Plantae Presents

How to Write Your Research Statement for an R1/R2 Tenure Track professorship in the USA

Friday, October 28, 2022
12:00 PM CDT

Eva M. Farré, PhD

Associate Professor, Department of Plant Biology, Michigan State University

Sonali Roy, PhD

Assistant Professor, Tennessee State University

Moderated by:
Sabrina Chin & Maryam Rahmati Ishka

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American Society of Plant Biologists

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Webinar Logistics

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How to write your research statement for an R1/R2 tenure track professorship in the American universities?

Friday, October 28, 2022, 12-1pm (CDT)

Organized by Women in Plant Biology (WiPB) Committee

Panelist:
Dr. Eva Farré, Associate Professor @ MSU (Mid career faculty) – Chair of the WiPB
Dr. Sonali Roy, Assistant Professor @ TSU (Early career faculty)

Moderators:
Sabrina Chin, Early Career Representative in WiPB (2020-2022)
Maryam Rahmati Ishka, Early Career Representative in WiPB (2021-2023)

Women in Plant Biology Vision and Mission

Vision: Foster a plant biology community that fully embraces rich diversity and gender equality

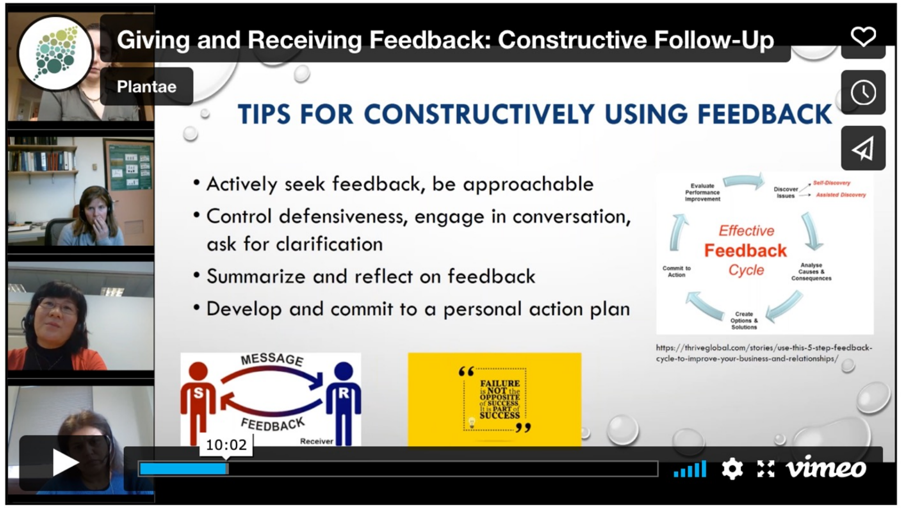
Mission: To promote gender equality, diversity, career development and leadership in the plant sciences.

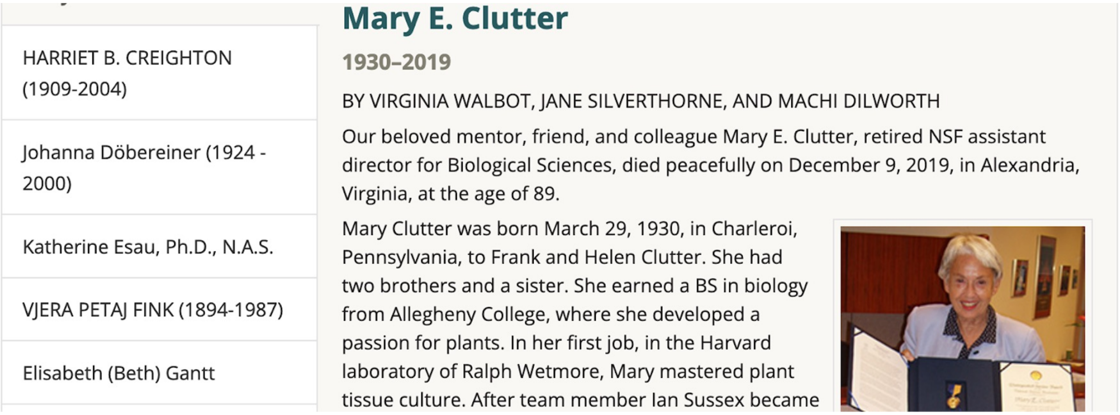
Committee members:
Eva Farre, Chair (2015-2023)
Andrew Foudree (2022-2025)
Sibongile Mafu (2020-2023)
Jenny Mortimer (2020-2023)
Dianne Pater (2020-2023)
Rebecca Roston (2021-2024)
Maryam Rahmati Ishka, Early Career Representative (2021-2023)
Burcu Alptekin Early Career Representative (2022-2024)
Crispin Taylor, Staff Liaison

@ASPB_WiPB

WiPB Activities

- ASPB Women's Young Investigator Travel Award
- Career development webinars & workshops
- Working for equality, diversity and inclusion:
    - Family leave policies
    - Publishing
    - Visibility & recognition





HARRIET B. CREIGHTON (1909-2004)

Johanna Döbereiner (1924 - 2000)

Katherine Esau, Ph.D., N.A.S.

VJERA PETAJ FINK (1894-1987)

Elisabeth (Beth) Gantt

Mary E. Clutter

1930–2019

BY VIRGINIA WALBOT, JANE SILVERTHORNE, AND MACHI DILWORTH

Our beloved mentor, friend, and colleague Mary E. Clutter, retired NSF assistant director for Biological Sciences, died peacefully on December 9, 2019, in Alexandria, Virginia, at the age of 89.

