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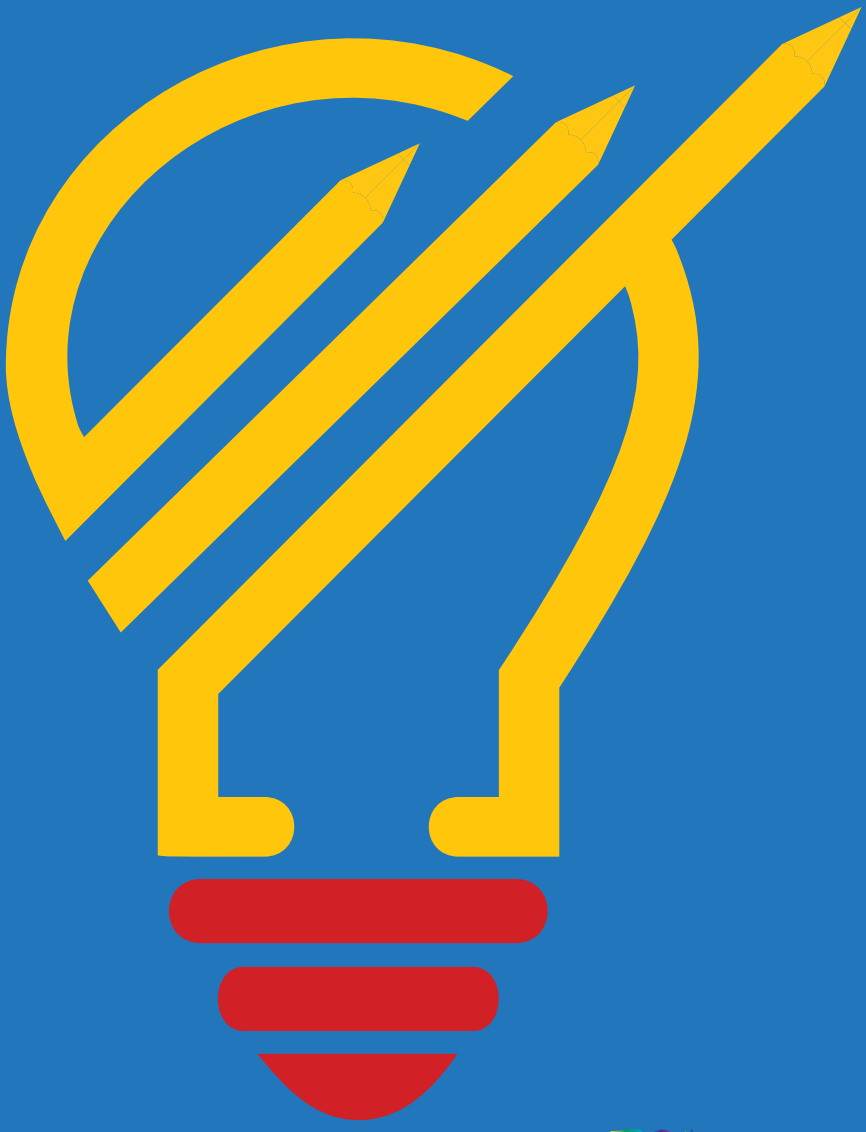

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SRA

FROM THE EDITOR'S DESK

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From the Editor's Desk

Timothy L. Linker
High Point University

Anniversaries are a time of celebration, as we reflect upon the past and look forward in anticipation. This issue of the *Journal of Research Administration* is no different. As an imprint of the Society of Research Administrators International (SRAI), the *Journal* is pleased to dedicate this issue in commemoration the Society's fiftieth anniversary. Throughout this issue, we rediscover our past, examine our present, and ponder our future.

The Society established the Journal in 1967. In the intervening forty years, the Journal has laid to page numerous articles that have shaped our profession. In this issue, we highlight two previously printed articles that are representative of our body of work. First, Edward N. Brandt's prophetic article Research Administration in a Time of Change, originally published in 1987, offers a research administration road map for the past thirty years. In it, Brandt offers his thoughts on how research administrators would need to respond to challenges on the horizon. Its clarity and consideration are timeless. Next, Dr. Robert Porter's 2005 Rod Rose Award winning article Why Academics Have a Hard Time Writing Good Grant Proposals, continues to be cited and used throughout our field. In it, Dr. Porter discusses the inherent differences in grant and academic writing styles. Dr. Porter also offers research administrators strategies to assist their faculty. Twelve years later, research administrators and faculty would both be well-served to read and incorporate Dr. Porter's precepts.

In examining our present, Snyder and coauthors examine the skills and knowledge needed to serve as a chief research officer in their article *The Roles of Chief Research Officers at American Research Universities: A Current Profile and Challenges for the Future*. The authors also offer insights on effective ways to prepare future candidates. In their article *Greater than the Sum of its Parts: A Qualitative Study of the Role of the Coordinating Center in Facilitating Coordinated Collaborative Science*, Rolland, Lee and Potter investigate the effort needed to effectively facilitate biomedical research spread across institutional, geographic and, often, disciplinary boundaries. Squilla, Lee and Steil share the lessons learned in creating a shared service model for research administration at Thomas Jefferson University in their article *Research Shared Services: A Case Study in Implementation*. Finally, their article *Perspectives on Institutional Bridge-Funding Policies and Strategies in the Biomedical Sciences*, Yates and Warren detail the rationale and factors that are critical to managing a successful bridge-funding program.

In looking to the future, Cindy Keil, SRAI President, offers a path forward for the Society's in the recently completed SRAI Strategic Plan. I encourage you to read the plan and learn about how SRAI is focusing on its members. The *Journal* is working to incorporate this plan by using its tenets as a lens for decision-making and programming.

As always, I want to thank the *Journal's* Deputy Director, Dr. Nathan Vanderford, and editorial board for their outstanding efforts. Your *Journal* team works hard to bring you the best in our field. I also want to offer a special note of thanks to all those who served on the *Journal* or authored articles in the past forty years. We gratefully acknowledge your efforts, without which, the *Journal* would not be where it is today. Finally, if you are a non-SRAI member and wish to have the *Journal* delivered to you via email, please sign up here or send a message with your name and institution to journal@srainternational.org.

ARTICLES

Reprint 1987: Research Administration in a Time of Change

Edward N. Brandt

Foreward

If you removed the dates and the referenced NIH increased funding, this article rings as true today as it did thirty years ago. The world's universities continue to serve as an unparalleled knowledge generator, solving some of our most difficult questions. Yet, as the pace of research seemingly quickens each year, and correspondingly its administration, it is useful to turn back the clock and see from where we came.

As the author suggested, we, as research administrators, focused considerable time and attention to the issues of protecting researcher time, promoting interdisciplinary research, determining efficient facilities use and sharing, creating effective accounting systems, and planning the growth of our research enterprises. Yet, our field is ever expanding into other areas, such as information security and scientific misconduct. Thirty years ago, the thought of a multi-faceted class of professionals dedicated to the efficient and effective management and administration of research would be an unrealized dream of a stalwart few, yet, here we are.

I wonder what the next thirty years will look like and, when we arrive, what Journal article will we look back upon and realize that the path forward was laid out before us the entire time.

— Tim Linker, JRA Editor-in-Chief

Abstract: *The field of biomedical research has undergone several changes in recent years. These include increased funding, the rapid development in scientific knowledge which speeds up the obsolescence of equipment, facilities and knowledge and the growing complexity of scientific problems. Research administrators can take steps to address these changes such as encouraging interdisciplinary research, making optimum use of resources and developing accounting systems for resources.*

Change. It is a very small word...only six letters...and yet, the meanings connoted arouse great emotions, including fear, anxiety, and occasionally great enthusiasm. Like all people, those of us involved in biomedical research are full of paradoxes. We deal in change virtually every day. New discoveries, new insights into biological processes, and scientific advances are the life blood of our activities. Yet, change that is not under our control is strongly resisted. Unfortunately, there is a lot of that.

Let me just review a few of the changes going on in the world around us.

First, the last 5 years [1981-1986] have seen massive increases in funding for biomedical research. Indeed, the NIH budget alone has risen over 50% in the past 5 years. That amounts to nearly $2.5 billion more funds available than in 1981. Yet, at the same time, we have seen competition for those funds also increase dramatically. In fact, at a higher rate. As a consequence, the

percentage of submitted proposals deemed to be of scientific merit that are funded drops each year and is now at about 25%. This competition forces investigators to spend a great deal more time developing proposals and creates increased pressures to produce quickly.

Second, the rapidity of advances in scientific knowledge and understanding leads to more rapid obsolescence of equipment, facilities, people, and knowledge. Such changes lead to a greater need for some flexible funding to maintain up-to-date scientific equipment and facilities as well as the ability to send faculty on sabbaticals for retooling of their skills.

Third, scientific problems are becoming more complex...demanding more and more interdisciplinary efforts. Yet, most of our institutional reward systems, including promotions, tenure and pay increases, are based upon individual efforts, not team efforts. Since most of our people have grown up in such reward systems, they have little or no experience in interdisciplinary research and, therefore, are reluctant to engage in it. Yet, that is where the action is.

Fourth, various components of our society are demanding greater accountability via regulation of what we do. Hence, all of us are involved in adapting to new regulations with respect to human experimentation, legal efforts to restrict animal experimentation, more rigidity in personnel rules, and similar steps. These efforts, of course, detract from the research activities.

Fifth, we are seeing new arrangements for biomedical research, including joint ventures with profit-making corporations and, indeed, corporations being developed by universities. These new arrangements have caused us to re-examine our concepts of conflicts of interest, communication of research results, and other aspects of the research environment.

Sixth, a new phrase has been added to our lexicon, namely, scientific misconduct. Whether the increased frequency is real or apparent, it has become a problem that must be faced. I first became involved with this while in Washington, and cases began to surface. At first, most of us felt that we were only seeing a few aberrant cases, but as the situation became more public, I was stunned at the number of investigations we were forced to undertake largely due to reports from scientists in academic institutions. Some of the more prestigious medical journals in the world have found it necessary to retract publications. Now, most academic institutions have policies in place to deal with something that was virtually unheard of 10 years ago. Those that don't have such policies should develop them. The reported occurrences have called into question the whole concept of peer review of scientific research. At least one journal now requires signed verification of the involvement of co-authors, and a conference will soon be held to explore better ways to ensure that articles published in our journals are valid reports.

Yet, some still say that scientific misconduct is not a problem; rather, a few people are making too much of a few instances. One can only wonder how many cases constitute a problem - one? - two? - three? - more? The acceptance of scientific results by the public is based upon credibility, and I would argue that one case is too many. It is our responsibility to initiate the steps necessary to prevent more.

Other things could be added to this list. The point is that the research environment is undergoing great change and that change is leading to confusion, uncertainty, and confrontation. An

enormous amount of creative energy is being wasted in this environment.

The fundamental question is, what can we do about it? In my opinion, persons charged with the responsibility of administering and leading research endeavors - whether they be in universities, research institutes, or industry - must become aggressive in their efforts. I would suggest the following.

First, we must not lose sight of the fact that our research enterprise is built on brains and hard work. Those individuals who have the talent and expertise to advance our knowledge must be given the opportunity to do so with a minimum amount of interference. We must find ways to protect them from all of these outside pressures while, at the same time, insisting that they be accountable in their efforts. That is difficult but essential.

Second, we must structure our programs to encourage interdisciplinary research. That means taking a fundamental look at our reward systems and providing whatever training and incentives are required to accomplish this. There is no set way to do this. Indeed, there are many ways to accomplish it. For example, one can have a loose collection of investigators, each of whom is working on their own research but who meet periodically to evaluate what is going on, to explore new directions for this research, and to see how their results fit together. At the other extreme is the formation of a team which makes assignments to each of the members to accomplish a goal.

The important message is that whatever the research problem, it now encompasses more than one discipline. Consider AIDS, heart disease, trauma, or any other modern problem in medicine. None of them are strictly biochemical, physiological, or the sole province of any one discipline.

Third, we must make maximum use of our resources. In my judgment, that means joint use of research equipment and other components of our facilities. When I first became heavily involved in research in the 1950s, I maintained my own animals in my own facilities, had all of my own research equipment, handled my own grants, and in short, had a totally independent operation. I was involved in computers with my own grant and my own computing equipment. Now, however, we share animal resources which are staffed by people trained in the management of research animals, and we depend heavily on central libraries, central computer facilities, and a host of other things. Yet we still insist that our laboratories be completely equipped even if we only use the equipment an hour or so a day. I have no doubt but that the funding agencies which are already taking steps to end this practice will end it. We need to be ahead of them so that we can influence their policies and directions to benefit our situation. If we do not develop our own approaches to these problems, we will have solutions imposed upon us.

Fourth, we must develop very effective accounting systems dealing with our resources. We need to know the age and repair history of all research equipment, especially the more expensive items; the training levels and experiences of technicians so that they can be transferred into places where they can be more productive; complete knowledge of research space, including air handling, electrical, and other aspects; and so forth. In that way, we can begin to predict replacement and upgrading costs for the future and begin to make the necessary plans to allocate our research accordingly.

Finally, we need to become experts at strategic planning for research. Most institutions will not be capable of developing research enterprises in all areas. The question is, which areas shall each institution develop? By developing great expertise in a few areas, we will make greater contributions than simply trying to cover the waterfront. That seems obvious but I know of very few institutions that do this sort of planning well. Again, during my time in Washington, I saw institutions that had numerous grants that were approved and unfunded in a wide variety of areas. Many of these grants were not funded because the reviewers felt that there was not an adequate critical mass or not enough of a commitment from the institution to warrant the allocation of funding to a particular proposal. Some institutions interpret this as a bias, but as a taxpayer, I found it a prudent way to solve research problems. After all, you have to realize that the NIH and ADAMHA and other granting agencies are not in the business of sustaining institutions. They are in the business of stimulating and funding the solution to health problems that plague Americans. That is their mission, and our society has wisely chosen to do this by involving a wide variety of institutions rather than simply developing governmental laboratories as is done in many other countries. Hence, federal funding agencies are held accountable on that basis and not on the criteria of whether a particular university was able to develop a biochemistry department.

This is the most exciting time in medicine that I have ever seen. Not only are we faced with great change in the scientific environment, we are also seeing great change in the health care environment. Let me remind you that academia is responsible for most of these changes. If we had not been so successful in advancing medical science, we would not be faced with the kinds of problems that we now face. Given the choice, I will accept the present situation. I have no doubt but that we can deal with the current problems. One approach is to just muddle along and hope to survive. That, however, does the country no good, our faculties no good, our students no good, and most of all, it does no good for those people whose hard-earned tax dollars are being spent in the hope that the results will improve their quality of life.

Effective research administration is important, indeed vital, if this country is to have a strong, productive medical research program. That we will cope with the current stress, I have no doubt, but each of us must participate

Editor's Note

This article, originally published in the Fall 1987 issue of the SRAI Journal and was subsequently reprinted in Fall of 1997, is based on a presentation at the Northeast Section meeting of the Society of Research Administrators International in Baltimore, Maryland, May 1987.

Reprint 2007: Why Academics Have a Hard Time Writing Good Grants Proposals

Robert Porter
Virginia Tech

Preface

My technique for getting a paper published: Start by thinking of a jazzy title, one that will tempt readers to dive in. In the summer of 2006, "Why Academics Have a Hard Time Writing Good Grant Proposals" seemed jazzy enough, and it worked. The paper was inspired by a phone call from a senior scholar at Virginia Tech, well known in his field, who was quite put out when his grant proposal was declined. Sensing the need for a consultation, I asked him to bring me the proposal, together with reviewers' comments. He did, and when he plopped the papers on my desk, on top was the lead reviewer's evaluation summary, which began "Reads like a journal article." A light bulb went off.

I had known for some time that successful grant proposals had a different style and feel than scholarly articles in academic journals, but I never thought very clearly about exactly what made the two styles so different. As I started to focus on the subject, several contrasting qualities were immediately evident, and others fell in line as I worked through the first draft. The paper seemed to write itself, and it was actually fun to do the necessary revising and editing before shipping off the final product to compete in SRAI's 2006 Symposium competition. To my surprise and delight it took first place, and was published in the Journal of Research Administration's Fall 2007 edition.

Looking back ten years later, one has to ask, has much changed since then? The answer: Not much. If anything, proposal writers are under even greater pressure these days to express their research ideas in clear, concise and persuasive prose, in a style that meets the heightened expectations of today's reviewers. For more than a decade, I have travelled throughout the country conducting grant writing workshops based on ideas in the paper, ideas that have been well received by researchers in many universities.

More recently, with generous support from SRAI's International Fellowship program, I have delivered similar presentations at conferences of the Association of Research Managers and Administrators (ARMA) in the United Kingdom and the European Association of Research Managers and Administrators (EARMA), which meets annually in various locations on the continent. Though funding sources and reviewing procedures differ a great deal from country to country, I'm delighted to report that the headaches associated writing strong grant proposals appear to be universal.

So I'm honored to learn my paper has been selected for reprinting in SRAI's 50th anniversary edition. I sincerely hope it will continue to be of help to grant writers and research administrators alike.

Robert Porter, PhD
Grant-Winners Seminars
Knoxville TN 37920
Tel: (865) 577-4816
Email: reporter@grant-winners.com

Abstract: *This paper discusses the contrasting perspectives of academic prose versus grant writing, and lists strategies grant specialists can use to help researchers break old habits and replace them with techniques better suited to the world of competitive grant proposals.*

Introduction

When they are new to the grant game, even scholars with fine publishing records can struggle with proposal writing. Many are surprised to find that the writing style that made them successful as academics is not well suited to crafting a winning proposal. To succeed at grant writing, most researchers need to learn a new set of writing skills.

Academic Writing

For purposes of this discussion "academic writing" is defined as that style commonly adopted for scholarly papers, essays, and journal articles. The following is a typical example:

> Taken together with the findings from the present study that (a) workplace aggression in the primary job was more closely associated with negative work experiences and (b) both situational and individual characteristics played a role in aggression in the secondary job, future research might benefit from a greater focus on the subjective salience of the job as a moderator of the relationship between workplace experiences and supervisor-targeted aggression. Indeed, despite the differential effects of situational and individual difference factors on aggression, it is notable that the individual difference factors exerted a consistent but relatively low-level effect on aggression across contexts, whereas the more salient situational experiences exerted context-specific effects. (Inness, Barling, and Turner, 2005)

Look at the Difference

To start, glance at the first pages in any sampling of winning grant proposals. The first thing you notice is that they look different from pages in typical academic journals. Sentences are shorter, with key phrases underlined or bolded to make them stand out. Lists are printed bullet style. Graphs, tables and drawings abound. Now read the pages more carefully. The writing is more

energetic, direct and concise. The subject matter is easy to understand, as there are fewer highly technical terms. Each time you learn something about a subject entirely new to you. You are intrigued by exciting new ideas that have a good chance for success. In short, you quickly agree that the review panels made the right choices in funding these proposals

The lesson here is a hard one for beginners: Success in grant writing is a matter of style and format as much as content. Make no mistake— the best written proposal will not win money for a weak idea. But it is also true that many good ideas are not funded because the proposal is poorly written (New & Quick, 1998; Steiner, 1988). Sometimes the failure is due to a weak or missing component that is key to a good proposal. The research plan may be flawed or incomplete. The evaluation methods might be inadequate. The researchers may not be qualified to carry out the work. But all too often, the core problem in a failed proposal lies in the writing itself, which bears too many characteristics of academic prose. (A baffled professor once came to my office bearing the written critiques he had received from reviewers of a failed proposal. One of them included this killer remark: "Reads like a journal article.")

Contrasting Perspectives

To understand the dimensions of the overall problem, consider the contrasting perspectives of academic writing versus grant writing:

Table 1. Academic Writing versus Grant Writing: Contrasting Perspectives

Academic Writing	**Grant Writing**
Scholarly pursuit: *Individual passion*	**Sponsor goals:** *Service attitude*
Past oriented: *Work that has been done*	**Future oriented:** *Work that should be done*
Theme-centered: *Theory and thesis*	**Project-centered:** *Objectives and activities*
Expository rhetoric: *Explaining to reader*	**Persuasive rhetoric:** *"Selling" the reader*
Impersonal tone: *Objective, dispassionate*	**Personal tone:** *Conveys excitement*
Individualistic: *Primarily a solo activity*	**Team-focused:** *Feedback needed*
Few length constraints: *Verbosity rewarded*	**Strict length constraints:** *Brevity rewarded*
Specialized terminology: *"Insider jargon"*	**Accessible language:** *Easily understood*

Scholarly Pursuit versus Sponsor Goals

Driven to make unique contributions to their chosen fields, scholars habitually pursue their individual interests, often with a good deal of passion. When seeking financial support for these endeavors, however, many find that potential sponsors simply do not share their enthusiasm. "A sound concept, but it does not fit our current funding priorities," or similar phrases, are commonly found in letters that deny funding. With the exception of a few career development programs, funding agencies have little interest in advancing the careers of ambitious academics. Sponsors will, however, fund projects that have a good chance of achieving their goals. This is why seasoned grant writers devote a good deal of time parsing grant program announcements, highlighting passages that express what the sponsors want to accomplish, and what kind of projects they will pay for. Then the writers adopt a service attitude, finding ways to adapt their expertise to match the sponsor's objectives. Finally, they test their ideas with grant program officers before deciding to write a proposal. As one of our university's consistently successful grant writers put it: "My epiphany came when I realized that grant programs do not exist to make me successful, but rather my job is to make those programs successful."

