Insights into Research Proposals

Daniel Serrano

Faculty Specialist

Institute for Research in Electronics and Applied Physics

Who has written a research proposal?

Who has written a research proposal to obtain funding*?

*i.e.: not part of your PhD candidacy requirements

1.

2.

Important matters for faculty [1/x]

Practical/immediate insight [1-(1/x)]

3.

4.

1. A lot of straightforward practical advice (e.g.: Google)

2.

3.

4.

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Writing implementation research grant proposals: ten key ingredients. Proctor et al. 2012 Implementation Science

Ten Simple Rules for Getting Grants. Bourne and Chalupa. 2006. PLoS Computational Biology

An Evidence-Based Guide to Writing Grant Proposals for Clinical Research. Inouye and Fiellin. 2005. Annals of Internal Medicine

Writing Competitive Research Grant Proposals (Suggestions from Program Managers at ACS)

The Genre of Grant Proposals: Considerations of Form and Rhetorical Force. Risjord (Emory)

Grant Proposals (or Give me the money!) (UNC Chapel Hill Writing Center) –includes budget info–

Fundamental Principles of Writing a Successful Grant Proposal. Chung and Shauver. 2008. J Hand Surg Am

How Not To Kill a Grant Application. Mohan-Ram. 2002. Science Careers (six-part series)

The Extra Bits of a Grant Application: A Cheat Sheet. Wild. 2018. NatureJobs

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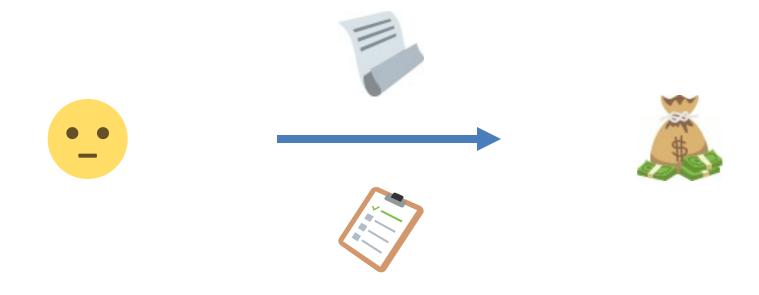
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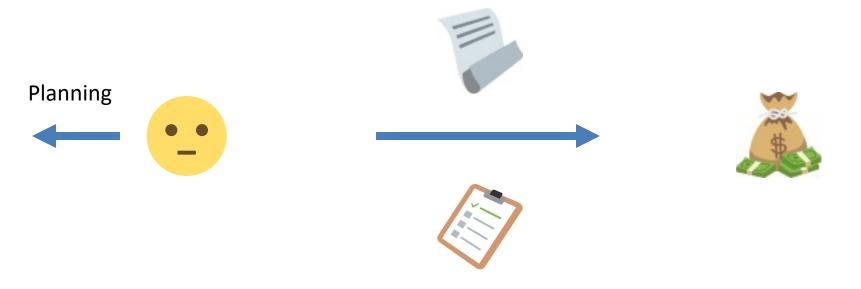
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1. A lot of straightforward practical advice (e.g.: Google)

2. Long-term (learning) process, extending back and forward

3.

4.

Long-term (learning) process, extending back and forward

Long-term (learning) process, extending back and forward

Planning

Long-term (learning) process, extending back and forward

Planning

Long-term (learning) process, extending back and forward

Planning

Perseverance

Long-term (learning) process, extending back and forward

Planning

Perseverance

Long-term (learning) process, extending back and forward

Planning

Perseverance

- Getting preliminary results to increase credibility and reduce risk

UNIVERSITY OF MARYLAND

DIVISION OF RESEARCH
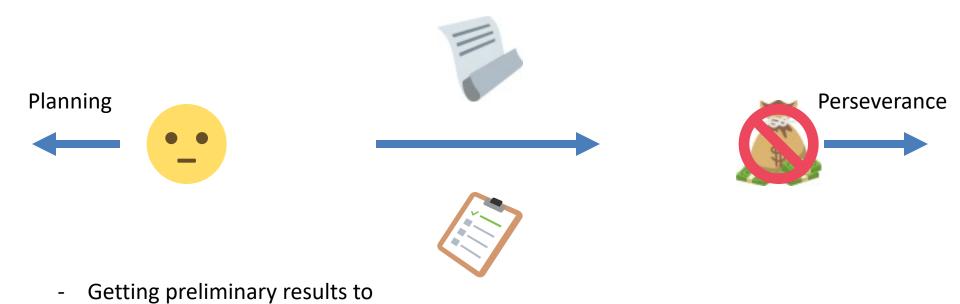
HOME   ABOUT   CAPABILITIES   RESEARCH DEVELOPMENT   RESEARCH ADMINISTRATION   PARTNERSHIPS   INNOVATION   NEWS/EVENTS   INTERNATIONAL

Home

Early Career Faculty Opportunities

Here is a list of links to funding agencies that provide opportunities to early career faculty. General discipline information is noted for each opportunity but please click on the link for more information. If opportunity is a limited submission, please visit the UMD Limited Submission and Seed Grant Portal ⧉ to find the competition and for application information. If you would like to add an opportunity to the list of have any questions, please contact the Research Development office:

