

BUILDING A RESEARCH PROGRAM AT AN AMERICAN UNIVERSITY: STRATEGIES FOR SUSTAINABLE SUCCESS

TWORZENIE PROGRAMU BADAWCZEGO NA AMERYKAŃSKIEJ UCZELNI: SKUTECZNE STRATEGIE

JERZY W. ROZENBLIT^{1,2 A,E,F}

¹ Dept. of Electrical and Computer Engineering

² Dept. of Surgery, The University of Arizona, USA

A – przygotowanie projektu badania | study design, **B** – zbieranie danych | data collection, **C** – analiza statystyczna | statistical analysis, **D** – interpretacja danych | interpretation of data, **E** – przygotowanie maszynopisu | manuscript preparation, **F** – opracowanie piśmiennictwa | literature review, **G** – pozyskanie funduszy | sourcing of funding

SUMMARY

This informational article discusses opportunities and strategies for how to develop an externally funded research program in the American academic environment, specifically in STEM (science, technology, engineering, and mathematics) disciplines. It is presented from a long-term perspective of a faculty member with active research, who has served in all ranks (assistant, associate, and full professor) and has led a large academic department at the University of Arizona for several years. It is stipulated that the employment offer for a junior faculty include an adequate start-up package which allows to set the research program in motion by establishing a laboratory and hiring graduate students. The spectrum of funding sources for STEM research is given with a brief annotation of the current funding climate and mechanisms in the USA. As junior faculty face negative submission outcomes, strong encouragement and pragmatic advice is needed so that faculty can focus their efforts, persist in grant competitions, and ultimately succeed. Grant planning and submission suggestions that might help in this process and lead to good outcomes are given. The article concludes with the stipulation that faculty maintain high standards of academic integrity, ethics, and quality and not succumb to potentially perverse incentives to pursue funds just for the sake of generating higher quantitative indicators of their productivity.

KEYWORDS: funded research, research program support, grant competition, grants and contracts

STRESZCZENIE

Niniejszy artykuł opisuje możliwości i strategie tworzenia programów badawczych z zewnętrznym finansowaniem na amerykańskich uczelniach w dziedzinach ścisłych (nauki przyrodnicze, technologia, inżynieria oraz matematyka). Artykuł jest napisany z perspektywy wieloletniego pracownika naukowego, który prowadzi badania i przeszedł przez wszystkie szczeble kariery naukowej (asystent, profesor nadzwyczajny i profesor zwyczajny) oraz przez kilka lat stał na czele dużego wydziału na University of Arizona. Propozycja umowy zatrudnienia dla młodszego członka kadry naukowej powinna zawierać odpowiedni pakiet początkowy, który umożliwi rozpoczęcie programu badawczego przez otwarcie laboratorium i zatrudnienie laborantów spośród studentów. Spektrum źródeł finansowania badań w zakresie nauk ścisłych jest opisane wraz z krótką wzmianką o obecnym klimacie finansowym i mechanizmach finansowania w USA. Ponieważ młodszy członek kadry naukowej zmierzy się niejednokrotnie z odmową przyznania środków, będzie potrzebował zachęty oraz pragmatycznych porad, które pomogą skupić wysiłki, wytrwać i nadal startować w konkursach dotacyjnych, co ostatecznie zaowocuje uzyskaniem finansowania. Niniejszy artykuł zawiera również sugestie, jak planować granty i składać wnioski. Na zakończenie autor wnosi o to, żeby kadra naukowa zachowała wysokie standardy akademickiej uczciwości, etyki i jakości oraz nie ulegała pokusie pozyskiwania środków finansowych jedynie w celu generowania wyższych wskaźników swojej produktywności.

SŁOWA KLUCZOWE: finansowane badania, wsparcie dla programu badawczego, konkursy dotacyjne, granty i umowy

INTRODUCTION

The old “publish or perish” adage of American universities has been to some extent supplemented by “bring money or you are out” “existential” anxiety among junior faculty, especially in STEM related fields. Graduate students are not typically funded by the departments of their major field of study. The exception are those who have Teaching Assistant contracts (such financial arrangements also offset most of the tuition costs), or fellowships, or purse the degree part time and are supported by their employer. Therefore, having external, i.e., grant or contract monies is a necessary condition for a faculty member to build and sustain a research program. This entails the ability to financially support master’s and doctoral students, to purchase laboratory equipment and supplies, fund conference and research meetings travel, etc. In essence, as such expenses are nowadays hardly ever covered by one’s home department, a faculty in a way directs a small “enterprise” whose sustainable success very much hinges on the availability of funds to support the above mentioned operational facets.