Mary Clutter was born March 29, 1930, in Charleroi, Pennsylvania, to Frank and Helen Clutter. She had two brothers and a sister. She earned a BS in biology from Allegheny College, where she developed a passion for plants. In her first job, in the Harvard laboratory of Ralph Wetmore, Mary mastered plant tissue culture. After team member Ian Sussex became

Outline of the Webinar:

- Get to know our panelists
- Panelist experience in selection committee and mentorship

- Research statement format

- Q & A

- Concluding remarks and helpful links

Eva M. Farré, PhD

(she/her/hers)

Associate professor at Michigan State University

Chair of the WiPB

- Research on the function of circadian clocks in photosynthetic organisms
- Completed a Ph.D. at Max-Planck Institute and University of Postdam, Germany
- Postdoc at The Scripps Research Institute and University of California, San Diego
- Involved in three search committees, with one ongoing

Sonali Roy, PhD
(she/her/hers)

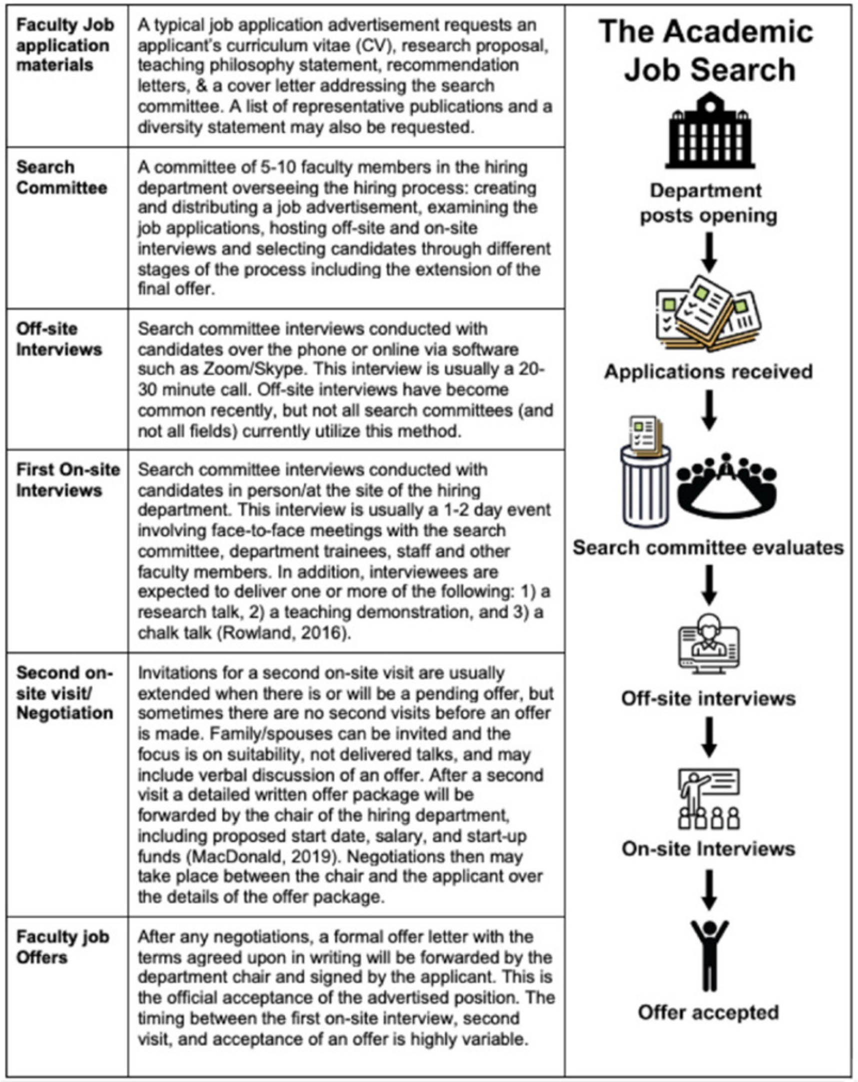
Assistant Prof at Tennessee State University

Email: sroy3@tnstate.edu

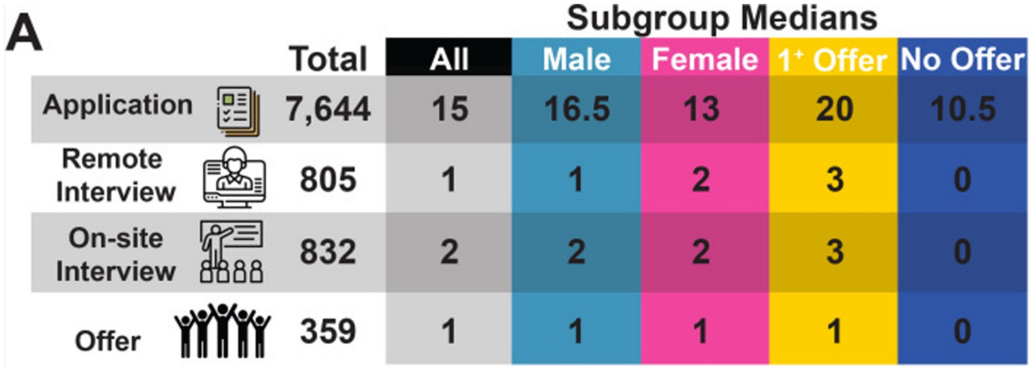
Twitter: @SonaliRoy_

- Small signaling peptides in the model legume, *Medicago truncatula* in nitrogen acquisition and root nodule symbiosis
- Completed her Ph.D. at the John Innes Center, UK
- Postdoc at the Noble Research Institute
- Recently hired as an assistant professor at Tennessee State University