Hana Kabashi,
Program Manager,
hkabashi@umd.edu ✉
(301) 405-4178

Federal Agencies:

- NIH Director's New Innovator Award ⧉
- NIH Director's Early Independence Award (Biomedical Research disciplines) ⧉
- NIH Mentored Quantitative Research Development Award (Parent K25) (Quantitative science and engineering faculty interested in integrating their expertise with NIH-relevant research) ⧉
- NSF/FDA Scholar-in-Residence at FDA ⧉ (Scientific and engineering issues concerning emerging trends in medical device technology)
- NSF Alan T. Waterman Award ⧉ (Any science or engineering fields supported by NSF)
- NSF Faculty Early Career Development Program (CAREER) ⧉ (Any science or engineering fields supported by NSF)
- NSF Earth Sciences Postdoctoral Fellowships (EAR-PF) ⧉ (Geosciences/Earth Sciences)

Home » Research Development
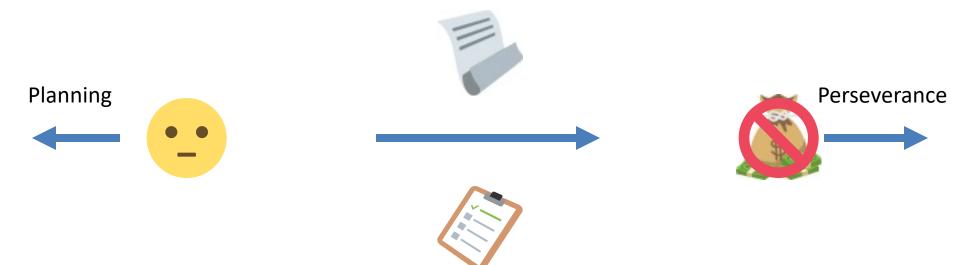
The Maryland Catalyst Fund

The University of Maryland Catalyst Fund (Click link for a PDF of program guidelines and details found on this page.) 📄

[APPLY]

The Maryland Catalyst Fund program – formerly known as the Faculty Incentive Program – is the University of Maryland's internal faculty research support program and a key resource in the university's overall effort to expand its research activity, visibility and impact. The program is designed to enable innovative research, incentivize the pursuit of large, complex, and high-impact research initiatives, and prepare UMD faculty to be more competitive for extramural research awards.

The Maryland Catalyst Fund consists of five funding categories (detailed in MCF table below).

- **New Directions Fund** providing support for faculty pursuing a new line of research, or pursuing particularly innovative research, writing, and / or creative work in fields where external funding is scarce. (Click link for category-specific guidelines and details) 📄
  - o **Annnual Due Dates:** May 1 and November 1.
    Find current/open competitions on UMD InfoReady portal 🔗
- **Fearless Ideation Workshops** supporting brainstorming events in high potential multidisciplinary topics leveraging unique strengths within UMD.(Click link for category-specific guidelines and details) 📄
  - o Applications are accepted four time a year: February 1, May 1, August 1, and Nov. 1
    Find current/open competitions on UMD InfoReady portal 🔗
- **Big Opportunity Fund,** supporting proposal development for faculty actively pursuing a large, high-visibility, externally-funded research opportunity (typically >= $2M/year).(Click link for category-specific guidelines and details) 📄
- **Strategic Growth Fund** supporting proposal development for faculty actively pursuing a major research opportunity in one of the following categories:

Long-term (learning) process, extending back and forward

Planning

Perseverance

- Getting preliminary results to increase credibility and reduce risk

- Understanding the program and if your research and project are a good fit

Search

Engineering (ENG)

Engineering (ENG) Home >

Chemical, Bioengineering, Environmental and Transport Systems (CBET) >

Civil, Mechanical and Manufacturing Innovation (CMMI) >

Electrical, Communications and Cyber Systems (ECCS) ⌄

   About

   Programs

   Staff

   Funding

   Awards

   News

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About the Division of Electrical, Communications and Cyber Systems

The NSF Division of Electrical, Communications and Cyber Systems (ECCS) supports enabling and transformative research at the nano, micro, and macro scales that fuels progress in engineering system applications with high societal impacts.

ECCS programs encompass novel electronic, photonic, and magnetic devices — and the integration of these devices into circuit and system environments, intelligent systems, control, and networks — for applications spanning communications and cyber technologies, energy and power, healthcare, environment, transportation, manufacturing, and other systems-related areas.

ECCS strongly emphasizes the integration of education into its research programs to ensure the preparation of a diverse and professionally skilled workforce. ECCS also strengthens its programs through links to other areas of engineering, science, industry, government, and international collaborations.

Division Programs

The Division has three program clusters, managed by teams of program directors, that reflect the increasing convergence of traditional disciplinary topics and the need for interdisciplinary approaches to emerging technological challenges.

- Electronics, Photonics and Magnetic Devices (EPMD)
- Communications, Circuits, and Sensing-Systems (CCSS)
- Energy, Power, Control and Networks (EPCN) *(formerly EPAS)*

See the ECCS organizational chart showing program directors and clusters.