In addition to this well established and time-tested model – which, by the way, gives faculty in all ranks quite a bit of autonomy in how their research program is run in terms of both the scale and subject areas – the changing dynamics of state, tax payer funded university budgets and how college and department units partake in such budgets, is putting an increasing pressure and emphasis on bringing more and more research funds. Such external funds can help offset some of the lacking state money.

In what follows, we describe how junior faculty go about “starting up” a program and what mechanisms can be used to purse research funding and sustain it once a research laboratory and team have been established. We also discuss how to avoid some pitfalls associated with hyper-competitive academic climate and conclude with a call for a healthy balance in academic endeavors.

THE HIRE

Typically, most faculty commence their academic careers immediately after obtaining their doctoral degree (PhD) either as assistant professors or, increasingly in STEM fields as post-graduate fellows (“post-docs”, in casual parlance). Post-doctoral experience allows them to build up a stronger publication record, have a supervisory role in advising graduate students in the host’s laboratory, and to hone their skills in grant proposal writing. In addition, working under an experienced faculty’s supervision provides an excellent insight into how an established research program is run.

The hiring process usually begins in the Fall semester, with most of the interviews conducted in the Spring, and job offers being extended prior to the Summer months. A generous “start-up” package [1] is a *sine qua non* element of such offers as it enables the prospective

faculty to establish the foundations of the research program and set up a physical laboratory space. Clearly, it varies in its specifics depending on one’s discipline and the nature of his or her scholarly work. For instance, a faculty whose work is highly experimental may require funds close to \$1Mil., whereas for more basic, theoretical research several hundred thousand dollars might be sufficient.

Offers in engineering and sciences also include, as part of the start-up, support for graduate students for a period of time, summer salary for two or three years (academic year contracts cover nine months of salary with the ability to supplement the additional three summer months from externally funded research), reduced teaching loads for the first five years while in the rank of non-tenured assistant professor, and miscellaneous operational funds. In essence, a good support foundation is laid out for an incoming faculty, from which a research program can and is expected to be built.

Indeed, with such offers, expectations are set that the faculty be successful not only in disseminating research outcomes in high quality scholarly media, but also that research funding will be secured to support the research in the long term perspective. Increasingly, such “return of investment” is expected in the more immediate future than the five year tenure-track probationary period of time. This, combined with the current funding climate (i.e., scarcity of funds) creates quite some high pressure and anxiety among junior faculty. Thus, the competition for funds commences.

THE PURSUIT

We do not focus here on strategies for writing successful grants and refer the reader to [1, 6] for details on how to prepare and submit successful proposals. Rather, we discuss potential pathways for securing and sustaining the funding.

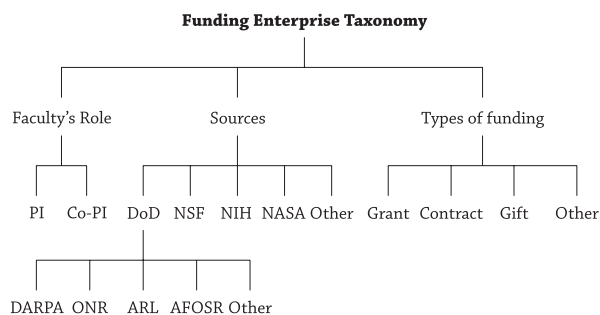


Figure 1. Taxonomy of the research funding enterprise

Most new faculty, especially those who have completed a post-doctoral assignment are quite familiar with the funding models. Still, they do face a number of choices in terms of a) what type of grants to pursue, e.g., basic, fundamental research or more applied projects, b) where to pursue such funding from, and c) who to team up with (or whether to submit single investigator proposals).

