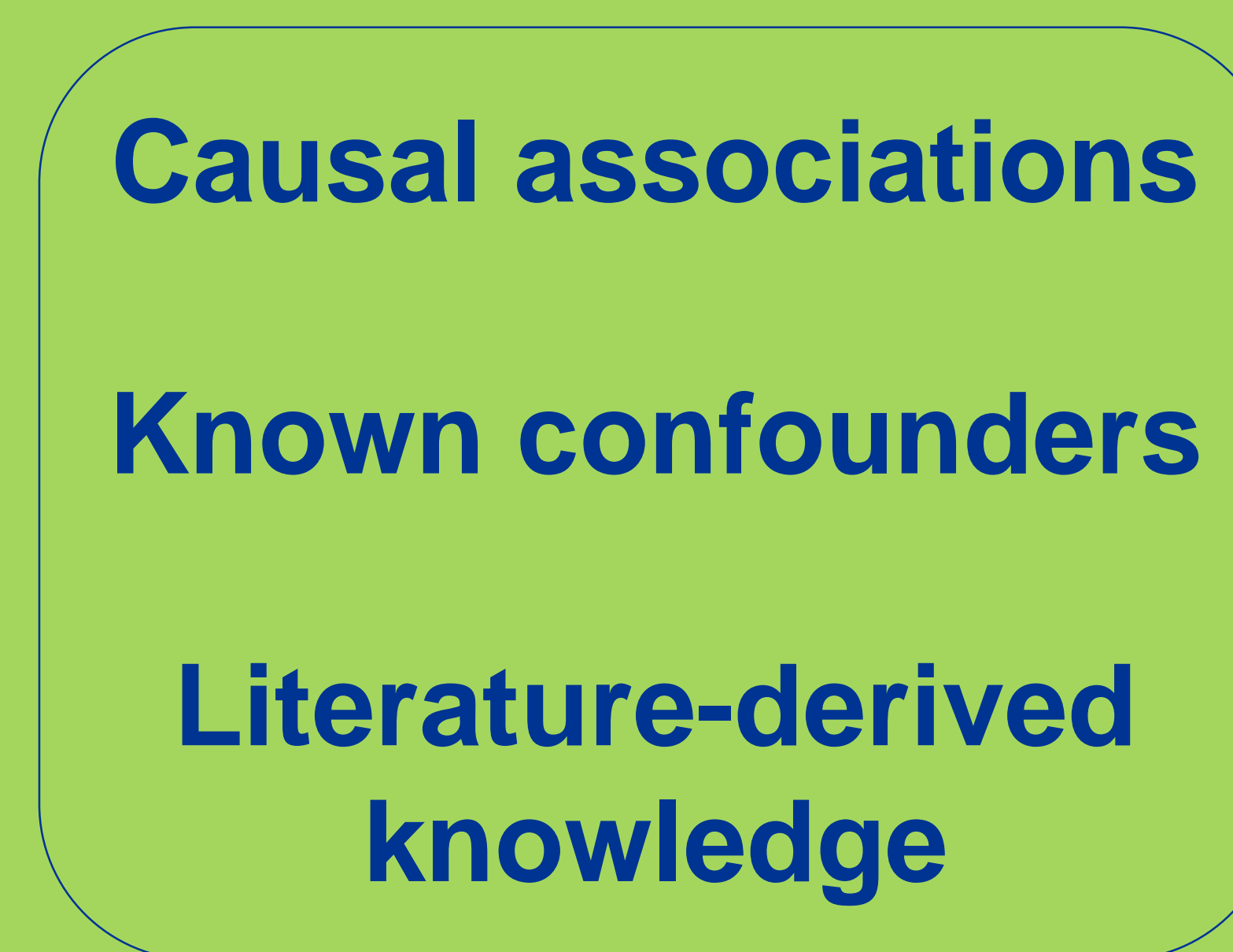
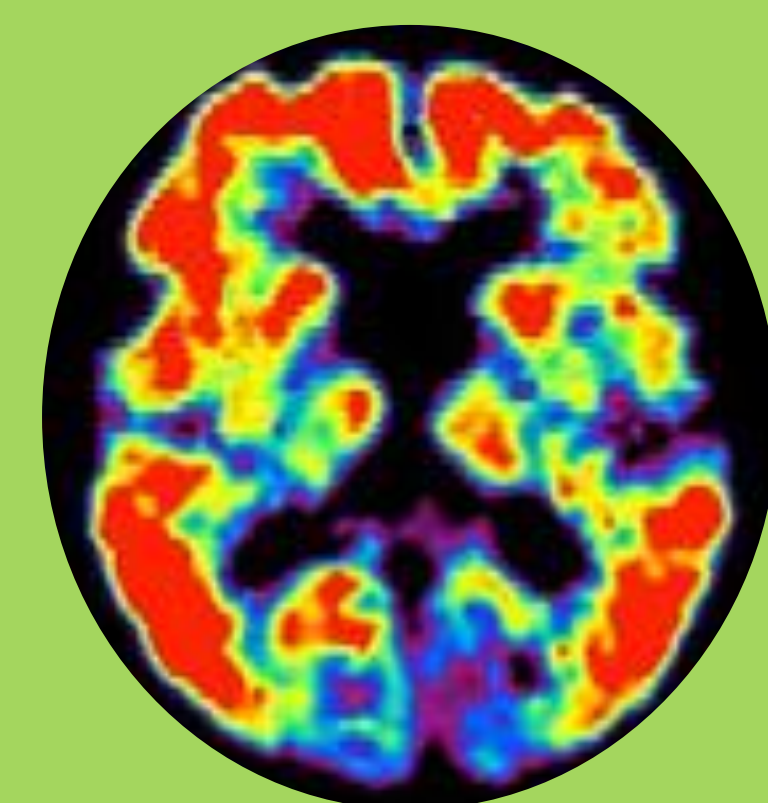
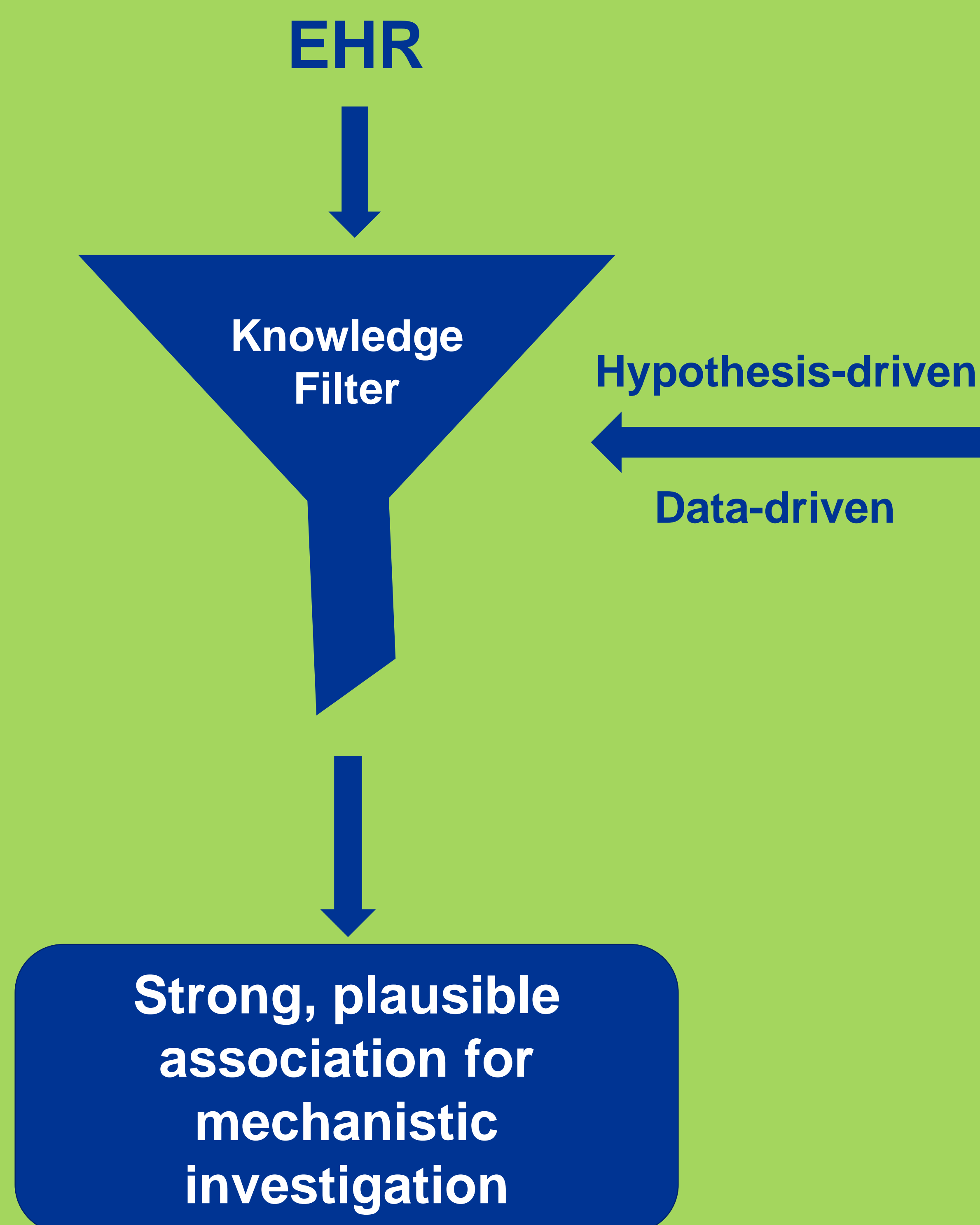
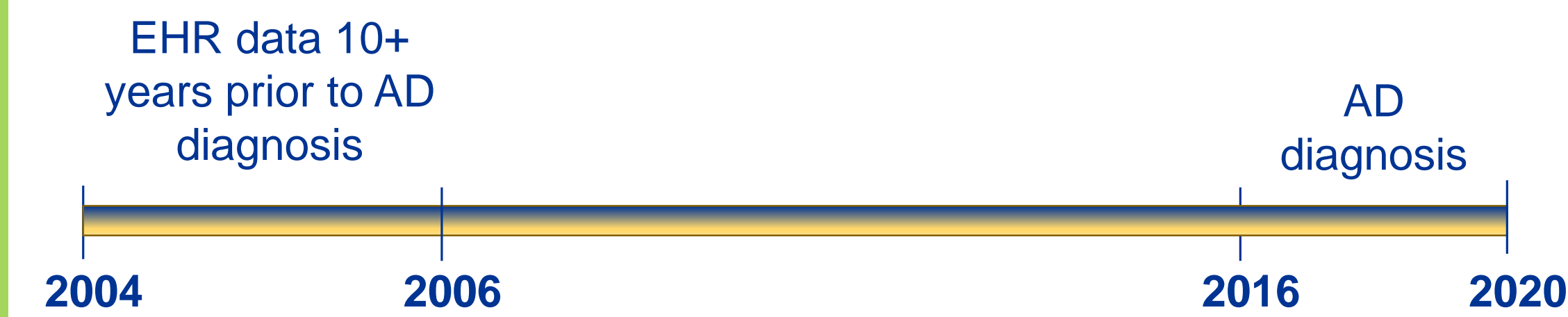