Division of Electrical, Communications and Cyber Systems

Electronics, Photonics and Magnetic Devices (EPMD)

CONTACTS

Name	Email	Phone	Room
Dominique Dagenais	ddagenai@nsf.gov	(703) 292-8339	
Eric G. Johnson	egjohnso@nsf.gov	(703) 292-7718	
Paul A. Lane	plane@nsf.gov	(703) 292-2453	
Dimitris Pavlidis	dpavlidi@nsf.gov	(703) 292-8339	
Usha Varshney	uvarshne@nsf.gov	(703) 292-8339	

PROGRAM GUIDELINES

Apply to PD 18-1517 as follows:

For full proposals submitted via FastLane: standard *NSF Proposal & Award Policies & Procedures Guide* proposal preparation guidelines apply.
For full proposals submitted via Grants.gov: the *NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov Guidelines* applies. (Note: The *NSF Grants.gov Application Guide* is available on the Grants.gov website and on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide)

SYNOPSIS

The **Electronics, Photonics and Magnetic Devices (EPMD)** Program supports innovative research on novel devices based on the principles of electronics, optics and photonics, optoelectronics, magnetics, opto- and electromechanics, electromagnetics, and related physical phenomena. EPMD's goal is to advance the frontiers of micro-, nano- and quantum-based devices operating within the electromagnetic spectrum and contributing to a broad range of application domains including information and communications, imaging and sensing, healthcare, Internet of Things, energy, infrastructure, and manufacturing. The program encourages research based on emerging technologies for miniaturization, integration, and energy efficiency as well as novel material-based devices with new functionalities, improved efficiency, flexibility, tunability, wearability, and enhanced reliability.

Areas managed by Program Directors (please contact Program Directors listed in the EPMD staff directory for areas of interest):

Electronic Devices

- Nanoelectronics
- Wide/Extreme- and Narrow-Bandgap, Semiconductor Devices
- Devices with New Functionalities based on Material-Device Interactions and Reliability
- Device-Related Electromagnetic Effects, Propagation and Scattering
- Microwave/mm-Wave/THz Devices
- Flexible, Printed Electronics
- Carbon-based Electronics
- Thermoelectric and Ferroelectric Devices

Photonic Devices

- Advanced Optical Emitters and Photodetectors, from Extreme UV to THz
- Single-Photon Quantum Devices
- Nonlinear and Ultrafast Photonics
- Nanophotonics and Photonic Integration
- Optical Imaging and Sensing Techniques
- Opto-Mechanical Nanodevices
- Optical Communication Components

Magnetic Devices

Long-term (learning) process, extending back and forward

Planning

Perseverance

- Getting preliminary results to increase credibility and reduce risk

- Understanding the program and if your research and project are a good fit

- Addressing reviewers' comments systematically and thoroughly

Core issues with proposal and how to address them

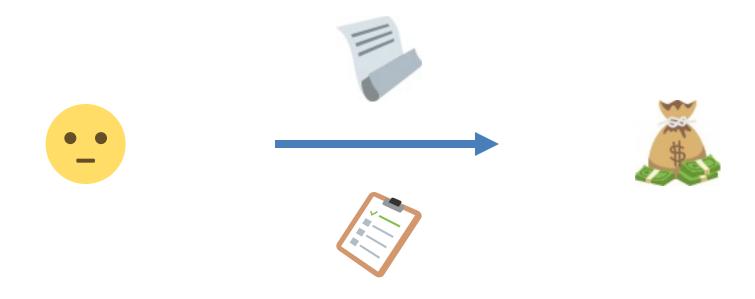| Review #	Score	Priority	Issue	Solution
1	Very good	Medium	Concerned about the number of papers published by the research group. Thinks problem is lack of a senior team member. Grad student support requested in proposal might not help. Wonders why the PI doesn't ask for senior personnel money.	Ping program officer about adding a post-doc or just put in a post-doc
1	Very good	Medium	Concerned about commitment from campus regarding the experiment safety efforts	Substantiate campus support from fire marshal or head of ESSR and decom. plan
5	Fair	Medium	The single essential task is to refurbish the 3m. However, discussion of this work is less than half a page in the 15-page proposal. Criticizes heavily using only one paper to base the idea that the baffles should be added. Says that more work should be done to justify this modification.	More details on the baffles and why. Simulations including baffles are not technologically possible at Re=9E8, so true predictive simulations are precluded.\n\nThat being said Grenoble plans to run more simulations using their codes.
5	Fair	High	Suggests using a smaller scale experiment than the 3 meter device for the precession studies.	Add more detailed section on our smaller scale water experiment
5	Fair	Medium	What is the role of Professor A? Only one sentence in Management Plan.	Clarify in management plan section Prof. A's role
5	Fair	Low	Thinks the lab already has an acoustic velocimetry system capable of measuring flows in liquid metals. So why is the sub-project necessary? If there is no such system, why aren't they seeking to purchase one?	Acoustics works in air but not demonstrated in liquids, that is why that research subplan is necessary