To help organize this spectrum of choices, in Figure 1 we have roughly categorized the dimensions of the research funding landscape. In it, faculty have often dual roles, both as Principal Investigators (PIs) and co-investigators (co-PIs). As the PI, they can act as sole investigators or leaders of a team. They can also team up with senior faculty or their peers to write collaborative proposals led by others. A good mix of roles is encouraged. Serving as the project's PI demonstrates the ability to attract funding for one's own research directions and ideas. It also shows leadership. Serving as a co-PI, attests to the ability to work with and contribute to a larger team. Historically, senior faculty would often involve younger colleagues in already established programs (assuming a synergy of interests and skill sets) in order to provide the initial, foundational basis for junior faculty research development. This model is still very much in place, typically in academic units with larger centers and strong senior faculty driven research programs. It serves well as a supplement to the start up funds discussed above.

Specific types of grants are exclusively designated as single PI projects. These, for example, are CAREER awards from the National Science Foundation [2] or the Young Investigator Award from the Office of Naval Research [3]. Such, highly competitive and prestigious, multi-year grants are de-facto enablers for building a successful long term research program.

The "what", "where", and "who" aspects of funding pursuits are inherently interconnected. Most large research universities provide good assistance to faculty at all ranks through the Office of Vice President for Research (or its equivalents) by notifications of new Requests for Proposals (RFPs), or Broad Agency Announcements (BAAs) from all the funding agencies, private foundations, and industry. (The author of this article, pioneered this concept at the University of Arizona by creating in 2005 the position of Research Development Director for his academic unit, whose responsibility was to assist all faculty in identifying the opportunities, connecting faculty with research program managers at funding agencies, and writing grant proposals. Since then, such positions have been created at both college and university administrative levels and have spurred additional research activities.)

Figure 1 lists major funding agencies in STEM. Traditionally, the National Science Foundation (NSF), National Institutes of Health (NIH), National Aeronautics and Space Administration (NASA) fund basic research, with NASA often providing very large, multi million dollar support for missions such as for example OSIRIS-REX [4]. Department of Defense (DoD) has been one of the cornerstones of academic research funding. A great variety of grant opportunities exist through DoD. They are listed at [5].

The Defense Advanced Research Project Agency (DARPA) typically supports more application oriented work while the Office of Naval Research (ONR), Army Research Laboratories (ARL), and Air Force Office of Sci-

entific Research (AFOSR) often seek proposals for foundational work. Other, smaller agencies typically focus on projects that meet their specific application needs. In addition, private sector entities provide opportunities to seek support through their research and development divisions. For instance, both Microsoft and Google corporations often announce competitions for special projects.

The funding vehicles are varied as well. They include grants (a norm for agencies such as NSF or NIH), fixed-price or time and material contracts, or at times gifts (from foundations, corporations, or philanthropic entities).

It is a given that there are truly numerous and very diverse opportunities to pursue research support, despite a rather high level of competition and limited funds available (and thus lower success grant award rates as opposed to two decades ago or so). Thus, the key question is: "How does a faculty become successful in winning and sustaining the funding?"

The fundamental prerequisites such as good, creative and novel ideas, well written proposals, an excellent, credible team with complementary areas of expertise and track records (Co-PIs who have a history of funding) must be in place for the proposal to be competitive. This is elaborated on in detail in [6]. Here, we provide some personal observations and experiences that have served the author and his mentees well over the years. These observations follow the timeline of an assistant professor's career progression.

The first academic semester for a new assistant professor is a mixture of excitement, exhaustion, and clearly adaptation to a new environment (as a matter of principle and tradition, virtually all American universities do not hire their own graduates). The first order of business on the research side of one's responsibilities is to establish a laboratory and recruit graduate students using start-up funds. This will typically take a semester's worth of time. If the incoming faculty teaches a graduate level course in the area of his or her research, this might provide an opportunity to recruit students into the laboratory.

As the same time, proposal preparations begin as the faculty identifies the pending grant requests and starts building collaborative ties with colleagues in the department and across the university. (This latter aspect is important to note as many calls for proposal nowadays emphasize cross-disciplinary endeavors, often spanning diverse fields of scholarly inquiry.) In departments with a strong culture of mentorship and support for young faculty, senior colleagues often extend an offer to join an existing center, participate in an ongoing project, or team up on proposal preparations that they will lead.

