Sowing the Seeds of a Solid Research Program

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Context - Current Trends in Research

- from national to international; globalization (overseas opportunities, collaborations)
- from individual research to team research;
- from narrow, disciplinary-oriented research to multi-interdisciplinary research;
- from small laboratories to larger research institutes, programs and centers
- from fragments to "big science" (e.g. sustainability, energy, health, security, infrastructure, etc. → complex systems);
- from public or university funded to multiple funding sources;
- from unbounded research to research within programs and projects;
- from national security to competitiveness and job creation;
- from utilization of resources to sustainable development.
- from well-defined basic/applied research towards “use-inspired” basic research

Adapted from Pasteur’s Quadrant: Basic Science and Technological Innovation, Donald Stokes, 1997

Research Evaluation Criteria

- **Quality** – In top/best compared to peer group (worldwide)

- **Impact** – Transformative vs. Incremental
  - Ask and answer important questions
  - Create new knowledge
  - Leads to new ways of thinking; new paradigms
  - Lays the foundation for further research in the field

- **Creativity / Originality / Novelty**

- Clear New **Contribution** (distinguished from graduate/ postdoctoral research, collaborators)

- **Technical Rigor / Depth**

- **Trajectory**
How to Select a Research Project (1)

• Think about and **anticipate some results** before doing the first study (pilot study)
• Consider the **interest of the outcome**
• Look for an **unoccupied niche** that has potential
• Go to talks and read papers **outside your specific area** of interest
• **Build on a theme** *
• Be prepared to **pursue a project to any depth** necessary
• **Differentiate yourself** from your mentors
• **Focus and consolidate**
• **Balance low and high risk** *

C. Ortiz – MIT (Kahn, 1994)
How to Select a Research Project (2): Balance the Continuum

“Low Hanging Fruit”

• **Find a balance between low risk and high risk projects**, but always include a high risk project in your portfolio.

• “Low Hanging Fruit” does not mean low impact!

• Try to have each graduate student get a mix of low and high risk.

• *Terminate projects that are not working. Be flexible and adaptable.*

“High risk”

C. Ortiz – MIT
Construction of a *Coherent* Research Program

Understand and be able to clearly articulate where your research program fits into the disciplinary landscape.

Universal Themes Tools/Expertise “A Core Story” Unique Research Identity

Project 1

Project 2

Project 3
Venn Diagram of Top People in the Field

Who are the superstars of all ranks, what are they doing, what is the intellectual relationship to the work of the candidate?

• Define who you are professionally -- what areas are you working in and looking to make an impact in; how do they overlap and who are the distinguished members of these fields; (if they find they have too many areas they are working in and there is no intersection, then you are likely lining themselves up for a problem and for not making any real impact anywhere)

• Can also map publications onto the diagram; the top journals of their field onto the diagram; the top conferences, as a means of helping them make decisions and choices.
Heilmeier Questions- Should be Answered Clearly in Research Grant Proposals

• What are you trying to do? Articulate your objectives using absolutely no jargon.
• How is it done today, and what are the limits of current practice / state of the art?
• What's new in your approach and why do you think it will be successful?
• Who cares?
• If you're successful, what difference will it make?
• What are the risks/challenges and the payoffs?
• How much will it cost?
• How long will it take?
• What are the midterm and final "exams" to check for success?
Team vs. Individual PI Grants

**Team Grants:**
- Utilize them to learn the inner workings of funding agencies
- Build collaborations
- Topic should be sufficiently related to your “Universal Theme” and ongoing projects
- Consider time requirements (off-campus? reporting requirements?)
- Organizing a team grant is a **HUGE** time sink

**Single PI Grants:**
- Apply for “Young Investigator” grants
- Apply for Center “Seed Grants”
- Apply for internal university grants
- Consider requirements of funding agency
Networking - Build a Team of Mentors (1)

- Intra- and Extra-departmental
- Seek multiple points of view, experiences
- Collaborators

What Information can Mentors Provide?
- **Time management** and setting career priorities, goals and choices to judiciously balance research, teaching, and service to the department, University, professional organizations and the community.

- Assisting in developing strategies to **manage multiple demands** on academic time, including knowing when to say “no”.
- Determining what the mentee must accomplish in a specific period of time to advance academically; **supplying honest criticism** about the current year as well as planning ahead; advising the mentee regarding what the department views as acceptable scholarship.

- **Reviewing and critiquing** manuscripts, abstracts, grant applications and presentations.

C. Ortiz – MIT
Networking - Build a Team of Mentors (2)

What can mentors assist with?

• Providing advice on institutional and departmental allocation of physical resources, including space, core facilities, equipment, and appropriate staff support.

• Providing guidance on departmental, institutional and national resources and opportunities available for professional development.

• Suggesting ways to improve scholarly output, including advising on grant writing, facilitating the development of professional collaborations, and encouraging participation at professional meetings; making the mentee aware of competitive grants and other opportunities for research funding; assisting in linking the mentee with other people, locally and nationally, who share common scholarly interests.

• Providing encouragement and promoting individual recognition (e.g., nomination for awards), and advice on how to “showcase” one’s work.

• Advising on the development and maintenance of an academic dossier, to include a list of referees to write letters of support for promotion, documentation of teaching responsibilities and evaluations, and a summary of committee participation.
• Definitely would encourage it, but don’t overdo it
• Select collaborators carefully
• Get rid of “dead weight”- don’t be afraid to say no
• Both parties have compatible and distinct core intellectual interests
• Ensure that collaborations contribute to Core Universal Theme of your research program
• Collaborators may be called upon to write tenure letters
• Discuss authorship /division of responsibilities in advance to avoid conflicts
• Ensure compatibility of personalities
Graduate Students

- Consider carefully students who want to switch research groups
- Consider grant requirements when assigning students to projects
- Create a climate of inclusivity
- Understand your students strengths / interests and tailor your management style accordingly
- Help students master increasingly difficult tasks to build self-confidence
- Set reasonable and attainable goals, and establish a timeline for completion of the project, provide timely feedback
- Meet with students on a regular basis
- Professional development / career advice

_How to mentor graduate students_ - U. Michigan