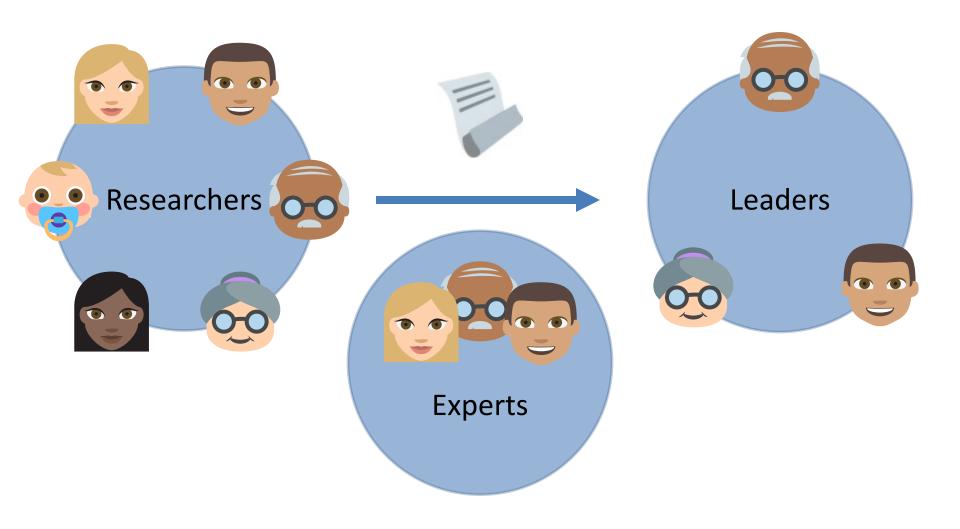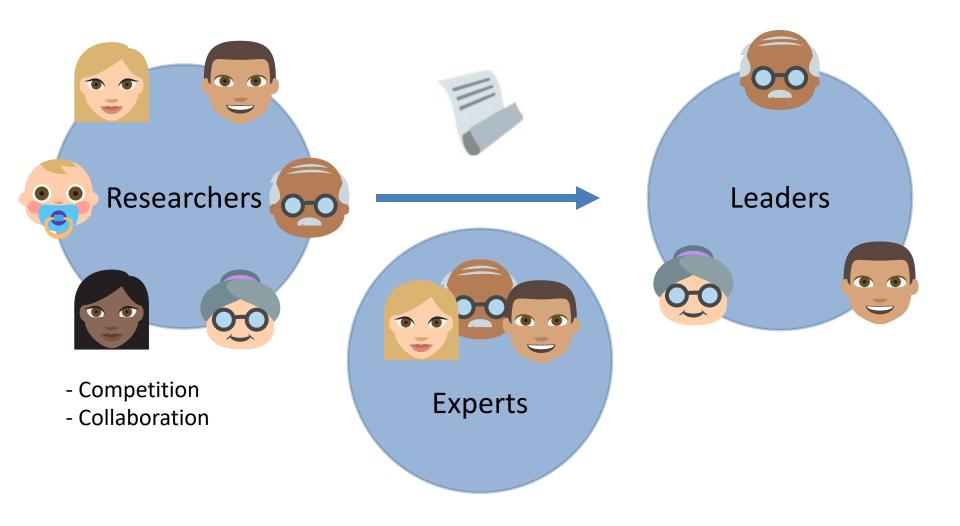1. A lot of straightforward practical advice (e.g.: Google)
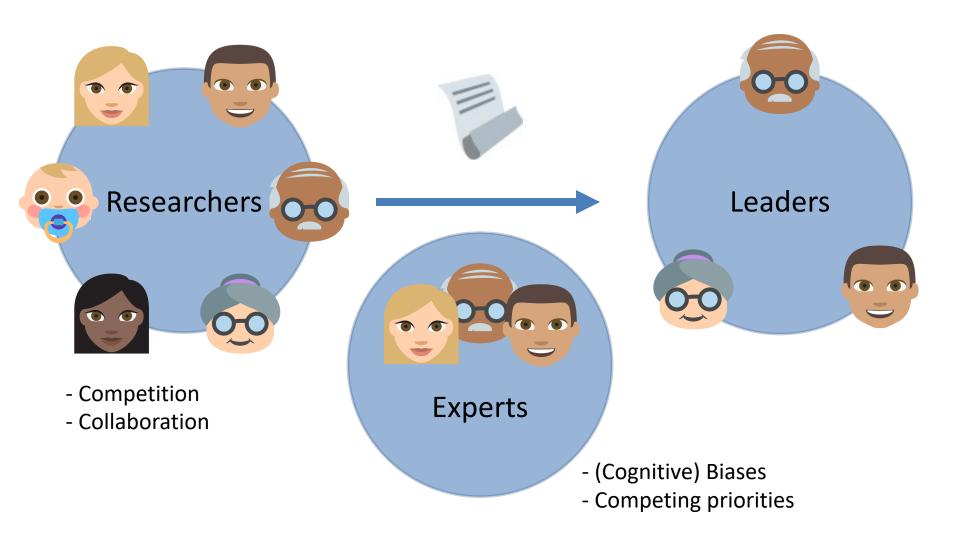
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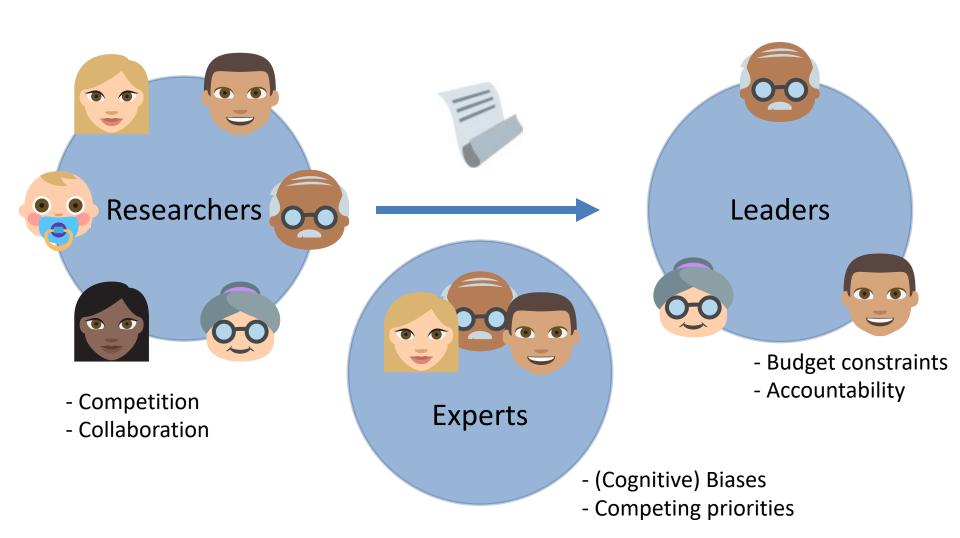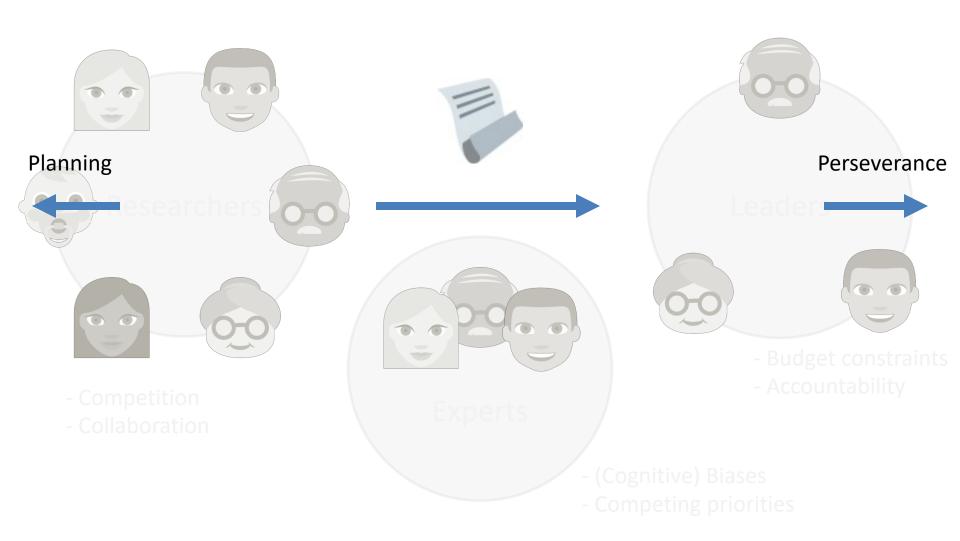
3. Humans factors are at every stage of the process