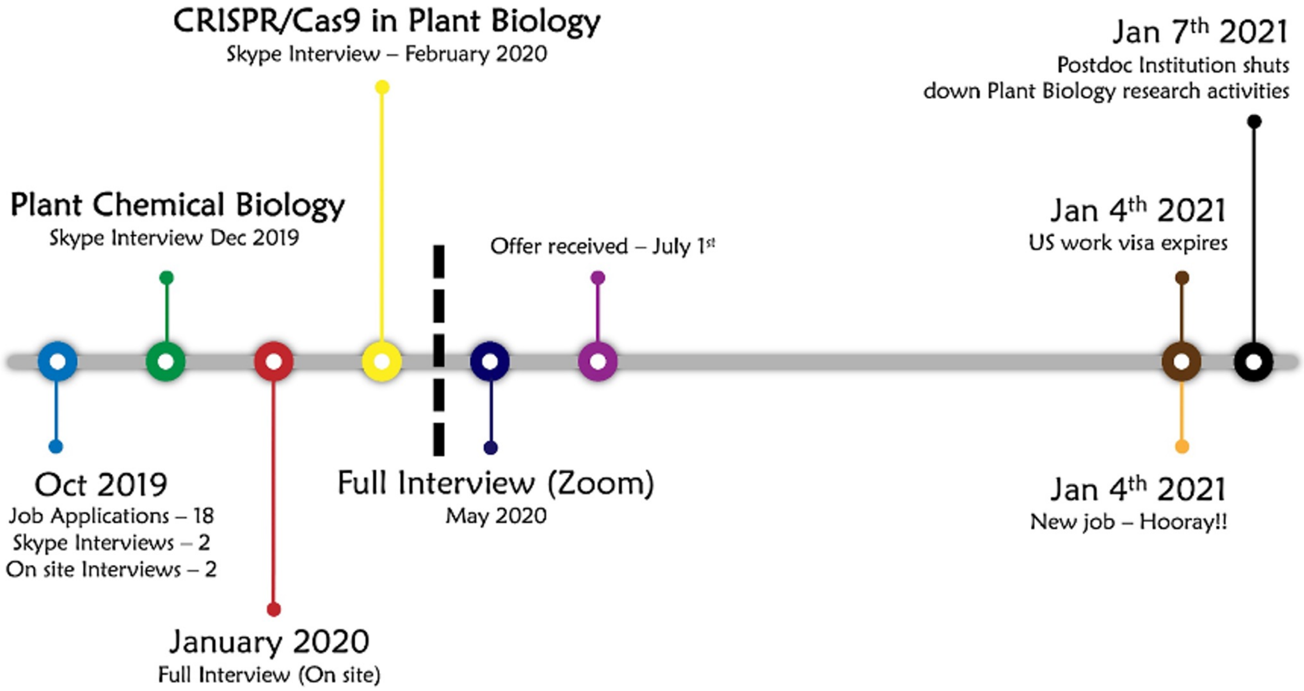
The Academic Job Search process



Faculty Job application materials	A typical job application advertisement requests an applicant's curriculum vitae (CV), research proposal, teaching philosophy statement, recommendation letters, & a cover letter addressing the search committee. A list of representative publications and a diversity statement may also be requested.	
Search Committee	A committee of 5-10 faculty members in the hiring department overseeing the hiring process: creating and distributing a job advertisement, examining the job applications, hosting off-site and on-site interviews and selecting candidates through different stages of the process including the extension of the final offer.	
Off-site Interviews	Search committee interviews conducted with candidates over the phone or online via software such as Zoom/Skype. This interview is usually a 20-30 minute call. Off-site interviews have become common recently, but not all search committees (and not all fields) currently utilize this method.	
First On-site Interviews	Search committee interviews conducted with candidates in person/at the site of the hiring department. This interview is usually a 1-2 day event involving face-to-face meetings with the search committee, department trainees, staff and other faculty members. In addition, interviewees are expected to deliver one or more of the following: 1) a research talk, 2) a teaching demonstration, and 3) a chalk talk (Rowland, 2016).	
Second on-site visit/ Negotiation	Invitations for a second on-site visit are usually extended when there is or will be a pending offer, but sometimes there are no second visits before an offer is made. Family/spouses can be invited and the focus is on suitability, not delivered talks, and may include verbal discussion of an offer. After a second visit a detailed written offer package will be forwarded by the chair of the hiring department, including proposed start date, salary, and start-up funds (MacDonald, 2019). Negotiations then may take place between the chair and the applicant over the details of the offer package.	
Faculty job Offers	After any negotiations, a formal offer letter with the terms agreed upon in writing will be forwarded by the department chair and signed by the applicant. This is the official acceptance of the advertised position. The timing between the first on-site interview, second visit, and acceptance of an offer is highly variable.	



A	Total	All	Male	Female	1⁺ Offer	No Offer
		Subgroup Medians				
Application	7,644	15	16.5	13	20	10.5
Remote Interview	805	1	1	2	3	0
On-site Interview	832	2	2	2	3	0
Offer	359	1	1	1	1	0



Fernandes, Jason D., Sarvenaz Sarabipour, Christopher T. Smith, Natalie M. Niemi, Nafisa M. Jadavji, Ariangela J. Kozik, Alex S. Holehouse et al. "Research culture: a survey-based analysis of the academic job market." *Elife* 9 (2020): e54097.

