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RESEARCH MANAGEMENT REVIEW

*The Journal of the National Council
of University Research Administrators*

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of University Research Administrators**

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EDITOR'S PREFACE

As the year 2007 comes to a close, so too does this issue of *Research Management Review*, an issue that has been in the works since late 2006. While it should be noted that the submissions to *RMR* this past year were not as constant as they might have been, the quality and the scholarship of the articles ultimately accepted for publication in this issue are quite noteworthy.

Thomas F. Meagher, a patent attorney, and Robert G. Copeland, a specialist in corporate law, both partners in the law firm of Duane Morris LLP, provide a thorough look at "Patent Issues Facing Universities" in the issue's first article. The article provides informed and well-documented advice on how best to ensure that a university's intellectual property rights are adequately maintained while still providing an environment that allows faculty publications to flourish.

Sharon Stewart Cole's article, entitled "Researcher Behavior that Leads to Success in Obtaining Grant Funding: A Model for Success," evaluates a previous model for predicting the capacity or ability of faculty members to successfully obtain grant funds. The author goes on to identify a comprehensive model for funding success across academic disciplines.

Timothy N. Atkinson and Diane Suitt Gilleland examine "The Scope of Social Responsibility in the University Research Environment" and address the role of research administrators in shouldering that responsibility along with the researchers themselves.

Finally, Jennifer Shambrook and Olga Brawman-Mintzer share the "Results from the 2007 Research Administrator Stress Perception Survey (RASPerS)," which was administered to over 600 persons in the field of research administration. The results, as well as the authors' analysis of them, are remarkable—and sobering.

2008 will welcome the arrival of a new editor of *Research Management Review*, Pamela Plotkin of Cornell University, who brings with her not only a background in research administration, but also more than twenty years of experience as a researcher and scholar in the field of zoology. As one who continues to remain an active scientist while pursuing her "day job" in research administration, Dr. Plotkin will no doubt provide perspectives to the journal that will keep it relevant and important in the years to come. We wish her well!

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Patent Issues Facing Universities

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ABSTRACT

Establishing an environment where faculty publications flourish while also ensuring that the university's intellectual property rights are properly maintained represents a challenge for the university research administrator. This article provides guidance on how to facilitate both of these fundamental goals in the context of four key issues affecting university patent interests: the risks publications can pose to patent rights; the impact of the CREATE Act on collaborative research endeavors; special considerations for patents resulting from government-sponsored research; and the importance of laboratory notebooks in documenting the date of an invention.

INTRODUCTION

In managing and overseeing the development of a university's patent portfolio, research administrators and technology transfer professionals typically face an arduous challenge in coordinating and reconciling the often differing interests of the university's researchers and administrators. On the one hand, university researchers place a heavy emphasis on garnering publication in scholarly, professional, or industry journals, which can bolster a university researcher's efforts toward receiving tenure or elevating their standing in their field of study. Given the importance of significant research results and the rush by university researchers to quickly disseminate relevant findings to interested colleagues in the scientific community, a researcher's first concern may not be about protecting the underlying intellectual property stemming from the research result. On the other hand, university officials often expend a

substantial amount of resources in fostering studies conducted by university researchers. In addition to expending monies to fund a project, a university also dedicates additional overhead such as laboratory space and manpower. While the university is undoubtedly motivated by altruistic motivations in supporting certain research proposals, including its interest in making inventions available under conditions that will promote their effective development and utilization in the public interest, it still hopes for a return on its investment to compensate for funds spent.

A university's return on its investment can best be maximized by properly leveraging available intellectual property protections, whether patent, copyright, trademark or trade secrets, all of which require proper adherence to legal guidelines. It is this delicate balance between the university researcher's objective to publish and the university's additional objective to protect that places the research administrator in the often inevitable—and unenviable—position of bridging the gap between these two interests.