4.

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Researchers

- Competition
- Collaboration

Experts

Leaders

Human factors are at every stage of the process

Researchers

- Competition
- Collaboration

Experts

- (Cognitive) Biases
- Competing priorities

Leaders

Human factors are at every stage of the process

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Experts
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Leaders
- Budget constraints
- Accountability

Human factors are at every stage of the process

Planning

Researchers

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Human factors are at every stage of the process

Planning

Perseverance

Researchers

Leaders

Experts

- Get help from a previous applicant (successful or not!) and get a hold of a previous successful proposal

- Become part of a proposal review panel

- Familiarize yourself with the program and the program officers
- Communicate with them

- Budget constraints

- (Cognitive) Biases
- Competing priorities
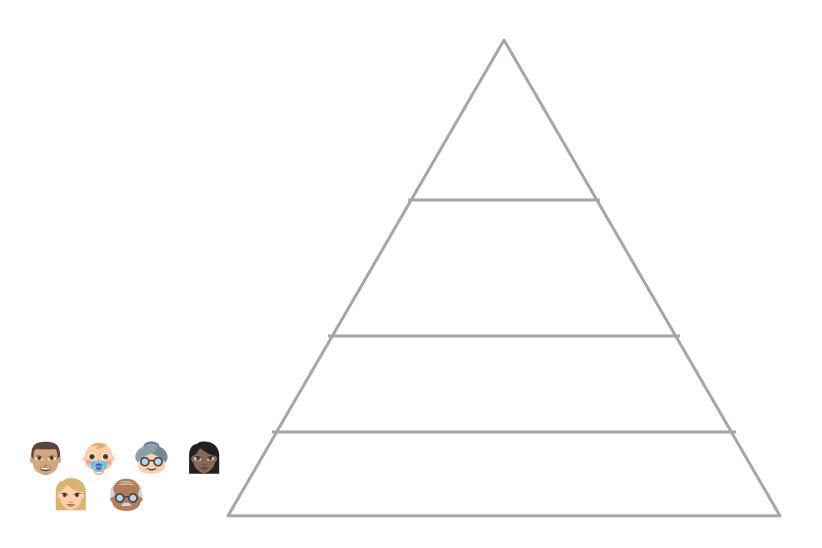
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4. Content matters, but presentation is critical