Research statement format for research universities

General format:

- 2-4 pages describing research accomplishment and future research plans, ie. big picture idea
- include 2-3 main research questions

Research Statement format vary among different universities

Examples of wording in actual job listing:

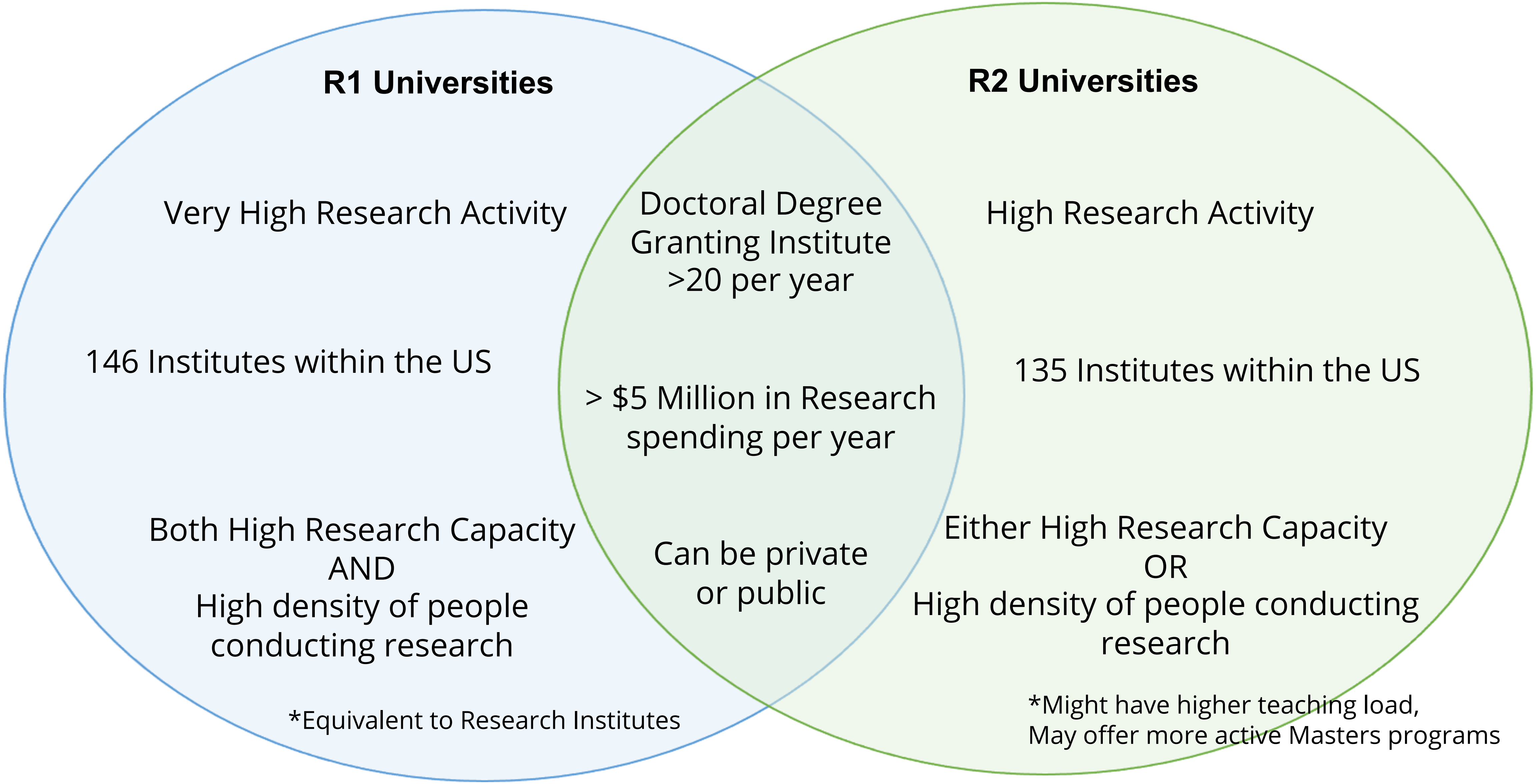
1. statement of research accomplishments and future objectives (combined)

2. statement of research objectives & brief description of research accomplishments (each as a separate documents)

3. summary of research accomplishments (up to 2 pages) & clearly focused description of future research plans (up to 3 pages) (each as a separate documents)

4. a 2-3 page summary of research interests including the relevance of the research, research accomplishments, and future research plans

What are R1 and R2 Universities?



The Carnegie classification of Institutions of Higher Education https://carnegieclassifications.acenet.edu/classification_descriptions/basic.php

What are Hiring Departments looking for?

- Someone capable of preparing a competitive tenure package in five years. (COMPETENT WRITER)

- A research leader who can bring in funding (for overhead costs)! (DEMONSTRATE A RESEARCH VISION)

- A pleasant colleague who can collaborate and share some of the teaching and service load. (PROJECT A SENSE OF EQUALITY)

The fundamental rule of writing any job statement

As scientists we require evidence. “Why should I believe you?”

The academic skepticism principle recommends that we show, not tell.

- Cite your own published research
- Include preliminary data for future grants
- Mention work performed with student mentees

Adapted from: The Professor is in, *The Essential Guide to Turning Your Ph.D. into a Job*, Karen Kelsky

Structure of a Research Statement

Template 1

DOCUMENT NAME, YOUR NAME

FONT: Arial/ Times New Roman
SIZE: 11-12 point

TITLE

Minimum Line spacing 1.0

Research Statement - Sonali Roy
Regulation of Nitrogen Acquisition by Peptide Hormones

Publication chronology: Past to present to future

PARA 1: Broad introduction to the topic

Cite your own research primarily, minimize citing the work of other scientists.

PARA 2: Major research findings from PhD. Should lead into skills or expertise required for first proposed project.

1 inch Margins

Figure 1: Summary figure of research area

PARA 3: Outline first project idea.

Stick to big picture questions, minimize experimental details but outline methodology.