Past versus Future Orientation

In academic writing, the researcher is describing work that has already been done: Literature has been reviewed, an issue examined, a thesis presented, a discovery made, a conclusion drawn. Grant writers, by contrast, describe in detail work that they wish to do. For some disciplines, good grant writing can be viewed as science fiction, i.e., it must be grounded in solid science, but the research design itself is a set of logical yet imagined activities that have yet to take place. This in itself is a major shift in perspective that seasoned scholars find difficult when starting to write proposals.

Theme-Centered versus Project-Centered

Scholarly writers are prone to dwell on theme, thesis and theory. Essays and books can be devoted to the authors' original thinking, contributions of past and present scholars, or the evolution of entire schools of thought. They draw us into the realm of ideas. Grant writers, however, draw us into a world of action. They start by sketching out an important problem, then they move quickly to describing a creative approach to addressing that problem with a set of activities that will accomplish specific goals and objectives. The overall project is designed to make a significant contribution to a discipline or to a society as a whole.

Academic writers often seek funding to "study," "examine," or "explore" some theme or issue. But this can be deadly, as sponsors rarely spend money on intellectual exploration. They will, however, consider funding activities to accomplish goals that are important to them. It is the project that interests them, not just the thinking of the investigator. Finally, academic essays end with their authors' final conclusions, while grant proposals end with their projects' expected outcomes.

Expository versus Persuasive Rhetoric

The academic writer uses language to explain ideas, issues and events to the reader. The aim is to build a logical progression of thought, helping the reader to share the writer's intellectual journey and to agree with the core themes of the piece. But the language in a grant has to be stronger; it must sell a nonexistent project to the reader. The writer has to convince the reviewer that the proposed research is uniquely deserving. The whole effort is geared toward building a winning argument, a compelling case that scarce dollars should be spent on a truly exceptional idea that has an excellent chance for success. Grant reviewers are a notoriously skeptical lot who reject a majority of proposals, so writers must use language strong enough to win their reluctant support. In effect, a good proposal is an elegant sales pitch.

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Impersonal versus Personal Tone

From their undergraduate term papers to their doctoral dissertations and numerous papers that followed, scholars have been conditioned to generate prose in proper academic style—cautious, objective and dispassionate, exclusively focused on the topic, with all evidence of the writer's persona hidden from view. Grant writers, however, seek the reviewers' enthusiastic endorsement; they want readers to be excited about their exemplary projects, so they strive to convey their own excitement. They do this by using active voice, strong, energetic phrasing, and direct references to themselves in the first person. Here are some examples:

> Our aim with this innovative curriculum is to improve the supply of exceptionally skilled paramedics with National Registry certification.
>
> This project will provide your grant program with a powerful combination of cutting edge nanoscale science and frontier research in applied geochemistry.
>
> Though we launched this large and ambitious program just two years ago, we are gratified by the regional and national awards it has garnered.

Sentences like these violate editorial rules of many scholarly journals.

Solo Scholarship versus Teamwork

With the exception of co-authored work, academic writing is mostly a solo activity. Perched at a desk, in the library or at home in the den, the solitary scholar fills page after page with stolid academic prose. When the paper or book chapter is completed, it may be passed to one or two readers for final proofing, but the overall endeavor is highly individualistic. Good grant writing, however, requires teamwork from the outset. Because their ultimate success depends upon nearly unanimous approval from a sizeable group of reviewers, grant writers place high value on feedback at every phase of proposal writing. Before the first draft, a thumbnail sketch of the basic concept will be sounded out with colleagues before sending it on to a grant program officer to test whether the idea is a good fit. Large multi-investigator proposals are typically broken into sections to be written and rewritten by several researchers, then compiled and edited by the lead writer. Many large proposals are submitted to a "red team" for internal review before sending them out to the funding agencies. Even single investigator proposals have been combed over repeatedly as the documents move from first draft to the final product. Proposals that bypass this essential process have a much greater chance of failure.

Length versus Brevity

Verbosity is rewarded in academe. From extended lectures to journals without page limits, academics are encouraged to expound at great length. A quick scan of any issue of The Chronicle of Higher Education reveals the degree to which simple ideas can be expanded to multiple pages. A common technique is to stretch sentences and paragraphs to extreme lengths. Consider the following example, which won a Bad Writing Contest sponsored by the journal Philosophy and Literature:

> The move from a structuralist account in which capital is understood to structure social relations in relatively homologous ways to a view of hegemony in which power relations are subject to repetition, convergence, and rearticulation brought the question of temporality into the thinking of structure, and marked a shift from a form of althusserian theory that takes structural totalities as theoretical objects to one in which the insights into the contingent possibility of structure inaugurate a renewed conception of hegemony as bound up with the contingent sites and strategies of the rearticulation of power. (Butler, 1997)

An extreme example perhaps, but its characteristics can be seen in many scholarly essays.

Grant reviewers are impatient readers. Busy people with limited time, they look for any excuse to stop reading. They are quickly annoyed if they must struggle to understand the writer or learn what the project is all about. Worse, if the proposal does not intrigue them by the very first page, they will not read any further (unless they must submit a written critique, in which case they immediately start looking for reasons to justify why the proposal should not be funded). When asked to describe the characteristics of good grant writing, senior reviewers put qualities such as "clear" and "concise" at the top of the list (Porter, 2005). Brevity is not only the soul of wit; it is the essence of grantsmanship. Or, to cite Mies van der Rohe's famous dictum about modern architecture: "Less is more."

Specialized Terminology versus Accessible Language

Every discipline uses specialized terminology, much of it dictated by the need to convey precise meaning. But there reaches a point where specialized words become needlessly complex and the reader becomes lost in a tangle of dense verbiage. As Henson (2004) points out, a spell comes over us when we know our writing will be evaluated, either by editors or by grant reviewers: We want our work to appear scholarly, so we habitually inflate our prose with large words and complicated sentences to achieve the effect of serious thinking. Unfortunately, such tactics have the opposite effect on readers. Alley (1996) shows how too many big words and convoluted expressions can result in muddled jargon:

> The objective of this study is to develop an effective commercialization strategy for solar energy systems by analyzing the factors that are impeding commercial projects and by prioritizing the potential government and industry actions that can facilitate the viability of the projects.

A sentence like this could kill a grant proposal on the first page. Grant writers cannot afford to lose even one reviewer in a barrage of obtuse phrasing. They must use language that can be understood by a diverse group of readers, some of whom may be as highly specialized as the writer, but most will be generalists. Reworking the cumbersome structure above, Alley comes up with simpler, more accessible language:

> This study will consider why current solar energy systems have not yet reached the commercial stage and will evaluate the steps that industry and government can take to make these systems commercial.

Fewer words with greater clarity—a tradeoff that will improve the score of any grant proposal. But how can one consistently strike a balance between scholarly precision and meaning that is clear to a mixed audience? One NIH web site on grant writing advises writers to study articles published in Scientific American (National Institute of Allergy and Infectious Diseases [NIAID], 2006). Here world class scientists use accessible language to teach a general readership about complex subjects while simultaneously informing them of cutting edge developments. Good proposals do the same. The following excerpt is from a recent Scientific American article on stem cells and cancer research:

> Conventional wisdom has long held that any tumor cell remaining in the body could potentially reignite the disease. Current treatments therefore, focus on killing the greatest number of cancer cells. Successes with this approach are still very much hit-or-miss, however, and for patients with advanced cases of the most common solid tumor malignancies, the prognosis remains poor. (Clarke & Becker, 2006)

Clinically accurate yet easily understandable, this would be a fine introduction to a grant proposal.

Remedial strategies

IGiven the contrasting perspectives listed above, what can the university research office do to help academics adapt to the unfamiliar standards of grant writing? First, recognize that no one likes to be told they do not write well, especially highly educated folk who are justly proud of their intellectual achievements. Nevertheless, proactive and tactful research administrators can do much to help instill good proposal writing habits. Here are five remedial strategies that instruct without offending.

1. *Home Grown Workshops*
   The big lesson is not to take rejection personally, because when you throw in the social dynamics of the panel, and the large number of proposals they've looked at in a short period of time, it's a crapshoot. Also, remember you're writing a document that most panelists are not going to read-they're going to look at parts of it, but they won't read it from start to finish-so you better put some eye-catching things in there to hold their attention. (D. Inman, personal communication, 13 May 2004).
2. *Reading Successful Proposals*
   Winning grants teach by example. By perusing several, the new grant writer will note some common differences from accepted academic style, and can be encouraged to mimic them. Successful proposals from one's own institution can be put online, with access limited to internal researchers. Copies of winning proposals can also be purchased from The Grant Center at reasonable rates: www.tgcigrantproposals.com. Finally, successful proposals can be obtained directly from federal agencies under the Freedom of Information Act, but be prepared to wait several months for the documents to arrive, with sensitive information deleted.
3. *Editing by a Grants Specialist*
   While no amount of editorial polishing can save a weak idea, a seasoned grant writer can add value to a sound concept by judicious editing. This is labor intensive at first but once the writer catches on to the simpler, livelier style of grant writing, the need for personal attention drops off rapidly.
4. *Red Team Reviews*
   Writing a strong proposal for a major multidisciplinary grant is a challenging project all by itself, one that can overwhelm the researchers, for whom grant writing is often an additional chore on top of full workloads. One effective tool is to form an internal review team consisting of experienced senior colleagues. If carefully selected for their expertise and reputations, their written comments can have great impact. Be warned, however: A considerable degree of gentle but persistent nagging is required for the writers to have the document ready for internal review with sufficient lead time before the sponsor's deadline.
5. *Writing Tips*
   Finally, the research office should post a set of simple writing tips on its web site. These are most helpful if examples of bad writing are contrasted with effective revisions. Seeing them side by side, readers will quickly spot which bad characteristics are their own, and will note how they can craft better versions. Alley's work, in particular, is peppered with

numerous examples of weak composition contrasted with more effective phrasing. A truly time tested source is Strunk and White's familiar Elements of Style (2000). Versions of this concise, lively handbook have been popular for nearly half a century, and its instructions for crisp and vigorous writing will give heart to academics who are trying to break old habits.

Conclusions

As competition intensifies for limited research dollars, proposal success rates for most agencies are declining. To be successful in this environment, proposals must be written in a strong, persuasive style, and academic writers accustomed to a different style need help to develop more effective writing habits. Such leadership can be provided by a proactive research office that is sensitive to this pervasive need.

Authors' Note

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Robert Porter, PhD
Grant-Winners Seminars
Knoxville TN
Tel: (865) 577-4816
Email: reporter@grant-winners.com

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The Roles of Chief Research Officers at American Research Universities: A Current Profile and Challenges for the Future

Kelvin K. Droegemeier
University of Oklahoma

Lori Anderson Snyder
University of Oklahoma

Alicia Knoedler
University of Oklahoma

William Taylor
University of Oklahoma

Brett Litwiller
University of Oklahoma

Caroline Whitacre
The Ohio State University

Howard Gobstein
Association of Public and Land-Grant Universities

Christine Keller
Association of Public and Land-Grant Universities

Teri Lyn Hinds
Association of Public and Land-Grant Universities

Nathalie Dwyer
Association of Public and Land-Grant Universities

Abstract: *The individual charged with stewarding the academic research and creative activity enterprise (i.e., Chief Research Officer or Vice President/Chancellor for Research), has tremendous responsibility and influence over the institution's ability to achieve its overall mission. Yet, the skills and knowledge required to successfully serve in this role have not been comprehensively studied. To address this deficiency, we synthesize the views of 78 sitting Chief Research Officers to document the academic and experiential pathways of respondents, their current roles and responsibilities, and future challenges. We provide recommendations for effective ways of preparing future candidates for this important role.*

Keywords: *Chief Research Officer; Vice President/Chancellor for Research; training; experience*

A Current Profile and Challenges for the Future

American research universities currently face an environment of change, marked by broad opportunities for growth in terms of research development, as well as many challenges (Brint, 2005). Opportunities arise in research from new and diversified sources of funding, via partnerships with private industry, and by focusing on innovative and interdisciplinary areas of inquiry (Brint, 2005). Challenges emerge from a variety of sources: unpredictable federal and state funding, escalating competition for resources, increasing regulatory and compliance requirements, and the erosion of public support for the importance of university research (NRC, 2014; NSB, 2012; RUFC, 2012). Thus, the ability of the individual charged with leading the research enterprise (e.g., Chief Research Officer or Vice President/Chancellor for Research, hereafter referred to as CRO) to balance a multitude of conflicting forces has a substantial influence on the institution's capacity to maintain and increase its research productivity (Kulakowski & Chronister, 2006).

However, the only study published to date examining the role of CROs revealed that little consistency exists among job descriptions of the position of CRO across institutions, suggesting that responsibilities of the position vary widely (Nash & Wright, 2013). Nash and Wright (2013) found that actual job descriptions for the CRO position focused on skills and knowledge different from those CROs view as essential. Their study indicated that incumbents typically have led a prolific research career and cited their scholarly work as vital to obtaining their position, while CRO job descriptions focus more on the leadership skills and business acumen necessary for success in the position.

Despite the insights provided by Nash and Wright (2013), questions remain about the skills, knowledge, and personal characteristics needed to succeed as a CRO. In addition, the means by which individuals acquire necessary skills and experiences to excel in the role are not clearly identified, nor is the process by which an institution might best ensure a strong and diverse pool of candidates to fill the role in the future. Given rapidly changing elements of the CRO role (Kulakowski & Chronister, 2006), it is imperative to look to future demands when developing a plan by which to fill the position in the future, ensuring that skills, knowledge, and characteristics representing the scope of the entire role are incorporated, including those that may not be easily developed in a traditional academic career path.

One particularly salient unanswered question is whether the processes (e.g., search committees, leader training and development, succession plans[1]) currently in place to identify and select CROs are adequate. Nash and Wright (2013) found that 83% of the individuals who become CROs were faculty members upon assuming the position. They also found that the CROs they surveyed cited their experience in research, and as faculty members, as the most helpful attributes in preparing them for the role of CRO. However, given the role of many CROs in compliance, intellectual property, export controls, economic development, and building relationships with the public and private sector, thereis a need to clarify whether the expertise possessed by faculty

[1] When using the term "succession plan," we refer to the process by which an institution broadly explores the interests and potential of its members to take on new roles and assists members in developing and strengthening competencies for these roles.

members meets the minimum qualifications required or highly desired for the role of CRO.

For example, most CROs are actively involved in a variety of professional organizations that are geared toward institutional leadership and development (e.g., Association of Public and Land-grant Universities, American Association of Universities, National Organization of Research Development Professionals), which may assist in building research-related skills and knowledge, as well as necessary relationships with the public and private sector (Nash & Wright, 2013). However, most faculty members are not involved with such organizations. Thus, institutions may consider whether alternative pathways to the CRO position may be possible and perhaps more likely and appropriately helpful for institutions in the future.

There is a substantial need to better document the necessary responsibilities, skills, and knowledge of the CRO position, and the variety of ways in which the role is enacted, in order to maximize the effectiveness of the position itself, assist those interested in obtaining the position in the future, and help university leaders and administrators responsible for hiring CROs choose candidates most likely to be effective in the role. Clarity about the essential characteristics of the role will assist universities not only in selecting the most promising candidate, but in providing guidance for encouraging and training future candidates.

The current study examines the above questions, providing a description of the structure and function of CRO offices, portraits of current occupants of the CRO role, expectations for change in the future of the role, and the means by which universities might best develop procedures to encourage skill development, recruit potential candidates, and evaluate current CROs. More specific knowledge in these areas is expected to contribute to enhanced means by which individuals, universities, and professional organizations can promote more effective training and mentoring for developing the necessary competencies of future CROs.

Method

The present study arose from a Spring 2013 meeting of the Council on Research Policy and Graduate Education (CRPGE, recently renamed the Council on Research, or CoR) within the Association of Public and Land-grant Universities (APLU). APLU, as North America's oldest higher education association with 195 public research and land-grant university members, serves as a microcosm of higher education at large. Across many meetings and discussions, it came to the attention of CoR—which is comprised of chief administrative officers who oversee research policy, administration and graduate education—that no comprehensive survey had been conducted of CROs. Because the chair of CoR at the time was an administrator at the University of Oklahoma (OU), APLU agreed to collaborate with OU researchers in developing and administering the survey.

The survey questions and design were finalized by a team of faculty and graduate students in Industrial/Organizational Psychology who have expertise in survey development and data analysis. The team received approval from OU's Institutional Review Board before administering

the survey. The finalized online questionnaire was sent to 155[2] members of APLU who were identified as serving in a research leadership role. Invitations were sent to email addresses provided by the individual to APLU's CoR, which directed participants to an online survey using the Qualtrics platform. The initial response period lasted approximately one month, and participants were emailed two survey reminders during this period. The original sample resulted in 57 completed responses. Preliminary data from these responses was presented at the annual meeting of the APLU in November 2013.

Multiple requests were made by attendees to reopen the survey to allow additional responses from those who had not previously completed the survey. The survey was thus re-opened at the end of 2013 for an additional four-week period, during which 22 additional responses were received. The majority of the items in the survey consisted of Likert-type items in which individuals indicated the degree to which they agreed with various statements, such as, "I have control over the allotment of space at my institution." Participants also were asked to respond to open-ended items to gain a fuller picture of the position (see Appendix 1 for a list of all questions in the survey).

In order to analyze these responses, one member of the research team read through each response, determined themes that represented the responses, and then rated the themes of each response. A second researcher compared the themes with the responses and examined the ratings. Any disagreement among the two was resolved through a consensus discussion. Any given response could reasonably express multiple themes and was coded accordingly.

Results

Efforts were made in conducting the survey to include only those individuals who, at that time, served as the highest ranking administrator of the research enterprise. However, it is possible that some others individuals were contacted. Thus, the response rate of 51% (79/155) is likely an underestimate of the proportion of members of APLU actually holding the CRO position.

Of responses received, the vast majority (92%) came from research universities: 51% from Carnegie Very High Research Institutions (now called Carnegie R1 or Highest Research Activity), 33% from Carnegie High Research Institutions, and 8% from doctoral research institutions (Carnegie Classification of Institutions of Higher Education, n.d.). Responses overwhelmingly (97%) were from public universities, including 41% from land-grant institutions (institutions historically designated by state legislature or Congress with the mission of teaching agriculture, military tactics, mechanic arts, and classical studies as set forth in the Morrill Acts). On average, the universities represented included 1354 FTE faculty (Standard Deviation (SD) = 918) and had $201 million (SD = $228 million) in yearly research expenditures.

In the following sections, we present survey results thematically, examining the structure and function of CRO offices, the role of CROs in university planning and resource allocation,

[2] The discrepancy between the number of APLU institutions and the number of CROs on the APLU email list is due to institutions located outside of the U.S. and members without CROs.

demographic composition of CROs as a group, professional and background experiences of CROs, future challenges to institutions, potential changes in the CRO role in the next five years, and suggestions for preparing future CROs. All analyses discussed in the results section are statistically significant at $p < .05$.

What characterizes the structure and function of CRO offices?

One aim of the study was to document the current structure of CRO offices. Our findings indicated that the average number of employees that directly report to CROs is 10.1 FTE, and ranged from 2 to 50 FTE. The average yearly operating budget of a CRO organization[3] was $17 million, which represented 12% of the total research expenditures for the institutions. In 63% of institutions, the budget of the CRO organization was equivalent to the amount of indirect costs recovered by an institution on research expenditures. On average, research expenditures amounted to $132,106 per FTE faculty member, with those in Very High Research Institutions expending more money per faculty member (M (mean) = $170,063 per FTE) than those in High Research Institutions (M = $109,987 per FTE ; $t(62) = 3.00$, $p < .05$). Expenditures per FTE were also higher at land-grant (M = $171,185 per FTE, SD = $80,662) than non-land-grant institutions (M = $104,318, SD = $74,296; $t(43)=2.29$, $p < .05$).

Regarding the structure of the CRO office, 70% of CROs reported directly to the President, 27% of CROs reported to the Vice President for Academic Affairs or the Provost, whereas 3% reported to other offices. As shown in Table 1 on page 31, which provides current responsibilities of CROs, CROs almost universally reported responsibility for the university Institutional Review Board (IRB), sponsored programs/pre-award services, research development, Institutional Animal Care and Use Committee (IACUC), and external funding. In addition, more than 75% of CROs were responsible for oversight of a research center/campus, patenting/licensing, export controls, research communications, and economic/technology development. Some of the least frequently reported responsibilities included supervising the graduate school/college, environmental health and safety, philanthropy, university press, and other responsibilities.

What role do CROs play in university planning and resource allocation?

Overall, 78% of CROs either agreed or strongly agreed that they were very involved in strategic planning at the university level. In contrast, 55% of CROs either agreed or strongly agreed that they were very involved in budget planning at the university level. In terms of university plans that guide the goals of research within an institution, 72% of CROs indicate that their university had or was currently developing an institution-wide strategic plan for research and/or graduate education. Of institutions having a plan in place, 68% of CROs reported that they, or one of their predecessors, led its creation. However, the proportion of universities that had an institution-wide strategic plan for undergraduate research was much lower, with only 23% of universities indicating such a plan existed. The CRO led the creation of that plan in only 18% of the schools that had a plan for undergraduate research.

[3] See Appendix 1 for relevant response options

Table 1. Primary Responsibilities of Current CROs

Responsibilities	**%**
IRB	96%
Sponsored programs, pre-award services	95%
Research development	94%
IACUC	90%
External funding	89%
Research center/campus	86%
Patenting/licensing	84%
Export controls	84%
Research communications	80%
Economic/technology development	78%
Sponsored programs, post-award services	65%
Private industry relations	59%
Federal relations	58%
Budget/strategic planning	44%
Radiation and laboratory safety	33%
Undergraduate research	32%
Graduate school/college	20%
Environmental health and safety	20%
Other	18%
Philanthropy	13%
University press	5%

CRO responsibilities related to cost sharing on grant proposals, and on resource allocation, also were examined. In our sample, 99% of CROs reported having some role in deciding whether cost sharing should be provided to a given external grant proposal, with 52% being solely responsible for these decisions. Overall, CROs had less control over allotment of space and facilities for research; 22% agreed or strongly agreed that they have control over the allotment of space and facilities. In addition, 56% of CROs reported having a role in providing funding to retain faculty who are considering leaving their institutions, and 73% having a role in funding start-up packages for new faculty hires.