Although these two goals are not inherently incompatible, careful coordination and management is necessary to ensure the university's proprietary intellectual property rights are not unnecessarily compromised by a university researcher's premature decision to disseminate research results to cohorts. Often, the greatest obstacle preventing a research administrator from accomplishing this tenuous balance is a tendency by researchers to disregard administrators' reminders of proper legal procedures and protocol as an impediment to furthering the "scientific process." Recognizing the difficulties faced by university research administrators and other technology transfer professionals in properly educating researchers about the university's interest in protecting its intellectual property rights, yet not encumbering a researcher's desire to share results, this article expounds upon a number of tips and pointers that can guide a research administrator's efforts.

RESEARCHER'S PUBLICATIONS AND HOW THEY CAN LEAD TO LOSS OF PATENTABILITY¹

A university research administrator must be wary of how a university researcher's efforts to publish research results can lead to a potential loss of patent rights if the research administrator fails to monitor the researcher's publication efforts very carefully. In academia, the axiom "publish or perish" has long guided researchers, and faculty at many universities are under discernible pressure to publish research findings or risk losing funding or the opportunity to obtain tenure. But while producing timely research results is a necessity, the rush to announce or publish findings can sometimes cause unforeseen problems in protecting a researcher's intellectual property rights, particularly patents.

The consequences are especially severe—and immediate—in regard to patent applications filed abroad. Most patent offices outside the United States require "absolute novelty" in deciding whether to issue a patent. That means that the invention must not be previously known to the public, has not been sold or offered for sale (publicly or secretly), and has not been made available to the public anywhere in the world in any way prior to the filing date. If an invention is not "absolutely novel," a patent will not be granted in most countries. Conversely, the U.S. does not require absolute novelty under its patent laws. Instead, an inventor is given a "novelty grace period" that gives an inventor up to one year to file a patent application after any publication, sale, or other act that places the invention in the public domain.

How does this affect a researcher's everyday work? Suppose your researcher is asked to give a presentation at his or her annual industry conference. While the invitation is undoubtedly a great honor and an opportunity for recognition, as he or she speaks at the podium, the unwary researcher could be ruining any chance to procure international patent rights for the university. Most foreign jurisdictions would deem an oral presentation as sufficient disclosure to trigger the absolute novelty bar. While under U.S. law a researcher has up to one year to file a patent application after the public disclosure, the very same researcher would likely surrender international patent rights by the time he or she finished the presentation.

U.S. patent laws provide their own pitfalls, in particular the "printed publication bar," which gives an inventor up to one year to file a patent application after publishing a description of his or her finding.² The "printed publication bar" is based on the postulate that once an invention is in the public domain for a given amount of time, it belongs to the public and can no longer be patented. A failure to file a patent application within one year will result in the permanent loss of the inventor's patent rights for the given invention.³

The critical question is this: what defines a "printed publication"? Generally, a reference will be classified as such if it has been made sufficiently accessible to the public. Certainly, a journal or magazine meets this standard, but courts have interpreted the term far more broadly than the traditional notion of publishing an article in a periodical. A researcher who is not careful can easily start the clock that can trigger the "printed publication bar" without even being aware of doing so.

It is very important, therefore, for a savvy research administrator to carefully monitor the exact date a university researcher publishes an article and also have a solid understanding of what additional actions can trigger the "printed publication bar" and its one-year deadline for filing a patent application. If a research administrator is not careful and is unaware that a researcher has initiated certain actions that trigger the start of the one-year clock, he or she runs the risk that the university will suffer a loss of U.S. patent rights if an application is not filed within the ensuing one-year period.

To the unwary research administrator, the "printed publication bar" to patentability may appear to be an easy administrative task to quantify and track. A research administrator may fall into the trap of believing that rigorous monitoring of the researcher's publication dates alone will suffice in avoiding the "printed publication bar." While monitoring a researcher's publication dates and making the appropriate filings with the patent office within one year will likely protect the university's intellectual property interests, there are in actuality a plethora of additional activities a researcher may undertake that may qualify as a "printed publication" and inadvertently trigger application of the "printed publication bar."