Content matters but presentation is critical

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Content matters but presentation is critical

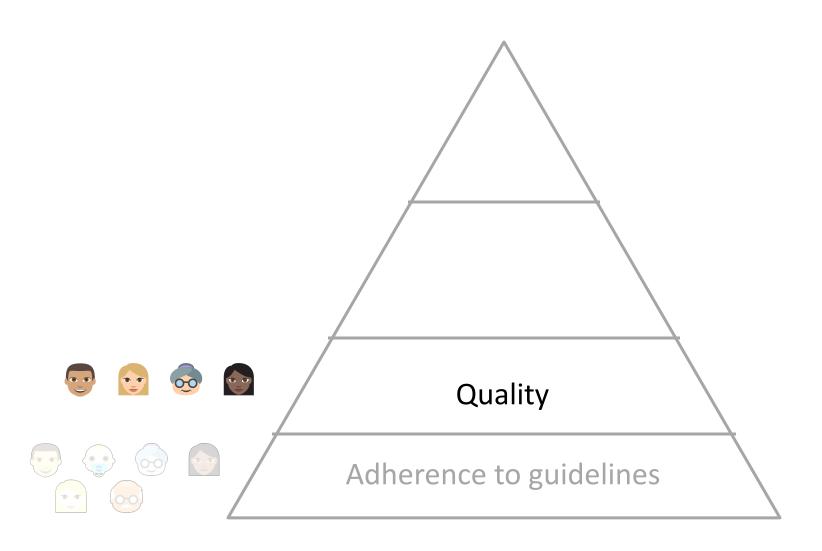# Content matters but presentation is critical

- Reviewers tend to operate by elimination process (through finding weaknesses) (van den Besselaar 2018 *Scientometrics*)

- Reviewers can have a hard time differentiating between good and excellent proposals; there can low agreement between reviewers about what is a good vs. an excellent proposal (Pier et al. 2018 *PNAS*; van den Besselaar 2018 *Scientometrics*)

- Your reviewers might not be as close to your discipline as you might expect (and field closeness has unpredictable outcomes) (Qi and Ulf 2015 *Res Eval*; Gallo et al. 2016 *PLoS ONE*)

Content matters but presentation is critical

Adherence to guidelines

Content matters but presentation is critical

Quality

Adherence to guidelines

Content matters but presentation is critical

Quality

Purpose of proposal:

Convince someone that I have the knowledge and resources to perform a needed, well-defined project realistically within given time and funding constraints

Team exercise and discussion

Purpose of proposal:

Convince someone that I have the knowledge and resources to perform a needed, well-defined project realistically within given time and funding constraints

Content matters but presentation is critical

Quality

Purpose of proposal:

Convince someone that **I have the knowledge** and resources to perform a needed, well-defined project realistically within given time and funding constraints

- **Background/Intro section:**
  - Show an understanding of the history and status of the field
  - Cite important contributions to the subject
  - Show an understanding of current problems/directions of the field
  - Show your standing in the field and your qualifications
    - o Might be other pieces of the application package (CVs, etc.)

Content matters but presentation is critical

Quality

Purpose of proposal:

Convince someone that I have the knowledge and resources to perform a needed, well-defined project realistically within given time and funding constraints

- **Team/Personnel section:**
  - Mention collaborators
  - Mention available personnel
- Mention institutional resources

Content matters but presentation is critical

Quality

Purpose of proposal:

Convince someone that I have the knowledge and resources to **perform a needed**, well-defined **project** realistically within given time and funding constraints

- **Intro/Background section**
  - Solves a problem in the field
  - Addresses a specific scientific problem
  - Addresses a societal need
  - Advances science

  Is aligned with the funding agency's broad and specific goals

Content matters but presentation is critical

Quality

Purpose of proposal:

Convince someone that I have the knowledge and resources to **perform a needed, well-defined project** realistically within given time and funding constraints

- **Research Plan section**
  - Explicit mention of the research goal(s)/question(s)
  - Systematic description of the aims/steps needed to address these goals