Responsibilities of the CRO frequently extend beyond the main university campus. In our sample, 35% had purview over a health campus/organization, 22% had purview over a veterinary campus/organization, and 57% had responsibility for a 501(c)3 non-profit research organization. CROs surveyed also indicated having external professional commitments, in that 99% of CROs served on professional boards, committees, commissions and councils external to their institution.

What is the composition of CROs as a group?

Analyses revealed that the majority of CROs are male (80%) and white (91%). These trends were generally consistent across Carnegie classification and land-grant status of the institution. Our sample was highly consistent with Nash and Wright (2013), in terms of the proportion of males (80% vs. 76%) and diversity (in both studies 91% of respondents were white).

Of those CROs who reported their terminal degree, 97.4% held a Ph.D. with only one CRO indicating an M.D. degree and one indicating an M.B.A. degree. On average, CROs received their terminal degree in 1984, with a wide range of other degree dates between 1966 and 2008. On average, respondents served as CRO for 4.6 years (SD = 3.89). The discipline of the highest degree held was predominantly science, with 27% receiving their degree in engineering, 25% in biomedical sciences, 23% in physical sciences, 13% in psychology and social sciences, 8% in health-related programs, and 5% in agriculture and related sciences (see Figure 1).

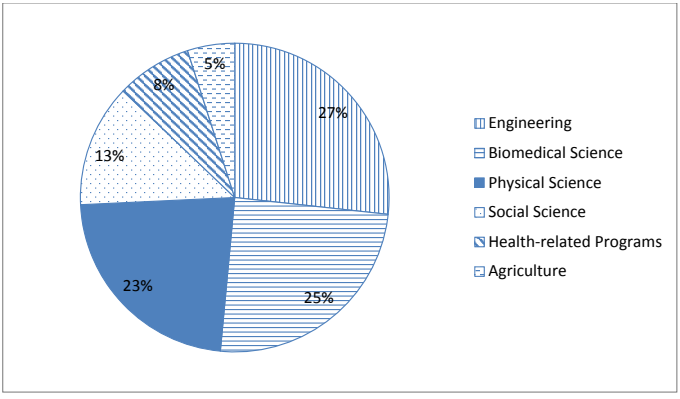

Figure 1. Distribution of CRO terminal degrees by discipline

What professional background and experiences do CROs possess?

CROs were asked to indicate the most important knowledge and skills they deemed necessary or useful for fulfilling their current roles (see Table 2). Knowledge of university culture was most highly cited, followed by developing strategic research areas and/or teams, knowledge of national research priorities, personnel management, and knowledge of developing and/or sustaining programs. In terms of essential skills, current CROs most frequently cited leadership skills, ability to influence stakeholders, ability to gain credibility in the eyes of faculty, strategic planning, and critical thinking (see Table 2).

Table 2. Essential Knowledge and Skills for CRO Role

Knowledge	**%**
University Culture	67%
Developing Strategic Research Areas and/or teams	65%
National Research Priorities	34%
Personnel Management	33%
How to develop and/or sustain programs	32%
Skills	**%**
Leadership	79%
Ability to influence stakeholders	53%
Ability to gain credibility in eyes of faculty	49%
Strategic Planning	45%
Critical Thinking	42%

The majority of CROs (87%) reported holding one or more administrative roles prior to serving as CRO. Most commonly, CROs had served as Vice, Associate, or Assistant CRO (49%) or Graduate Dean/Graduate Program Director (20%), although a variety of other positions were also reported. Approximately 7% of CROs indicated they had never held an academic position as a professor at any level. When asked what experiences were instrumental to obtaining their current position as CRO, the top answers included personal research experience, being a Department Chair, serving as Dean or Associate Dean, and acting as Center/Institute Director (see Table 3).

Overall, the majority of current CROs received little direct training for their position. In our sample, 44% of CROs indicated that they either agreed or strongly agreed that they received formal or informal training that allowed them to be a competitive candidate for their current position, and 49% of CROs agreed or strongly agreed that they had received mentoring that contributed to achieving the role of CRO. Regarding training once CROs are in the position, only 33% attended the formal APLU orientation and training for new research officers and graduate deans. The most helpful aspect of the APLU orientation was reported to be networking opportunities with other CROs. Additionally, merely 28% agreed or strongly agreed that the

Table 3. Instrumental Events, Activities, and Experiences Contributing to Becoming CRO

Contributing Experiences	**%**
Personal Experience as Researcher	27%
Department Chair/Head	24%
Dean/Associate Dean	20%
Center/Institute Director/Assistant Director	18%
Previous role in office of CRO	15%
Program officer or other role at national agency	13%
Leadership in national level organizations	12%
Work in industry/private sector/corporate	9%
Experience with national laboratories	8%
Mentoring	5%
Experience with strategy	3%
Experience with external relations	*3%*

opportunities for professional development they currently received at their institution were helping them to excel as CRO.

What challenges do institutions face in the next 3-5 years?

Although the CROs surveyed appeared to be satisfied with their jobs (80% indicated they would accept the position again), our results suggest the potential for a high degree of turnover in the CRO role in the near future. A majority (74%) of CROs indicated that they plan to remain in their position for fewer than 6 years (see Figure 2).

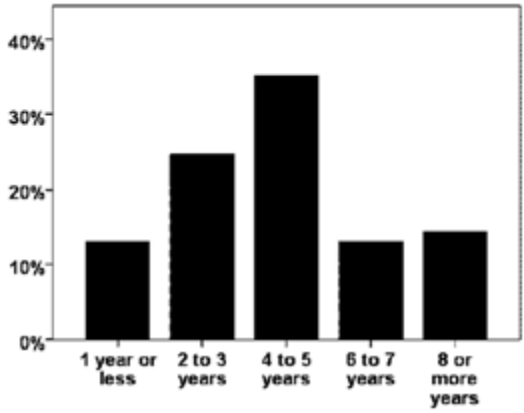

Figure 2. Length of time CRO intends to stay in position

Interestingly, 31% of CROs reported they intend to pursue a position as university President following their tenure as a CRO. This intention is in sharp contrast with responses to a question that inquired about the frequency of promotion from CRO to President at the university; 62% of CROs indicated that a CRO had never become President at their university. Thus, the challenges of universities to train and hire future CROs are paralleled by a lack of clarity about realistic career paths following the position of CRO.

Correlational analyses were conducted to examine whether various factors were associated with the length of time an individual intended to remain in the CRO position. Variables that correlate significantly vary in tandem, such that an increase in one is associated with an increase in the other, in the case of a positive correlation, and a decrease in one variable is associated with an increase in the other variable, in the case of a negative correlation. Control over the allotment of research space on their campuses, and role in determining cost sharing on grant proposals, were moderately positively related to intended length of time in the CRO role ($r = .33$, $p < .05$; $r = .27$, $p < .05$, respectively). Opportunities for professional development were also positively related to intention to remain in the CRO role ($r = .31$, $p < .05$), as was the degree to which a succession plan was in place at the institution ($r = .24$, $p < .05$). Carnegie classification was moderately negatively associated with length of intention to act as CRO ($r = -.30$, $p < .05$), with CROs in higher Carnegie-ranked institutions more likely to report the intention to leave sooner. Thus, these analyses reveal two things: (1) CROs who had greater input into decision making about resources and greater opportunities for professional development, and whose institutions have succession plans, indicated they intend to remain in the role for a longer period of time; and (2) CROs at more research-intensive (i.e., Carnegie Research Very High and Research High) institutions intend to remain in their positions for shorter periods of time.[4]

Although current CROs reported intending to remain in their position a fairly short period of time, only 16% of CROs agreed or strongly agreed that their institution has established a clear path to developing the background needed for someone to attain the position of CRO. Additionally, CROs from institutions without plans for CRO successors indicated that they intend to leave sooner than those individuals at universities with a succession plan.

Findings from the current study indicated an approximately equal focus on internal and external candidates for the CRO role among the institutions responding. In particular, 26% of respondents indicated that previous searches were mainly internal, with some search for external candidates, 23% reported that searches were mainly external, with some search for internal candidates, and 31% indicated an equal focus on internal and external candidates. Regarding development of future CROs, only 41% of current CROs reported that potential future CROs were provided with a moderate or great deal of mentoring in the last three years by the current CRO and/or the institution. The amount of training and mentoring of future CROs was fairly consistent across Carnegie High and Very High institutions, and land grant and non-land grant institutions.

[4] There is no significant difference across Carnegie ranks in the current length of time CROs have served. Thus, this finding indicates a shorter overall intended time in position for CROs in higher Carnegie ranked institutions.

What changes are likely in the CRO role in the next 3-5 years?

The high potential for future change in responsibilities and demands for the CRO position is exemplified by change within the careers of current CROs. Notably, a majority of CROs (68%) reported that their responsibilities had changed over the course of their time in the position. The ability to accommodate these changes also may serve as a marker of CRO candidates with high potential for success.

When asked about emerging challenges for CROs (see Table 4), the most highly cited concern was funding issues, reflecting the trend toward unpredictable state and federal funding for research (RUFC, 2012). Economic development was the second most frequently cited challenge, followed by developing relationships with industry, fulfilling the burden of regulatory compliance, and promoting research collaboration and faculty development.

Table 4. Most Commonly Reported Emerging Challenges

Emerging Challenges	**%**
Funding issues	76%
Economic Development	31%
Relationships with Industry	26%
Compliance Burden	24%
Research Collaboration	15%
Faculty Development	11%

These emerging challenges may require some additional knowledge and skills, or increased focus on certain knowledge and skills, beyond what is currently required or expected in the CRO role. The ability to communicate and relate to external stakeholders was most frequently cited (by 38% of respondents) as an emerging need, likely due to the fact that such relationships are required for seeking funding and support from state and federal entities as well as for economic development. Leadership and management skills again were cited as essential by 36% of respondents, similar to findings for the current CRO role. CROs also reported a greater need to successfully foster teamwork and collaboration among institutional partners as well as faculty researchers (36%), and a greater requirement to gain support and collaboration from industry and the private sector (30%). The importance of strategic planning, including creating and executing a plan for university research development, was also emphasized by 26% of CROs. Finally, 25% of CROs acknowledged the significance of developing partnerships and promoting strong communication with internal stakeholders, such as the President, Provost, Deans, and faculty.

How should the next generation of CROs be prepared?

Nash and Wright (2013) proposed four pathways to the CRO role, which we used to examine the experiences of the CROs in our sample. These pathways were 1) through faculty/academic positions, 2) through administrative positions in the research office, 3) through positions in private

industry, and 4) through a combination of administrative/private industry positions followed by academic positions prior to the CRO role. In our sample, 83% of CROs followed a traditional faculty/academic pathway to the CRO role, in which an individual begins as assistant professor, and moves on to full professorship and then to university leadership, before being appointed CRO (Nash & Wright, 2013). Approximately 7% reported following a combination pathway, consisting of an administrative position in private industry or government, followed by a position as a faculty member or higher education administrator, moving higher in the ranks of academic administration. No CRO took a purely administrative or private industry path. Approximately 10% of respondents could not be categorized based on the information provided.

Experience in research administration and other administrative capacities, as well as training in leadership, management, and/or communication, were suggested by respondents as primary ways to develop needed skills in the faculty rank. CROs also identified management of large organizations, general research experience, and training specific to the CRO role as productive activities to develop future CROs. A complete list of the actions most highly endorsed to prepare future CROs is provided in Table 5.

Table 5. Recommended Actions and Resources to Prepare CROs

Knowledge and skills	**%**
Research Administration	20%
Administration experience (not including research administration)	18%
Leadership, Management or Communication Training	16%
Experience in the office of the CRO	16%
Management of large organizations	14%
General research experience	12%
CRO-specific training resources	10%
Training from APLU/CoR	10%

Discussion

The present study explored the structure and function of CRO offices, the role of CROs in university planning and resource allocation, the demographic composition of CROs as a group, the professional and background experiences of CROs, the challenges expected by CROs in the next five years, and suggestions for preparing future CROs. Several findings that reveal potential steps to increase effectiveness of the future of the CRO role emerged.

The majority of CROs responding report directly to the university President. The position of CRO encompasses a variety of roles, often including the IRB, sponsored programs/pre-award services, research development, IACUC, and external funding. CROs were likely to be highly involved in research strategic planning, somewhat less likely to be involved in institutional strategic planning, and reported playing a role in grant cost sharing, retention packages and start-up packages. However, they reported less control over research facilities and space. The majority

of institutions had a strategic research plan in place that guided the actions of the CRO.

In many university administration roles, diversity among leaders is lacking (Cook & Kim, 2012). Unsurprisingly, this was found to be true among leaders of the research enterprise as well. CROs were likely to be male and white and to hold Ph.D.s, particularly in engineering, biomedical science, or physical science.

Overall, the majority of current CROs received little direct training for their position. Less than half of respondents indicated receiving formal or informal training, or mentoring relevant to the CRO role.

The intended remaining time in the position of CROs was fairly short; a large portion of CROs indicated plans to serve for fewer than 6 more years. What is particularly concerning about the situation of high future turnover is the small proportion of institutions with a succession plan in place for the CRO role. Given the expected high turnover in CRO ranks during the next several years, along with the importance this position holds in the university, institutions would be wise to develop plans to establish a pool of qualified future candidates and, as noted below, to think more expansively about how qualifications can be met by candidates from non-traditional pathways.

CROs provided helpful insight on future challenges of the role and effective ways of preparing future CROs. Emerging concerns about funding issues, economic development, relationships with industry, and the compliance burden imply that a background in administration, research experience, leadership, and management of large organizations are essential skills for upcoming CROs.

Recommendations

Based on the current study, we suggest that institutions could take several steps to promote avenues by which effective CRO candidates can be both developed and identified. The first step is to specify the most essential competencies for the position within the institutional context. In order for universities to develop adequate candidate pools for the CRO position and select the most effective individual for the role, deep understanding of the nature of the position is essential. Detailed information about the skills and knowledge needed now, and in the future, should inform leadership transition plans, including the training and mentoring needed to develop the next generation of CROs. These can be derived from analysis of the current position, as well as consideration of future challenges. The current study provides a guide to knowledge and skills that may be considered.

In addition, it should be noted that a strategic plan for research and/or graduate education is a critical foundation on which the pathway to the CRO role can be based. In our study, the presence of such a plan was associated with several important variables. Institutions with a strategic plan for research had higher research expenditures, the CRO had been in the position longer, the CRO had both received and provided greater mentoring, and the CRO was more likely to report that the current developmental opportunities at the university were helping him/her to excel in the position.

Institutions also should establish a means by which faculty or professional research staff members who possess the necessary characteristics for a CRO role or the potential to develop them can be identified (Clunies, 2004). An effective practice can be developed by institutions to identify individuals who have high potential for taking on leadership roles and provide the necessary preparation for those individuals to assume CRO roles in the future (Klein & Salk, 2013). Mechanisms such as yearly faculty evaluations may be one way in which individuals who are successful and willing to take on leadership roles are identified. Succession plans articulating transparent pathways by which faculty members who are interested in developing leadership skills may nominate themselves provide a mechanism for increasing the diversity of faculty members with relevant skills.

This process of identification should not begin when individuals attain administrative positions, but as early in the career as possible (McCall, 2004) and should be on-going, followed by regular opportunities for training, mentoring and development. Each faculty member identified should be provided a plan that outlines steps by which to develop needed skills and be given the opportunity to participate in work experiences and assignments, mentoring, and workshops that will assist in developing these skills (Clunies, 2004). Given the high rate of future turnover of CROs and the small proportion of universities with established plans for identifying future candidates for the CRO position, institutions should place emphasis on developing plans to ensure that a pool of high caliber applicants is available for future CRO searches.

Consideration should be given to preparing individuals internal to the university for the position, as well as to recruiting external candidates who have had the required preparatory experiences. Throughout these processes, it is important to broaden the search beyond faculty members and administrators at other universities in identifying individuals capable of assuming the CRO role.

The CROs in our study suggested a set of recommended experiences and training that would contribute to developing future candidates for the position. The first suggestion is to provide experience in research administration, such as temporary appointments in the CRO office. Ideally, this opportunity would be offered in a transparent manner, such as a faculty fellow process by which interested parties can apply to take on responsibilities in research administration. Opening the process to all qualified and interested faculty is likely to allow diverse individuals (in terms of gender, ethnicity, and discipline) to express interest. Our findings indicate that experience in administration other than research is also suggested as a pathway to prepare the next generation of CROs. This could include full-time administrative positions as well as temporary opportunities in the Provost's office, Dean's office, or as an Assistant Chair or Director.

General research experience was also noted as an important development opportunity. Experiences can be enriched to the extent that the university offers workshops and support for applications for funding, particularly for notable awards such as the NSF CAREER program and large center awards. In addition, given our findings emphasizing the promotion of research collaboration and teamwork as a future skill for CROs, encouragement and recognition of, and reward for, collaborative and interdisciplinary funding efforts would be helpful.

Training in leadership, management, and/or communication were also suggested as ways to develop needed skills in the faculty rank (see http://www.ou.edu/fla.html for one such program targeted toward developing fungible leadership skills for faculty.) Specific training in these skills will enable many otherwise successful faculty members to achieve the additional skills needed for administrative effectiveness.

Internal and external candidates may bring different strengths to the CRO role and thus recruitment should strive to broadly attract candidates. In particular, external candidates should also be sought, as they may be better able to facilitate change and likely do not suffer from biases due to precedent or personal obligations as internal candidates may (Barden, 2009). Due to the discrepancy between the reported equal emphasis on internal and external search strategies and the very small proportion of CROs who reported never holding an academic position, it can be surmised that university efforts, to date, to search externally are primarily focused on recruiting from other academic institutions. Because of the unpredictability of state and federal funding and other changes in higher education, it is important that universities modify their recruitment and selection methods, including looking to non-academic advertising and recruitment outlets, when searching for future CROs. In addition, professional organizations (e.g., Association of Public and Land-grant Universities, American Association of Universities, National Organization of Research Development Professionals) could provide opportunities for training and development of essential skills to assist individuals in more effectively navigating a pathway to the CRO position.

Although perhaps more challenging, structural changes to the CRO role also have the potential to draw a wider pool of competitive candidates and promote retention of effective CROs. In our survey, the most frequent suggestion for changes to the position to improve effectiveness was increasing authority, autonomy, and voice. Other data in our survey support this suggestion, revealing that greater input into budget planning and strategic planning at the university level, greater control over allotment of space and facilities for research, and greater flexibility with regard to the CRO budget were associated with CRO satisfaction with the position and intention to remain in the job. Other suggestions by CROs to change the position included more funding, more staff, and a direct reporting relationship to the President.

Conclusion

Research universities are remarkably complex institutions that are both extraordinarily innovative as well as notably cautious in their willingness and ability to change. A core component of the mission of research universities is scholarship and creative activity across a wide array of disciplines—a component that exists within an environment challenged by increasing competition and compliance, flat or diminishing research funds and problematic state support. The role of the CRO in this complex ecosystem is central for ensuring the existence of a transformational climate of research advancement and its associated impacts on the educational experience (Dingerson, 2006).

The growth and expansion of research universities is tightly connected to the presence of CROs with the ability not only to lead administrative functions, but also to serve as agents of

transformation to encourage institutions to maintain the adaptability necessary to flourish in an ever-changing and unpredictable environment.

Due to the expected turnover among current CROs during the next several years, research universities should focus attention on generating a stream of emerging leaders through institution-wide strategic plans and strategic plans for research, as well as providing opportunities for promising faculty members to develop the skills known to predict success among current CROs and expected to be necessary to address future challenges faced by those in the role. In addition, universities and professional organizations should acknowledge that individuals emerging from pathways other than academia, such as research administration, government, and the private sector, offer skills and abilities that may match the essential skills needed for effective future CROs. Both directing resources toward mentoring and training to develop needed competencies in promising faculty members and making connections with well-positioned individuals outside of academia may provide the most effective means of ensuring a diverse and accomplished pool of candidates for the CRO positions of the future.

Authors' Note

William Taylor is currently employed as Research Scientist at The Human Resources Research Organization, Brett Litwiller is currently employed as Senior Statistician at State Farm Insurance, Christine Kellis is currently employed as Executive Director at Association for Institutional Research, and Teri Lyn Hinds is currently employed as Director of Policy Research & Advocacy at NASPA - Student Affairs Administrators in Higher Education.

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Lori Anderson Snyder
Associate Professor, Department of Psychology
University of Oklahoma
455 W. Lindsey St.
Norman, OK 73019
(405) 325-4582
Email: lsnyder@ou.edu

Kelvin K. Droegemeier
Vice President for Research and Regents' Professor of Meteorology
University of Oklahoma

Nathalie Dwyer
Research Associate & Project Coordinator
Association of Public and Land-Grant Universities

Howard Gobstein
Executive Vice President
Association of Public and Land-Grant Universities

Teri Lyn Hinds
Director, Research & Data Policy
Association of Public and Land-Grant Universities

Christine Keller
Vice President, Research & Policy Analysis
Association of Public and Land-Grant Universities

Alicia Knoedler
Executive Associate Vice President for Research
University of Oklahoma

Brett Litwiller
Data Analyst
University of Oklahoma

William Taylor
Data Analyst
University of Oklahoma

Caroline Whitacre
Senior Vice President for Research
The Ohio State University

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Appendix 1. Survey Questions and Response Options

Questions About Your Institution

1. *What is the Carnegie Basic Classification of your institution?*

Select one.