Various courts have interpreted the term "printed publication" far more broadly than the traditional notion of simply publishing an article in a periodical.⁴ Generally, a reference will be classified a "printed publication" if it has been made sufficiently accessible to the public. *Id.* In deciding whether a reference is a "printed publication," most U.S. courts have focused on the public's accessibility to the reference and the means used to disseminate the reference.⁵ For a research administrator, this means that many other actions in addition to journal publications could potentially qualify as a "printed publication" and start the one-year countdown. The most overlooked and most common scenarios occur in the context of dissertations and industry conferences.

For example, most universities require researchers and aspiring Ph.D. candidates to submit a thesis or a dissertation that elucidates their research findings. While the submission of a thesis is considered standard operating procedure, the simple submission of the required thesis or dissertation may lead to triggering the “printed publication bar,” and prevent the university and researcher from obtaining proper patent protection.

In one well-known case, *In Re Hall*, the Federal Circuit considered whether a **single** thesis submitted by a doctoral student to the university and subsequently indexed, catalogued and placed on the shelves of the university library, qualified as a “printed publication.”⁶ The student’s catalogued thesis was readily accessible to any member of the public via the library catalog system.⁷ Even though there was only one copy of the student’s thesis in the university library, and even though the student’s thesis was not made available anywhere else nor published in any periodical, the Court deemed the thesis a “printed publication,” and the student was barred from obtaining a patent because he filed a patent application more than a year after his thesis was made available to the public. *Id.* The court focused on the fact that the catalogued thesis was “sufficiently accessible” that anyone with an interest in the subject matter could find the thesis by exercising reasonable diligence. *Id.*

The implications of *In Re Hall* for a research administrator are clear. If a researcher independently submits a dissertation or thesis to the university library without the research administrator’s knowledge, and the dissertation or thesis subsequently becomes available to the public, the one-year deadline for filing a patent application has already begun. If the research administrator is not aware of the researcher’s actions and does not learn of the cataloguing until a year later, the university will lose its right to any patent that could have otherwise been obtained from the publicly accessible dissertation. To avoid such a scenario, efforts should be made by the research administrator to educate researchers and graduate students about this issue and, if feasible, to work with the graduate school and the university library to monitor submissions of theses and dissertations.

In addition to monitoring researcher dissertations and journal submissions when attempting to avoid the “printed publication bar,” research administrators and other technology transfer professionals also need to be cognizant of a researcher’s actions at industry conferences, especially given recent court decisions that have expanded the definition of “printed publication” even more broadly than in the past. In *In Re Klopfenstein*, the Federal Circuit considered whether an inventor’s use of a slide presentation at an industry conference was sufficient to trigger the “printed publication bar.”⁸ The inventor had given a presentation at the conference and posted the presentation slides onto poster boards. The printed slide presentation was displayed for only two and one-half days during the conference, but no copies of the presentation were handed out, and the presentation was never catalogued or indexed in any library or database. *Id.* Even though the inventor’s presentation was never distributed to the public or indexed and placed in a database, the court nonetheless deemed the posted patent slides a “printed publication.” *Id.* Given the inventor had made no effort to prevent the audience from copying the presentation and given the large number of people skilled in the art who viewed the presentation, the poster boards were considered sufficiently accessible to the public to qualify as a “printed publication” and start the one-year clock for submitting a patent application. *Id.*

The implications of *In Re Klopfenstein* are important for universities. The researcher should inform the appropriate administrator or technology transfer office of the researcher’s plans to present at an industry conference well in advance. This will allow the administrator to review and

amend the presentation as necessary or implement additional protective measures, such as those mentioned in *In Re Klopfenstein* (“license agreements, non-disclosure agreements, anti-copying software or even a simple disclaimer informing the viewing public that no copying of the information will be permitted”). *Id.* By implementing these measures, the university may be able to avoid needlessly extinguishing its patent rights.

