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

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

3. Humans factors are at every stage of the process

4. Content matters, but presentation is critical

Important matters for faculty [1/x]

Practical/immediate insight [1-\{(1/x)\}]
1. A lot of straightforward practical advice (e.g.: Google)

2.

3.

4.
1. A lot of straightforward practical advice (e.g.: Google)

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


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–


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

Planning

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

- Getting preliminary results to increase credibility and reduce risk
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)
The Maryland Catalyst Fund

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

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)
  - **Annual 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)
  - Applications are accepted four times 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

- Getting preliminary results to increase credibility and reduce risk
- Understanding the program and if your research and project are a good fit
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.
Addressing reviewers' comments systematically and thoroughly.

Division of Electrical, Communications and Cyber Systems

Electronics, Photonics and Magnetic Devices (EPMD)

CONTACTS

<table>
<thead>
<tr>
<th>Name</th>
<th>Email</th>
<th>Phone</th>
<th>Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dominique Dagenais</td>
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</tr>
</tbody>
</table>

PROGRAM GUIDELINES

Apply to PD 18-1517 as follows:

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

- 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

<table>
<thead>
<tr>
<th>Review #</th>
<th>Score</th>
<th>Priority</th>
<th>Issue</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Very good</td>
<td>Medium</td>
<td>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.</td>
<td>Ping program officer about adding a post-doc or just put in a post-doc</td>
</tr>
<tr>
<td>1</td>
<td>Very good</td>
<td>Medium</td>
<td>Concerned about commitment from campus regarding the experiment safety efforts</td>
<td>Substantiate campus support from fire marshal or head of ESSR and decom. plan</td>
</tr>
<tr>
<td>5</td>
<td>Fair</td>
<td>Medium</td>
<td>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.</td>
<td>More details on the baffles and why. Simulations including baffles are not technologically possible at Re=9E8, so true predictive simulations are precluded. That being said Grenoble plans to run more simulations using their codes.</td>
</tr>
<tr>
<td>5</td>
<td>Fair</td>
<td>High</td>
<td>Suggests using a smaller scale experiment than the 3 meter device for the precession studies.</td>
<td>Add more detailed section on our smaller scale water experiment</td>
</tr>
<tr>
<td>5</td>
<td>Fair</td>
<td>Medium</td>
<td>What is the role of Professor A? Only one sentence in Management Plan.</td>
<td>Clarify in management plan section Prof. A’s role</td>
</tr>
<tr>
<td>5</td>
<td>Fair</td>
<td>Low</td>
<td>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?</td>
<td>Acoustics works in air but not demonstrated in liquids, that is why that research subplan is necessary</td>
</tr>
</tbody>
</table>
1. A lot of straightforward practical advice (e.g.: Google)

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

3. Humans factors are at every stage of the process

4.
Human factors are at every stage of the process
Human factors are at every stage of the process.
Human factors are at every stage of the process

- Competition
- Collaboration
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

- Competition
- Collaboration

Experts

- (Cognitive) Biases
- Competing priorities

Leaders

- Budget constraints
- Accountability
Human factors are at every stage of the process.

- Planning
  - Competition
  - Collaboration

- Experts
  - (Cognitive) Biases
  - Competing priorities

- Leader
  - Budget constraints
  - Accountability

- Perseverance
Human factors are at every stage of the process.

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

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

3. Humans factors are at every stage of the process

4. Content matters, but presentation is critical
Content matters but presentation is critical
Content matters but presentation is critical
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 be 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
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
    - Might be other pieces of the application package (CVs, etc.)
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
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
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

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

- Make reviewers happy
- Quality
- Adherence to guidelines
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
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.
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.

The three aims of this project are:

Aim 1: Title - Description.
Aim 2: Title - Description.
Aim 3: Title - Description.

The way these aims connect to each other is x.
Content matters but presentation is critical

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.
Content matters but presentation is critical

Make reviewers happy

- Know your audience
- Be straightforward
- Use visual hierarchy

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vs.

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Content matters but presentation is critical

- Quality
- Adherence to guidelines
- Cater to reviewers
- Polish/Uniqueness
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.
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 OR Leukocytes

4.5 μm

Transwell inserts OR Cover slips

16h

Leukocyte transmigration to bottom chamber

Endothelial docking structures and CAM-endocytosis
Content matters but presentation is critical

**Uniqueness/Polish**

- **Figures**
- Formatting/Organization
- Ask someone else to read it
Content matters but presentation is critical

Uniqueness/Polish

NETWORK BIOLOGY ACROSS SCALES

MOLECULAR/CELLULAR
DATA: Gene expression
INFORMATION: Reconstructed gene regulatory network
INSIGHT: Reconstructed gene networks reveal key differences between cell types

CELLULAR/ORGANISMAL
DATA: Brain activity
INFORMATION: Brain network diffusion
INSIGHT: Altered network diffusion patterns can help identify functional deficits

ECOLOGICAL/BEHAVIORAL
DATA: River network topology
INFORMATION: Model estimates for species richness
INSIGHT: Darker shades indicate greater species richness

From data to information to insights
Content matters but presentation is critical

Uniqueness/Polish

The Path to an Interdisciplinary PhD through our NRT Program

Broadening Activities
- NRT Seminars
- P2P Tutorials
- Internships
- Outreach
- Career Development Workshop
- Annual NRT Symposium

Discipline-bridging Intro Course
Out-of-field Seminar
Content matters but presentation is critical

Uniqueness/Polish

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

<table>
<thead>
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<th>2018</th>
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<td>NSF I-Corps</td>
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<td>DRIF</td>
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<td>Product stage</td>
<td>Research and development</td>
<td>Prototype development + initial speed/performance tests</td>
<td>α product (showcase)</td>
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<td></td>
<td></td>
<td></td>
<td>β product (early adopter sales)</td>
</tr>
</tbody>
</table>

- Hire part-time legal counsel
- Form company
- Hire part-time CEO
- Hire sales and marketing
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.

Content matters but presentation is critical

Uniqueness/Polish

- Figures
- Formatting/Organization
- Ask someone else to read it
Content matters but presentation is critical

Uniqueness/Polish

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

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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.
Content matters but presentation is critical

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

3. Humans factors are at every stage of the process

4. Content matters, but presentation is critical
Daniel Serrano
dsvolpe@umd.edu