RU/VH: Research Universities (very high research activity)

RU/H: Research Universities (high research activity)

DRU: Doctoral/Research Universities

Master's L: Master's Colleges and Universities (larger programs)

Master's M: Master's Colleges and Universities (medium programs)

Master's S: Master's Colleges and Universities (smaller programs)

Bac/A&S: Baccalaureate Colleges--Arts & Sciences

Bac/Diverse: Baccalaureate Colleges--Diverse Fields

Bac/Assoc: Baccalaureate/Associate's Colleges

Tribal: Tribal Colleges

2. *Are you at a public or private institution?*

Select one.

Public

Private

3. *Are you at a land grant institution?*

Select one.

Yes

No

4. *Approximately how many full-time faculty (tenured, tenure track, and research only) are at your institution?*

5. *What were the approximate research expenditures for your institution, or the campus for which you have responsibility, for the latest year data are available?*

6. *In which region is your institution located?*

Select one.

New England (CT, ME, MA, NH, RI, VT)

Mideast (DE, DC, MD, NJ, NY, PA)

Great Lakes (IL, IN, MI, OH, WI)

Plains (IA, KS, MN, MO, NE, ND, SD)

Southeast (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA, WV)

Southwest (AZ, NM, OK, TX)

Rocky Mountain (CO, ID, MT, UT, WY)

Far West (AK, CA, HI, NV, OR, WA)

Questions About You

7. *What is your gender?*

Select one.

Female

Male

Prefer not to disclose

8. *Are you Hispanic or Latino?*

Select one.

Yes

No

Prefer not to disclose

9. *Please specify your race (select all that apply).*

Select all that apply.

American Indian or Alaska Native- (A person having origins in any of the original peoples of North and South America (including Central America), and who maintains a tribal affiliation or community attachment.)

Asian- (A person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam.)

Black or African American- (A person having origins in any of the Black racial groups of Africa – includes Caribbean Islanders and other of African origin.)

Native Hawaiian or Other Pacific Islander- (A person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.)

White- (A person having origins in any of the original peoples of Europe, the Middle East, or North Africa.)

Prefer not to disclose

10. *Please list your highest degree attained (e.g., M.S., Ph.D.) and the year in which you received it.*

Terminal Degree:

Year:

11. *In what discipline is this degree? (Select all that apply)*

Select all that apply.

Agriculture, Agriculture Operations, and Related Sciences

Architecture and Related Services

Area, Ethnic, Cultural, Gender, And Group Studies Basic Skills and Developmental/Remedial Education

Biological and Biomedical Sciences

Business, Management, Marketing, and Related Support Services

Citizenship Activities

Communication, Journalism, and Related Programs

Communications Technologies/Technicians and Support Services

Computer and Information Sciences And Support Services

Construction Trades Education

Engineering

Engineering Technologies and Engineering-Related Fields

English Language and Literature/Letters

Family and Consumer Sciences/Human Sciences

Foreign Languages, Literatures, and Linguistics

Health Professions and Related Programs

Health-Related Knowledge and Skills

High School/Secondary Diplomas and Certificates

History

Homeland Security, Law Enforcement, Firefighting and Related Protective Services

Interpersonal and Social Skills

Legal Professions and Studies

Leisure and Recreational Activities

Liberal Arts and Sciences, General Studies and Humanities

Library Science

Mathematics and Statistics

Mechanic and Repair Technologies/Technicians

Military Science, Leadership and Operational Art

Military Technologies and Applied Sciences

Multi/Interdisciplinary Studies

Natural Resources and Conservation

Parks, Recreation, Leisure, and Fitness Studies

Personal and Culinary Services

Personal Awareness and Self-Improvement

Philosophy and Religious Studies

Physical Sciences

Precision Production

Psychology

Public Administration and Social Service Professions

Residency Programs

Science Technologies/Technicians

Social Sciences

Theology and Religious Vocations

Transportation and Materials Moving

Visual and Performing Arts

Questions About Your Professional Experience

12. *What non-academic administrative positions did you hold prior to your current position? (Select all that apply.) Select all that apply.*

Vice President/Vice Chancellor for Research

Associate or Assistant Vice President/Vice Chancellor for Research

Graduate Dean/Graduate Program Director

Associate or Assistant Graduate Dean/Associate Graduate Program Director

Chief Technology Transfer/Economic Development Officer

Associate or Assistant Technology Transfer/Economic Development Officer

No Administrative title

Other (*please specify*):

13. *How long (in years) did you hold your most senior administrative position?*

Select one.

Less than 1 year

1 year

2 years

3 years

4 years

5 years

6 years

7 years

8 years

9 years

10 years

11 years

12 years

13 years

14 years

15 years

16 years

17 years

18 years

19 years

20 years

More than 20 years

14. *What academic positions have you held throughout your career? For each title indicate whether you have held the position in the past or presently hold. Select all that apply.*

Associate Professor

Professor

Department Chair/Director or Associate Chair/Director

Dean

Associate Dean

Center Director or Associate Director

Assistant, Associate or Vice Provost

Endowed Professor or Chair

Program Officer

No Academic Title

Other Academic Title not listed above: (Please specify and indicate whether you currently hold or previously held the position)

15. *What administrative title(s) do you currently hold?*

Select all that apply.

Vice President/Vice Chancellor for Research

Graduate Dean/Graduate Program Director

Chief Technology Transfer/Economic Development Officer

Other (*please indicate*):

16. *How long (in years) have you held your current position(s) as VPR/VCR?*

Select one.

Less than 1 year

1 year

2 years

3 years

4 years

5 years

6 years

7 years

8 years

9 years

10 years

11 years

12 years

13 years

14 years

15 years

16 years

17 years

18 year

19 years

20 years

More than 20 years

17. *How long do you plan to remain in your current position?*

Select one.

1 year or less

2 to 3 years

4 to 5 years

6 to 7 years

8 or more years

18. *What career path do you plan to pursue after you leave your current position?*

Select all that apply

President

Provost

Teaching Faculty

Research Faculty

College Dean

Same position at a different institution

Other (please describe):

None (I plan to remain in this position for the rest of my career)

19. *On how many professional Boards, Commissions, Committees, and Councils external to your institution do you currently serve? Select one.*

0

1

2

3

4

5 or more

Questions about the Structure of your Current Position

20. *To whom (what position) do you directly report?*

Select all that apply.

President/Chancellor

Vice President for Academic Affairs/Provost

Vice Chancellor for Research

Graduate Dean

Other (*please specify*):

21. *How many people are in your research VPR/VCR organization? Enter a number.*

22. *How many people report directly to you? Enter a number.*

23. *Which of the following campus functions are included in your portfolio of responsibilities? (Check all that apply) Select all that apply.*

Human research protections - Institutional Review Board (IRB)

Environmental Health and Safety

Radiation and Laboratory Safety

Export controls

Economic/technology development

Patenting/licensing

Research communications

Institutional Animal Care and Use Committee (IACUC)

Graduate school/college

Sponsored programs, pre-award services

Sponsored programs, post-award services

Research development

Philanthropy

Undergraduate Research

Private Industry Relations

University Press

Research Center/Campus

Budget/Strategic Planning

Federal Relations

External Funding

Other (*please specify*):

24. *Do you have a 501(c)3 non-profit organization, such as a research corporation or center, in your portfolio that you are responsible for running, or that reports directly to you?*

Select one.

Yes

No

25. *Do you have purview over a health campus/organization?*

Select one.

Yes

No

Other (*please specify*):

26. *Do you have purview over a veterinary medicine campus/organization?*

Select one.

Yes

No

Other (*please specify*):

27. *How much flexibility do you have with regard to your budget, i.e., to invest in research and/or graduate education? Select one.*

1 - No Flexibility

2 - Not Much Flexibility

3 - Some Flexibility

4 - Considerable Flexibility

5 - Complete Flexibility

28. *Is the size of your budget linked to institutional indirect cost recovery?*

Select one.

Yes

No

Other (*please specify*):

29. *What percentage of indirect cost recovery contributes to your budget? (select one) Select one.*

1-20%

21-40%

41-60%

More than 60%

30. *What is the approximate dollar amount of your VPR/VCR yearly budget?*

*For computing the mean CRO yearly operating budget and proportion of total research expenditures made up of CRO yearly operating budget, the midpoint of each category was used.

Select one.

Less than $1 Million

$1 Million to $5 Million

$5 Million to $10 Million

$10 Million to $20 Million

$20 Million to $30 Million

$30 Million to $40 Million

$40 Million to $50 Million

$50 Million to $60 Million

$60 Million to $70 Million

$70 Million to $80 Million

$80 Million to $90 Million

$90 Million to $100 Million

$100 Million to $200 Million

$200 Million to $300 Million

$300 Million to $400 Million

$400 Million to $500 Million

More than $500 Million

31. *Do you have a role in funding startup packages for new faculty or professional research staff hires relative to other offices? Select one.*

Yes

No

32. *What percentage typically do you fund?*

Select one.

1-20%

21-40%

41-60%

More than 60%

33. *What is your role in deciding whether cost sharing should be provided to a given grant proposal submission? Select one.*

1 - Not Responsible

2 - Partly Responsible

3 - Solely Responsible

34. *What is your role in providing money for grant proposal cost sharing relative to other offices once the decision to provide it has been made? Select one.*

1 - Not Responsible

2 - Partly Responsible

3 - Solely Responsible

35. *Do you have a role in funding retention packages relative to other offices?*

Select one.

Yes

No

36. *What percentage typically do you fund?*

Select one.

1-20%

21-40%

41-60%

More than 60%

37. *How much do you agree with the following statements?*

Select one per row.

1 - Strongly Disagree

2 - Disagree

3 - Neither Agree nor Disagree

4 - Agree

5 - Strongly Agree

I am very involved in budget planning at the university level.

I am very involved in strategic planning at the university level.

38. *Do you have an institution-wide strategic plan for research and/or graduate education? Select one.*

Yes

No

Other (*please specify*):

39. *Did the VPR/VCR (you or a predecessor) lead its creation?*

Select one.

Yes

No

40. *What are the primary goals of the strategic plan? (Choose all that apply.)*

Select all that apply.

Developing or growing research interactions with the private sector

Developing or growing undergraduate participation in research

Developing or growing diversity among research faculty and/or students (e.g., recruiting more international faculty and/or students)

Developing or growing diversity of fields of research (e.g., promoting new methodologies and fields of research represented at institution)

Developing or growing amount of multidisciplinary research

Obtaining more external funding from federal agencies

Developing or growing research interactions with non-profit foundations

Linking research with philanthropic giving to your institution

Developing or growing applied research and development

Other (*please specify*):

41. *Do you have an institution-wide strategic plan for undergraduate research?*

Select one.

Yes

No

42. *Did the VPR/VCR (you or a predecessor) lead its creation?*

Select one.

Yes

No

43. *How much do you agree with the following statements?*

Select one per row.

1 - Strongly Disagree

2 - Disagree

3 - Neither Agree nor Disagree

4 - Agree

5 - Strongly Agree

I have control over the allotment of space and facilities for research.

44. *During the past 10 years, how many people have held your position? Please begin with the most recent, and list the duration of each person and their disciplinary expertise, if possible, even if the office changed in structure).*

Questions about Training

45. *How much do you agree with the following statements?*

Select one per row.

1 - Strongly Disagree

2 - Disagree

3 - Neither Agree nor Disagree

4 - Agree

5 - Strongly Agree

I received formal or informal TRAINING that allowed me to be a competitive candidate for my current position(s).

I received formal or informal PERSONAL MENTORING that allowed me to be a competitive candidate for my current position(s).

46. *What type(s) of training/mentoring and from what source(s)?*

47. *What other events, activities or experiences were instrumental in enabling you to attain your current position(s)?*

48. *Have you participated in the formal APLU Orientation program for new research officers and graduate deans?*

Select one.

Yes

No

49. *How helpful did you find the APLU orientation (the formal orientation program for new research officers and graduate deans)?*

Select one.

1 - Very Unhelpful

2 - Unhelpful

3 - Neither Helpful nor Unhelpful

4 - Helpful

5 - Very Helpful

50. *What was particularly helpful about the APLU orientation, and what would have made it more helpful? (If you did not attend, please leave this question blank)*

51. *How much mentoring of potential future VPRs have you or your institution been providing during the past 3 years?*

Select one.

1 - None

2 - Very Little

3 - A Moderate Amount

4 - A Great Deal

52. *How much do you agree with the following statement?*

Select one per row.

1 - Strongly Disagree

2 - Disagree

3 - Neither Agree nor Disagree

4 - Agree

5 - Strongly Agree

The opportunities for professional development I receive at my institution are helping me to excel in my current position.

53. *Would you accept the position(s) you now hold if offered it (them) today? Why or why not?*

Current state of the VPR position

For the next two screens we'd like to gain information about your perception of your position. For the first we'll focus on knowledge and experience, for the second we'll focus on skills.

54. *Of the KNOWLEDGE/EXPERIENCE listed below, rank-order the top 3 most important knowledge/experience required in order to effectively carry out your current role as a research VP/VCR at your university.*

Held a previous position at a state or federal agency, or private foundation

Previously held or currently hold a position on key state or federal agency committees or boards

Participated in policy making activities at the institutional, state or national levels

Held a position within a private company

Understanding of how to develop and/or sustain collaboration between the university and other organizations/institutions

Understanding of how to develop and/or sustain collaboration between the university and companies/corporations

Understanding of how to develop and/or support strategic research areas and/or teams

Understanding of how to develop and/or sustain programs

Understanding national research priorities

Understanding personnel management

Regulatory and compliance knowledge

Legal knowledge (e.g., intellectual property, export controls)

Understanding university culture

Understanding the culture and policies of grant-issuing organizations (e.g., NSF, NIH, private foundations, etc.)

Understanding university-government relations

Basic knowledge of all fields of research at the university

Other (*please specify*)

55. *Of the SKILLS listed below, rank-order the top 3 most important skills required in order to effectively carry out your current role as a research VP/graduate dean.*

Active listening

Critical thinking

Time management

Strategic planning

Leadership

Supervision

Ability to influence stakeholders (e.g., President, fellow Deans, Trustees, etc.)

Negotiation

Ability to gain credibility in eyes of faculty

Teamwork

Conflict resolution

Communication/media/public relations

Successful grant-writing

Managing large budgets

Other (*please specify*)

56. *Please list the top 3 knowledge/skills/experiences that will be needed to be successful at this position in the NEXT 3 to 5 years. Please list them in order of importance, with the knowledge/skill/experience that will be most important listed first.*

57. *How much do you agree with the following statement?*

Select one per row.

1 - Strongly Disagree

2 - Disagree

3 - Neither Agree nor Disagree

4 - Agree

5 - Strongly Agree

My responsibilities have changed during my time in the VPR/VCR position.

58. *What new challenges, responsibilities, or roles has your position taken on recently?*

Select all that apply.

Human research protections - Institutional Review Board (IRB)

Environmental Health and Safety Radiation and Laboratory Safety

Export controls

Economic development

Technology development

Patenting/licensing

Research communications

Institutional Animal Care and Use Committee (IACUC)

Graduate school/college

Sponsored programs, pre-award services

Sponsored programs, post-award services

Research development

Undergraduate Research (funded with research grants)

Undergraduate Research (unfunded by research grants)

Philanthropy

Private Industry Relations

University Press

Research Center/Campus

Foundation relations

Development

Online-Education

Globalization/Internationalism

Budget/Strategic Planning

Federal Relations

Crowdfunding

Commercialization of university research

Export control

Graduate student unions

Dotted reporting lines

Other (*please specify*):

59. P*lease list the top 3 emerging trends or challenges for VPRs. Please list them in order of importance, with the knowledge/skill/experience that will be most important listed first.*

60. *What have been the greatest challenges of your position since being appointed to it? Rank order top 3.*

Insufficient internal funding

Insufficient external funding

Insufficient importance placed on research by the university

Ineffective reporting structure

Declining federal budgets

Too many activities for one person

Burdensome federal compliance regulations

Insufficiently bold administration

Faculty who are insufficiently bold and unwilling to take risks

Lack of rewards for research

Difficult political atmosphere in the university

Limitations in my preparation for the position

Other not listed above: (*please specify*)

61. *What have been the greatest rewards of your position? Rank order the top 3.*

Helping faculty achieve their goals

Helping students achieve their goals

Seeing advances made in the scholarly enterprise

Helping create jobs

Building infrastructure for future research

Seeing society benefit through the university's research efforts

Fundraising for research projects and activities

Other not listed above: (*please specify*)

62. *What changes should be made in your position(s) to improve overall effectiveness?*

63. *At your institution, how many people who held the VPR position have later become Provost or President?*

Succession Planning

64. *In the past, how has your university typically filled the VPR position?*

Select one.

1 - Only Internally

2 - Mainly internally, with some search for external candidates

3 - Equal focus on internal and external candidates

4 - Mainly externally, with some search for internal candidates

5 - Only Externally

65. *How much do you agree with the following statement?*

Select one per row.

1 - Strongly Disagree

2 - Disagree

3 - Neither Agree nor Disagree

4 - Agree

5 - Strongly Agree

My institution has a succession plan or clear path to developing the background needed for someone to attain my current position.

66. *What actions and resources would best prepare VPRs for the expected challenges and responsibilities of the future? [open-ended]*

Greater than the Sum of its Parts: A Qualitative Study of the Role of the Coordinating Center in Facilitating Coordinated Collaborative Science

Betsy Rolland, PhD MLIS MPH
University of Wisconsin-Madison Carbone Cancer Center

Charlotte P. Lee, PhD
University of Washington

John D. Potter, MBBS PhD
Public Health Sciences Division, Fred Hutchinson Cancer Research Center; Department of Epidemiology, School of Public Health, University of Washington; Centre for Public Health Research, Massey University

Abstract: *As collaborative biomedical research has increased in size and scope, so, too, has the need to facilitate the disparate work being done by investigators across institutional, geographic and, often, disciplinary boundaries. Yet we know little about what facilitation is on a day-to-day basis or what types of facilitation work contribute to the success of collaborative science. Here, we report on research investigating facilitation by examining the work of two coordinating centers (CCs), central bodies tasked with coordination and operations management of multi-site research. Based at the Fred Hutchinson Cancer Research Center, both CCs were run by the same team and part of National Cancer Institute-funded consortia engaged in what we call "Coordinated Collaborative Science." These CCs were charged with facilitating the collaborative work of their projects, with the aim of helping each cancer-epidemiology consortium achieve its scientific objective.*

This paper presents the results of a qualitative, interview-based study of the coordinating centers of two National Cancer Institute-funded consortia. Participants were observed in meetings and interviewed about their work in the consortium. A grounded-theory approach was used to analyze field notes and interview transcripts. We found that each CC engaged in four types of facilitation work: (a) structural work; (b) collaboration-development work; (c) operational work; and (d) data work. Managerial and scientific experience and expertise have been institutionalized in processes and procedures developed over decades of managing consortia.

By applying collective decades of experience and expertise in the facilitation of collaborative work, the CC PIs and staff were able to provide the consortium with a neutral, third-party view of the project, keeping it on track toward its scientific objectives, and providing leadership

and support when needed. The CCs also helped the consortia avoid some of the pitfalls of collaborative research that have been well documented in the literature on team science. As such, the CC saved research-site personnel time, effort, and money. Further research on the development of facilitation standards is crucial to the success of Coordinated Collaborative Science.

Keywords: *coordinating centers; team science; cancer epidemiology; coordination; facilitations*

Background

In recent years, biomedical research has become increasingly collaborative (Falk-Krzesinski et al., 2011; Wuchty, Jones, & Uzzi, 2007). Today's large research challenges such as global climate change and the early detection of cancer can only be addressed in large, multi-site, multi-disciplinary collaborative efforts, as they require the input of scientists from disciplines as disparate as epidemiology, ecology, sociology, clinical medicine, molecular biology, population genetics, and veterinary medicine. The development of information and communication technologies (ICTs) has allowed scientists to work together in larger numbers, on increasingly complex problems, over ever greater distances. Such large collaborative projects bring together scientists from different labs, different disciplines, and different institutions, generally bringing all these disparate elements together into a functioning whole. Yet this collaboration comes at a cost. Coordinating large numbers of dispersed researchers working on such complex questions across geographic and institutional boundaries requires a substantial commitment of time and resources (Cummings & Kiesler, 2007). This administrative burden often falls on the lead Principal Investigator (PI) and his/her staff.

In the field of cancer epidemiology, multi-site research projects are increasingly employing coordinating centers (CCs) as a tool to ease that administrative burden by offloading it onto a group with substantial experience in the coordination of such projects (Rolland, Smith, & Potter, 2011). A CC is a central body tasked with coordination and operations management of a multi-site research project. We call this type of collaborative science "Coordinated Collaborative Science," defined as collaborative research done with the support of a CC. While other types of collaborative science may use similar facilitation techniques or experience similar challenges, Coordinated Collaborative Science concentrates much of that facilitation work in the CC itself and, thus, represents a unique perspective on facilitation.

A CC is generally formed to support a specific project, such as a consortium tackling a problem that can only be addressed by employing a networked structure. Seminara et al. (2007) define networks in epidemiology as "groups of scientists from multiple institutions who cooperate in research efforts involving, but not limited to, the conduct, analysis, and synthesis of information from multiple population studies" (p. 1). Such networks can be built and/or funded in a variety of ways; however, in Coordinated Collaborative Science, the research centers and the CC are generally funded as individual components of the network by separate Requests for Application (RFAs) or, occasionally, by contracts. The CC does not usually have an official pre-existing connection to any of the research centers.

