

THE NEED FOR EXTERNALLY FUNDED RESEARCH

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Research at the Frontline

Picture a young faculty member who has just received her or his new appointment as an assistant professor in a scientific field at a major university in the United States. If you are a professor yourself, and one who has gone through the whole process of promotion and tenure, chances are that the image you conjure in your mind is that of a young professional torn by ambivalent feelings of a strong desire to succeed but filled with the fear that she or he may fail. You will immediately recall the many demands placed upon a young assistant professor, such as the need to teach courses that she or he has never taught before; to start putting together a research laboratory; to begin the planning and writing of research grant proposals; and to conduct research studies as if there were no interruption, no translocation into a new environment, no other demands placed on this young assistant professor, and no discontinuity in the availability of talented research associates who can collaborate with her or him in carrying out the research studies. Why am I focusing on the difficulties facing a starting assistant professor? The answer is that if I am to describe as honestly as I can the view from the “frontlines” about the conduct of research, I have to confront the demands that gnaw at us continuously about the need to excel in teaching, to participate in service to our institution and our discipline, and to conduct high quality and highly competitive research and scholarship. The beginning of one’s academic career in many respects represents the zenith during an academician’s life of feelings of uncertainty about the likelihood of success and of the urgency to be productive in teaching, research and service.

Of the three tasks that each academician is supposed to execute with great aplomb, the one presenting the highest risk in terms of an enduring academic career and the one for which the evidence of success or failure accumulates most slowly is research. The truth is that none of us knows whether we are talented enough to conduct high quality research, the type of research that will generate new knowledge, that will push the frontiers of our field forward, and that will be of value to the discipline for many years to come. It has been said by some that most academic researchers do not ever achieve the lofty goals described above during their career as researchers. The same individuals would also contend that only the research of a minority of academicians, most operating in some of the finest research universities in the country, can be considered truly imaginative and generative of new knowledge and new ideas.

I know these arguments because I was the recipient of such evaluative judgments. As I was leaving the research environment of a medical center where I received my training, the general expectation was that I would fail in my research efforts as a faculty member in a department of the College of Liberal Arts and Sciences in a major public university. “Too much teaching and too little time for research,” I was told, would doom my chances to perform any

significant scientific research. These are, of course, not the words that build confidence in a young professional starting on his first position in academia.

The truth, though, about any scientist or academician who is fully immersed in the conduct of research is that he or she harbors a significant amount of uncertainty about his or her scientific work and research career regardless of the comments made by colleagues. Uncertainty is a constant companion in the life of most researchers - uncertainty about whether they are falling behind in the use of the newest technologies, whether they are asking the right questions, whether their work will be judged to be sound and substantial or trivial and pedantic, and whether they will receive support to continue their research efforts. The key questions are, of course, whether faculty researchers ever outgrow these abiding feelings of doubt and whether constant concerns about the quality of one's research and the gathering of new information detracts from efforts to succeed as teaching faculty. The answer to the first question is that throughout their careers researchers retain the sense of uncertainty with which they started in research. Success in publishing one's work and competing for research funding does not eliminate the fear of falling behind in completing research projects in a timely manner, adopting the most powerful technologies needed in their research, pursuing questions that may not have a measurable impact on the field, or having that vital funding for the research discontinued. The most successful researchers are those who are not only possessed by such uncertainties, but who transform those uncertainties into a strong sense of urgency.

Experienced and successful researchers will readily identify an important parameter for success in research: timing. Even a few months of delay in deciding to initiate a research program in a particular area may determine whether an investigator will make an important contribution to the field, or the field will move past him or her. In highly competitive areas of science, a delay of a few months may eliminate the chance that one's ideas will dominate the scientific thinking in a given area. This is not merely a blow to a researcher's ego, it may be crippling to an investigator's research program. Those who determine the theme of scientific discourse also control the ideas about what represents important research and, ultimately, which research efforts should receive support, i.e. be funded. If one loses in the arena of ideas, then one most likely also loses in the competition for securing funds. Loss of success in obtaining research funding could very quickly destroy the research productivity and future research career of a faculty member. Successful researchers know how important the timing of completion of a research project is, and it is for this reason that they are working today on those ideas that they hope to see funded two, three, or four years from now. As a fellow researcher once told me, "Use today's money to prepare to ask for tomorrow's research money."

What many individuals in the business world frequently do not appreciate is that successful researchers are similar to successful entrepreneurs; they have a strong drive to succeed, a sense of urgency about grabbing onto opportunities, a fear that they may not succeed, but also a gambling spirit that they will be the ones who do succeed. Not all faculty members, of course, have this strong sense of urgency and gambling spirit, any more than all businessmen have a true "entrepreneurial" spirit.