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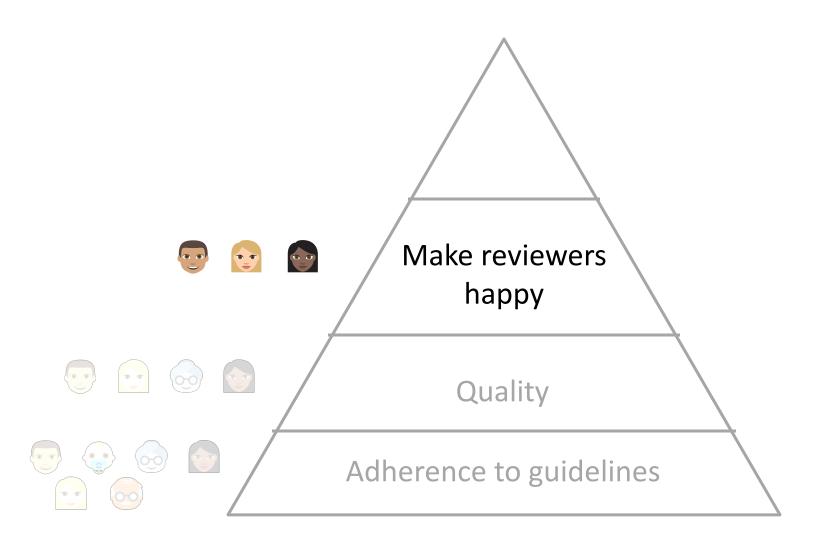## Quality

Purpose of proposal:

Convince someone that I have the knowledge and resources to perform a needed, well-defined project realistically **within given time** and funding **constraints**

- **Timeline section**
  - Connected to the aims/steps mentioned in Research Project

Content matters but presentation is critical

Quality

Purpose of proposal:

Convince someone that I have the knowledge and resources to perform a needed, well-defined project realistically within given time and funding constraints

- **Budget section**
    - Itemized list:
        - Physical resources
        - Services
        - Personnel
    - Budget justification (why is X money allocated to Y resource?)

Content matters but presentation is critical

Content matters but presentation is critical

Make reviewers happy

- **Know your audience**
- Be straightforward
- Use visual hierarchy

- Understand the review logistics
- Research the general composition of the review panel

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Make reviewers happy

- Know your audience
- **Be straightforward**
- Use visual hierarchy

In this paragraph I'm going to use a bunch of extra text to describe my three research aims and what each aim entails. Aim number one is the following and it entails the following. The work done here will allow us to continue to Aim number 2. Aim number two is the following and it entails the following. Aim number three is the following and it entails the following.

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Make reviewers happy

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Make reviewers happy

- Know your audience
- Be straightforward
- **Use visual hierarchy**

I'm a reviewer and I've read twenty applications already. I'm tired and everything I read sounds the same, but I waited until the day before my review scores are due so I have to keep going and I might or might not see the most important parts of this proposal, which is what I could be reading right now, but I just skimmed over it and it will make it harder for me to assess this proposal.
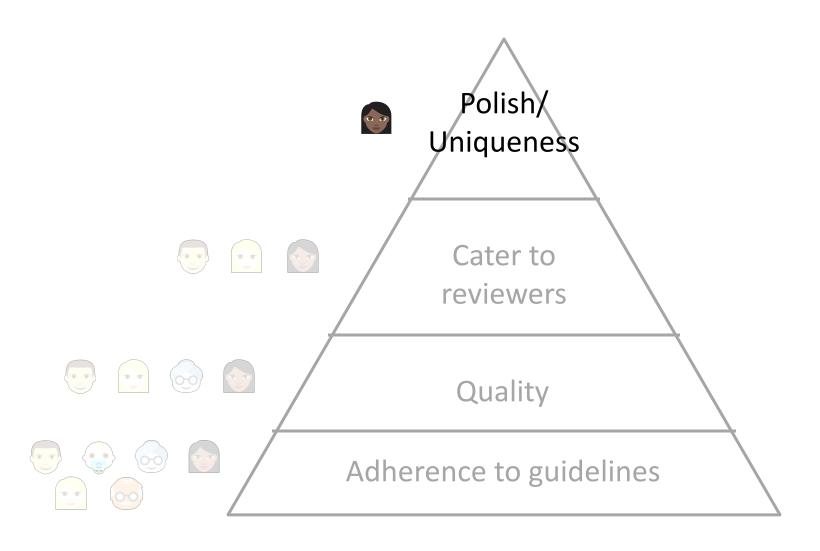
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Polish/
Uniqueness

Cater to
reviewers

Quality

Adherence to guidelines

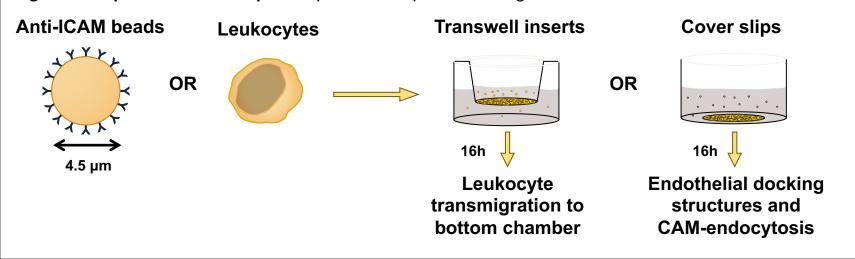# Content matters but presentation is critical