We know very little about either how such networks function or how best to facilitate them. In fact, there is no definition of what facilitation means in the context of Coordinated Collaborative Science. CCs receive very little guidance as to how to go about their tasks beyond the vague, high-level expectations laid out in the funding agency's RFA. Few CCs write about their work, leaving new CC PIs and managers to devise their practices anew without evidence of efficiency or efficacy. NIH spends millions of dollars each year supporting such networks and their CCs, yet little research has been done on how the CCs work, how to structure these CCs, or precisely which aspects of the research project should be allocated to the CC. This research presented here seeks to rectify that deficiency by investigating and documenting the work practices of two CCs currently involved in Coordinated Collaborative Science. To that end, we have identified areas of the collaborative process that are enhanced by the work of the CC. The areas on which CC members chose to focus, along with their tools and techniques, are the result of collective decades of experience coordinating multi-site projects. As such, they represent crucial sources of knowledge, which, in turn, could be used to improve the process of collaboration in other networked-science projects. Though limited by its focus on just two CCs at one institution, this research represents a crucial first step toward defining the work of CCs and what constitutes facilitation in Coordinated Collaborative Science.

What We Know about CCs

In the mid-1970s, the National Heart, Lung, and Blood Institute (NHLBI) began a project called Coordinating Center Models Project (CCMP) in an attempt to better understand CCs in clinical trials (Symposium on Coordinating Clinical Trials, 1978). At that time, clinical trials were still a fairly new method of doing research and large amounts of money were being spent to coordinate those trials. Yet very little was known about what made a good CC or how to run a CC most effectively. To address these issues, a CCMP research team was designated, made up of scientists who were interested in the design and implementation of clinical trials. Their approach consisted of a survey of those involved in six NHLBI-funded clinical trials, as well as interviews with key staff members. The results were reported at a conference in 1978 and published soon after (Symposium on Coordinating Clinical Trials, 1978).

One of the key findings of the CCMP was that it was not possible to identify a common set of activities across the CCs (Symposium on Coordinating Clinical Trials, 1978). The research group concluded that there was no one model of a CC. They apparently did not consider the possibility that the great variation in activities and attitudes stemmed from the fact that CCs represented a new organizational model with no existing blueprint and that CC leaders were creating policies and procedures in reaction to the events around them. Perhaps the variation could be traced to the lack of standards both for running a CC and for communicating among CC leaders.

Soon after the CCMP report was published, investigators from several clinical trials published articles about their CCs. These were not empirical studies but, rather, reports written by the CC and clinical-trial leadership detailing how their own CC worked, including a list of the activities for which the CC was responsible, as well as assessments of issues or problems and particularly interesting solutions that were devised for working in a clinical trial. Although the

articles described vastly different levels of detail about what a CC should do, all stressed that the primary responsibility was to ensure the quality of the science. Blumenstein, James, Lind and Mitchell (1995) stated that the CC's primary mission is "to assure the validity of study findings that eventually will be disseminated in publications and public presentation" (p. 4). Going into slightly more detail, Mowery and Williams (1979) wrote that monitoring the implementation and adherence to protocol are the primary responsibility of the CC. Rifkind (1980) added delivery of results to the community in a timely and high-quality manner.

The specific responsibilities listed by these authors vary widely, ranging in level of detail from "statistical and content methodological support" (Bangdiwala, de Paula, Ramiro, & Muñoz, 2003, p. 61) to "ordering study medications" (Meinert, Heinz, & Forman, 1983, p. 356). Some articles divided responsibilities into categories, most of which are common in theme, if not in a specific label. These categories include: (1) statistical coordination and management; (2) study coordination; and (3) administrative and secretarial support. The first category of responsibilities involves data, including data management and analysis, monitoring data collection, and performing quality assurance (see, for example: Blumenstein et al., 1995; Bangdiwala, et al., 2003; Meinert et al., 1983; Curb et al., 1983; Margitic, Morgan, Sager, & Furberg, 1995; Greene, Hart, & Wagner, 2005; Lachin, 1980; Berge, 1980; and Winget et al., 2005). The second category involves coordinating studies, including developing protocols and forms, monitoring adherence to the protocol or performance monitoring, developing computer systems, training staff, documenting and archiving of study information, communications, adhering to institutional policies, reporting, allocating CC resources, and preparing manuscripts. Administrative and secretarial support included functions such as fiscal management, meeting and site visit organization, budget preparation and management, securing equipment rentals, and personnel management, as well as general secretarial support (Bangdiwala, et al., 2003; Meinert et al., 1983; Curb et al., 1983). These last two categories were sometimes conflated into one, but the described duties were consistent.

One overarching theme raised in some of the papers is the difficulty of staffing a CC. CCs are expected to have on-staff expertise in a wide range of activities, including administration, statistics, federal regulations, human subjects, technology, and organizational development. At the same time, the CC's organizational structure is expected to evolve over the course of the project in response to changes in the work, while minimizing costs. At a workshop at the CCMP kickoff in 1977, the group reported:

> One major managerial problem has to do with the establishment of a large, well-trained staff and whether personnel should be retained or transferred out once a study is terminated. Many university-based coordinating centers are locked into the cycle of maintaining these staff positions and have invested much time and effort in staff training in order to fulfill their function. Frequently the only way personnel can be retained is to proceed directly into another study. Since this option is not always available, there is a clear danger in creating too large a coordinating center within a university setting. (Meinert, 1977, p. 265)

This staffing difficulty is even more challenging given the current financial climate and budget cuts at NIH. Finding funding to support the infrastructure of a CC, as opposed to funding a CC

for a specific project, is thought by some of us to be virtually impossible. This situation leaves CCs with the dilemma of losing experienced staff and institutional memory or continuously taking on new projects, not necessarily on anything like an optimal schedule.

Curb et al. (1983) and Blumenstein et al. (1995) noted that one of the major problems of running a CC is the time crunch inherent in such a project. Once funded, CCs are expected to get the project up and running quickly, with little attention paid to the set-up phase. These papers argued that more time spent on securing agreement on organizational issues such as data-sharing agreements, authorship policies, and communication, as well as scientific issues such as common data, survey forms, and required technologies, would have made the project run more smoothly and, thus, produce better science more quickly (Curb et al., 1983). CC managers also noted that more time for close-out and staff time to support manuscript writing at the end of the projects would have, similarly, led to even stronger outcomes for the project (Blumenstein et al., 1995).

There is a great variety in the organizational models followed by the different CCs described in the literature. Blumenstein et al. (1995) described several different models of clinical trials and several different models of CCs, although no discernible pattern for matching these was described. Curb et al. (1983) noted that "[t]he role of a coordinating center in a multicenter clinical trial varies with the particular design and organization of each trial" (p. 171). Their implication is that the organizational structure of the CC must also be a consequence of the trial it supports. Curb also asserts that responsibilities, and, therefore, the staffing makeup, of the CC must shift as the trial progresses through its phases.

Thus, the literature on CCs is lacking a comprehensive model of what different kinds of CCs look like, how they are formed, how they should be managed, or even what impact they have on the projects they are coordinating. Furthermore, the projects being coordinated are structured in many different ways, with little understanding of what types of CCs might work best for these different types of projects. In short, we know very little about how either CCs or the projects they coordinate actually function.

Methods

The findings presented reflect research on two consortia, known here as the Biomarker Network and the Screening Network. (The network and participant names are pseudonyms.) Their CCs are housed at the Fred Hutchinson Cancer Research Center (FHCRC) in Seattle, WA, and are run by a group at FHCRC that specializes in the management of multi-site research projects, the Science Facilitation Team (SFT). Thus, the two CCs share many staff and PIs, making them ideal to explore the work required to support consortia with different scientific objectives.

The Biomarker Network has been in operation for approximately 12 years and has, as its overarching scientific objective, the discovery and validation of biomarkers for cancer diagnosis and prognosis. The aim of this program is to establish the efficacy and reliability of such markers for use in clinical practice. The Biomarker Network has many research sites and affiliate members around the world.

The Screening Network is a relatively new project, having been funded approximately four months before fieldwork began (Fall 2012). It seeks to improve cancer screening in the United States by developing a deeper understanding of the process and by searching for ways to personalize screening recommendations based on risk profiles. The specific aim of the Screening Network is the creation of a repository of screening information across populations at seven research centers in order to understand the impact of screening. Three of these research centers are focused on breast cancer, three on colorectal cancer, and one on cervical cancer.

For this qualitative, interview-based study, we interviewed 17 consortium members, including nine CC staff and PIs, two funding-agency representatives, three Biomarker Network PIs, and three Screening Network PIs. The interviews were semi-structured with questions focused on the work of the consortium and the CC. Interviews were digitally recorded and transcribed, then coded using qualitative-analysis software according to interview questions and themes using a grounded-theory approach (Charmaz, 2009). We also conducted 95 hours of observations of meetings of the SFT over the course of seven months and attended three of the larger, in-person meetings of the consortia themselves.

This research was approved by the Institutional Review Board of the Fred Hutchinson Cancer Research Center. Written consent was obtained from all participants.

[In this paper, data from participant interviews are noted by the participant's name and transcript line number in parentheses (e.g., (Martha, 382)).]

Results

Coordinated Collaborative Science

The CCs under study were charged with facilitating coordinated collaborative science. As the name implies, the employment of a CC as a tool to facilitate the network's scientific objectives is a defining characteristic of coordinated collaborative science. Per the RFAs, the CC's primary responsibilities revolve around the operational and logistical coordination of the collaborative activities and data management and data analysis for collaborative projects. CC staff and PIs are expected to organize all network meetings, guide all the collaborative activities to ensure the production of high-quality data, create systems to manage the project's data, and perform statistical analyses on those data (Biomarker Network RFA, Screening Network RFA). The CC also plays a role in generally helping the group of diverse sites work together as a network. However, as will be shown below, that role is not always well defined or even agreed upon.

The research centers are the grantees charged with performing the scientific work as proposed in their grant applications. The precise nature of the work of each research center varies, from recruiting patients to extracting data from databases, but is all done in service of the overarching scientific objectives as defined in the RFA. In addition to their scientific work, the research center PIs are expected to participate in the collaborative activities of the consortium. These activities include attendance at meetings, contribution to discussions about the scientific direction of the consortium, active involvement in Working Groups that make decisions about scientific

implementation, and participation in resource (e.g., biosample or data) sharing in compliance with consortium policies (Biomarker Network RFA, Screening Network RFA).

The funding agency representatives in a consortium, highly respected scientists in their own right, are there to represent the funding agency's interests; the aim is to ensure that the work proceeds as expected by the original proponents of the project. Funding agency representatives answer questions about the agency's expectations and policies, in addition to giving input on the scientific direction. Like the research center PIs, the funding agency scientists are expected to attend all meetings and contribute to the discussions on achieving scientific goals (Screening Network RFA). They also participate in working groups, as appropriate. They work very closely with the CC to track the progress of the CCEN, generally through participation in frequent conference calls between NCI and the CC.

Both consortia in this study are funded as cooperative agreements, a specific type of NIH funding in which the funding agency representatives have "significant scientific and administrative input" into the operations of the network (Biomarker Network RFA). The funding agency representatives are not permitted to give direct instructions to the grantees, either to the CC or the research center PIs, on how to do their work, but are expected to give suggestions and guidance to ensure the project is meeting the funding agency expectations (Rebecca, 63).

A Typology of Work

In developing a typology to describe the facilitation of collaborative work by a CC, we began with the categories of CC work presented in Rolland et al. (2011), which documented the work of one specific CC, the Asia Cohort Consortium Coordinating Center, and included four types of activities: collaboration development; operations management; statistical and data management; and communications infrastructure and tool development. Our review of the literature on CCs, primarily papers from individual CCs, produced a list of activities that fit into the Rolland et al. (2011) categories. We then noted that the categories of work in the respective RFA focused on two main areas of responsibilities: facilitating network activities and work that involved data (i.e., data management and statistical analyses). Reconsidering our data and the types of work described by participants, as well as types of work we observed, we developed the typology described below. We chose to fold the Rolland et al. (2011) category of "communications infrastructure and tool development" into "operational work" because the staff, skills, and overall objectives involved in both were largely the same. Though the RFAs do not mention "collaboration development" as a responsibility of the CC, participants mentioned the work that they did to negotiate the activities of the consortium frequently enough that it necessitated its own category.

The observed CCs engaged in a wide variety of complex tasks while facilitating collaboration. Some of these tasks were consistent across projects, such as organizing conference calls and meetings, whereas others were more closely tied to the scientific objectives of the specific program.

We have divided these tasks into four areas of responsibility:

1. Structural work;
2. Collaboration development work;
3. Operational work;
4. Data work.

We briefly describe the first three types of work here, then delve more deeply into the fourth, as it is in data work that the experience and expertise of the CCs play out most explicitly and most clearly show the deep and lasting impact of the work of a CC.

Structural work

Structural work consists of those activities that shape the official rules of the project and dictate the organizational structure of the consortium, once funded and initiated. Most of the structural work is done by the funding agency in the development of the RFA, which specifies the scientific objectives of the project, the governance structure (i.e., required committees and how the scientific direction will be set), and the overall responsibilities of the grantees. Although this work is predominantly in the realm of the funder, the CC may need to participate if changes take place during the funding cycle or in the development of the RFA to re-fund a consortium. The structural work of a consortium—and its impact—is also discussed in a related paper published separately.

One example of the CC's involvement in developing the structure of its consortium is evident in the Biomarker Network CC's influence on the RFA for the Biomarker Network's third funding cycle. Toward the end of its second funding cycle, the Biomarker Network CC suggested the introduction of "team project" requirements for each organ-specific working group as a way to increase the amount of collaborative science taking place within the consortium. Some in the CC felt that not enough collaboration was happening within the biomarker-discovery labs, which was holding back the entire Biomarker Network. Adam, a Biomarker Network CC PI, reported, "'[t]eam projects' is a concept we proposed after the [first] two cycles ... because we saw [that, for] the individual biomarker-discovery lab, most of them just do not have [the] ability or capacity to move the biomarker to validation. So we thought maybe they needed some help. And so if we have team projects, as a team they can pool resources together, pool expertise together, can recruit the sample quicker and they can identify [some] of the most important questions" (Adam, 275). These team projects are still getting off the ground, but have already led to greater collaboration among the discovery labs, which the CC hopes will result in more biomarkers to validate (Adam, 345). Adding more responsibilities to the project requirements in the RFA is engaging in structural work.

Collaboration-development work

Collaboration-development work is defined here as the extra work scientists participating in a collaborative project do to elevate the disparate groups of individuals and institutions toward a

functioning whole, or, in the words of many of our participants, to make the consortium "greater than the sum of its parts." This work includes participating in committees and working groups, negotiating roles and responsibilities of consortium participants, creating meeting agendas, reviewing consortium documents such as governance manuals, and aligning human-subjects applications across projects and institutions. Such work takes a great deal of time, yet was rarely accounted for in the time commitment that research sites allocated in their grant proposals. Participants noted that they often participated in several committees or working groups in each consortium, each with a monthly conference call and associated work. They also noted that these groups rarely had defined objectives and could just waste time if not well led.

The prioritization of work in the face of limited resources falls into the category of collaboration-development work. One of the processes developed by the Biomarker Network CC was a system to evaluate proposed collaborative projects. During the first grant period, the Biomarker Network CC realized that they did not have the resources to coordinate all of the studies being proposed by research center PIs. Accordingly, the CC PIs rated each project based on criteria such as scientific impact and required resources and then ranked them. At first, funding agency representatives and the Executive Committee were very resistant to this approach, thinking that the CC has overstepped its bounds; indeed, they rejected the idea. However, the CC presented their rationale and methods to the NCI and Executive Committee at their next site visit and the visitors were quickly convinced that this was the right approach.

> So our proposal to NCI is we help them to identify [the best proposals] because we had so many team projects and the NCI thought we should coordinate all. And we said no, no, that's not possible. So we offered to read those [submitted] team projects and identify which ones we think are the good ones, good in the sense that their prospective collection does not have bias and it's more likely to be very useful by the end. And so we will rank them as higher priority and we propose that we coordinate those. So at first they were not happy. They wanted us to [coordinate] all [the proposals]. They had a site visit, I think in year one, and that was one important question. So the NCI project director and the two chairs of the Biomarker Network [visited us for our site visit]. We presented our thinking, and we [told] them here are our rankings. And so after our presentation, they had a closed discussion. And so after that then it's yeah, we'll do it the way you guys say it. And they never raised that issue again. ... Because our criteria are clear. If it is approved, the study design principle is a prospective collected, and those are high quality ones that we ranked high (Adam, 371).

The CC's experience with study coordination and scientific expertise allowed them to make a rational, evidence-based case for which studies should receive access to the CC's limited resources. Furthermore, they had done so using criteria that were objective and drawn from the scientific objectives of the Biomarker Network. The effect of this action by the CC was twofold. First, by creating an objective system of scoring based on scientific merit, the CC eliminated some of the political issues around evaluating the projects; e.g., scientists are not immune to the pressures of supporting a project because it is proposed by a powerful colleague. Second, by providing leadership in the area of project prioritization, the CC saved the Biomarker Network from wasting a substantial amount of time: had the CC not done this, all the work of devising criteria, scoring each project on those criteria, and ranking them would have taken considerable time in

future Steering Committee meetings.

The Screening Network, on the other hand, struggled in the area of collaboration-development work as a result of differences of opinion over roles and responsibilities, compounded by disagreements over the scientific goals of the project. These disagreements resulted in much effort being devoted to discussion of the overarching purpose of the collaboration and how to work together. These conflicts are discussed in greater detail in a related paper published separately.

In general, the observed CCs took the lead on all collaboration-development work, organizing committees and working groups, scheduling conference calls and tracking their work, coordinating the writing of any governance documents, and creating a central human-subjects document that could then be altered by participating research centers. This leadership and the work done by the CC on behalf of the research sites not only centralized coordination, ensuring greater alignment among tasks, but aimed to reduce the amount of time that research-center PIs needed to spend on it.

There is another, less tangible benefit of the CC's leadership of the collaboration work. Because they had been working with consortia for many years, CC PIs and staff were able to guide the groups toward overall policies that had proven beneficial in the past. Furthermore, because the CC personnel had a high-level overview of the consortia and what each research center was doing, they were better able to ensure that specific policies worked for the majority of participants. Finally, as a neutral party, the CC was in a position to negotiate differences among participating research centers and to ensure that the achievement of objectives remains the consortium's highest priority.

Operational work

The *operational work* of the CCs comprises the administrative and technologic tasks done in support of the group's scientific objectives. The aim is to help the group's diverse and varying tasks function in a coordinated fashion, e.g., each CC organized conference calls so the groups could get together and draw up plans for data collection, harmonization, and analysis. Operational tasks include building the project's website, developing and administering email listservs and other communications, organizing meetings and conference calls, and tracking the consortium's publications. Although these tasks are not considered "scientific work," their performance by CC PIs and staff allows research center PIs to spend less time thinking of, and dealing with, project administration and more time working on science.

The CC group's previous experience with coordinating collaborative research meant they were able to start quickly. They had existing contracts with conference call providers, had systems in place for scheduling conference calls, and had computer programmers on staff. In fact, the Biomarker Network CC had spent substantial amounts of time developing these systems and was able put them into use rapidly when awarded the grant to manage the Screening Network CC.

Whereas operational activities, in general, require little scientific knowledge to complete, they have a profound impact on the group's ability to achieve its scientific goals. Anyone who has

ever spent time organizing a conference call involving dozens of participants across multiple time zones understands how much work it really entails. When that effort is multiplied by any number of committees and sub-groups, it can become almost a full-time job in a large, complex consortium. We are unable to quantify the precise amount of time spent on operational work; however, the Biomarker Network consortium had one full-time (100% FTE) project coordinator engaged only on this aspect. The Screening Network started with a project coordinator devoting a smaller amount of time but, by the end of our observations, was hiring a full-time coordinator. Additionally, the project managers of both projects spent substantial amounts of time on operational work, as did the computer-programming staff.

Data work

Both CCs engaged in substantial amounts of data work, the focus of which is the generation of the highest-possible-quality data for collaborative projects. Again, the range of activities in this category is wide and varies based on the scientific objectives of the particular project. In the Biomarker Network, standardized protocols had to be developed in each biomarker trial to ensure uniform collection of data and samples, whereas, in the Screening Network, common data elements (CDEs) had to be extracted from existing databases by participating research sites. (CDEs are standardized definitions of data to be collected or shared (National Cancer Institute, 2014)). Each of these goals required the CC PIs and staff to draw upon their expertise to ensure the collection of the correct data.

It is in this area of data work that the CC's experience and expertise played out most explicitly, with the greatest impact on the consortium's progress toward its scientific objectives. The CC team has learned important lessons from each study they have coordinated, lessons that have then been incorporated into improved processes for subsequent studies. Specific examples of data work that the Biomarker Network CC team developed and improved in the light of their previous experience include: a) the establishment of common data elements and data-entry forms; and b) the creation of eligibility-criteria flowcharts.

Common Data Element (CDE) Development:

Although the research center PIs writing the protocols and leading the studies were responsible for defining the aims of a validation study, they relied heavily on the expertise of the CC in both leading the conversations to discern precisely which data should be collected and how to represent those data in the data-entry system. The actual data needs of a validation study vary based on the proposed clinical purpose for the marker. When possible and appropriate, the CC tried to standardize the data collected from each study into common data elements. For example, the CC might use a CDE to standardize the way data on smoking are collected, requesting "Cigarettes Per Day" and "Years Smoked" from each study participant for studies. Because these CDEs had been used in the past, in both Biomarker Network and other studies run by the Science Facilitation Team, they have been vetted and shown to be well behaved and useful (Kieran, 185). The CC has compiled a list of standardized CDEs, which allows for the more rapid development of protocols, in that a PI could review the list and select those most applicable to the study (Kieran, 181). If new CDEs were necessary for a new study, they were created and could also be incorporated into

future projects.