Figure 1. This figure illustrates the result of a literature-informed graphical causal model answering the causal question: "Does sildenafil (Viagra) affect AD?" Semantic MEDLINE database was used as the knowledge repository to identify confounders depicted in the graph. Arrow thickness represents strength of the association.



Context

Type of analysis

First analysis of its kind:

- Associations 10+ prior to a diagnosis of Alzheimer's disease
- Inpatient + outpatient data
- Complete EHR data - medical history, medications, lab results, family history, procedures, demographics, and vitals.
- Integrates detailed control of confounders identified through both typical literature review and machine reading of the literature

Scale of analysis

> 9,000 cases and >72,000 controls

Team

Multidisciplinary members from three schools (Medicine, Public Health, Computing & Information)

Project Deliverables

- Data mart of UPMC EHR data with both cases and controls
- Case-control and machine learning analyses for AD and associated factors
- Preliminary results on causal associations through knowledge graphs
- Abstracts and manuscripts with results
- National Institute of Ageing (NIA) R01 grant proposal for long-term funding

Potential Impact

Provide novel hypotheses to advance research on prevention of AD

- Identify potential disease-course-altering markers for further investigation
- Long-term research plans (using follow-on funding) will generate much-needed disease trajectories & mid-level mechanistic models of great value to AD research community
- A new data mart for use by the wider community of AD researchers

Collaborators

Dr. Arthur Levine
Michelle Kienholz
Dr. Howard Aizenstein
Dr. William Klunk
Brian McLay and the R3 team

Pittsburgh Center for Artificial Intelligence Innovation in Medical Imaging

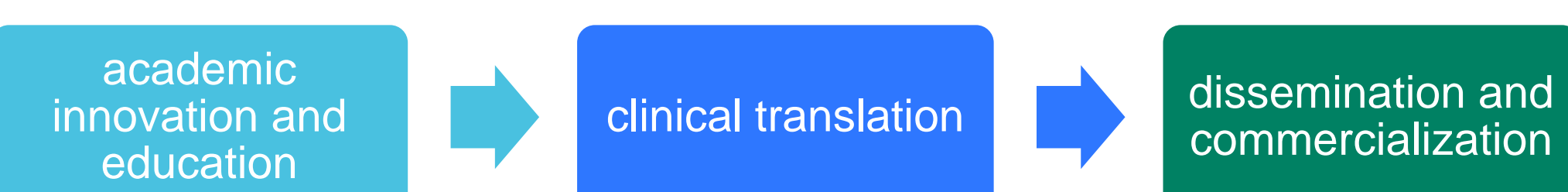
Shandong Wu, PhD,
Lead Investigator, Department of
Radiology, University of Pittsburgh

Motivation

- 90% of all healthcare data comes from medical imaging. More than 97% goes unanalyzed or unused.
- Artificial Intelligence (AI) is the new revolutionary technique for medical research and is reshaping tomorrow's clinical practice in medical imaging
- Opportunity for medical imaging AI at Pitt
 - align goals of researchers and clinicians
 - facilitate cross-unit collaboration
 - synergize multi-disciplinary expertise
 - share data and resources

Project Description

- Unify a multi-disciplinary team from Pitt schools of Medicine, Engineering, and SCI
- Scale our competitive and complementary research efforts in computational/engineering and clinical sciences
- Pursue targeted large-scale external funding from multiple sources: NIH P41 and T32.



Context

- Pittsburgh has talents, technology, data, clinical resources, and AI ecosystem, but lacks an imaging AI collaboration hub.
- The imaging AI Center engages more than 70 members from 12 academic departments at Pitt/UPMC/CMU, including 28 clinicians and 44 researchers.
- Strong partnership with Pittsburgh Supercomputing Center, UPMC Enterprise, Pittsburgh Health Data Alliance, Pitt CTSI, Center for Military Medicine Research, Center for Biologic Imaging, Pitt CREATES, Pittsburgh Liver Research Center, etc.