Speaking at conferences is what researchers do; the challenge facing the research administrator is to make sure that the proper steps have been taken beforehand to protect the researcher’s ideas. For example, conferences usually require speakers to submit abstracts detailing proposed topics of conversation. Often, conference moderators will post this abstract on a Web site or distribute it to conference attendees, all without the researcher’s knowledge or explicit permission. Either of these actions may be enough to trigger either the “absolute novelty bar” or start the clock running for the “printed publication bar,” and prevent the university from obtaining certain patent rights. The best way to prevent such a scenario is to maintain maximum control over the dissemination of the researcher’s invention at all times. Do not assume that others will treat the disclosure of the researcher’s work as confidential and proprietary.

The safest course is to be proactive. Do not put the university’s patent rights in jeopardy by waiting until after research results are published or disclosed to file a patent application. File a sufficiently descriptive patent application (either a provisional patent application or a regular utility patent application) in the U.S. before publicly disclosing the invention, whether the disclosure occurs via a periodical, an industry conference, an Internet abstract, or even posting research results on a poster board outside your office. Filing a U.S. patent application before disclosure establishes a priority filing date and protects the researcher’s idea both domestically and, with subsequent foreign filing, abroad as well.

Protecting patent rights can be as valuable to the researcher and the university, or more so, than meeting publishing requirements. With foresight and planning, along with open dialogue with the researchers, a research administrator can severely mitigate the risk of inadvertently triggering the “printed publication” and “absolute novelty” bars, and properly protect both the university’s and the researcher’s interests.

THE IMPACT OF THE CREATE ACT ON UNIVERSITY RESEARCH ENDEAVORS

In the U.S., a patent may not be obtained if it contains only obvious differences from the prior art.⁹ An invention will be deemed “obvious” and not patentable if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious to a person having ordinary skill in the art to which the subject matter pertains. *Id.* Prior art can take many forms, including past research efforts created by the same research team or by different research teams, so sharing information with another party could potentially obviate the possibility of garnering a patent via an obviousness rejection.¹⁰

The Cooperative Research and Technology Enhancement Act (the “CREATE Act”) was enacted in March 2004 in an effort to promote collaborative research among universities and industry. Before enactment of the CREATE Act, only subject matter that was commonly owned by the same individual, company, or university was entitled to exclusion from being asserted as prior art against new inventions made by that same entity. In other words, before the CREATE Act, so

long as the subject matter involved the same inventors, all working for the same entity, a patent applicant could escape an obviousness rejection under the patent statute. What the patent statute failed to address, however, were inventions developed by research teams working together with researcher teams from one or more *different* universities or corporations. This gap in the law proved problematic by discouraging collaborative efforts among different universities and corporations based on the tangible fear of triggering an obviousness rejection. Nowhere was this concern more apparent than in the controversial decision reached by the Federal Court of Appeals in *OddzOn Products, Inc. v. Just Toys, Inc.*¹¹

Decided in 1997, in *OddzOn* the Federal Circuit found that confidential and proprietary information derived from a collaborative research partner from a different entity or university than the inventor could be considered prior art and could serve as evidence of obviousness against any patents made by the collaborating parties.¹² As a result of the *OddzOn* decision, even when structured research relationships were involved, the simple exchange of information between research teams from different universities could create an obstacle to patentability via an obviousness rejection. There simply was no exclusion for researchers working for different employers collaborating under a joint research venture. Faced with the possible loss of otherwise viable patent rights, the *OddzOn* decision had a severe chilling effect on universities contemplating sharing certain research findings with other research entities.