If the conduct of research by a faculty member requires these substantial efforts that are well above and beyond the daily tasks of class preparation, lecturing to students, advising, and

performing service for one's department, school, university, or discipline, then why do faculty pursue research in an academic environment? A partial answer is that the process of discovery of new facts is very highly reinforcing to any researcher. When a prediction is made about the possible outcome of an experiment and the data gathered confirm the prediction, this is as dramatic a moment in one's life as having won a large sum of money in the lottery. This is why the success or failure of an experiment can cause rather dramatic changes in a researcher's mood.

A second reason for pursuing research studies within an academic environment is the fact that such activity reaches to the core of what academic life is, i.e., the close intellectual interaction between professor and student. The mentoring of graduate students and post-doctoral associates takes us back to the process of teaching used in the earliest universities established, the philosopher-teacher who lived and taught in a continuously interactive environment with his (it was almost exclusively "his" in the early days of structured universities) students. The conduct of research in an academic environment also involves the sharing of knowledge between professor and student or research associate, the demonstration of techniques for experimental design and execution, the joint planning of a tightly reasoned experimental attack into unknown territory, the teaching of all precedents and intricacies of the discipline that may predict the outcome of an experimental study, and the sharing in the happiness of new discoveries or in the deliberate redesign of the experiments in case of failure. In my experience, the direct personal interaction involved in designing or analyzing experiments together with post-doctoral associates and graduate students who work with me, as well as the process of mentoring these individuals on the intricacies of the conduct of experimental research, is frequently the highlight of my day. As someone who still works at the "frontline" of research while trying to function also as a faculty member and an administrator, thinking about and discussing research ideas with colleagues is still one of the most thrilling aspects of my duties as an academician.

It is true that many of these activities do not need to be performed within the confines of an academic institution. But, the opportunity to incorporate the newest observations and ideas from recent discoveries into my lectures to graduate and undergraduate students, transforms what could become a routine experience of teaching the same topic again and again into an exciting undertaking. In my years in academia I have observed that many excellent teachers are also outstanding researchers who derive pleasure by being able to transfer their knowledge and their excitement about their research areas to their students. In their way, these faculty researchers are paying their debt to society for the training that they received as students and post-doctoral associates and for the opportunities they were given to pursue this very high form of intellectual activity. These are the reasons, I believe, why so many excellent research scientists do not leave academia to pursue careers in research institutions or in research divisions of industrial companies.

What I have described above is the life of a faculty researcher, a life full of many wonderful reinforcers for success in the research arena coupled with many periods of self-doubt and worry. Accomplishments in this arena by any faculty member of a university, whether young or old, experienced or inexperienced, frequently come at the expense of having free time to engage in extra reading, social interactions, and just plain enjoyment of life. Planning and thinking about new experiments, executing the crucial experiments that prove or disprove an important idea, analyzing large arrays of data, putting intellectual order to the results of research

findings, writing up the results of the research endeavors in manuscripts prepared for publication or in proposals submitted to funding agencies does take its toll on the time that a faculty member has to pursue other interests. As a faculty researcher I can easily recognize those who are performing well in research and teaching. They are frequently the ones who are in their offices or laboratories late into the night, during weekdays, weekends, and holidays.

University Support for Faculty Research

It is not surprising that some of the very productive research faculty are impatient with colleagues who perform little research. The faculty who have structured and manage very active and competitive research programs are sometimes perplexed by the expectation that they and their cohorts who do not carry as many burdens should share equally in the distribution of both reinforcers (primarily merit pay increases) and teaching or service burdens. Some of these very active researchers may also feel that the administrators of their academic units or of the university do not appreciate their contributions, or are too willing to judge their worth to the academic unit and the university solely on the amount and extent of undergraduate teaching and advising that they perform. If a university values the contributions of its research faculty and the dedication that most of them exhibit in the pursuit of excellence in both research and teaching, then it should provide substantial and clearly distinguishable reinforcers to the productive research faculty and should modify some of the expectations with respect to the amount of teaching and advising that they perform. It is not necessary that a university pamper these individuals, rather that it frees some extra time for active researchers to pursue the conduct of investigative work.

What should a major research university do so that the likelihood of success of the research faculty is enhanced? In my opinion, this begins by providing an adequate “start-up package” to newly hired faculty, especially to faculty researchers in scientific areas that need expensive instrumentation and supplies to set up a research laboratory and initiate a research program. Given the very high competition for research funding that exists currently in the United States, we should not be thinking only of providing adequate funds for the purchase of instrumentation and supplies for the laboratory of a new faculty member, but also of providing support for the hiring of research assistants and associates for a two year period. Individuals who can perform the experimental work while a new faculty member works hard at writing grant proposals to receive external funding or while she or he is putting together the materials for new courses, is an almost absolute necessity. In addition, recognition of the enormous amount of effort that it takes to get a research program started and funded, most universities should make it a policy that the expectations for teaching during that first, critical year in the life of an academic researcher, are minimal. A faculty member who has to prepare for two or more new courses that he or she may have to teach during the first year at a university is a faculty member who is not likely to pursue research grant funding very vigorously, let alone succeed in receiving such funding.