Primary project goal

advance innovative imaging
artificial intelligence (AI) research,
clinical translation, and
commercialization by synergizing
computational expertise and
clinical resources at Pittsburgh



Project Deliverables

- **Year 1:** monthly meetings/seminars to discuss current/existing research/projects, ideas, clinical needs/pain points, and solutions; Exploring funding opportunities and fostering sub-groups of interest for collaborations on specific ideas; Crafting pilot projects to implement by the Momentum Funds for potential inclusion in the NIH P41 center grant application; Starting to publish together to build collaboration track records.
- **Year 2:** Year 1 academic activities continue; Identify competitive projects from the funded pilot projects and form strong investigator teams for the P41 application to be submitted by the end of Year 2; Organize an AI symposium.

Potential Impact

- Will bring researchers, clinicians, entrepreneurs, and students/trainees together to collaborate and perform workforce development in medical imaging AI projects;
- Will build a shareable infrastructure which benefits the Pittsburgh community by advancing knowledge; improving patient care, accelerating commercialization development, creating jobs, and enhancing educational innovation;
- Will develop multi-disciplinary projects and forms competitive teams to pursue large research program funding;
- **Ultimate outcome:** a world-class imaging AI research and translation center to significantly expand the medical imaging AI research and industry ecosystem in Pittsburgh through sponsored research and to start new AI companies that enable healthcare providers to provide higher quality patient care at a lower cost.

Acknowledgements



Intimacy Directing and Education: Staging Scenes of Sex and Violence for the Academic Performer

Karen J. Gilmer

Motivation

Support Chancellor Gallagher's initiative to help Prevent Sexual Misconduct on University of Pittsburgh campuses by:

- Employing Intimacy Directors on theatre productions where scenes of intimacy and violence are involved
- Educating students and faculty on the skills and techniques for consent and best practices when staging scenes of sex and violence in the classroom, rehearsals and theatre productions
- Creating respectful classrooms and safe space environments that demonstrate best practices when staging scenes of sex and violence

Project Description

- Host workshops on Staging Intimacy for University of Pittsburgh's Theatre Arts department students and faculty through Intimacy Directors International (IDI) and Theatrical Intimacy Education (TIE)
- Attend Intimacy Directing workshops and training sessions for accreditation to be a certified Intimacy Director

Two Tools of Intimacy Directing

*Button

Self care cue word for the performer when there is a question, a need for a pause in the action for an emotional, physical or mental self care when staging intimacy and sexual aggression

*F.R.I.E.S

Freely given Consent

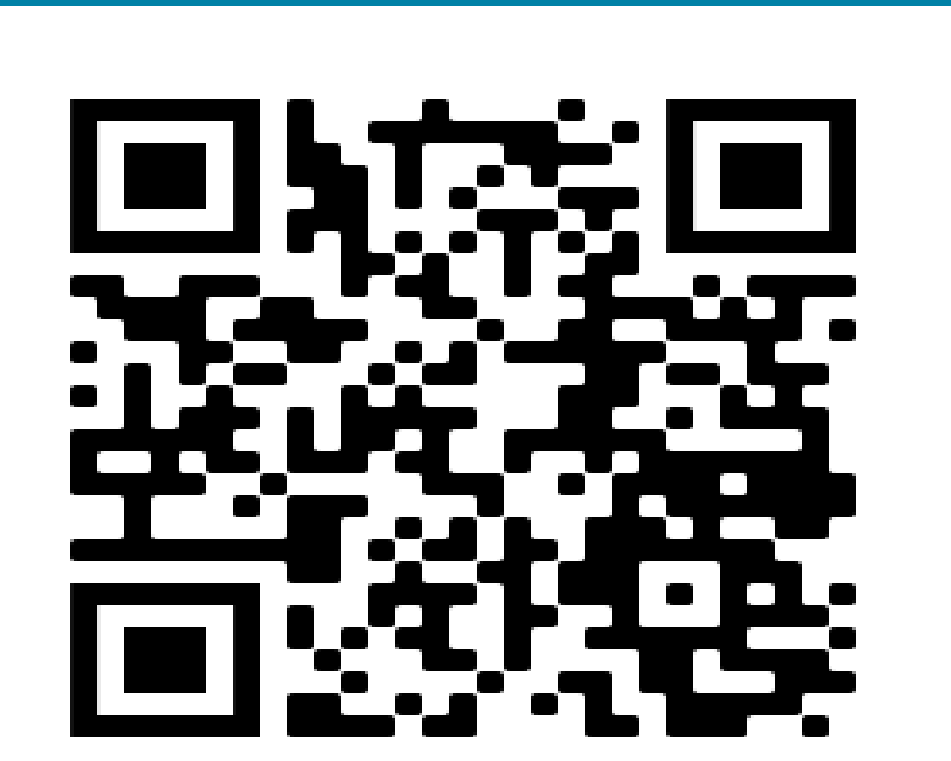
Reversal of Consent with no judgement

Informed about the storytelling and the use of staged intimacy or sexual aggression

Enthusiastic consent

Specific and choreographed action

BUTTON* AND F.R.I.E.S* INTIMACY EDUCATION TOOLS TO EMPOWER CONSENT AND BEST PRACTICES WHEN STAGING SCENES OF INTIMACY



Context

- Due to the growing number of plays that have staged sex and violence clear and established boundaries, positive body image and no judgement are newly ideas promoted by intimacy directing
- Teaching and creating a safe and supportive environment for staging sex and violence
- Inspiring students to demonstrate safe practices and incorporate best practices when staging scenes of sex and violence with or without an intimacy director

Project Deliverables

- Continue to attend Intimacy directing workshops and training sessions to complete the accreditation process
- IDI and TIE workshops will have been conducted and the system incorporated into the theatre department's policies, classrooms, curriculums and productions
- My certification in Intimacy Direction will allow me to serve as such for University of Pittsburgh productions
- Establish a relationship with Title IX on formalizing department policies on prevention of sexual misconduct

Potential Impact

- Staging Intimacy establishes ways to stage scenes of sex and violence that empower the performer's agency with collaborative and enthusiastic consent
- Puts a system in place when the actors are the agents in the staging with or without an intimacy director
- Changing the culture and creating an environment where established boundaries when staging scenes of intimacy are less "weird"

References and/or Acknowledgements

- Intimacy Directors International (IDI)
- Intimacy Directors and Coordinators (IDC)
- Theatre Intimacy Educators (TIE)

Using Environmental Scans to Guide Campus Sexual Misconduct Prevention

Janine Talis, MPH, CPH^{1,2}
Elizabeth Miller, MD, PhD^{1,2}
Carla Chugani, PhD, LPC^{1,2}
Robert Coulter, PhD, MPH¹
¹University of Pittsburgh
²UPMC Children's Hospital of Pittsburgh

Motivation

- Address high rates of SV among students on campus identified in the AAU-University of Pittsburgh report through engagement of campus stakeholders
- Engage populations most vulnerable to violence on college campuses (students of color, with disabilities, and/or LGBTQ+)
- Assess existing policies on campus and suggest improvements based on open dialogues with stakeholders.

Project Description

- Synthesize campus environmental scans from College Health RCT (PRO14110392)
- Conduct listening sessions with student organizations to present findings and receive feedback/recommendations
- Present data from scans and listening sessions to University stakeholders within the context of the AAU report

Context

- Over a quarter of women (26.9%) on campus reported SV victimization.¹
 - Minority, LGBTQ+, and students with disability reported similar/higher rates of SV.¹
 - Results consistent with a large, RCT across 28 college campuses which sought to decrease alcohol-based SV by enrolling students through campus health centers.
- Through our work with other colleges, we are able to provide a comprehensive picture of how colleges “universally” and University of Pittsburgh specifically are/not addressing SV
 - Special attention to populations found to be most vulnerable to violence.

Address the high rates of sexual violence (SV) among students on campus through the engagement of campus stakeholders and policy analysis.