The information provided in the protocol was used by the CC to develop the CDEs, but conversations were still required to ensure that the right data were collected. When asked about the process of developing the data-collection protocol, Edith, a CC staff member, described a meandering, iterative process of working with the study PIs to nail down precisely which data they wanted to collect. She noted that the process was time-consuming because of the need to have, at least in practice, multiple conversations to ensure that everyone is talking about the same thing.

> I could walk you through [the process] but it's really more like wandering around in the forest. It's an iterative process. ... So when someone proposes a project they usually say, "We want to collect these kinds of information about the patients that are supplying these samples or the patients that are being analyzed in some way." And they can be fairly general. And so we will talk to them and say, "Okay, let's try to come up with a specific list of all the data points that will collect this information that you want." Sometimes we use data lists from other projects and adapt them. And we'll send them either an Excel sheet or a Word document that is more precise. Then they'll say, "Oh yeah, well we really didn't mean that, that, that. We meant this, this, this. And this is what this other study did and the way they collected it, but that's not the way we think about it so we want it phrased differently." (Edith, 174).

As this makes obvious, PIs unprompted could find it difficult to express precisely what data they wanted for their research. One of the ways in which the CC added value to the data work of the consortium is by leading this process of tightly specifying the data to ensure that its collection would be rigorous and focused. If the data collected are not exactly what the researchers need in order to confirm the validity of the biomarker, the entire study will be much less valuable, perhaps fatally flawed. Previous experience with CDEs helps avoid this outcome.

When asked for a specific example of a time when she experienced that disconnect between what a research center PI thought s/he wanted and what s/he actually wanted, Edith described this incident:

> A project that we're working on currently, one of the forms is collecting information on lung nodules, and we have never collected that kind of information before. So, we're collecting information from either CT scans or MRIs. And there are a lot of technical data points that have to do with running a CT machine or an MRI machine that we don't necessarily know what they really mean. But it's obvious to the clinicians who do it all the time. And so we've had a lot of back and forth about how best to organize that information and exactly what information is needed. And we finally realized that what we really wanted was not information for every CT scan, but information on every nodule, whether it was a CT scan or an MRI. And then we'd follow that nodule and follow up, and that was a huge difference. And so just working that out took a lot. So, you start with what they give you and you try to figure it out but then you have to go back to them and say, "Well, I think this means this, and it would look this way in our system. Tell us what needs to change." (Edith, 271)

Here, we see how, by an iterative process, Edith discovered that the required data centered not on

a CT scan or MRI, but on each visualized nodule and what was known about it and done to it. These required two fundamentally different data structures, a conclusion obvious, perhaps, only to those who specialize in thinking about data collection.

Creation of Eligibility-criteria Flowcharts:

A second example of experience and expertise being used to improve systems and processes is the CC's work on developing eligibility-criteria flowcharts. When designing a clinical validation study, it is crucial to have precisely defined and scientifically appropriate criteria to determine who is eligible to be enrolled. There were some early Biomarker Network studies where the eligibility criteria encoded in the protocol and, subsequently, in the data-entry forms, proved to be in error—either eligible participants were not enrolled or ineligible participants were. Subsequently, the CC developed a detailed process to ensure that all parties were deeply familiar with the criteria for eligibility and that this understanding was precisely encoded into the protocol (Edith, 249). This development was designed to ensure that both: (a) the PIs themselves were clear on the implications of the eligibility criteria they had proposed; and (b) there were no misunderstandings in terminology or intention as the CC interpreted what the PI had proposed (Edith, 184). Edith described her goal in developing the eligibility-criteria flowcharts as explicitly documenting who would be included vs. excluded in such a way that the logic contained in the flowchart could be easily programmed into the data-entry system, all with the goal of ensuring that the proper participants had been recruited.

> My goal in an eligibility flowchart is to combine in one document all the online phrasing of each data point that's required to determine exclusion and inclusion. And also the place in the database where the programmer can find where that data point will be stored. And also the – so you found this data point, it's got this value for this person, what do you do with that? And so the idea is for each, to create a point where you start off with a data point. You describe everything about it, and you have arrows that point to the options depending on the value of the data point (Edith, 222).

In essence, Edith's work on the eligibility flowcharts acted as a bridge between the data work of identifying the eligibility criteria and the operational work of building the data-entry system.

The development of the flowcharts required iterative conversations among the PI of the protocol, Edith, other CC staff, and the project statisticians at the CC, who were called in to evaluate the eligibility criteria and calculate the number of participants likely to be recruited under the proposed rules at the proposed sites. From these conversations, the CDE specialist created a flowchart that made explicit the data that determined eligibility. For example, the first data point used to determine eligibility might be age, say, excluding any patients under 60. Next, a check on the patient's previous diagnosis of cancer might exclude more patients, possibly recruiting only those with no previous cancer. Such detailed attention to eligibility decisions allowed the PI to adjust the recruitment strategy and choose the study sites before, rather than after, the study began, saving time and money. There might still be adjustments once the project was underway but they would be likely to be less dramatic as a result of these steps. This work resulted in fewer ineligible participants being enrolled and fewer eligible participants being missed.

The aim of the CC data work described here was to ensure that the study sites generated high-quality data that could then be sent to the CC for analysis. By using their experience with previous studies to improve data collection in subsequent studies, the CC took advantage of the skills and knowledge, both individual and collective, which had been developed over more than a decade of study coordination. This focus resulted in studies that operated more smoothly because the routine challenges of designing a study, e.g., data collection and eligibility, have already been addressed and codified.

In interviews with both internal and external Biomarker Network participants, this data work was noted as critical to the success of the project. When asked about the role of the Biomarker Network CC, Karen, a CC staff member, noted first that it was to ensure high-quality data for the validation studies (Karen, 38). Several other members of the CC also stressed that high-quality data are the top priority for all the data work that they do. The focus on quality stems not just from a desire to do their jobs well, but also from an understanding that only high-quality data will securely underpin the group's scientific objectives. If the data were suspect, the Biomarker Network would lose the ability to make claims about the quality of a biomarker, as described by Tamara, a Biomarker Network staff member:

> I think it's a process of educating folks that if you're trying to figure out a usable biomarker, it's imperative that your samples are uniform and are of the highest quality. So it benefits you to follow these protocols and I think it's educating the people to think in a bigger picture. This is going to be better science if we all do it in a standardized way that is of quality. And then ultimately we will have better outcomes because you won't have some crazy data set. ... And so then we'll know, gosh, that biomarker failed and I'm pretty comfortable that it failed because my samples were of quality or, wow, that biomarker had awesome results and I'm really confident with my data because my samples were really good quality. (Tamara, 370)

Tamara noted that it was the CC's responsibility to make sure that validation-study sites understood why compliance with the protocol was so crucial, underscoring the importance of the communications work done by the CC.

In addition to their work facilitating consortium-level work, the Biomarker Network CC was charged with developing novel statistical methods for biomarker science. When the Biomarker Network began, little was understood about how to ensure that biomarker validation studies were reliable. As James, a Biomarker Network research center PI, noted, "the science of biomarkers is complicated. ... Say you have a blood test or a urine test that you think finds a cancer early – one would like to think that there is a very simple design of a study that will confirm that. Actually, it is extraordinarily complex" (James, 35). The CC has made major contributions to the field of biomarker science by creating study design and clinical validation criteria for biomarker discovery and development (Pepe, Feng, Janes, Bossuyt, & Potter, 2008; Pepe et al., 2001).

Thomas, an NCI representative, described the importance of the work of the CC, noting the lasting impact of the CC's statistical work not only on the Biomarker Network but on the field of

biomarker science overall.

> For example [CC statistician] is so well-known in the area of cleaning and early detection for her statistical research. [Adam], again, very well-known in the field, so they come up with some creative ideas and one of the creative ideas that you can think about was their publication on five-phase criteria for biomarker discovery and development. What should drive the study design? So they talk about clinical endpoints, then what sort of specimens are needed for that, to meet their clinical goal. So the probe design expands on five-phase criteria to elaborate on the requirements of the biomarker validation, depending on the organ sites you deal with. So I think those are the unique contributions that CC has made to the research within their coordinating center and this has been partially because we have leaders in the field of statistical design at Fred Hutch. So those were something that they did for the larger community but they also conducted studies within their center and that are very useful for everything we do within Biomarker Network. (Thomas, 109)

In addition to the obvious benefits to the Biomarker Network of developing stronger and more reliable methods for validation studies, the CC's work on statistical methods and study design have had the added benefit of boosting the entire field of biomarker science.

Thomas further described the substantial impact of the CC data work on the Biomarker Network, noting that he wished they had more funding for the CC to expand their services from work on trans-Biomarker Network projects to the individual projects of the research centers.

> Honestly, I don't want to brag about it but [CC staff] are so well-appreciated by members of the [Biomarker Network] that some of the members started asking whether [the CC] can advise individual members on their statistical study design. That was not possible because of the funding restrictions and also the funding limitation. But [CC] agreed that on a case by case basis they will help individual investigators if the study is likely to lead to a large validation study. (Thomas, 153)

The biostatisticians of the CC have developed such a reputation as those who elevate the quality of studies that Thomas of the NCI wished they could be involved in the statistical work of the research centers' individual studies, as well, especially in the realm of designing stronger studies. Well-designed studies result in more valid conclusions; even null studies produce new knowledge. Unfortunately, the resources of the CC are limited so that they are able to coordinate only four to five trans-Biomarker Network validation studies at a given time.

The Screening Network CC (essentially the same group), on the other hand, struggled with data work. During the period of observation, the majority of data-related work done by the Screening Network CC was focused on securing agreement from the Screening Network research centers about which data elements to send to the data repository and in what form. As they worked toward that objective, the CC tried to use its extensive knowledge of cancer-related data elements to steer the group toward choosing data that would result in the best analyses. The CC's experience in data collection within the Biomarker Network had given them a deep understanding of the potential pitfalls in collecting and harmonizing such data; however, due to organizational issues with roles and responsibilities as detailed in a companion paper, the CC experienced difficulty

in getting the research center PIs to agree on which data to collect and paradoxically struggled to exploit their own experience and knowledge in data-collection procedures to the benefit of the Screening Network (Edith, 315; Nigel, 509).

Discussion

Each CC's work in facilitating its consortium provided valuable services, as well as a unique perspective on the project, allowing it to facilitate the collaborative work that could drive the consortium toward its scientific goals. Because of its experience in coordinating consortia, the CC was able to help the groups create processes and policies that were effective and supported the science. This, then, is the essence of facilitation in Coordinated Collaborative Science: moving a consortium toward its scientific objectives through the application of expertise in the following areas.

1. *Objectivity and Big-Picture Thinking*: One of the great advantages a consortium gains from the addition of an independent CC is a neutral third-party with a high-level view of the entire research program. The CC occupies a unique position in that it is simultaneously a grantee and a scientific contributor, yet it is not a research site in the consortium. As such, the CC enjoys a level of camaraderie with the other grantees and can speak their language, but also has a direct relationship with the funding agency. As a neutral facilitator, the CC can use its position to guide the consortium to stay focused on the overarching goals and scientific objectives of the project without getting distracted by its own agenda. This was the first major advantage of an independent CC that research center PI participants identified in interviews.
2. *Leadership*: A strong CC can provide leadership in an environment that is generally devoid of it. The cooperative agreement structure is such that it is led by a Steering Committee, which may be made up of dozens of research center PIs, CC PIs, and funding agency scientific staff. What this means, in practice, is that everyone is in charge and no one is in charge; progress is dependent on one or more people stepping up and taking leadership roles, which may or may not happen. When the CC has strong PIs who are well-versed in leadership of consortia and understand what it takes for a consortium to flourish, the consortium as a whole benefits. The Biomarker Network CC PIs, among other roles, took leadership in their assessment of proposed team projects.
3. *Development of Governance and Operating Procedures Policies*: As with leadership, the expertise of the CC team comes into play when the consortium is deciding upon governance policies and operating procedures, as well as organizing meetings and running conference calls. Although these activities seem relatively straightforward and are thought of as primarily administrative tasks, the decisions that are made and encoded into the consortium's practices have a lasting scientific impact. For example, a governance structure that allows a small Steering Committee to decide which collaborative projects move forward without input from the rest of the consortium's members can: (a) result in substandard projects being approved for political, rather than scientific, reasons; (b) dissuade non-SC members from submitting projects; and (c) damage feelings of

community and consortium-focused efforts. Meetings and conference calls can quickly go from productive and organized to chaotic and frustrating without a strong facilitator. It is difficult, if not impossible, to accomplish scientific progress in that kind of chaos

4. *Data Development and Project Management*: CC PIs and staff were not just experts in the biostatistical methods needed to run the appropriate analyses; they were also experts in the conversations and processes required to produce the right data to accomplish a study's goals. As described in the sections on CDE Development and Eligibility Flow Chart Creation, Edith and the CC team were not experts in CT scans and MRIs but, rather, experts in the work needed to collect the right data. A CC cannot possibly have expertise in every area of biomedicine and the establishment of CDEs for every disorder. Although the scientific knowledge they do have proves very useful, their skill in leading conversations toward the collection of appropriate data, as evidenced by both these examples, may be even more important to the outcome of a validation study.
5. *Centralizing and Offloading Work*: A well-run CC saves participating research center PIs and staff substantial amounts of time by offloading administrative tasks from the research sites onto the staff of the CC. This process allows research site PIs to spend more time doing science and less time on organizational and administrative tasks. In general, the research site PIs whom we interviewed were committed to an average of 10% FTE on the consortium under discussion. This time commitment encompassed not only their responsibilities for their independent projects at their local sites, but also their responsibilities to the consortium. Considering an average work week of 40 hours per week (a marked underestimate for most working scientists), the 10% commitment gives them four hours per week to meet their obligations for this project. Clearly, any work the CC takes on helps PIs accordingly. The CC's focus on producing high-quality data likewise saves time and effort for the PIs: the upfront effort that the CC puts into establishing data structures and data-collection instruments saves the project PIs from having to do or redo considerable amounts of work. Finally, the contribution of the CC can allow research sites to spend less of their grant funding on administrative and organizational aspects of the project. Although we were unable to measure this saving directly, it was mentioned by several participants.

And yet, from the examples given here of the struggles of the Screening Network, it is clear that the experience and expertise of the CC are not enough. We have to ask why, precisely, was the CC not able to apply their established, vetted, and proven systems and processes to ensure strong facilitation of the Screening Network? We present one answer to this question in our companion paper that describes major differences in the RFAs that initiated the Screening Network and Biomarker Network. Simply put, when the CC is not able to engage fully as facilitators, for whatever reason, the consortium suffers. We also have seen the cost of a weak CC in the setting of other consortia.

Furthermore, the skill set of the Science Facilitation Team at FHCRC is unique and developed over decades of experience in managing collaborative research. We must ask how other CCs can develop similar skills without needing to first invest decades of work.

Conclusion

CCs such as the one described in this paper are powerful, underused tools that facilitate Coordinated Collaborative Science, tools that show great promise in helping groups of researchers working on pressing problems to make greater progress. By applying collective decades of experience and expertise in the facilitation of collaborative work, the CC PIs and staff were able to provide the consortium with a neutral, third-party view of the project, keeping it on track toward its scientific objectives, providing leadership when needed. The CCs also helped the consortia avoid some of the pitfalls of collaborative research that have been well-documented in the literature on team science. By doing these things, the CC saves research site personnel time, effort, and money.

Yet groups such as the Science Facilitation Team discussed here are rare, primarily because of the difficulties in developing and sustaining such an organization under the project-based funding model of scientific research. This is as true today as when the 1978 Coordinating Center Models Project report was written. It is extremely challenging for an organization to maintain the systems, personnel, and knowledge base required to facilitate collaborative science at this level without consistent funding. We call on the National Institutes of Health to begin considering such groups as essential components of all collaborative projects, funding them as infrastructure rather than an administrative component of individual projects and especially of large collaborative research. There are precedents for such a move, exemplified by the Supercomputer Centers funded by the National Science Foundation. Our research begins to support the hypothesis that coordination and facilitation have as deep and lasting an impact on the scientific progress of a project as its computing facilities.

Furthermore, we call for more research on CCs, team science initiatives, and consortia to develop guidance for new CCs as they develop their own systems and processes to facilitate Coordinated Collaborative Science. As mentioned earlier, few resources exist to help in this area, but we believe the development of templates and sample governance manuals could greatly decrease the time and effort required to guide a consortium through its initial start-up phase.

This research on CCs and their facilitation of collaborative research is a beginning. We need to develop a deeper understanding of this facilitation work and seek ways to better document the processes and procedures that the CCs described here use in such a way that their knowledge can be transferred to other groups that facilitate collaborative research. We also need ways to train the various consortium participants—funding agency representatives, research-center PIs and CC personnel themselves—in what facilitation entails.

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Betsy Rolland, PhD, MLIS, MPH
University of Wisconsin-Madison Carbone Cancer Center
800 University Bay Drive, 210-19
Madison, WI 53705
(608) 262-8314
Email: brolland@wisc.edu
Other affiliations: Public Health Sciences Division, Fred Hutchinson Cancer Research Center; Human Centered Design & Engineering, University of Washington

Charlotte P. Lee, PhD
Associate Professor, Human Centered Design & Engineering
University of Washington

John D. Potter, MBBS, PhD
Member and Senior Advisor
Public Health Sciences Division, Fred Hutchinson Cancer Research Center; Department of Epidemiology, School of Public Health, University of Washington; Centre for Public Health Research, Massey University

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Research Shared Services: A Case Study in Implementation

Brian Squilla
Thomas Jefferson University

Jenna Lee
Huron Consulting Group

Andrew Steil
Huron Consulting Group

Abstract: *The private sector has been moving toward the idea of consolidating administrative functions within organizations since the 1980s. While this sector has traditionally implemented shared services with cost reduction in mind, traditionally through economies of scale, many universities across the country have begun to explore the concept of managing the research enterprise with hopes of finding an enhanced model for supporting operational and administrative processes. While several university-based shared service campaigns have allowed for reinvestment of time and money into mission-critical endeavors, the complex realities of assessment, design, and implementation make it a potentially daunting undertaking. This manuscript describes the strategic challenges of implementing a shared service model for organizing research administration at a major academic medical center, Thomas Jefferson University.*

Keywords: *Research Shared Services, Research Administration Transformation, Organizational Realignment, Metrics, Reporting*

Introduction

Over the past few years there has been increasing attention toward the idea of shared services as a model for supporting research administration at research-intensive institutions (Gideon, 2012). As with any type of organization, this model has pros and cons. While there is no one-size-fits-all model for research shared services, this type of organization generally has the following attributes: a level of centralization of services that are traditionally performed by local (school/department) research administration personnel, standardization of these services across the stakeholders served, and a Service Level Agreement (SLA) that guarantees support and level of services provided to customers, which can include a feedback mechanism and metrics to measure the quality of support.

At their core, shared service centers represent a redefined organizational model coupled with the opportunity for process transformation and technology enhancement. There are a variety of different models that can be executed based on the needs of the customers and the goals of the university. Leadership must consider the services that will be provided and determine which

model best balances the implementation goals with the potential impact on the stakeholders served (Cluver & Stevens, 2014). While institutions that have this type of organization vary in their approach, there are three primary models for research shared services:

1. *Model A: Cradle-to-Grave*
   – Grants administrators serve as part of teams or pods and are responsible for cradle-to-grave research administration (both pre- and post-award).
2. *Model B: Specialization*
   – Grants administrators serve as part of teams or pods, but are responsible solely for pre- or post-award.
3. *Model C: Hybrid*
   – Grants administrators serve as part of teams or pods, but each team or pod designs their services in their unique fashion—one may have grants administrators responsible for both pre- and post-award, while another may have their administrators specialize.

In the following paper we outline the high-level steps to launch this type of organization at your institution and outline one university's experience—Thomas Jefferson University (TJU)—to illustrate the process and lessons learned from their design and implementation. As institutions begin to consider this type of model for research administration, it is critical they approach it with an eye toward change management, engagement of key stakeholders, and ongoing communication and monitoring post-implementation.

Making the Business Case – Do Research Shared Services Work for Your Institution?

The goal of research shared services is to reorganize transaction-based activities that occur in decentralized units and departments so they become the core services of a new, specialized organization or group. Before implementing, each institution should have a unique business case outlining the opportunity for research shared services. The business case focuses on the unique needs of the Principal Investigators (PI), central units, and the institution at large. It is important to define why research shared services are a good fit for your institution, which elements your model will incorporate, and what results you expect to achieve (Azziz, 2014).

While some institutions may approach shared services as a cost savings measure (as they might finance, IT, or HR shared services), with research, an organization should think about it as an investment. The higher education climate mandates that institutions consider mission over margin when approaching an organizational change such as shared services. Higher education's mission and overarching goals mean that cost efficiency will not always determine operating decisions. For example, the University of New Hampshire's implementation was motivated by the standardization of services, enhancements to training offerings, improving internal controls, and eliminating "shadow systems" (Stony Brook University Senate, 2012). The return on investment for this method of service delivery transformation works by providing high levels of training, professional development, and cross-collaboration to employees, while breaking

down organizational silos and retaining PIs through delivering the necessary services with a high level of quality. If an institution believes in the caliber of its faculty and commits to building an administrative infrastructure capable of submitting and managing more complex sponsored research, then the increase in indirect costs will more than pay for this shared service investment.