(May or may not mention potential collaborators by name)

Use Sub-Headings

PARA 4: Major research findings from postdoc work.

Figure 2: Research Plan Overview.

PARA 5: Outline second project idea. (At least two but can have more project ideas).

Mention targeted federal funding agencies or grants such as NSF CAREER.

Optional: Use **Bold**, *italicized* and underlined text to emphasize

PARA 6: Summary, Suggestions of collaborative research projects in the department.

References: Science Citation style (minimum space)

1-4

My Statement Structure

Research Statement - Sonali Roy
Regulation of Nitrogen Acquisition by Peptide Hormones

INTRODUCTION: Overview of Nitrogen and Root Nodule Symbiosis

Summary of known peptides in Nitrogen acquisition and nodulation (Figure 1)
Overarching qs: How do legumes integrate nutrient-signaling pathways and the symbiosis signaling pathway to acquire N from their environment?

PROJECT 1: Outline fundable research question

AIMS:

RATIONALE:

Figure 1: Summary figure of research area

PAST EXPERIENCE: Highlight relevant PhD and Postdoc papers

OBJECTIVES: Transcriptomics, Genetics

PROJECT 2: Outline fundable research question (Target- NSF or USDA)

AIMS:

RATIONALE:

PAST EXPERIENCE: Relevant Postdoc research

OBJECTIVES: Genome Wide Association Studies

Figure 2: Research Plan Overview.

PROJECT 3:

Summary: My research program will uncover the fundamental principles of peptide hormone signaling and function. Peptide biology is a nascent area of research, especially in context of the legume-rhizobia symbiosis and N-uptake by roots and we will find methods to translate their biostimulant activities to the field.

Literature Cited:

Roy S., et al., (2020) The Plant Cell.
Roy S., et al., (2018) Teaching Tools in Plant Biology: Lecture Notes. The Plant Cell (online), doi/10.1105/tpc.118.tt0718.
Boschiero C.*, Lundquist, P.K.*, Roy, S.*, et al., (2019). Current protocols in plant biology
Roy S., et al., (2017) Plant Physiology 174, 326-338.
Breakspear A., et al. (2014) The Plant Cell 26, 4680-4701.
Kevei Z., et al., (2002) Molecular plant-microbe interactions 15, 922-931.
Wang L., et al., (2019) Molecular plant 12, 1211-1226.

Adapted from: The Professor is in, *The Essential Guide to Turning Your Ph.D. into a Job*, Karen Kelsky

Examples of Figures to Include

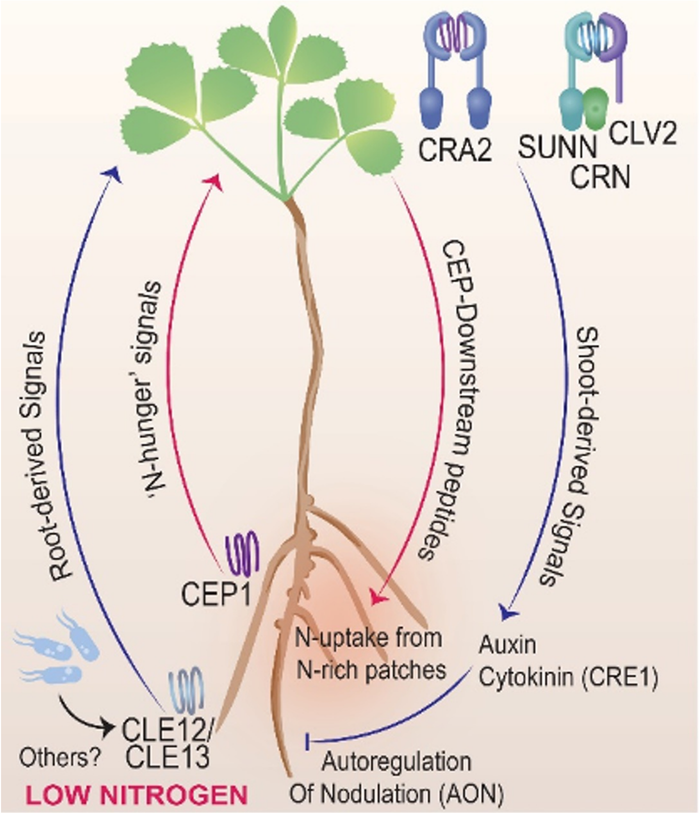


Figure 1. Peptide hormones in N-acquisition. Uptake of Nitrogen, the first limiting nutrient for plant growth is mediated by two distinct peptide hormone signaling pathways. How plants prioritize these pathways is currently not known. Identifying upstream regulators and novel peptides that influence N-acquisition will help reduce fertilizer dependency in agriculture.