Project Deliverables

- Synthesize environmental scan data from across 28 college campuses included in RCT
 - Includes examining policies/practices related to SV, alcohol use, support for students with disability/LGBTQ students.
- Produce a concrete set of policy/protocol recommendations for the campus at large based on feedback from students
 - Identify the gaps the currently exist among the University's current SV protocols, practices, and policies
 - Compare these to what does/not exist on other college campuses
 - Present list of strategies – intervention, prevention, resources, etc.

Potential Impact

- Create a foundation to build community change within the University as a whole, based on data and multi-level stakeholder engagement.
- Identify short- and long-term strategies for reducing SV perpetration among college students.
- Improve the accessibility of resources and services available to those who have experienced SV.

Acknowledgements

- The entire Miller Team
- Campus health and wellness centers through PA and WV
- Futures Without Violence
- NIAAA: grants # R01 AA023260; R03 AA025780

References

1. Cantor D, Fisher B, Chibnall S, et al. Report on the AAU Campus Climate Survey on Sexual Assault and Misconduct: The University of Pittsburgh. Westat; 2019.



Determinants of future cognitive development: A motor training study

Klaus Libertus,
Darcy Smith,
Ran An

Department of Psychology
University of Pittsburgh

Motivation

- Do motor skills predict children's ability to learn about the world?
- Can we use simple motor training to promote healthy development?

Project Description

- Parents will play games with their three-month-old babies designed to encourage the onset of independent grasping.
- The long-term effects of the games will be assessed at 10 and 16 months (see Figure 1).
 - Measuring cognitive skills with tasks tapping into executive functioning and tool use behaviors.
- Study team members:
 - Klaus Libertus (PI), Darcy Smith (graduate student), and Ran An (lab coordinator), as well as one Pitt undergraduate student (TBD).

Longitudinal training study aiming to identify how motor experiences during infancy influence emerging cognitive abilities predictive of school readiness.

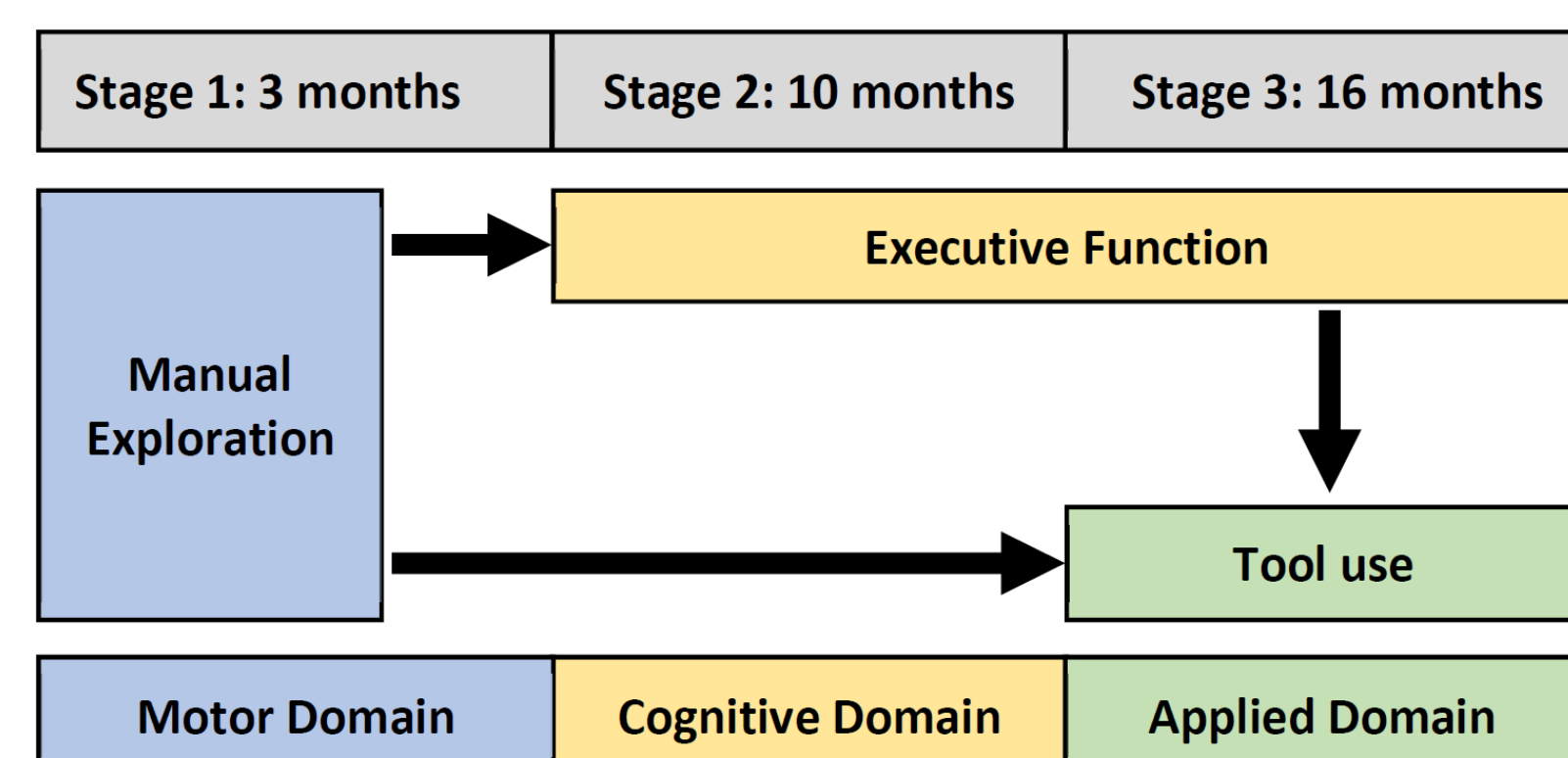


Figure 1: Study outline and predicted associations between early motor development, emerging executive function skills, and applied problem-solving.

Context

- Motor skills predict some developmental disorders.
- Embodied cognition suggests that learning is facilitated by our motor skills.
 - Do early emerging motor skills affect cognitive development, with potential long-term impacts for school readiness skills?
- The current study extends previous training studies to examine effects outside of motor domain
 - Emerging executive function skills and applied problem-solving during tool use.



Project Deliverables

- This seeding grant project aims to test 40 infants using four different training methods
- Training success will be quantified, and methods adjusted if necessary
- Preliminary results will be submitted to at least one conference
- Graduate student will use data for design of dissertation work
- Pilot-data will be used for future grant application
 - Targeting R21 submission in Spring 2022



Figure 2: Primary motor training method that will be used in the current study

Potential Impact

- Findings have implications for theory and practice
- Provide evidence for a developmental cascade linking motor with cognitive skills
 - Providing a mechanism explaining developmental change
- Provide empirical evidence for embodied cognition perspective
- Applications outside Psychology
 - Physical Therapy
 - Clinical interventions
 - Robotics and artificial intelligence