Universities increasingly offer assistance through the Office of Vice President for Research workshops on proposal writing, budgeting, submission procedures, and, as mentioned before, help in identifying relevant requests for proposals from a broad variety of agencies, foundations, and the private sector.

As the academic year progresses, the work supported by start-up funds gains momentum and preliminary results, early publication drafts, and conference papers, form the foundation and evidence for ideas proposed in grant applications. Proposals are written and budgeted depending on the scope and available funds. Typically, faculty's summer months, graduate students' Research Assistantships, travel, equipment (if needed), and supplies are built into the budget. Some grants offset a portion of the academic year (AY) through what is called AY buyout. This allows the faculty at higher ranks to reduce their teaching load and dedicate more time to the project. In the author's department, 12.5% of the AY salary allows for a one course reduction in teaching. Budgets also include overhead (indirect costs), roughly in the 50% range of the direct costs.

Proposals get submitted and the anticipation begins. The evaluation process takes from a few to several months. (Some agencies, ask for a preliminary "white paper" proposal concept which serves as an early filter. Only 50% or 30% of white papers that have passed the preliminary evaluation get an invitation for the full proposal submission. This is a good process that speeds up the assessment cycle, and narrows the field of final contenders.) Decisions are more often than not negative – the odds of winning an award may be as low as the 5–8% range. "What now?", a disappointed and often frustrated junior faculty asks.

PERSISTENCE AND PATIENCE

However distressful negative submission outcomes might be, they are quite likely, given the highly competitive funding climate and statistically low odds of success (for excellent proposals, too).

Clearly, strong encouragement and pragmatic advice is needed so that junior faculty can focus their efforts, persist in grant competitions, and ultimately succeed. In what follows, we outline possible steps that might help in this process and lead to good outcomes.

- *Focus the efforts on the core areas of your expertise:* given the high pressure to attract external funding to the university, faculty often write numerous proposals taking a "shotgun" approach in hopes of perhaps being awarded one of them. This dilutes their efforts, and seldom results in good quality, well focused proposals.
- *Develop an excellent understanding of what the RFP calls for:* RFPs contain good but often broad descriptions of what the funding agency is seeking, what outcomes it expects. It is a good strategy to consult with Program Managers/Directors responsible for a specific call to get detailed insights into what the scope, expectations, anticipated directions, and the program's long term strategic goals are. Examine current grants in the program to know what types of proposals won funding and who the investigators are.
- *Visit funding agencies:* "face time", direct personal interactions with Program Managers (PM) assist in understanding the scope of programs and RFPs as noted above. In addition, such meetings allow the PM to get to know the faculty, learn about their ideas and skill sets. Start-up funds can be used for travel to such meetings.
- *Team up with strong partners:* for a multi-investigator proposal, invite colleagues with excellent reputation and funding record to participate. Do this across the college, university and if appropriate involve collaborators from other institutions.
- *Follow-up with PMs on declined proposals:* proposal evaluations are shared with the PIs. It is imperative that the PI contact the PM to better understand which aspects of the proposal were competitive and which were not. Ask for guidance in revising the proposal so that it can be better focused and re-submitted in the next evaluation cycle.
- *Ask for exploratory/seed grant opportunities:* discuss with PMs a possibility for a small exploratory grant to prove your ideas. Grants such as NSF EAGER (Early-concept Grants for Exploratory Research) [7] provide small levels of funding but a short evaluation cycle, and higher odds of success.
- *Volunteer to serve on review panels:* offer your professional service as a reviewer on proposal assessment panels. This is an excellent opportunity to a) assist the agencies in the selection process and b) learn about how the peer review process works, what types of proposals get selected and why.
- *Take an active role in formulating RFPs:* as you establish professional relations with PMs, participate in workshops and conferences and offer your assistance in formulating directions for the program. This will position you well in how to best respond to potential calls for proposals.
- *Become a Program Manager:* as you mature in your professional career, gain tenure and get promoted to higher ranks, serve as a PM with a funding agency. These arrangements called Intergovernmental Personnel Act (IPA) Assignment [8] allow faculty to spend 3–4 years with an agency while retaining their academic positions. Acting as a PM is an opportunity to shape new research directions for the nation.
- *Sustain your efforts:* in the likely event that ultimately some of your proposals will get funded, do not rest on your laurels and plan accordingly for how to sustain, and grow the program. In essence, persistently continue executing all the above steps.
- *Do not give up!* However frustrating the process might be, good ideas and proposals get funded as evidenced by the many active projects all across the country.