High-Level Steps for a Research Shared Service Implementation

Step 1: Review Core IT and Human Resource Components Related to Research Administration

In order to understand your organization's readiness for a shared services model, it is important to consider the HR and IT components currently in place. Does your institution have an IT model that can support a more centralized model of local grants administration support? For example, at TJU, one of the requirements that became important to investigators was a detailed projection report for each of their active grants. While it was known that this support varied across departments in quality and frequency, TJU lacked the IT infrastructure to support the real-time projections that many faculty desired. To make up for this lack of IT support, the model required more staff support to create these reports manually. This was a substantial factor in determining the number of Full-Time Equivalents (FTE) required to support the research infrastructure.

Human Resources benefits are another area to explore prior to implementing this type of model. You should consider the total rewards as they relate to all benefits of other institutions in your area and what benefits they can guarantee employees. In order to attract and retain top talent to your research shared service center, you should be able to offer the same or better benefits than the local departments and local institutions offer. Another opportunity with this model is to partner with your institution's HR department to create detailed, new job descriptions coupled with a compensation analysis of these new positions reflecting the duties needed to execute this plan. For example, at TJU, HR was a key partner and member of internal committees in completing these analyses and building career ladders for the members of the new organization.

An institution should consider the current research administration talent in their organization. If the institution previously had many local schools and departments that did not dedicate individuals to the profession of research administration, then it will be a challenge to implement this type of model. You will need to add time to the implementation schedule to train and on-board your new employees.

Step 2: Decide on the Model that is Best for your Institution

Once the internal assessment is complete, it is important to present those findings to your most important constituency—the research faculty. This group should be engaged at the beginning of your process as well as throughout the design and implementation phases. The faculty are most affected by the change and will have the largest stake in the outcome.

TJU implemented a Faculty Advisory Committee (FAC) early on in its implementation process, and it was this body that advised on the design of the research shared service group. Ideally, this

group would be presented with the findings of the assessment phase:

1. Current state of IT supporting research administration and the ability to support a centralized, standardized model of local grants administration support.
2. Current state of HR recruitment and ability to recruit top research administration talent.
3. Proposed models for support and the pros and cons of each.

Based on these findings, the committee should weigh in on which model to move forward with and help to identify some of the challenges that will be faced by other faculty members and department administrators.

Another option at this stage is to present a panel of research shared service experts from other institutions (preferably local institutions, if this model exists in your area) to speak with the faculty and current department administrators regarding their own lessons learned. Hearing from peer institutions often holds more weight than asking your constituents to imagine how this new model could operate.

Step 3: Recruit the Leader/Director

It is important to begin recruiting your director immediately after your institution has decided to move forward with research shared services. This should be the first job description written, analyzed for compensation, and posted—all the better if you already have someone at your institution who can fill this role. This is the first and most critical position to fill in your new organization.

There are two critical qualities for the director of a new organization: 1) the ability to facilitate well and 2) the ability to successfully navigate the political climate at an institution. Of course, you will seek a candidate with technical abilities in research administration as well, but these two "softer skills" are essential for the leader of a new organization within your institution.

The new director will need to own the process and become the face of your new research shared services organization. The earlier that person is involved, the more invested they will become in the process and the decisions being made. The director also must begin developing those important core relationships with individuals at your institution—finding those key influencers

Does Your Candidate Have What it Takes?
√ **A Facilitator** – Possesses excellent leadership abilities and is capable of overseeing multiple functions and departments. – Has a unique passion for service excellence and integrity. – Displays advanced skills in strategy development, systems planning, and change management. √ **The Ability to Navigate Political Waters** – Exudes emotional intelligence and professionalism in building strategic university relationships. – Works collaboratively and acts persuasively in sensitive situations (i.e. skills in conflict management).

Figure 1. Candidate Profile

and making sure they are involved in the process.

Step 4: Develop Messaging and Performance Measurements

Rather than a discrete step, messaging is something that should be threaded throughout your implementation and used to capture continuous feedback. Your key stakeholders will want and need frequent updates on the progress of the new organization and key decisions regarding the design. TJU, for example, implemented a monthly town hall meeting during their implementation process. Integral to these meetings were frequently asked questions and major decisions regarding job postings, hiring, and transition to the new organization.

In the months following implementation, TJU leadership began a rebranding effort with the goal of formalizing the partnership between their new shared service organization, Research Administration Center of Excellence (RACE), and the Office of Research Administration (ORA), the university's central pre-award office.

The Offices of Research Support Services, as the parent organization is now called, provides a much needed bridge between the university's faculty-centric support services for research administration at TJU. The relationship between RACE and ORA has been critical in developing and refining the current research administration support model. Much of the organizational success can be attributed to team building and cross-collaboration initiatives such as WRAP (Working Research Administration Partnership) meetings, Research Support Services monthly management meetings, and brown bag training sessions. Key accomplishments of these initiatives include:

1. Creation of roles and responsibilities matrices/FAQs spanning the full life cycle of research administration;
2. Professional development opportunities (e.g., multiple NCURA workshops hosted at TJU);
3. Establishment of an Online Training Library consisting of 38 research administration training courses in Blackboard; and
4. Development of an ORA SLA that complements the RACE SLA.

The Research Support Services leadership also provides updates to the campus' research community. This is a great opportunity to obtain feedback from the research faculty and school and departmental administration. Some examples of these forums are departmental meetings, professorial meetings, as well as the Provost Council and the Jefferson Committee on Research. The purpose of these meetings is two-fold: RACE leadership provides a general update, including an overview of the unit's key performance measures, comparing the organizational performance against the agreed-upon SLA, and the VP of Administration provides a macro overview of the state of research administration at TJU.

As part of the overall strategy for monitoring the progress of the new organization and to ensure the communication mechanisms employed were having the desired effect, TJU instituted several feedback loops for the research community. Upon implementation, all RACE staff placed a link to a 2-question survey in their e-mail signatures. Essentially a "how am I doing survey" allowed

for real-time feedback on services provided. In addition, the FAC continued to meet and bring feedback from the faculty being served to the project leadership team as the implementation was rolling out. This mechanism was essential in giving faculty an outlet—through their peers—to express feedback and help tweak the model as necessary. Finally, the Research Support Services leadership also instituted semi-annual surveys to research faculty regarding services received in both ORA and RACE—an effort to ensure that the full research administration life cycle was operating at the level desired.

Step 5: Finalize Timeline

Implementation is a multi-step process that does not follow a defined footprint. As such, you should allow your institution ample time to evaluate, redefine, and adjust the project implementation timeline where appropriate. The circuit breaker steps, highlighted below, are necessary components of any implementation. These defined steps allow project stakeholders to step back and re-evaluate the project goals and institutional impact of the proposed service delivery model. Below is a sample phased timeline for the implementation of a research shared service center.

Phase 1: Plan **Phase 2: Evaluate** **Phase 3: Design** **Phase 4: Implement** **Phase 5: Optimize**

Phase	Primary Outcomes	Expected Duration
Phase 1: Plan	– Establish project goals, milestones, and communication strategies o Establish project goals and objectives with project team o Develop project plan and timeline o Identify stakeholders for and create steering committee o Identify stakeholders for and create faculty advisory committee, if applicable	3-4 Weeks
Phase 2: Evaluate	– Assess the current local research administration model and provide potential path to optimization to enable leadership to make a "go/ no-go" decision o Conduct interviews and workshops with faculty, staff, and leadership to understand the current local research administration support system o Evaluate service delivery through qualitative surveys to the customers and service providers (e.g. customer satisfaction survey) o Identify opportunities to improve service delivery o Evaluate current IT and HR structure supporting research administration and ability to support new, proposed organization o Propose initial solutions to address opportunities including, but not limited to, governance, organizational structure, staffing requirements, etc. o Conduct impact analysis to evaluate institutional readiness for change	2-3 Months
CIRCUIT BREAKER—validate the decision to implement research shared service		
Phase 3: Design	– Create roadmap for transformative change o Develop task force(s) in charge of organization implementation, including appropriate committee structure o Create implementation roadmap o Finalize organizational structure and staffing requirements, including job descriptions o Develop and validate new governance model and structure o Design new processes, including enabling technology, roles and responsibilities matrices, and process documentation	3-6 Months

	○ Develop Service Level Agreements (SLA), as appropriate	
CIRCUIT BREAKER—validate the decision to implement select model of research shared service		
<u>Phase 4:</u> Implement	– Provide project management and operational assistance throughout the implementation ○ Identify, revise, and finalize policies and procedures determined as areas of focus by senior leadership ○ Document business processes and update documentation and other supporting materials to reflect institutional policy changes ○ Complete training and deployment planning, prepare facilities and workspace, and finalize transition steps and timing ○ Review and finalize SLA with institutional stakeholders ○ Deploy hiring plan ○ Support units, as needed, to reorganize the work of unit-based staff to accommodate the new service delivery model	6-8 Months
<u>Phase 5:</u> Optimize	– Ensure the sustainability of project goals and optimal results ○ Identify maintenance plan for on-going training ○ Implement and monitor new process, monitor progress, and identify/resolve issues ○ Measure defined Key Performance Indicators (KPIs), implement continuous improvement, and conduct customer and employee satisfaction assessments ○ Expand technology footprint to support service delivery improvements ○ Develop/refine training materials to instruct faculty and staff on changes to policies and its impact on the day-to-day operations ○ Devise stakeholder communications and messaging of policy and process changes ○ Assess staffing annually as it relates to the size of your institution's sponsored research portfolio to ensure ongoing SLA criteria is met ○ Expand technology footprint to support service delivery improvements ○ Develop/refine training materials to instruct faculty and staff on changes to policies and its impact on the day-to-day operations ○ Devise stakeholder communications and messaging of policy and process changes ○ Assess staffing annually as it relates to the size of your institution's sponsored research portfolio to ensure ongoing SLA criteria is met	Ongoing

Figure 2. Implementation Timeline

Thomas Jefferson University – The Research Shared Service Opportunity

As TJU embarked on a new blueprint for strategic action, one of the areas of focus was high-impact science. The Provost's research strategic vision focused on programmatic team science and a diversification of TJU's sponsored research portfolio. Research administration was a major component in delivering the Provost's vision. The opportunity was to ensure that TJU's research administrators were positioned and trained to assist research faculty with preparing more complex proposals from a variety of sponsors. TJU also wanted to ensure that research administrators were trained and had the tools from a post-award perspective to manage the complex grants once awarded.

The vision of creating a shared service model was to provide faculty-centric research administration support across TJU by standardizing processes and restructuring positions. This vision included enhancing service for all researchers across campus, ensuring consistent processes and procedures across schools and departments, and providing grants management staff a clear career path and opportunities to grow their careers through professional development and networking.

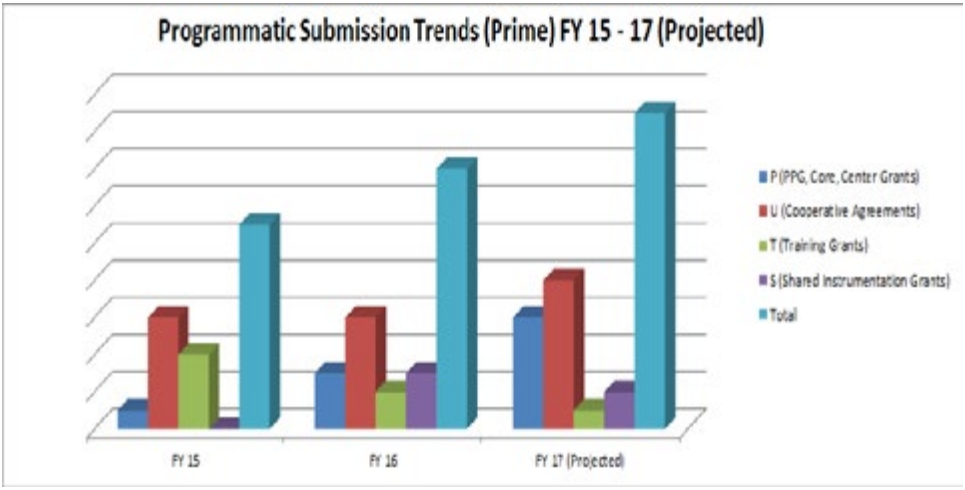

Figure 3. Programmatic Submission Trends

Lessons Learned

Implementing any new organization has its challenges—a research shared service group is no exception. Indeed, because this type of office is integral to the success of PIs and research faculty, it tends to garner much more attention at institutions than other types of organizational change (e.g., a Human Resources or IT shared service organization).

While TJU's shared service implementation was ultimately successful, there were several critical lessons learned from their process:

1. Identify the Decision Makers: It is important that there is a clear leader at the helm

during a shared service implementation. It should be clear what person or governing body has authority to make the final decisions. As much feedback as you are garnering during this process, keep in mind that there will be disagreements. There are going to be points of impasse and someone at your organization with political clout and authority should be on point to make a final decision and provide an explanation for that decision. While this occurred later in the TJU implementation, it was not immediately clear in the early stages who had ultimate decision-making authority. This caused some confusion at critical junctures that could have been avoided with a stronger governance structure in place.

2. Create a Clear Career Path: One of TJU's stated goals for implementing a shared service organization was the creation of a clear career path for research administrators. In creating the new positions for the shared service group, an attempt was made to differentiate between levels of Grants Administrators to accomplish this goal. While this worked to some degree, it was not until after implementation that a new Grants Coordinator position was created. This position became an entry-level job whose primary responsibility was taking on the administrative tasks of each team. This became the gateway position for employees to enter the organization and grow into the Grants Administrator I role. Had this path been clearly defined at implementation, better support could have been provided for Grants Administrators as they learned their new portfolios.
3. Define Flex: A benefit of this type of research administration support is the ability for team members to provide the same type and level of support, no matter what school or department is being served. It is critically important to develop standard operating procedures and an SLA between the new organization and its customers. There is, however, also a need to define the term "flex" within the shared services group. This is often a confusing proposition because many universities are not accustomed to having standardized operating procedures for tasks across schools and departments. Many schools and departments are given almost complete autonomy within the organization for most tasks and research administration support is no exception. The idea of using team members across shared service teams and flexing support when one team is busier than another is a learned skill rather than something that occurs naturally within the group. This idea of flex should have been better defined at TJU, with pilot groups employed prior to full implementation.
4. Anticipate Initial Challenges with Workload and Faculty Experience: SLAs are an excellent vehicle to assist in building relationships and setting expectations between research shared service centers and their customers. When implementing an SLA, leaders should anticipate some degree of difficulty in executing the agreement out of the gate. At TJU, Grant Administrators needed to quickly learn their portfolio, build a rapport with PIs, while also learning new processes and institutional intricacies. This made the SLA, at times, difficult to execute. SLAs can quickly become unnecessarily bureaucratic and burdensome without proper attention to initial feedback and workload-related problems within the center. The agreement should be perceived as a living framework for an

evolving and organic relationship of transactions between the stakeholders and providers. Proper attention and evolution of SLAs can be a great benefit to research shared service centers as their services and results mature.

5. Determine Staffing Requirements and Institutional Variables: RACE staffing requirements were originally developed based on a declining sponsored research portfolio. During evaluation, the project team identified 50+ individuals involved in research administration who were, at the time, fragmented throughout various schools and departments. The initial goal of research shared services was to decrease this overall FTE count, centralize approximately 27 dedicated Grant Administrators, and reduce the cost for administering research. After several months of workload-related challenges, RACE leadership made the decision to conduct a two-phased staffing recalibration, which resulted in an increase of six FTEs, for a total 33 RACE staff members. This staffing increase was primarily due to onboarding difficulties, institutional-specific knowledge gaps, and additional required services that were not fully automated. The first question asked during evaluation should have been "how many FTEs are required to provide the administrative infrastructure to execute the research strategic plan?" This question was only answered after the recalibration of RACE. In retrospect, the project team should have worked with senior leadership to consider the implications of executing the research strategic plan and its effect on staffing requirements. Two years later, there is documentation illustrating the growth of TJU's programmatic research and complex proposal submissions (e.g., SPORE, program projects and large collaborative research projects). Previously, the expertise to support this type of research was sporadic within departments. Today, TJU is effectively doing "more with less" and has a dedicated team of research administration professionals fostering a stronger foundation for service, institutional collaboration, compliance, scalability, and personal career growth. Research shared services is an investment, not only in terms of time and cost, but also in executing your institution's own vision for research strategy and growth.
6. Engage an External Partner: Most, if not all, academic institutions lack the bandwidth, mindset, and ongoing commitment to pull off a large-scale transformation such as research shared services. External partners enable institutions to execute their strategic vision and provide assistance in the trenches during the ramp-up period of the new organization. Research institutions do not have the luxury of pausing while a shared service center is implemented and external partners help to fill this gap while new Grants Administrators are trained and onboarded.
7. Phase Implementation: Inclusion of departments within the research shared service center should span several phases, starting with the units most in need of the service. The last phase should include those departments that previously had established research administrators at the local level.

What Worked Well?
√ **Incorporating Open Houses Quarterly**, whether by team, specialty, or portfolio
√ **Including the Purchasing function** within the organization, allowing schools and departments to utilize shared service personnel to order research supplies
√ **Scientific Editor** – This new service to faculty was added as a part of the new organization, but could be separate from a research shared service center
√ Schools and departments without previous local research administration support began increasing proposal submissions. For the first time, they felt there was consistent, **stable support for their researchers**
√ Lessons learned as a part of the research shared service implementation made **future organizational changes easier**, such as the Jefferson Clinical Research Institute (JCRI)
√ **Service Level Agreement** – The document clearly outlined the difference in service between the central offices and the new shared service organization
√ **Monitoring** – Creation of an organizational dashboard, which is currently sent to research administration leadership on a monthly basis. In turn, the data is analyzed and assembled into a monthly metrics report, creating organizational transparency and accountability
√ Establishing a **new culture for research administration**. Previously, this was one of "policing" – now it is centered around customer service and cross-collaboration, involving both RACE and ORA

Figure 4. Lessons Learned

Conclusion

A research shared services organization has the potential to bring a consistent and high level of service to PIs, while also minimizing compliance risk and ensuring that research administrators serving schools and departments are skilled, trained professionals. However, to make the transition to this type of organization, research-intensive institutions must approach the process thoughtfully and with attention toward change management and data-driven decisions. It is vital to consider the value proposition of this type of change, followed by a detailed assessment of the current state of research administration. Once a course of action is agreed upon, with clear decision makers at the helm, it is important to create clear and broad-reaching messaging to the research community as the implementation moves forward. Clear messaging and a continuous feedback loop, coupled with clear metrics showing progress toward goals, will ensure that the shared services organization maintains accountability and superior service now and in the future.

Authors' Notes

This manuscript is based on a two-year assessment and subsequent implementation of a research shared service center at Thomas Jefferson University in Philadelphia, Pennsylvania. The organizational realignment discussed in this paper stemmed from the Provost's strategic vision for research focused on programmatic team science and to ensure that TJU's research administrators were positioned and trained to better assist research faculty in the development of more impactful science. This paper, in its earlier form, was published in abbreviated copy in the March/April 2016 edition of NCURA Magazine, the journal of the National Council of University Research Administrators. This manuscript provides a complete narrative of the goals, challenges, and lessons learned by TJU in successfully implementing a more suitable organizational structure for supporting researchers at the university.

Andrew Steil
Associate
Huron Consulting Group
550 W. Van Buren Street
Chicago, IL 60607 USA
Telephone: 708-514-0899
asteil@huronconsultinggroup.com

Brian Squilla
Vice President of Administration
Chief of Staff to the Provost and Dean of Sidney Kimmel Medical College
Thomas Jefferson University

Jenna Lee
Director
Huron Consulting Group

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Perspectives on Institutional Bridge-Funding Policies and Strategies in the Biomedical Sciences

Robin M. Yates BSc, BVSc (hons), PhD, MTEM
University of Calgary

Amy L. Warren BSc., BVSc (hons), PhD, Diplomate ACVP
University of Calgary

Abstract: *Bridge-funding by tertiary-educational institutions allows researchers to continue their research in times of funding loss. With the ever-declining funding rates for major medical research institutions in North America, and the global economic downturn, it is crucial to critically assess institutional policies surrounding the allocation of bridge-funding. We review the theoretical framework of bridge-funding decisions and present theoretical factors that determine the success of bridge-funding. We also report the results of an online survey of bridge-funding policies in major medical research institutions in North America.*

Keywords: *Bridge-funding, research administration, research management, research leadership*

Introduction

With steadily declining funding success rates for academic research by major funding organizations in North America, such as the National Institutes of Health (NIH) and the Canadian Institutes of Health Research (CIHR), academic researchers are facing month-by-month uncertainty with respect to the financial stability and sustainability of their research programs. The NIH funding success rates for first time operating research grants (R01 and equivalent) has dropped from 38% in 1998 to 18% in 2015 (NIH, 2015), and the success rates of CIHR open operating grants have dropped from 33% in 2005 to 18% in 2014 (CIHR, 2014). Significant and unexpected reductions in funding success rates inevitably increase the probability that any academic research program will encounter a period of underfunding or complete lack of funding. This phenomenon is putting pressure on research-intensive tertiary education institutions (TEIs) who historically have financially supported underfunded researchers between grants with bridge-funding. The slow recovery of the global economy from the financial crisis of 2007-8 (IMF, 2014) has eroded the financial stability of most TEIs, causing internal research funding programs to be stretched thin (Glied, Bakken, Formicola, Gebbie, & Larson, 2007; Holbrook & Sanberg, 2013; Neiman, 2013).