Recognizing the negative effects of the *OddzOn* decision, the CREATE Act sought to remedy the aforementioned adverse possible repercussions. Legislatively preempting *OddzOn*, the CREATE Act provides that patentability will no longer be prevented when the patent is a result of research conducted between more than one different entity pursuant to a joint research agreement, so long as that agreement meets the following three requirements: (i) the joint research agreement must be in effect on or before the date the claimed invention was made; (ii) the claimed invention must be made as a result of activities undertaken within the scope of the joint research agreement; and (iii) the patent application must disclose or be amended to disclose the names of the parties to the joint research agreement.¹³ For universities adhering to the requirements of the CREATE Act, the dangers of triggering an obviousness rejection by virtue of sharing information with other research facilities are severely diminished.

However, the party invoking CREATE agrees that the patent is only enforceable if it is not enforced separately from the earlier patent that is being disqualified as prior art by CREATE. More particularly, the owner of the rejected application must: (a) waive the right to separately enforce the patent; (b) agree that the patents shall be enforceable only during the period that the patents are not separately enforced; and (c) agree that the waiver is binding upon the owner, its successors, or assigns.¹⁴ On the other hand, the owner of the “disqualified” patent is not bound by a terminal disclaimer made by the party invoking CREATE and, thus, it would appear that the owner of the “disqualified” patent could unilaterally render the other party’s patent unenforceable by enforcing the “disqualified” patent separately.

What follows is an example provided by the Patent Office to show how the CREATE provisions are applied:

- Company A and University B have a joint research agreement (“JRA”) in place prior to invention X. Professor BB from University B communicates invention X to Company A. University B files a patent application on invention X on November 12, 2004.

- Company A files an application disclosing and claiming invention X', an obvious variant of invention X, on December 13, 2004.
- University B retains ownership of invention X and Company A retains ownership of invention X'.
- Company A files an information disclosure statement citing the University B's patent application of invention X.
- The Patent Office Examiner makes a rejection of the claims of invention X' under 35 USC 103(a) as being obvious in view of the application of invention X.
- Company A properly invokes the prior art disqualification under 35 U.S.C. 103(c) as amended by the CREATE Act.
- The Examiner makes an obvious double patenting rejection of the claims of invention X' in view of the claims of invention X.
- Company A files a proper terminal disclaimer under new 37 CFR 1.321(d) to overcome the double patenting rejection (note: there is a common enforcement of the patents requirement in addition to a common term requirement).
- The Examiner may allow the application of invention X, assuming no other issues need to be resolved in the application.¹⁵

A university research administrator needs to be careful in defining the "scope" of the subject matter covered by a joint research agreement. The broader the definition, the decreased the likelihood that new inventions arising out of the collaboration may be deemed outside the scope of the joint research agreement, and therefore not protected from the prior art exception proffered by the CREATE Act. So a university research administrator should carefully consider all possible subject matter when defining the scope of work covered under a proposed joint research agreement, to prevent falling outside the auspices of the CREATE Act's protection against a possible obviousness rejection.

SPECIAL CONSIDERATIONS FOR PATENTS SPONSORED WITH GOVERNMENT FUNDS

The use of government funds opens up a whole other set of concerns for universities concerned with protecting their patent rights. When a university research project is either fully or partially funded by government funds, research administrators and other technology transfer professionals need to be well versed in the requirements of the Bayh-Dole Act.¹⁶ Implemented in 1980, the Bayh-Dole Act (hereafter the "Act") permits small businesses and nonprofit institutions, including applicable universities, to retain title to inventions made using federal funds.¹⁷ The Act was enacted to further federal policy of "using the patent system to promote the utilization of inventions arising from federally supported research or development and to promote collaboration between commercial concerns and nonprofit organizations, including universities." *Id.*

For a research administrator managing a research project funded with federal funds, the Act and its many implications are important to consider. First, the Act applies to any inventions "made" by the university research team during the term of the contract with the government. It is important to note that the term "made" has a broad scope and is defined in the Act as anything "conceived or first actually reduced to practice in the performance of work under the contract."¹⁸ Thus, it is important to recognize that the Act applies not only to inventions that are created during the term of the contract, but also to inventions that are conceived *prior* to the contract but reduced to practice during the term of the contract. This corollary applies even if the government

is not the sole source of funding for either conception or reduction to practice. Consequently, tracking when an invention is conceived and when it is reduced to practice is of vital importance. The research administrator must make careful annotations whether a particular invention is covered by the Act, because the invention will be bound by the Act's requirement for the duration of its patent term.