Uniqueness/Polish

- **Figures**
- Formatting/Organization
- Ask someone else to read it

For our experiment, we will coat microparticles with antiICAM and then we will add either these particles or leukocytes to either transwell inserts or coverslips. For transwell assays, we will do these analyses. For coverslip assays, we will do these other analyses. Transwell inserts and cover slips support confluent human umbilical vein endothelial cell (HUVEC) or mouse lung endothelial cell (MLEC) monolayers, activated with TNFα for 16 h to mimic inflammatory ICAM-1 overexpression
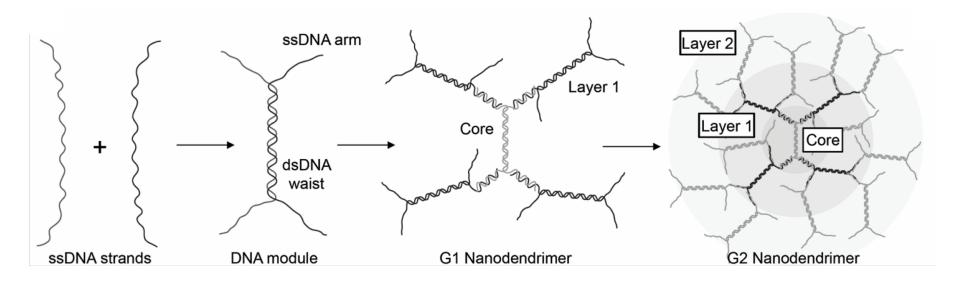
vs.

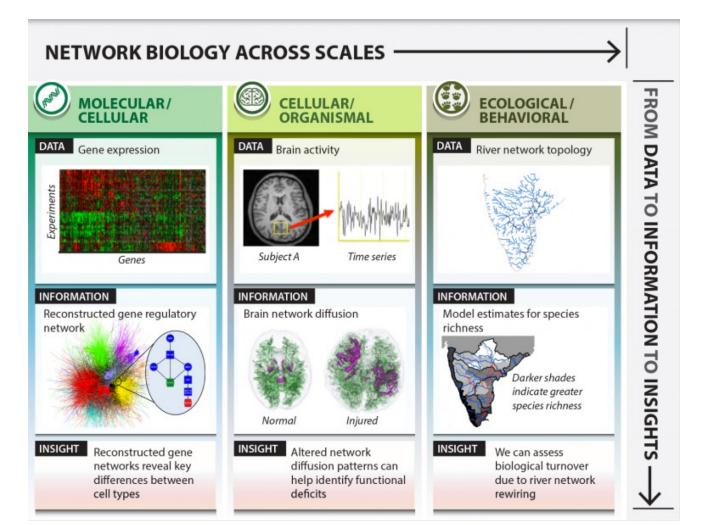# Content matters but presentation is critical

Uniqueness/Polish

For our experiment (Figure 1), we will coat microparticles with antiICAM and then we will add either these particles or leukocytes to either transwell inserts or coverslips. For transwell assays, we will do these analyses. For coverslip assays, we will do these analyses. Transwell inserts and cover slips support confluent human umbilical vein endothelial cell (HUVEC) or mouse lung endothelial cell (MLEC) monolayers, activated with TNFα for 16 h to mimic inflammatory ICAM-1 overexpression.

Figure 1 – Experimental technique. Very brief description of the figure.

Anti-ICAM beads

4.5 µm

OR

Leukocytes

Transwell inserts

OR

Cover slips

16h

Leukocyte transmigration to bottom chamber

16h

Endothelial docking structures and CAM-endocytosis

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Uniqueness/Polish

- **Figures**
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Content matters but presentation is critical

Uniqueness/Polish

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Uniqueness/Polish

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	2017				2018				2019			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Funding source	**UMD** DRIF			**MII** TA Phase			**NSF** I-Corps	**MII** CA Phase			**ARO** SBIR	
$				115K			50K	150K			500K	
Product stage	Research and development			Prototype development + Initial speed/performance tests				α product (showcase)			β product (early adopter sales)	

Hire part-time legal counsel

Hire part-time CEO

Form company

Hire sales and marketing

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Uniqueness/Polish

- Figures
- **Formatting/Organization**
- Ask someone else to read it

Intro/Background: Here is the proposal's intro where I describe the status of the field, and how this connects to the problem I want to address.

Preliminary studies: Here I describe what I have done so far to address this problem.

Research goals: Here I describe my three goals. Goal 1 is this. Goal 2 is this. Goal 3 is this.

Conclusion: Here I summarize the proposal and reiterate why the work is important.

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Uniqueness/Polish

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Conclusion: Here I summarize the proposal and reiterate why the work is important.

vs.

S.1. Intro/Background: Here is the proposal's intro where I describe the status of the field, and how this connects to the problem I want to address.

S.2. Preliminary studies: Here I describe what I have done so far to address this problem.

S.3. Research goals: Here I describe my three goals:
    Goal 1 is this.
    Goal 2 is this.
    Goal 3 is this.

S.4. Conclusion: Here I summarize the overall goal of the proposal (**S.3., Page X**) and reiterate why the work is important.

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Uniqueness/Polish

- Figures
- **Formatting/Organization**
- Ask someone else to read it

SOFWERX example

Content matters but presentation is critical

Uniqueness/Polish

- Figures
- Formatting/Organization
- **Ask someone else to read it**

- Someone outside your field (different perspective, mimic out-of-field reviewers)

- Successful (or unsuccessful) previous applicant

1. A lot of straightforward practical advice (e.g.: Google)

2. Long-term learning process, extending back and forward

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dsvolpe@umd.edu