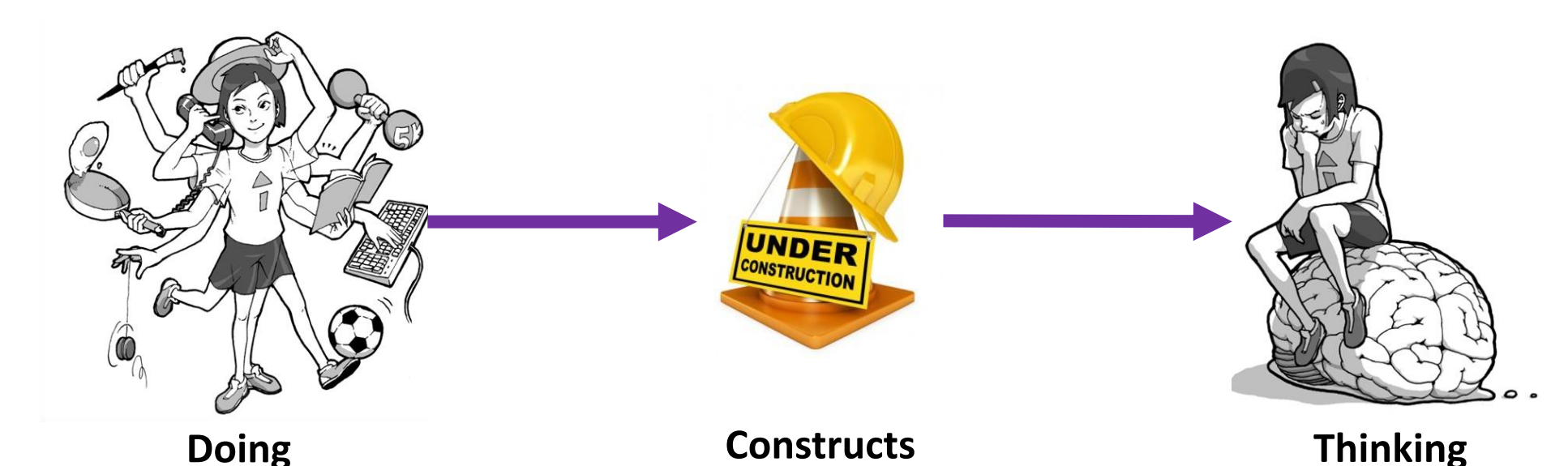


Figure 3: Theoretical framework, adapted from: Pfeifer & Bongard (2007)

Pilot Data

- Collected pilot data in November and December 2019
- Will implement changes to data collection procedure to ensure project success
 - Move to 100% online data collection
 - Make more use of parent-report measures

References

- Please see our lab website for more information:
 - www.onlinebabylab.com
- Full grant application with references can be accessed via QR code

Corporate Venture Capital in China: A Field Study

Ravi Madhavan, Peiyuan Huang
Katz Graduate School of Business

Motivation

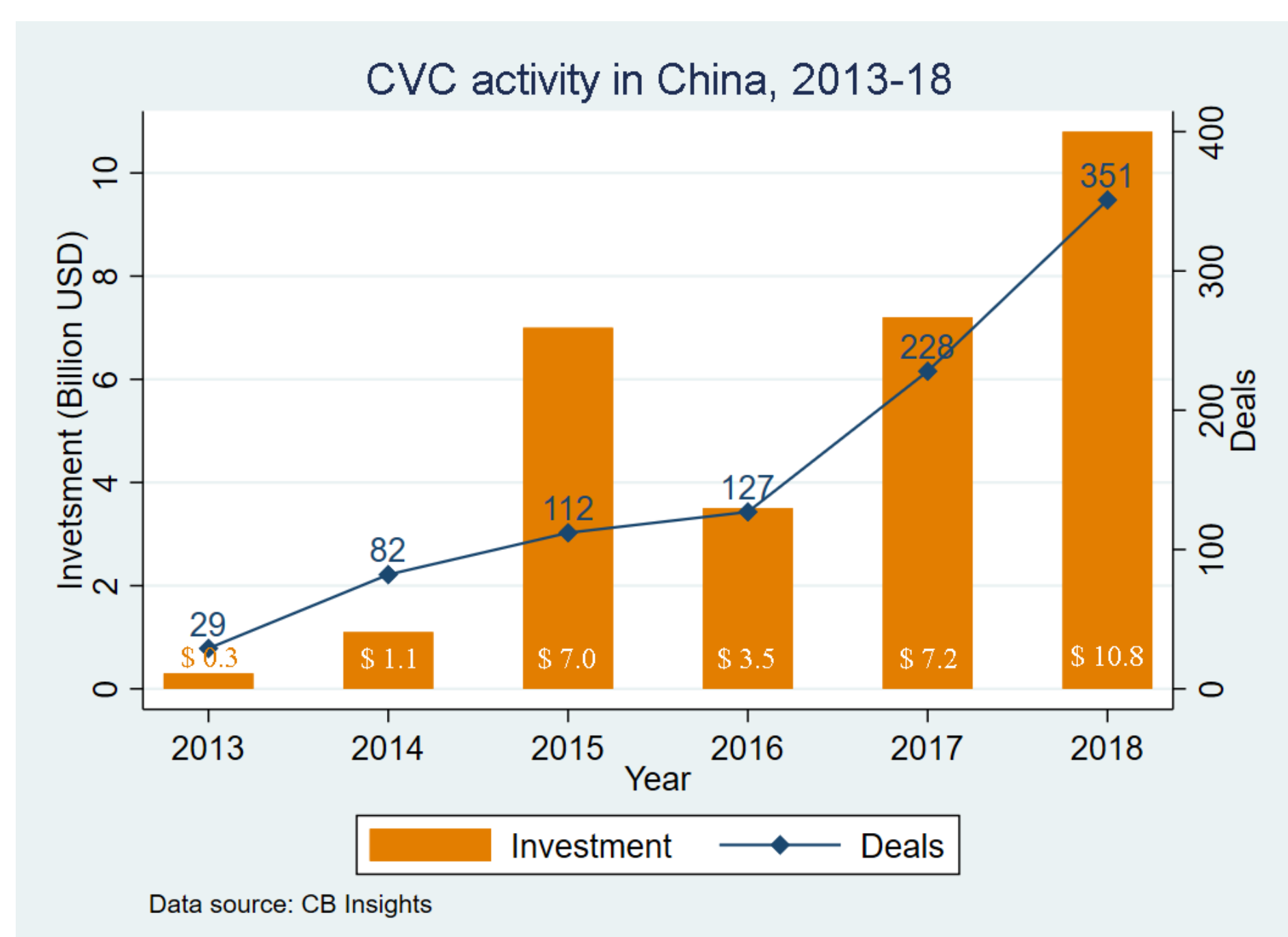
- Innovation in China is a topic of great interest to the policy, science and business communities
- While many aspects have been studied – including IP regimes, R&D investment, etc. – the financing of innovation is not well understood
- Representing corporate investment in startups, Corporate Venture Capital (CVC) is a key element of innovation financing today

Project Description

- We will conduct a field study of the CVC ecosystem in China, interviewing key participants and observers about
 - Emergence – origins and growth drivers
 - Evolution – current state and trends
 - Institutional context – unique features

Context

- CVC is a critical piece of the innovation puzzle, linking startup innovations to industrial scale
- Crucial complement to independent venture capital
- Although relatively recent, Chinese CVC activity has accelerated



Our goal: understand how Chinese enterprises finance innovation by mapping the emergence and evolution of Corporate Venture Capital (CVC) in China

Project Deliverables

- Field work reports, 2020
- Conference presentations
 - Strategic Management Society, 2021
 - Academy of Management, 2021
 - Academy of International Business, 2021
- Journal submission
 - Strategic Management Journal, late 2021

Potential Impact

- Contributes to understanding a key driver of innovation in China: how it is financed
- Clarifies a mechanism that brings together the major players in the China innovation ecosystem
 - CVC in China uniquely links government, startups, state-owned enterprises and private companies
- Facilitates a comparison of China's emerging CVC capabilities to that of the US
- Initiates consideration of political returns to CVC, a novel construct in the field of innovation strategy

References and/or

Acknowledgements

- Thanks to Pitt Momentum Funds program and the Katz School for financial support
- For background on impact of CVC in innovation, see Huang & Madhavan (2020), "Dumb money or smart money? Meta-analytically unpacking corporate venture capital", working paper.



Grandparent Caregivers: A Strength-based Model

Fengyan Tang & Betsy Farmer
School of Social Work

Motivation

- How do grandparent caregivers (GCs) define resilience?
- What individual and system factors contribute to resilience?
- How do service providers help GC develop resilience?