When an invention is covered by the Act, the most important requirement to keep in mind is that the university must take certain steps to retain title to the intellectual property funded by federal funds.¹⁹ Obtaining title to the patent is not automatic. *The Act requires a researcher to timely identify any inventions made with federal funds and to notify the federal government whether it elects to retain title to the invention.*²⁰ A failure to strictly comply with the requirements of the Act can result in the title being transferred to the federal government, and the university being left with nothing to show for its research efforts. *Id.* For example, in one recent case the federal government forced an inventor using federal funds to transfer title of a patent to the government because the inventor failed to properly and timely inform the federal government of an invention developed with federal funds.²¹ In addition, a failure by the university to perfect title of inventions created with federal funds can prevent the university from even enforcing the patent against possible infringers in certain circumstances.²² Any lack of diligence on the part of the research administrator to strictly comply with the requirements of the Act may result in loss of patent title to the government of a technology the university could otherwise license or use for itself. Research administrators must carefully keep abreast of their researchers' discoveries, and promptly report any such discoveries to the appropriate government agent as soon as possible so as to not risk losing the benefit of the discovery.

Additional provisions in the Act could also severely encumber a university's patent rights should the research administrator not properly follow the Act's requirements for federally funded inventions. The Act provides the federal government with certain "march-in" rights that require the patent holder to grant certain licenses to designated third parties if the government determines that: (1) such a compulsory license is necessary because the patent holder has not taken effective steps to achieve practical application of the subject invention, i.e., the patent holder has not taken reasonable measures to commercialize the invention; (2) such action is necessary to alleviate health or safety needs that are not reasonably satisfied by the patent holder; or (3) such action is necessary to meet requirements for public use specified by federal regulations and such requirements are not reasonably satisfied by the patent holder.²³ Depending on the invention and the surrounding circumstances, it might not be in the university patent holder's best interests to license the invention in question. A savvy research administrator needs to be wary of the government's "march-in rights" for university inventions funded by federal monies and take appropriate measures to avoid undesirable licensing scenarios that could stem from the federal government exerting its "march-in" rights.

In addition, when licensing inventions funded by federal funds, a researcher administrator needs to be aware that another important requirement of the Act mandates that the university receiving title to the invention cannot grant to any person the exclusive right to use or sell the invention in the United States *unless* the licensee "agrees that any products embodying the invention or produced through the use of the subject invention will be *manufactured substantially in the United States.*"²⁴ Therefore, before a research administrator finalizes any exclusive license agreement involving federally sponsored technology, s/he should determine whether any planned manufacture by the licensee incorporating the licensed technology will be "substantially in the

United States.” A failure to meet this requirement can trigger the government’s march-in rights under the Act.

From the foregoing discussion, it is clear that research administrators must ensure that researchers and university officials alike are aware of what the Bayh-Dole Act requires. A failure to follow its protocols could result in a loss of title in an invention, mandatory uses of the invention not fully desired by the researcher or university, and a loss in revenue and a failure to fully recoup investment dollars.

THE IMPORTANCE OF LABORATORY NOTEBOOKS IN ESTABLISHING DATE OF INVENTION

Often, competing research teams at different university labs will independently examine the same issue or try to solve the same problem. Among these various research teams, there is a feverish and intense competition to be the first to discern the answer for any given issue. In addition to the accolades and the additional funding that usually go to the first team to discover a breakthrough, being deemed the “first” entity to render a discovery is of vital importance for purposes of obtaining proper patent protection.