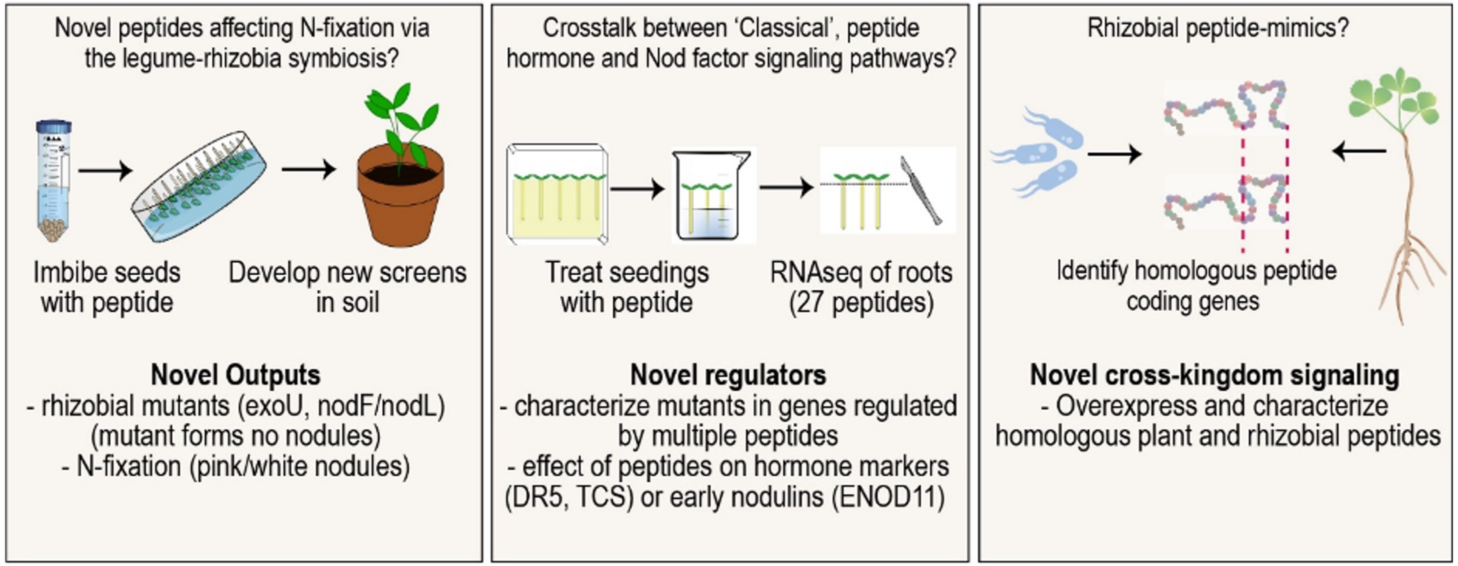


Figure 3. Proposed routes to understand role of peptides in legume-rhizobia symbioses.

Examples of potential funding sources to explore

Some Federal Grants Early Career researchers are eligible for

1. National Science Foundation CAREER Awards
2. NSF Building Research Capacity of Faculty in Biology (BRC-BIO)
3. United States Department of Agriculture Seed grants
4. NSF Plant Genome Research Project
5. NSF Plant Biotic Interactions

Grant Proposal Vs. Research Statement

GRANT PROPOSAL:

Objective 3: Identify ligand binding receptor candidates using co-immunoprecipitation followed by mass spectrometry

Using reverse genetics, we will accomplish a thorough characterization of *LRR-RLK* genes during root nodule symbiosis; and arbuscular mycorrhizal symbiosis through collaborations with Dr. Lena Muller at the University of Miami (Unfunded Collaboration - See Letter of Collaboration). To set up a more direct approach for identifying peptide receptors we will collaborate with Dr. Chazin's laboratory at the neighboring Vanderbilt University.

Outcome 3a: Binding partners of two bioactive peptides will be completed using co-immunoprecipitation followed by mass spectrometry. We will use two approaches to identify receptors (1) Synthesize Biotin labeled peptides and (2) overexpress peptideCDS:tag fusion constructs in *M. truncatula* hairy roots and perform co-immunoprecipitation experiments to pull down the ligand bound membrane receptors. Since there are several unknowns in this approach for example whether the biotinylated peptide retains it's biological activity, this objective will focus on setting up a working protocol. We propose to do this using (1) A peptide for which the putative receptor has been identified by genetic approaches; this will act as a control to pull down MtXXX and co-receptors if any. (2) A bioactive peptide which preliminary data…

RESEARCH STATEMENT:

Research Area 3: How are peptides perceived by legume roots?

Rationale: While efforts to identify specific nutrient- or symbiosis-regulated peptide signals are increasing, only a handful of cell surface receptors are currently known. The function of peptide hormones depends on their perception by cognate leucine-rich repeat receptor-like kinases (Roy and Muller, 2021). Peptide receptors identified to date are found in LRR-RLK clade XI (Shiu and Bleecker, 2001).

Past Experience: During my postdoc I developed a collection of *Tnt1* mutant insertion lines in Leucine Rich Repeat Receptor Like Kinases Clade XI genes.

Objectives: I will combine reverse genetics approaches such as CRISPR-cas9 mediated gene editing with biochemical techniques such as co-immunoprecipitation to identify peptide ligand receptors.

Do's

- The first step toward writing well is to write badly.
- Write for a non-expert plant scientist.
- Block 1 month for writing these documents and then keep editing.
- Ask for feedback! (Trusted mentor, informal mentor network, colleagues)
- Use the active voice
- Stick to page limits, pay close attention to wording used in job advertisement.

Adapted from: The Professor is in, *The Essential Guide to Turning Your Ph.D. into a Job*, Karen Kelsky

Don’ts (I made all the mistakes, so you don’t have to)

- Don’t be afraid of going over 1 page unless specified. (Not enough room to explain ideas)
- Don’t write things like “Continuing” this as a sub-project of my postdoc advisors research plan that I bring with me (Obviously but suggests I am not an independent thinker)
- Don’t use ANY of the following: fascinating, interesting, amazing, remarkable, passionate OR attempt to, hope to, try to, believe that. (No emotion or wishfulness in scientific writing)
- Minimize experimental details. Instead write a broad methodology that you will use. (showcase your expertise that will be valuable for collaboration)
- Don’t cram ALL your ideas into the statement.