Project Description

- Survey 100 GCs who participate in local agency programs
- Conduct focus groups among 30 GCs
- Conduct focus groups among 20 service providers

Context

- Challenges and adversities faced by GCs raising grandchildren
- GCs' strengths: resilience, positive caregiving appraisal, adaptive coping strategies, self-help and help-seeking skills
- Lack of interventions simultaneously targeting the grandparent and service providers

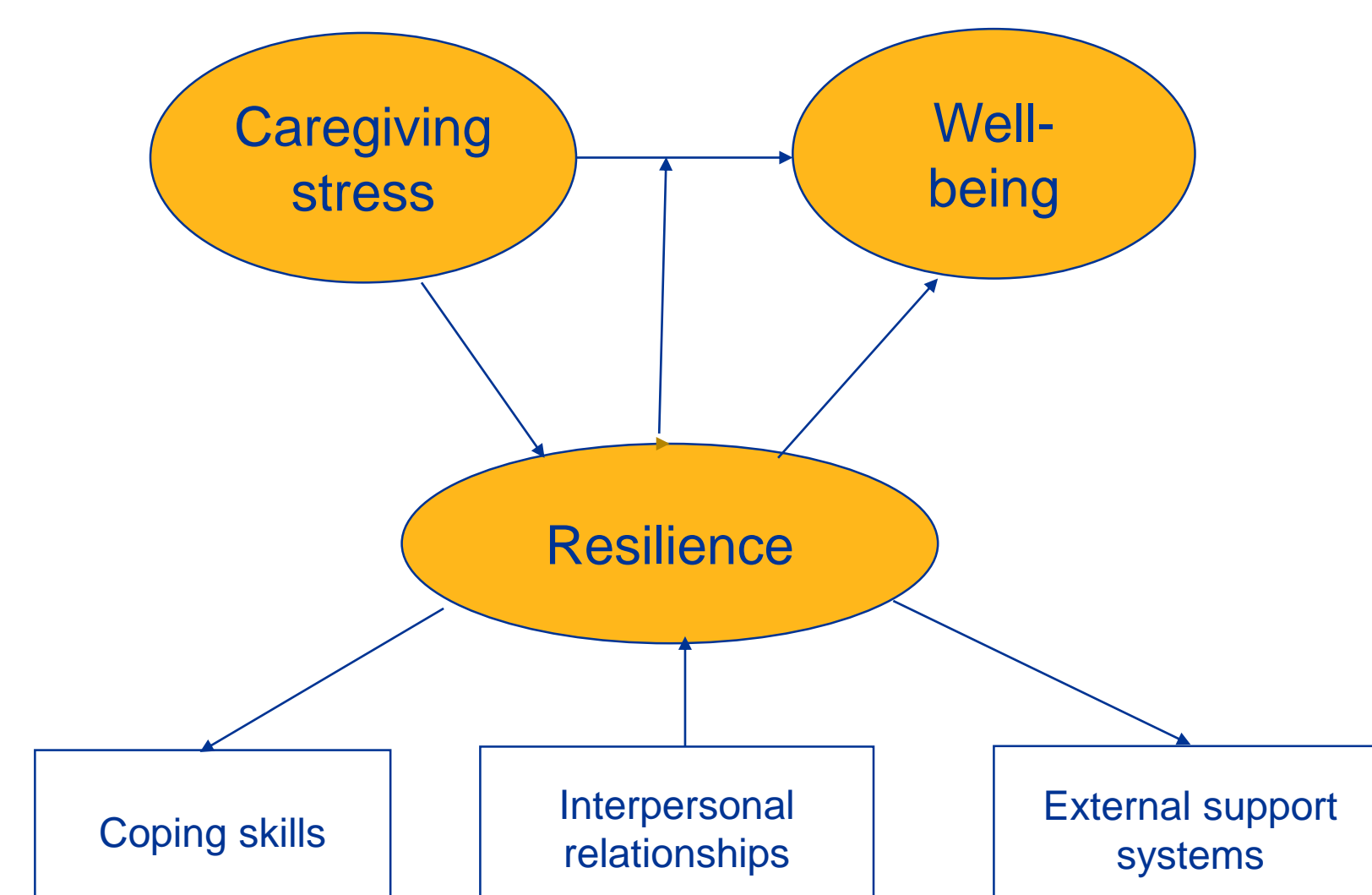


Figure: Conceptual model

Individual coping skills, interpersonal relationships, and external support systems contribute to resilience and well-being among grandparents raising grandchildren.

Project Deliverables

- Mid-term 'exam'
 - We will find out how GCs understand their strengths and challenges in raising grandchildren
- Final 'exam'
 - We will find out how service providers perceive GCs' strengths and challenges
- Outputs by the end
 - We will design a strength-based model of interventions improving GCs' capacity of using external support systems and enhancing resilience
- Within 1-2 years after the project
 - Disseminate research findings to academic and community audiences
 - Seek for funding to test the model and interventions

Potential Impact

- To enhance custodial grandparents' resilience and well-being
- To improve the contexts of family and community where grandparents raising grandchildren
- Advance external support systems for GCs and their families
- Develop interventions that tailor to the needs of GCs in reliance on both individual and system resources

References

- Choi, M., Sprang, G., & Eslinger, J. G. (2016). Grandparents raising grandchildren: A synthetic review and theoretical model for interventions. *Family and Community Health, 39*, 120–128.
- Hayslip, B., Fruhauf, C. A., & Dolbin-MacNab, M. L. (2019). Grandparents raising grandchildren: What have we learned over the past decade? *The Gerontologist, 59*, e152–e163.
- Hayslip, B., & Kaminski, P. L. (2005). Grandparents raising their grandchildren: A review of the literature and suggestions for practice. *The Gerontologist, 45*, 262–269.
- Mendoza, A.N., Fruhauf, C.A., MacPhee, D. (2019). *The International Journal of Aging and Human Development*, first published online: April 22, 2019.



Plasticity & Possibility in Regenerative Biology

Emily Wanderer
Department of Anthropology

Motivation

- Much has been written about extinction in the age of the Anthropocene. Extinction processes have been analyzed for what they tell us about the consequences of human actions and about nature, science, conservation, and for their power to generate action. Alongside analyses of extinction and human impacts on global ecosystem come reports on regeneration. Scientific work on regeneration, like that on extinction, has both practical and symbolic power. This project analyses both the social contexts shaping regeneration research as well as its cultural impact.

Project Description

Scientists studying developmental and regenerative biology are exploring new possibilities for the plasticity of human biology. Often drawing on research with non-human model organisms, these fields are producing knowledge about organismal development, growth, and regeneration in order to transform these processes.

This research raises a number of important anthropological questions:

- What are the lab practices through which animals are made to demonstrate regenerative capacities?
- How do scientists make comparisons and translate findings about non-human life into human biology and how does this research reconfigure our relation to non-human organisms?
- What consequences does framing biology as regenerative have for our understanding of animal biologies and the environment more broadly?
- What implications does this research have for the limitations of the human body and what it means to be human?

Context

- This research will contribute to anthropological research in three areas: multispecies ethnography, post-genomic biology, and the relationship between science, markets and capital.



How do the cultural, political, and economic contexts of regenerative biology shape how scientists imagine what life could or should be?