In the United States, the person who first reduces an invention to practice is by default deemed the first and true inventor of a given invention.²⁵ This default position can be refuted, however, if another entity can show it was actually the first to “conceive” the invention and that it exercised reasonable diligence in later reducing that invention to practice, even though it may have reduced the invention to practice after another entity. *Id.* The purpose of requiring “reasonable diligence” to reduce the invention to practice” is to assure the invention was not abandoned or unreasonably delayed.²⁶ Therefore, if an entity can prove “conception” of an invention at a date earlier than another entity claiming title to the same invention, the entity with the earliest “conception” date will be deemed the true inventor so long as that entity can illustrate it exercised reasonable diligence towards reducing the invention to practice.²⁷ In other words, establishing the earliest possible conception date coupled with a reasonable diligence towards reducing the invention to practice will go a long way towards an inventor being granted title to an invention.²⁸

Understanding what exactly encompasses “conception” and what constitutes “reasonable diligence towards reduction to practice” under U.S. patent law is vital for protecting the interests of both the university and its researchers. The university undoubtedly expects that any worthwhile discovery will ultimately receive patent protection, while the researcher wants to receive full credit for being the first to discover any given innovation. A research administrator who properly understands the importance of “conception” and “reasonable diligence towards reducing the invention to practice” in establishing patent rights and who from the first day of research implements procedures that capture evidence of “conception” and “reasonable diligence towards reducing the invention to practice” can act as an integral component in helping both the university and the researcher reach their stated goals.

In general, to prove “conception,” an inventor must have formed in his or her own mind a “definite and permanent idea of the complete and operative invention, as it would be applied in practice.”²⁹ The idea must be so “clearly defined” in the inventor’s mind that “only ordinary skill would be necessary to reduce the invention to practice, without extensive research or experimentation.” *Id.* In addition, the inventor also needs to prove that after initial invention

“conception,” the inventor exercised “reasonable diligence towards reducing the invention to practice.” When determining an invention “conception” date and “reasonable diligence towards practice,” a court will take into account any and all relevant documentation and testimony. A court will consider the oral testimony of the inventors regarding “conception,” and “reasonable diligence towards reduction to practice” but under such circumstances will also require corroboration from another source before vesting full credence in the inventor’s testimony. *Id.* When relying on purely physical evidence to establish a “conception date” and “reasonable diligence towards reduction to practice,” however, corroboration from another source is not required and the physical evidence will be judged on its own merits. *Id.*

With these legal principles in mind, a savvy university research administrator or other technology transfer professional should immediately recognize that the best methodology for proving an invention “conception date” and “reasonable diligence towards reduction to practice” is a total reliance on physical evidence. Unlike inventor testimony, physical evidence does not require corroboration and can stand on its own merits. The content and nature of physical evidence can be controlled from the initial stages of research and supplemented as needed. Conversely, inventor testimony in a court of law may not be controllable or there may not be sufficient additional evidence to corroborate the inventor’s testimony. Therefore, it is vital that universities concerned with establishing the earliest possible invention “conception date” and “reasonable diligence towards reduction to practice” take the proper measures from the very beginning of a researcher’s project to preserve all pertinent physical evidence pertaining to the expected invention.

Often, the best available tool for providing physical evidence of an invention is a researcher’s laboratory notebook. Numerous courts have placed great credence in evidence comprised of laboratory work performed by scientists and contemporaneously recorded in a lab notebook for establishing an invention “conception date” and “reasonable diligence towards reducing an invention to practice.”³⁰ It is important to encourage university researchers to maintain detailed laboratory notebooks. Not only is a meticulously kept laboratory notebook important for recording pertinent test results and guiding ongoing research protocols, but maintaining an accurate laboratory notebook can help a researcher and the funding university to secure patent rights to any patentable concept that may result during a given research phase.