The first few years in the career of faculty researchers are the most crucial in determining the future productivity and success of these individuals. A research program that operates with minimal funding and is operating in spurts of activity followed by inactivity will never become a solid platform on which future accomplishments can be based. If a university truly values the

research talent that it has managed to attract to its ranks of faculty members, then it should create all conditions for guaranteed success. This should include providing well-planned mentoring of the new faculty members by accomplished research faculty as well as readily available assistance in research grant preparation and review prior to submission to funding agencies. Success early on in a faculty member's career begets success for the long run.

It is obvious that the approaches that a university takes to cultivate its research faculty should not be restricted solely to efforts made to enhance the success of the newly hired faculty. As important as any "start-up" package that a university might put together is, the creation of a "research-supportive" environment is equally important in attracting and keeping research faculty in a university. What characterizes a "research-supportive" environment are some of the things described above, such as reinforcing faculty who are active in research and setting up differential levels of teaching obligations. A "research-supportive" environment should also include the creation of facilities and services that enhance research productivity. Universities need to make major investments in the purchase of shared instrumentation and the establishment of modern computational facilities, the provision of special services such as statistical consultants, instrument design laboratories, laboratories that perform sophisticated measurements in the physical and natural sciences, and support staff for establishing liaison with funding agencies, preparing manuscripts and grant proposals, managing budgets, and preparing materials for effective communication. Furthermore, as funding from the federal and state governments is diminishing, another important aspect that universities need to include in creating a "research-supportive" environment is that of providing staff with expertise in negotiating contracts with the private sector for the support of research, in fostering technology transfer efforts from universities to private companies, and in protecting the intellectual property of the faculty and the university through patents and license agreements.

The Need for the Pursuit of External Funding for Research at a University

The creation of excellent research programs within the university community of faculty researchers requires very substantial investments which undoubtedly diminish the pool of funds available for other needs of a university, possibly even constrain some investments made in the area of instructional improvements. This poses a great dilemma for most comprehensive universities. The issue, of course, is why should a university make these substantial investments in the research sector. The answer is based on what the mandate of a comprehensive research university is. The conduct of research and graduate training are two key components of this mandate. Extended a bit further, one may argue that the reason that society gives faculty at universities the right to earn life-time tenure is because it expects them to pursue the generation of new knowledge unhindered by political or social pressures. Tenure is not granted merely for the purposes of performing good teaching. But, as outlined above, the conduct of research requires very substantial investments and it is for this reason that both public and private funding for research is being pursued vigorously by all major universities.

It is nearly impossible for a comprehensive university to train graduate students in the physical, natural, behavioral, or social sciences without adequate funding for the conduct of original research. There are few programs in those fields that can attract graduate and post-graduate students solely on the basis of offering excellent theoretical training without any

component of laboratory or applied scientific research training. If one assumes that students are attracted to the programs that offer the best opportunities for “hands on” research training, then not only should those programs maintain active and well-funded research, but they also need to have established well-funded graduate training programs. Thus, a key ingredient of a “research-supportive” environment is the partnership between government, private sector and universities in the funding and support of the training of graduate and post-graduate students in the disciplines represented in a comprehensive research university.

Success in achieving external funding to assist in the establishment of vibrant graduate training programs depends heavily on the presence of faculty who are active and well-funded researchers and who direct vigorous research programs. The majority of the faculty in academic units with successful graduate research training programs are tenured for life, as one would expect for truly accomplished academicians who have succeeded in all spheres of academic performance. Yet, it has frequently been pointed out that the most dangerous aspect of tenure is the feeling of self satisfaction and the slow but progressive diminution of the efforts of the faculty to be bold and to work hard to discover new horizons for their disciplines. Although, in my experience, most faculty members do not retire “on the job” just because they have received tenure, there is some truth to the observation stated above. There is certainly no magic bullet to cure creeping complacency in the post-tenure period. Not even devotion to research can guarantee the prevention of slowing down in one’s dedication to the pursuit of new knowledge. However, if one subjects himself or herself continuously to the scrutiny of their peers, especially their peers outside their own university, there is a greater probability that she or he will remain current in their knowledge and research skills. This is one of the major reasons why faculty should never stop conducting research or having their research papers and grant proposals reviewed and evaluated by the community of researchers around the nation and the world. Subjecting both one’s own research program as well as the graduate training programs of the department to a peer review process may be the only antidote to complacency and slow drift to a state of irrelevancy. Therefore, the need to pursue the funding of vibrant and successful research and training programs should be a characteristic that spans the entire career of a faculty member, from the shaky first steps into the world academic research by a young assistant professor to the more secure and confident walk through programmatic research by a seasoned full professor.