Project Deliverables

- This project will consist of multi-sited ethnographic fieldwork
- Key field sites
 - Training courses for scientists on stem cells and regenerative biology
 - Laboratories focused on basic and clinical science on regeneration
 - Biotech start ups
- Methodology
 - Participant observation research and ethnographic fieldwork in a variety of sites
 - Interview transcription, coding field notes, and other data analysis
- Follow-on funding strategy: use preliminary data from this fieldwork to support Wenner-Gren and NSF applications
- Publishing plan:
 - Fieldwork funded by this grant will allow me to publish 1-2 articles
 - This fieldwork and subsequent research will ultimately result in a monograph

Potential Impact

- The promise of regenerative biology has become particularly compelling in the Anthropocene, the moment in which human activities have begun reshaping geological processes. This project will provide an understanding of the key issues this field presents for both environmental conservation and human social life. As global environmental crises including rising extinction rates demonstrate the limits of biological flexibility and adaptability, regenerative biology appears to offer a technological fix and an alternative future for some.



Project mascot: the axolotl
Image credit: fronx (<https://www.flickr.com/photos/fronx/>) is licensed under CC by 2.0 (<https://creativecommons.org/licenses/by/2.0/>)

Building Organizational Democracy

Trevor Young-Hyman,
Katz Graduate School of Business

Motivation

- Examples of organizational democracy
 - Worker cooperatives
 - Credit unions
 - Producer cooperatives
 - Utility cooperatives
 - Partnerships
- Organizational democracy has various positive social externalities
- Conversion from conventional structure to workplace democracy is a puzzle
 - Tension with strong leadership
 - Democratic participation unfamiliar to most workers

Fig. 1: Total household income and wage income by type of worker and certification status of the employer (in 1000 CFA per month).

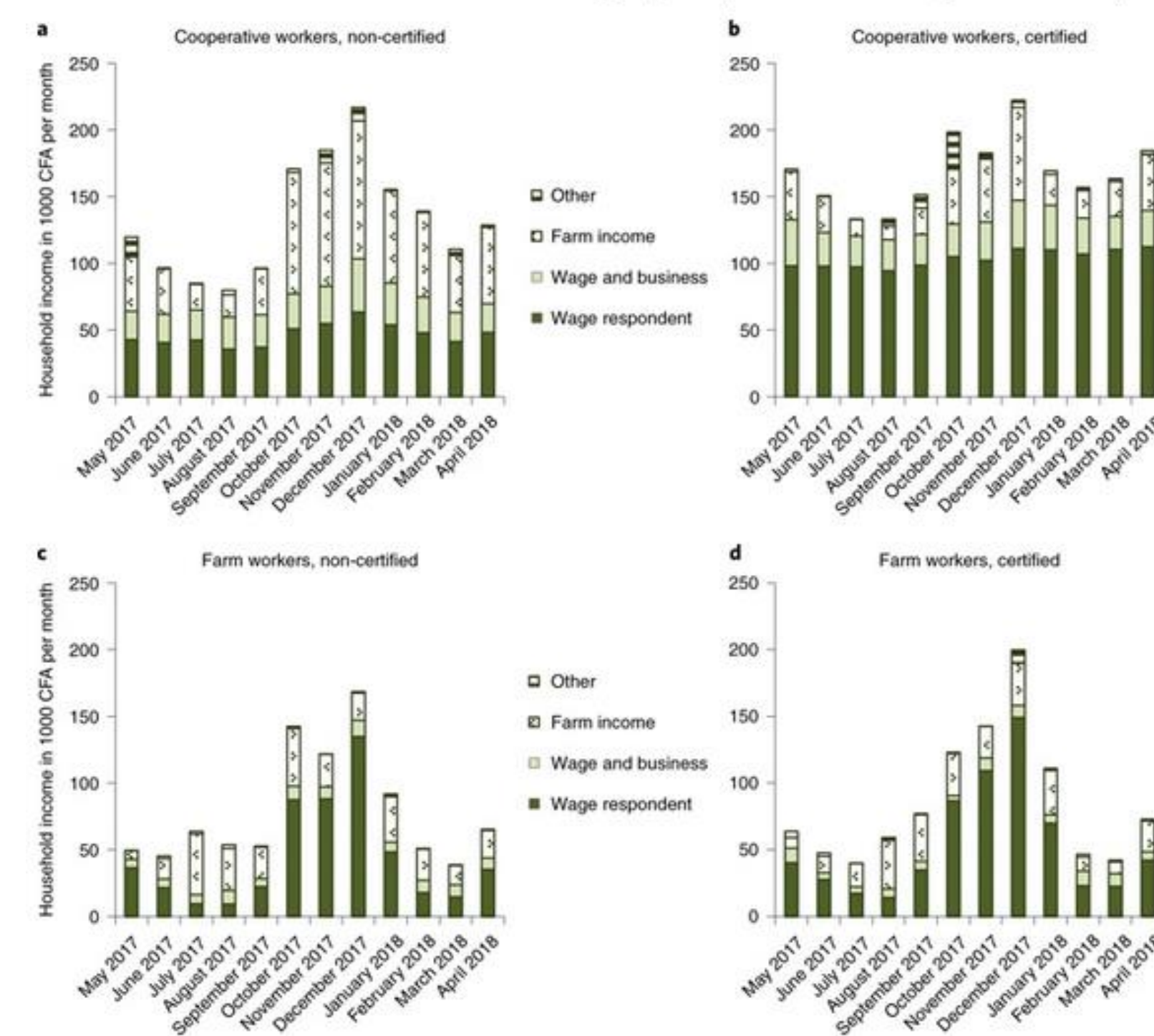


Chart2: Wages and Wage Stability in Farming Cooperatives (Source: Meemken et al. 2019)