Bridge-funding is a mechanism by which institutions can financially support a researcher or research group between external grant funding periods. As the name implies, this is not intended to be a perpetual source of operational funds, but to "bridge" the financial gap between past and future external funding. When executed successfully, it creates a win-win situation: the researcher is able to continue his/her research program and career progression; the institution

retains a productive research asset, while emboldening other researchers in the institution with a sense of security that facilitates their own research decisions (Glied et al., 2007; Neiman, 2013). When executed poorly, the researcher's career is unnecessarily drawn out and internal funds are depleted. Hence, the decision of who or what to bridge-fund, for how much, for how long, and what conditions should accompany bridge-funding is paramount, particularly in these times when other sources of income for institutions are also uncertain. Indeed, Paul Neiman (the first director of the Basic Sciences Division of the Fred Hutchinson Cancer Research Center, Seattle, WA) states in reference to decision-making in bridge-funding management: "*In times of financial stress there may be no other more important need for a research institution to address*" (Neiman, 2013, p. 17).

Despite the importance of institutional bridge-funding mechanisms for the stability of research careers and the global academic research system as a whole, there is surprisingly little literature on the policies, strategies and management of bridge-funding schemes. Given this scarcity of information, much of this paper will draw upon opinion-based literature and personal observation. To address the deficiency of data on the topic, a brief analysis of publicly available policy documents on bridge-funding from medical faculties in North America will be presented. This document does not attempt to critically evaluate the effectiveness of particular bridge-funding strategies—although such studies are particularly warranted. Instead, it attempts to provide a considered perspective on current bridge-funding strategies and the rationale behind these schemes. .

Who, what and how to bridge-fund: application of the principles of cost-benefit analysis

In a perfect world, all researchers who request bridge-funding would be supported at the level and term requested. In reality, the institution is most likely to provide bridge-funding to a proportion of those researchers who are underfunded and at a level that may be suboptimal (Glied et al., 2007). Hence, those in academic leadership positions need to strategically allocate bridge funds to maximize institutional sustainability and do so in a logical and defensible manner (Taylor, 2006). The simplest economic principle that could be theoretically applied to strategic allocation of funds in a business decision would be cost-benefit analysis (CBA). Simply, the objective of the CBA would be to calculate the ratio between the estimated costs and the total anticipated benefit (Scarborough & Bennett, 2012). For determining bridge-funding for individual cases, a simple CBA would ideally identify the lowest bridge-funding amount and the shortest possible time that would give the greatest return (e.g., facilities and administrative (indirect) costs from future external grants). If it were anticipated that the costs outweigh the benefit, bridge-funding—purely from a CBA perspective—is not a sound investment. When establishing priorities to optimally deal with multiple bridge-funding requests and finite funds, applying CBA principles can assist in determining a strategy to reach Pareto optimality (an equilibrium reached through allocation of resources where no one person can be made better off without someone else being made worse off (Scarborough & Bennett, 2012)). While the core principles of CBA and Pareto efficiency are rational approaches, their application to setting bridge-funding priorities becomes more complex, particularly because predicting the benefits of bridge-funding in different cases and quantifying

the non-monetary advantages are at best unreliable (Kern, 2011; Nelson, 2006). While risk can be incorporated into CBA using probability algorithms, the complexity of calculating risk and the vague parameters precludes a strictly analytical approach. Hence, qualitative indicators should be used to guide reasonable predictions of the probabilities and the magnitude of benefit.

Given the topic, it is almost impossible to resist the physical "bridge" analogy. Merriam-Webster defines a bridge as "a structure carrying a pathway or roadway over a depression or obstacle" (Bridge, n.d.). Likewise, bridge-funding is a financial structure that may allow the researcher or research group to survive a downturn in funding. When building a physical bridge, however, the other side of the gap is visible and the decision how and whether to build the bridge is simplified. Deciding the format and whether or not to bridge-fund a researcher is complicated by the uncertainty of what, if anything, does the bridge-building link to in the future? Nonetheless, the analogy illustrates some of the outcomes of bridge-funding in an obvious manner. Three world-renowned bridges will be used to illustrate three bridge-funding scenarios: the Peace Bridge between New York State and Ontario; the Seven Mile Bridge in the Florida Keys; and the Bridge to Nowhere in Whanganui National Park, New Zealand.

Low cost: high benefit —The Peace Bridge

The Peace Bridge was completed in 1927, joining the USA and Canada across the Niagara River (Figure 1). This single bridge allows safe passage from one expansive land mass to another. This example is an optimal outcome of bridge-funding. The researcher with a solid track record uses bridge-funding to allow his/her research team to return to solid, consistent, externally sponsored program funding. Researchers who have a high probability of falling into the "Peace Bridge" category should be obviously prioritized for bridge-funding. Additionally, the level of bridge-funding should be sufficient to allow the researcher to maintain productivity and research personnel during the bridging period (Perkel, 2012). Hence bridge-funding may not be "low cost" (as the subtitle states), but it is "cost-effective" as the researcher does not lose skilled personnel, research models or momentum on key projects that are needed to win future funding. Predictors of researchers that fit into the Peace Bridge category may include:

- Established investigator (mid-career or mid-late-career),
- Consistent funding record through a number of external funding agencies (multiple overlapping grants in a diversified portfolio)*,
- A defined and stable research program that aligns with the funding priorities of major external granting agencies,
- Studying an area that shows an upward or stable trend in funding success*,
- Previously received little or no internal funding support,
- High scores and positive reviews on recent unsuccessful grant applications and the ability to address stated deficits,
- Consistent or increasing publication output of high impact*,
- Good reputation in the field,

- Significant protected time for research,
- Indicators of a high level of enthusiasm, personal effectiveness and dedication to research activities,
- Record of collaboration and willingness to collaborate with other researchers*,
- Highly effective, well-trained research team, and
- State of the art infrastructure/instrumentation and/or unique model systems.

(*adapted from Perkel, 2012)

Figure 1. The Peace Bridge. Photograph by Óðinn. Source: Creative Commons (Óðinn, 2008).

High cost: low benefit — The Seven Mile Bridge

The Seven Mile Bridge connects Knight's Key to the Little Duck Key in Florida (Figure 2). It is one of the middle sections of the Overseas Highway connecting mainland US to the Florida Keys via a series of forty-two bridges. Travelling south on the Ocean Highway, a traveler will spend a significant amount of time on bridges and end up at a quaint, but small land mass, Key West. This type of bridge-funding is less than optimal. The researcher has already received a disproportionate level of internal funds and in the future will require significant bridge-funding to span the multiple gaps between sporadic external grants. In this scenario, researchers may be given low priority for future bridge-funding (or other internal funding schemes). Many TEIs have

strict policies that preclude serial bridge-funding of researchers; however, funding may be allowed under special circumstances (see below) (Lange, Riskin, Brainard, & Denton, 2003). Predictors of researchers that fit into the Seven Mile Bridge category may include:

- Early- or late-stage researcher,
- Inconsistent funding record*,
- A constantly changing project-based or case-based research program,
- Previously held regular internal funding support,
- Inconsistent scores and reviews on previous grant applications,
- Little alignment of area of study with priorities of major external granting agencies,
- Studying an area of low relevance or considered antiquated by funding agencies*,
- Sporadic publication output*,
- Low impact output*,
- No reputation in the field,
- High turnover in research personnel and
- High commitment to teaching or administrative activities

(*adapted from Perkel, 2012)

Figure 2. The Seven Mile Bridge. Photograph by I. Matrek. Source: Creative Commons (Matrek, 2009).

Low cost: no benefit — The Bridge to Nowhere

The "Bridge to Nowhere" is a bridge over the Mangapurua Gorge in the Whanganui National Park in New Zealand (Figure 3). Constructed in 1936, before roads were built in the area, the bridge still stands without roads leading to it in either direction, as the terrain was deemed unsuitable to farm or inhabit. With respect to bridge-funding, this is the lowest possible priority. Even if the level of bridge-funding required is minimal, it does not increase the possibility of future funding success, making the benefit zero. Strictly speaking from a CBA perspective, such bridge-funding is a poor investment and funds would be best spent elsewhere. Predictors of researchers that fit into the Bridge to Nowhere category may include:

- No or outdated funding record*,
- No recognizable research program,
- Low scores and negative reviews on previous grant applications or no previous applications,
- Inability to address stated deficits in previous unsuccessful grant applications,
- No alignment of area of study with priorities of major external granting agencies,
- Studying an area of low relevance or considered antiquated by funding agencies*,
- Low publication output*,
- Low impact output*,
- No reputation in the field,
- Little or no protected time for research and
- Indicators of a low level of enthusiasm, personal effectiveness and a lackadaisical approach to research activities.

(*adapted from Perkel, 2012)

Figure 3. The Bridge to Nowhere. Photograph by J. Ebrey. Source: Creative Commons (Ebrey, 2005).

Other considerations: Special Circumstances

CBA and Pareto efficiency approaches do not recognize social aspects of allocation of funds such as fairness, social justice and contribution or alignment with other strategic objectives of the institution (Scarborough & Bennett, 2012; Sen, 1993). When assigning priority to bridge-funding schemes, consideration of circumstances that fall out of the simple CBA calculations can be essential to build and sustain trust and morale as well as to support diversity within the TEI (Lintz, 2008; Taylor, 2006). Although many policy documents do not specifically list special circumstances, several articles outline the need for prioritizing specific faculty for bridge-funding based on circumstances such as gender, maternity/paternity or health leaves, mid-career scientists and regulatory obstruction of research (Baldwin, DeZure, Shaw, & Moretto, 2008; Chapman & Guay-Woodford, 2008; Dankoski, Palmer, Laird, Ribera, & Bogdewic, 2012; Fried et al., 1996; Gross, 2007; Holleman & Gritz, 2013; Jagsi, Butterton, Starr, & Tarbell, 2007; Powell, 2010; 2011; Whiteside et al., 1997). Other considerations that can be strategically used to retain the vitality and further the mission of the TEI include maintaining graduate education standards, enhancing the teaching-research nexus, promoting innovation and alignment with research priorities of the faculty or institution (Neiman, 2013; Shine, 1997; Wilkerson & Irby, 1998).

Referenced is a case study that examined the outcomes of a targeted bridge-funding program addressing the needs of women and maternity in academic research, highlighting the need for inclusion of special considerations in bridge-funding strategies. In 1997, Massachusetts General Hospital created a bridge-funding program to specifically address the challenges facing women research faculty during their reproductive years (Fried et al., 1996; Jagsi et al., 2007; Jagsi et al., 2006). The bridge-funding "Claflin Awards" aimed to increase retention and long-term productivity of women faculty. Findings from the longitudinal study conducted in 2005-2006 found that the Clafin program increased faculty retention, productivity and academic promotion of the awardees. Furthermore, the cost of the targeted bridge-funding program was dramatically offset by the subsequent external funding attracted by the awardees (Jagsi et al., 2007). Hence, the implementation of a bridge-funding strategy that specially targeted a sub-population of faculty not only was considered socially-responsible and built morale but it also resulted in a favorable cost-benefit ratio. This example highlights the complexity of the CBA related to bridge-funding decisions and the deficiency in many of the bridge-funding policies with respect to special considerations.

Survey of bridge-funding policies from North American medical faculties

Since very little literature is dedicated to the policies and management of bridge-funding schemes, a brief analysis was conducted by the authors of the current bridge-funding policy documents from 28 North American medical faculties. The choice of faculties included in the study was based on the following criteria:

- research-intensive medical faculty,
- accredited by the Association of American Medical Colleges (AAMC), and
- current and comprehensive bridge-funding policy document that was publicly available through the internet (AAMC, 2014).

A list of the 28 medical faculties examined is found in the appendix. Given these criteria, the data are biased towards faculties that have transparent and comprehensive bridge-funding programs. Bridge-funding policy documents for each of the faculties were downloaded for analysis. Following review of a sub-selection of seven documents, a series of criteria/questions were defined and were subsequently used to extract data from all 28 documents. These data were tabulated and categorized according to parameters that addressed: 1) eligibility; 2) factors and process of funding decisions; and 3) the terms of the bridge-funding awards. Although limited in scope, to the authors' knowledge this is the most exhaustive comparison of bridge-funding policies of any medical faculties to date.

Eligibility for bridge-funding

Table 1. Survey of criteria that determined eligibility for faculty bridge-funding.

Eligibility	**Yes**	**No or not specified**	**Not determined**	**Total**
Must have submitted an unsuccessful grant application to a major agency	27 (96%)	1 (4%)	0 (0%)	28 (100%)
Must hold a full-time primary appointment	23 (82%)	5 (18%)	0 (0%)	28 (100%)
Dependent of previous bridge-funding history (terms vary)	19 (68%)	9 (32%)	0 (0%)	28 (100%)
Dependent on matching funds provided by department/school	13 (46%)	15 (54%)	0 (0%)	28 (100%)

Review of the 28 policy documents revealed considerable overlap with respect to the parameters that determined the eligibility of applicants for bridge-funding (Table 1). Almost all institutions (27/28) required that the researcher had applied for and been unsuccessful for grant funding by a major funding organization (e.g., NIH). Parameters of the unsuccessful grant application and reviews were also extensively used to determine the bridge-funding priority. Unsurprisingly, the majority of the institutions (23/28) specified that applicants had to hold a full time primary appointment, with two faculties stipulating that these must be tenured or tenure-track appointments. The majority of institutions also used the previous bridge funding history of potential applicants to determine eligibility (19/28). Terms varied significantly with some institutions excluding all applicants who had received any bridge-funding (11/28), while others restricted new bridge-funding to those with a history of bridge-funding over the prior 1-5 years (5/28). The variation on the requirement for matching funds by departments or schools (13/28) most likely reflects the diversity of institutional-departmental financial relationships.

Factors and process of funding decisions

Table 2. Survey of criteria and process used to determine faculty bridge-funding priority.

Priority determined by	Yes	No or not specified	Not determined	Total
Received a high score/favorable reviews on unsuccessful grant application	20 (71%)	8 (29%)	0 (0%)	28 (100%)
Demonstration of previous continuous funding	20 (71%)	8 (29%)	0 (0%)	28 (100%)
Likelihood of success in next grant application	25 (89%)	3 (11%)	0 (0%)	28 (100%)
Merit of research topic	20 (71%)	8 (29%)	0 (0%)	28 (100%)
Research proposal's ability to increase chance of grant success	20 (71%)	8 (29%)	0 (0%)	28 (100%)
Value of faculty member	8 (29%)	20 (71%)	0 (0%)	28 (100%)
Financial need	7 (25%)	12 (75%)	0 (0%)	28 (100%)
Internal review of unsuccessful grant	3 (11%)	25 (89%)	0 (0%)	28 (100%)
Process involving recommendation by internal committee	20 (71%)	5 (18%)	3 (11%)	28 (100%)
Unilateral decision by the Associate Dean of Research (or equivalent)	5 (18%)	20 (71%)	3 (11%)	28 (100%)

The criteria and process used to rank, prioritize or decide upon applications for bridge-funding displayed minimal variability (Table 2). There was significant commonality between policy documents with respect to prioritizing those applications that have the greatest chance of being awarded grants in the future (25/28), and those that had scored well in the last funding cycle (20/28). Demonstration of previous and continuous funding success was also used to rank applicants by many institutions (20/28). Interestingly, only a few policies prioritized based on the financial need of the applicant (7/28). Anecdotally, several stated that a significant reduction in grant revenue was sufficient to justify bridge-funding in order to maintain research momentum irrespective of the total funds held by the investigator. Much emphasis was also placed on the bridge-funding proposal itself by the majority of institutions and the ability to increase the chance of grant success in the next granting cycle (20/28). Several documents specifically asked applicants to address previous reviews and outline how the proposed work would strengthen the resubmission of the unsuccessful grant. Other, rather ill-defined, criteria used by some institutions to evaluate bridge-funding applications included "value of the faculty member" (8/28) and "merit of the research topic" (20/28). The specific parameters of what determined value and merit were nebulous. The process by which the bridge-funding applications were ranked and awarded also varied. The majority of institutes (20/28) evaluated the applications by committee, whereas 5

out of 28 stipulated that it was entirely at the discretion of the Associate Dean of Research (or equivalent).

Terms and levels of bridge funding awards

Table 3. Survey of term and conditions of faculty bridge funds.

Terms of bridge funding	**Yes**	**No or not specified**	**Not determined**	**Total**
Set maximum on amount awarded (cap)	24 (86%)	4 (14%)	0 (0%)	28 (100%)
Maximum term of one year	24 (86%)	3 (11%)	1 (4%)	28 (100%)
Maximum term of two years	3 (11%)	24 (85%)	1 (4%)	28 (100%)
Requirement to repay	1 (4%)	27 (96%)	0 (0%)	28 (100%)

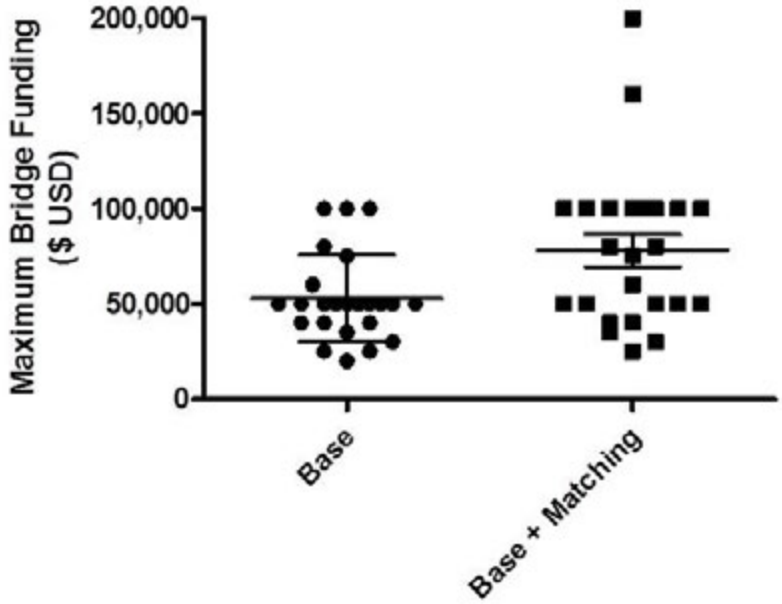

Figure 4. Maximum bridge-funding allowable as stipulated by 24 out of 28 bridge-funding policy documents from North American institutions. As some policies required matching funds from departments or schools, these amounts have been included in the right column

Review of the terms of the bridge-funding polices revealed a high degree of similarity between programs. The vast majority had a limited term of one year (24/28) and a cap on the maximum amount of funds that can be awarded (24/28). The maximum amount varied considerably between institutions (Figure 4). Other conditions of the award included requirements of regular or final progress reports, internal review of future grant submissions and in, one case, a requirement to pay back the bridge funds from the "indirect cost recovery" funds that the department received for future grants from the funded investigator.

Closing Remarks

There are common themes in the allocation of bridge-funding in medical research institutions in North America. In most institutions, eligibility relied on the applicants applying for or previously holding major external grants (most commonly NIH funding), having a full-time and primary appointment in the faculty or department providing the bridge-funding, and not having held bridge-funding in the recent past. Eligible applications were then commonly ranked based on their likelihood of securing funding in the next granting cycle (ensuring the highest "benefit" for institutes in a CBA model). This likelihood was assessed based on favorable review scores in the recently failed grant cycle and on a previous strong history of external funding. Finally, institutions in general required that bridge-funding applicants include a detailed plan of how the investigator would re-establish external funding within a year of the bridge-funding period. Together, these criteria support selecting faculty members that commonly are aligned with the "Peace-Bridge" or low cost: high benefit theoretical model of bridge-funding. These applicants had the highest likelihood of re-establishing independent funding in a short period of time.

In this age of declining grant funding success rates, institutional bridge-funding programs are becoming increasingly critical to the maintenance and progression of academic research (Glied et al., 2007; Holbrook & Sanberg, 2013). Concomitantly, the economic instability of TEIs and oversubscription to bridge-funding programs are forcing academic leaders to make arduous decisions in order to preserve and promote sustainable research within their department or institution (Neiman, 2013). Robust, logical and defensible bridge-funding policies should be the cornerstone of future bridge-funding programs. Moreover, quantitative studies that ascertain the effectiveness of particular bridge-funding policies, particularly with respect to special circumstances, are critically needed to direct effective bridge-funding strategies.

Robin M. Yates BSc., BVSc. (hons), PhD., MTEM
Associate Dean
Faculty of Graduate Studies, University of Calgary
Calgary, Alberta, T2N 4N1, Canada
(403) 210-6249
rmyates@ucalgary.ca

Amy L. Warren BSc., BVSc. (hons), PhD., Diplomate ACVP
Associate Professor Veterinary Pathology
Department of Veterinary Clinical and Diagnostic Sciences, Faculty of Veterinary Medicine, University of Calgary

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Appendix

List of Faculty/Schools of Medicine used for analysis of bridge-funding policies.

1	Boston University School of Medicine
2	Case Western Reserve University School of Medicine
3	Duke University School of Medicine
4	Emory University School of Medicine
5	Johns Hopkins University School of Medicine
6	Northwestern University The Feinberg School of Medicine
7	Ohio State University College of Medicine
8	Perelman School of Medicine at the University of Pennsylvania
9	Stanford University School of Medicine
10	State University of New York Upstate Medical University
11	Tulane University School of Medicine
12	University of South Florida Health Morsani College of Medicine
13	University of California, Davis, School of Medicine
14	University of California, Irvine, School of Medicine
15	University of California, San Francisco, School of Medicine
16	University of Cincinnati College of Medicine
17	University of Colorado School of Medicine
18	University of Illinois College of Medicine
19	University of Kentucky College of Medicine
20	University of Louisville School of Medicine
21	University of Medicine and Dentistry of New Jersey - New Jersey Medical School
22	University of Medicine and Dentistry of New Jersey - Robert Wood Johnson Medical School
23	University of Michigan Medical School
24	University of Oklahoma College of Medicine
25	University of Rochester School of Medicine and Dentistry
26	University of Vermont College of Medicine
27	University of Washington School of Medicine
28	Virginia Commonwealth University School of Medicine


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