Adapted from: The Professor is in, *The Essential Guide to Turning Your Ph.D. into a Job*, Karen Kelsky

Examples of successful Research Statements

WILD TOMATO AS MODEL FOR STUDYING SALT STRESS TOLERANCE

Tomato is one of the most important horticultural crop in the USA and worldwide. However, due to its breeding history, it has limited genetic diversity. Tomato's cultivating conditions often result in increased soil/substrate salinity[1], reducing the productivity of commercial elite varieties. Species closely related to cultivated tomato, like *S.pimpinellifolium*, show high water use efficiency[2], as well as salt tolerance (Fig.2). Additionally, wild tomato plants exhibit high diversity in plant and leaf architecture[3], which might affect plant performance under salt stress. The recent advances in genome sequencing of *S.pimpinellifolium*[4] open the doors for forward genetic and omics studies, where we can dissect the genetic components of their salt stress tolerance. Developing breeding programs for tomato varieties with increased abiotic stress tolerance will not only allow growing tomatoes in low-tech countries, where the fresh water availability is limiting plant productivity but will also decrease the environmental impact of tomato horticulture in the well-developed infrastructure countries, such as the USA.

PLANT ARCHITECTURE AS A KEY MODEL TO SALINITY TOLERANCE

Plant architecture responds to the changing environment by optimizing the balance between investment in the new organs and the costs of their maintenance. The compactness of the plant decreases water loss[5], leaf-shape complexity affects photosynthetic efficiency[6], while the maintenance of lateral root emergence ensures salinity tolerance at the seedling stage[7]. Although the above-mentioned traits have important role in plant performance, they are often studied separately, using different experimental setups. Recent advances in phenotyping[8,9] yield new possibilities for studying plant growth, architecture and performance. Statistical tools, such as quantile regression[10], will allow quantification of individual traits to overall plant performance in adverse environmental conditions. Branching of above or belowground organs can be easily described using fractal-based Lindenmayer-system[11], yet its application has not been pursued beyond theoretical biology. I intend to implement simultaneous measurement of root and shoot architecture and describe changes therein by combining dynamic and fractal-based models. By studying the development of all the organs simultaneously under control and salt stress conditions, I can quantify the biomass re-distribution across the tolerant and susceptible genotypes between leaves, roots, and flowers. Studying both shoot and root phenotypes in one system will provide the full picture of the plant stress response and reveal the complementary processes.

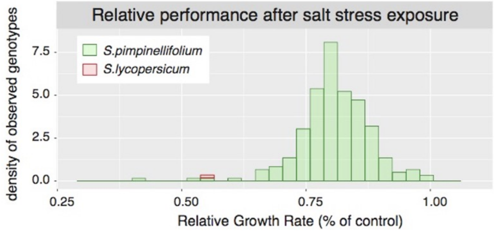


Figure 2. Natural variation in salt stress tolerance in *S.pimpinellifolium*. The relative performance of 215 *S.pimpinellifolium* accessions and one *S.lycopersicum* line (cv. Moneymaker) is based on the shoot growth rate under salt stress relative to control conditions. The salt stress was imposed 3 weeks after germination and the growth rate is based on two weeks of observations. The presented data was obtained at Prof. Mark Tester's group (KAUST), which agreed to share it as preliminary resource.

[1] Carmassi et al., J. of Plant Nut. 2005
[2] Cantero-Navarro et al., 2016 Plant Sci.
[3] Darwin et al., 2003 Systematics and Biodiv.
[4] Razali et al., 2017 bioRxiv
[5] Borba et al., 2017 Genet Mol Res.
[6] Nicotra et al., 2008 Oecologia
[7] Julkowska et al., 2017 The Plant Cell
[8] Gehan et al., 2017 PeerJ
[9] Tovar et al., 2018 Plant Sciences
[10] Julkowska et al., 2018 MVApp Figshare
[11] Lindenmayer, 1968 J. Theoret. Biology

Research Theme III: Process simulation of plant structure

Accomplishments

In the context of shape formation, the opportunity to study the interplay of distinct shape forming processes on different biological scales is currently missed. Translating this interplay into experimentally observable measures is an open, yet high –risk/high-reward area of my research. To date, typical models assume a locally fixed and symmetric plant shape while the plant grows in size, complexity and volume. It is key to recognize that the growth process of a plant implies lateral growth of a tissue within the surrounding physical space whenever a plant part elongates. As a postdoc, I developed the Fiber Walk model (Figure 2) as a formal model of geometric random growth that describes the effect of simultaneous lateral expansion of randomly growing lines (Bucksch, Turk, and Weitz, 2014). There are many consequences to this explicitly spatial treatment of growth. For example, I have shown that blocked regions are formed that are impossible to occupy by a growth process. Furthermore I showed that an increasing amount of expansion of any thickening process results in a straighter grown shape, thus, creating a spatial constraint to development.

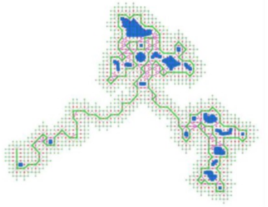


Figure 2: The Fiber Walk model (Bucksch, Turk, and Weitz, 2014) as a 2D example. On the left preliminary computations of blocked regions (blue) created by a 2D Fiber Walk (green) on a square lattice are shown. Purple lines indicate locations where the curvature of the walk was influence by itself and red points indicate the regions occupied by expansion.