DOING THE “RIGHT THING”

Edwards and Roy [9] present a strong case for finding a better balance in how scholarly endeavors are incentivized and managed. They argue that the hypercompetitive academic environment, relentless pressure to bring in research dollars, quantitative metrics of productivity distort faculty's efforts and lead to substandard outcomes, decreased quality, and loss of integrity in academic conduct.

Junior, untenured faculty are vulnerable and very susceptible to such pressures as they structure their efforts in a manner that would lead to successful promotion and award of tenure. The burden of ensuring that they act with high integrity and a sense of purpose which aids their professional development falls

on university administration and good mentors who should create a nurturing culture in the units. At the same time, it is important for the faculty to embrace the values of academic ethics, quality, and high standards, and to understand that good work combined with diligent efforts does get rewarded in the long run.

ACKNOWLEDGMENT

The author would like to thank Professor Donata Kurpas, MD, PhD for providing the stimulus to prepare this review. The Polish-American Fulbright Commission has supported the author's research activities in Poland in Spring 2017. This support is gratefully acknowledged.

REFERENCES

1. Sivakumar S. How to maximize your start-up package as a new assistant professor. ASCB: an international forum for cell biology [online] 2016 Oct [cit. 06.04.2017]. Available from URL: <http://www.ascb.org/compass/compass-points/maximize-start-package-new-assistant-professor/>
2. National Science Foundation Faculty Early Career Development Program [online] [cit. 06.04.2017]. Available from URL: https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503214
3. Office of Naval Research Young Investigator Program [online] [cit. 06.04.2017]. Available from URL: <https://www.onr.navy.mil/Science-Technology/Directorates/office-research-discovery-invention/Sponsored-Research/YIP.aspx>
4. NASA OSIRIS-Rex [online] [cit. 06.04.2017]. Available from URL: <https://www.nasa.gov/osiris-rex>
5. GRANTS.GOV [online] [cit. 06.04.2017]. Available from URL: <https://www.grants.gov/web/grants/learn-grants/grant-making-agencies/department-of-defense.html>
6. Koziel JA. Successful grant-writing strategies for junior scientists: an American public university perspective. *Puls Uczelni* 2016; 10(4): 21–25.
7. Dorman E. NSF EAGER Grants for Innovative Research: Relatively Easy to Get and Highly Underused [online] 2014 Sep [cit. 06.04.2017]. Available from URL: <http://osp.finance.harvard.edu/blog/nsf-eager-grants-innovative-research-relatively-easy-get-and-highly-underused>
8. Intergovernmental Personnel Act (IPA) Assignments [online] [cit. 06.04.2017]. Available from URL: <https://www.nsf.gov/careers/rotator/ipa.jsp>
9. Edwards MA, Roy S. Academic research in the 21st century: Maintaining scientific integrity in a climate of perverse incentives and hypercompetition. *Environmental Engineering Science* 2017 Jan 1; 34(1): 51–61.

Word count: 3436

• Tables: –

• Figures: 1

• References: 9

Sources of funding:

The review was funded by the author.

Conflicts of interests:

The author reports that there were no conflicts of interest.

Cite this article as:

Rozenblit JW.

Building a research program at an American university: strategies for sustainable success. *MSP* 2017; 11, 1: 10–14.

Correspondence address:

Jerzy W. Rozenblit
The University of Arizona
Dept. of Electrical and Computer Engineering
Dept. of Surgery
Tucson, AZ 85721, USA
e-mail: jr@ece.arizona.edu

Received: 24.02.2017

Reviewed: 01.03.2017

Accepted: 13.03.2017