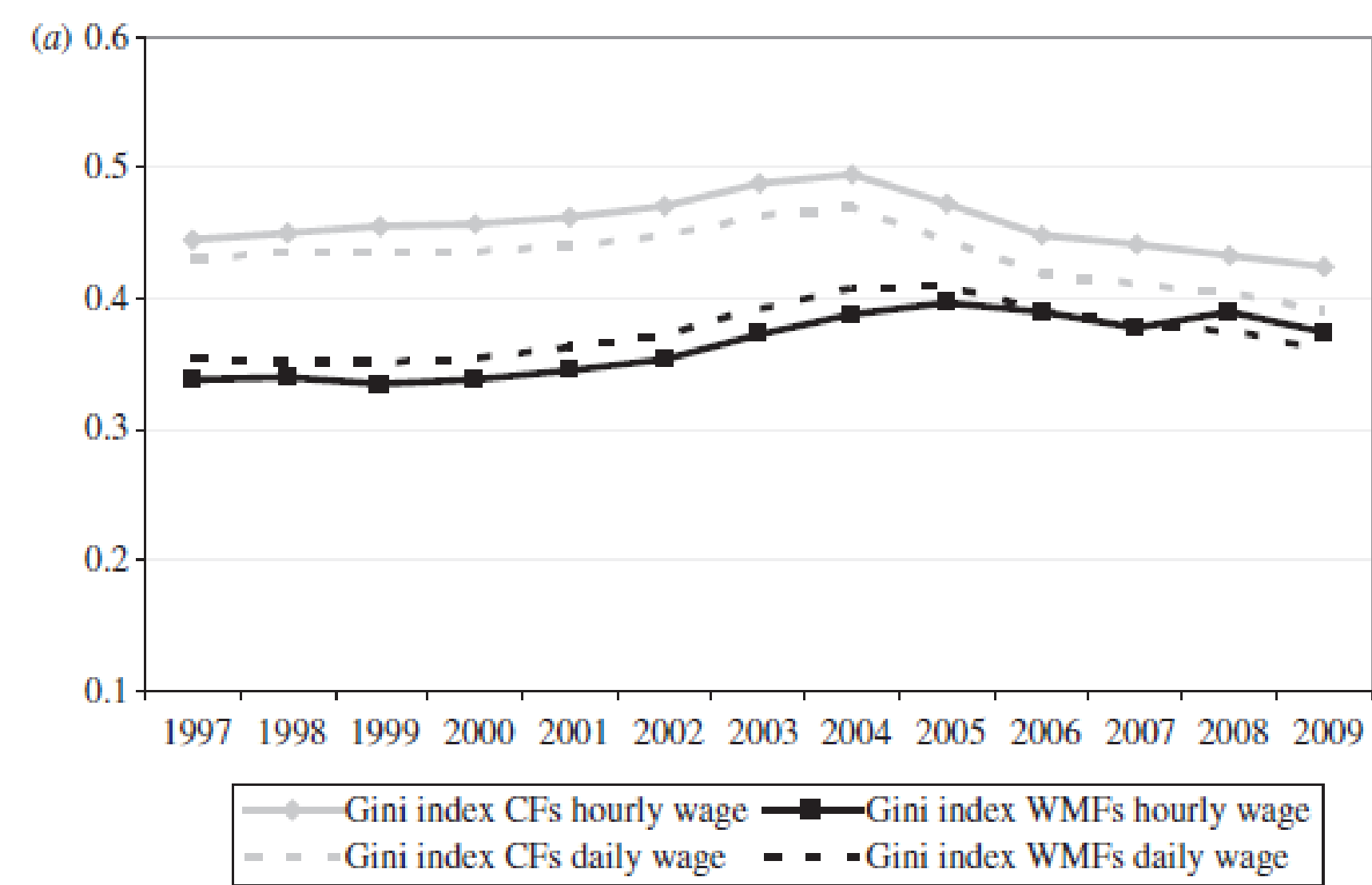


Chart 1: Wage Inequality in Conventional Firms and Worker Cooperatives (Source: Burdin 2016)

This project will examine *how* organizations *transition* from centralized power structures to *organizational democracy*.

Project Description

- Ethnography of interpersonal dynamics during conversion process
 - Two years of data collected
 - Tracking evolution of governance structure
 - Tracking evolution of individuals' involvement
- Automated video data collection
- Data
 - Audio transcripts
 - Video recordings



Figure 1: Illustration of Video Data Collected Through Video Conferencing System

Context

- Current research emphasizes when an organization become more democratic, focusing on external factors
- This study will focus on internal dynamics
 - Role of the founder
 - Events that accelerate or impede change

Project Deliverables

- Mid-term deliverable – December 2020
 - 25,000 pages of transcribed meetings
 - 60 hours of recorded video
- Final deliverable – May 2021
 - Manuscript on process model of workplace democracy emergence
- Extension of project – December 2021
 - Extension of data collection to multiple firms in process of conversion
 - Pittsburgh Taskforce of Worker Ownership
 - National Center for Employee Ownership

Potential Impact

- Offers practical solution to salient policy problem
- Facilitates alternative economic development strategy



Developing University Infrastructure to Foster Equity and Inclusion in College Classrooms

Kevin Binning, Psychology and LRDC
Lorna Keams, UCTL
Linda DeAngelo, Education
Christian Schunn, Psychology and LRDC
Erica McGreevy, Biological Sciences

Motivation

- To change Pitt culture in ways that foster equity and inclusion
 - We seek to implement across Pitt a social psychological intervention that has been shown to close performance gaps at Pitt.
 - In so doing, we seek to train instructors on the mindset of the intervention, how to run the intervention, and how to evaluate the intervention
 - In these ways, we seek to have a broad, lasting impact on the culture of Pitt

Project Description

We seek to:

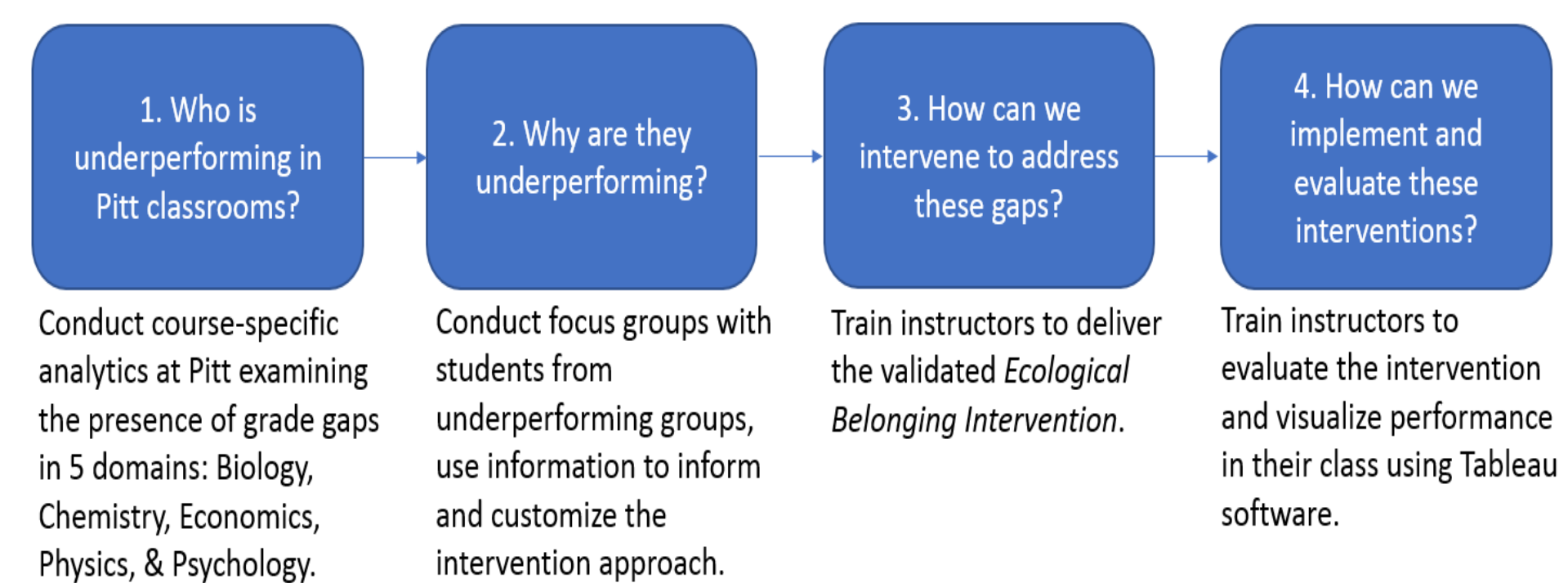
- Understand where (which courses) gaps in equity exist
- Understand *why* these gaps exist
- Train and support instructors to run an ecological belonging intervention
- Evaluate the effects of the intervention

Context

- Instructors currently are not able to “know their students” – to know where gaps in equity exist and what they might do about them
- We seek to change that by equipping instructors with knowledge about their students and with knowledge of ways to address equity in their classroom with an intervention

Chart 1: A four-step process for building a faculty analytics program focused on testing interventions to foster equity in college.

Classroom Analytics for Equity (CAFE) Scholars Program at a Glance



Train instructors to understand and address problems with equity in their classrooms.

Project Deliverables

- We seek to establish a proof-of-concept for the faculty training program, which we term the CAFÉ Scholars program (Classroom Analytics for Equity)
- We will produce a proposal for a large-scale federal grant that will then expand from the proof-of-concept to establish the program at Pitt.

Potential Impact

- Our goal is that instructors who participate in our program will undergo a lasting change in their mindset and teaching practices that will foster equity and inclusion in their classrooms and, with time, the University more broadly.
- We hope that the program will then serve as a model for similar programs at collaborating universities, including Indiana University and the University of Minnesota

References and/or Acknowledgements

We have collaborating partners at IU and UM:

Indiana University Team

Dennis Groth, Vice Provost for Undergraduate Education

Linda Shepherd, Senior Assistant Vice Provost
George Rehrey, Principal Instructional Consultant, Scholarship of Teaching and Learning Program:
Martha Oakley, Professor, Department of Chemistry

University of Minnesota

Sehoya Cotner, Associate Professor, Biology Teaching and Learning