Key Collaborator: Jonathan Lynch (Penn State, USA), Greg Turk (Georgia Tech, USA)

Future Work

Which mathematical process characteristics describe the drivers of shape formation? I seek to address the understudied relationship between a shape generating process interplays with internal shape regulating processes. Here, an exemplary long-term goal is the feedback between the curvatures of growing branch surface and the internal plant hormone gradients. The simple interplay to study here is that every newly grown tissue occupies new space, which in turn limits possible curvatures of later grown tissue. However, state-of-the-art experimental research assumes a static relation between curvature and hormone gradient (Grieneisen et al., 2007). The current Fiber Walk model exhibits the mechanisms to simulate the mathematical space of branching structures to investigate the limits of possible spatial branch arrangements. Such limits potentially translate into limits of plant breeding for optimal root structures. I identified cross-scale coupling of internal hormonal scale and external geometric plant growth dynamics as a high-risk/high reward element of my research program. I seek collaborations with experimentalists and theorists to define and describe the shape regulating processes of plants. A potential funding source is the "Studying Complex Systems" program of the James S. McDonnell Foundation.

Genetic Basis of Epigenomic Diversity: (Target Funding Source: NSF MCB):

Observed variation in methylomes both within and between species (Figure 1) points towards genetic and mechanistic differences. Identification of the basis of this variation is important to understanding the epigenome interacts with other sources of variation to generate phenotypic diversity. DNA methylation is only part of the equation. A multitude of histone modifications, histone variants, and associated factors exist that all shape the epigenomic landscape. The natural diversity of these modifications have not been explored in the same way that DNA methylation has. Furthermore, many of these factors interact to define and maintain chromatin states. To more fully understand epigenomic diversity I will explore a range of epigenomic modifications using CHIP-seq and MethylC-seq. To complement this data, I will also identify open and closed chromatin regions using ATAC-seq and/or DNase-seq. This will be done for several species from across the angiosperms and for a diverse set of accessions within each species to identify both intra- and inter-species levels of variation.

It is clear that both cis- and trans-acting genetic factors underlie epigenomic variation (Figure 2). For example, a transposon insertion may act in cis to affect the chromatin state of a neighboring gene, while presence-absence variation of key enzymes in establishing the epigenome can have trans-acting effects at multiple loci. Technologies such as BioNano optical mapping and long-read sequencing technologies like PacBio or Oxford Nanopore will be used identify within species sources of variation that contribute to epigenomic variation. By combining these genomic and epigenomic data sets, the genetic basis of diversity for multiple epigenomic factors will be identified and integrated to provide a systems view of genetic and epigenomic interactions.

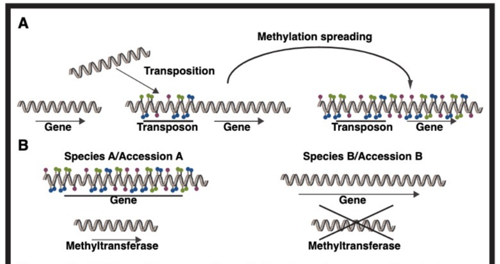


Figure 2: A) Cis-acting genetic variation from transposotion induces DNA methylation in a neighboring gene. **B)** In species/accession A, a functional copy of a methyltransferase leads to methylation of a gene in trans. In species/accession B, absence of the methyltransferase leads to a loss of DNA methylation at the corresponding loci.

The Epigenomics of Reproductive Modes (Target Funding Source: NSF PGRP):

Growing evidence in the field points to mechanisms of reinforcing chromatin states in germ-line cells, enabling the propagation of these chromatin states in the next generation. As a result of this reinforcement, random changes in chromatin state (epimutations), can occur and can be inherited through sexual reproduction. However, plants have evolved a multitude of

Magdalena Julkowska, Research Statement

https://github.com/RILAB/statements/blob/master/job_applications/research_university/2018_Julkowska_ResearchStatement.docx

Alexander Bucksch, Research Statement

https://github.com/RILAB/statements/blob/master/job_applications/research_university/Bucksch_ResearchStatement_2015_UGA.pdf

Chad Neiderhuthh, Research Statement

https://github.com/RILAB/statements/blob/master/job_applications/research_university/Niederhuth_Research_Statement.pdf

https://github.com/RILAB/statements/tree/master/job_applications

Characteristics of a great research statement

Explains your research contributions so far:

- Matches your CV
- Explains the intellectual drive/vision of your research
- Explains your intellectual and/or technical input in collaborations
- Highlights signs of success: important discoveries, funding etc.
- Links well with your future research plans

Explains your future research plans: gets your colleagues excited

- They can understand your research question
- They can see themselves collaborating with you
- They see that how your work can get funded (e.g. preliminary results)
- Your work fits a expertise gap in the department or university

Application package ranking

- Application package is evaluated as a whole with cover letter, CV, research, teaching and diversity statements and letters of recommendation.

- Applicants that fulfill the job advertisement will be shortlisted by the selection committee.

- Ranking process can differ in departments and universities. Candidates are typically ranked by number and averaged across the choices of selection committee.

- Subsequent rounds of short listing will be based on opinions of the selection committee and inputs from other faculty members.

Q & A

Please ask questions or share your opinion on the chat box

Concluding remarks

- Writing a research statement is difficult. Be mindful to budget enough time and revise it for each job application.
- Write about a research program that you are personally interested in and is unique but also doable to ensure funding.
- Keep multiple versions of research statements to suit different universities during your job hunt.

Links to useful resources:

https://github.com/RILAB/statements
Research Statement (Cornell)
Research statements for faculty job applications (UPenn)
5 Simple Tips for Writing a Good Research Statement for a Faculty Position (Enago Academy)
We also recommend this book: "A Ph.D. is not enough: A Guide to Survival in Science"
"The Professor is in" by Karen Kelsky https://theprofessorisin.com/buy-the-book/
The Future PI Slack https://futurepislack.wordpress.com/

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Plantae Presents

Eva M. Farré, PhD

Associate Professor, Department of Plant Biology, Michigan State University

Sonali Roy, PhD

Assistant Professor, Tennessee State University

Moderated by:
Sabrina Chin & Maryam Rahmati Ishka

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