Given the time constraints of impending deadlines and the demands of ever changing research direction, experience has shown that instead of maintaining detailed lab notebooks, some researchers may be tempted instead to keep a general notebook for “final” results and otherwise take notes and record observations in “working” notebooks, on loose-leaf sheets, or on anything within arm’s length that can be grabbed and written upon. Although recording results in such a haphazard manner may seem to be a necessary reality for many researchers, it presents a logistical nightmare for research administrators attempting to document a researcher’s use of resources, progress towards reaching research milestones, and efforts in establishing the earliest invention conception date and subsequent reasonable diligence towards reduction to practice. Armed with the knowledge of how important physical evidence is in establishing an invention “conception date” and “reasonable diligence towards reduction to practice,” university research administrators must educate the researcher that it really is in the best interest of the researcher, the university, and the project sponsors to keep a singular set of detailed notebooks for use in recording *all* aspects of the research, including everything from raw data and observational jots to more articulate observations and thought out plans on how the research will proceed. Compiling this information in one centralized location is vital not only because the notebook can be used as

evidence to prove invention conception, but also in establishing the earliest possible invention conception date. With that documented evidence, the university can protect its interest in any possible issued patents.

To this end, administrators should implement a system that encourages the researcher to employ consistent practices in maintaining a detailed laboratory notebook for patent purposes and assure the researcher that the time spent in doing so will actually supplement the research and not serve as an impediment or undue burden on progress. What follows are a series of suggested, simple protocols that research administrators should consider when advising researchers and when examining the efficacy of existing university policy on laboratory notebooks: (1) Advise researchers to use bound notebooks with numbered pages and to make consecutive entries. This will ensure the proper chronology of the research and ensure no vital conception data are misplaced or lost. (2) Recommend that the researcher not leave any spaces or blank pages between entries and draw a line through a blank page to indicate it was intentionally left blank. By implementing this simple requirement, the research administrator can eradicate the possibility the researcher might backdate entries or place results in an incorrect chronological order. (3) Advise that the researcher use pens with non-erasable ink and avoid using pencil or other erasable writing instruments. Implementing such a simple measure will ensure the data are not compromised or inadvertently rendered unreadable via the passage of time. In addition, the use of permanent recording instruments will dispel any concerns that results were doctored or manipulated to meet patent requirements. (4) If a researcher finds it necessary to delete incorrect entries, advise the researcher to strike out mistakes or entries intended to be removed and then date and sign or initial any changes or deletions. (5) Follow the advice of your first grade teacher and write legibly! The most meticulously kept laboratory notebook is absolutely useless if nobody (including the researcher) is able to decipher the entries after the fact. (6) Recommend that the researcher err on the side of providing more detail and clarity, with the goal that someone not familiar with the book or the person making the entries could read it and understand what was done and observed. (7) The notebook should not be limited to actual test results. Encourage researchers to include dated entries that outline when important ideas were conceived, including notes from brainstorming sessions, and when work on ideas began and was completed. Too often, many researchers believe this type of information to be immaterial and neglect to include it in their notebooks. But for the purpose of establishing an invention conception date, this data is invaluable to the university research administrator and should be captured as best as possible. (8) If a researcher finds it necessary to rely on materials external to the laboratory notebook, efforts should be made to include them in the notebook. For example, instead of placing printouts from instruments in a separate location or loosely placing the printouts in the notebook, the researcher should permanently fix such materials to the notebook with glue, tape, or staples, and date the entry and sign across the external page and the notebook page to evidence its original, unaltered placement in the notebook. This will ensure vital research data are not lost or misplaced and will maintain the integrity of the research timeline. (9) The research administrator should implement a regularly scheduled (i.e., weekly) meeting wherein a person uninvolved in the research reviews and signs laboratory notebook entries as a witness. This person should *not* be someone who might be considered an inventor or might otherwise be disqualified as not constituting a bona fide, disinterested witness should he or she ever be called to testify about the invention conception timeline.

By implementing these relatively simple procedures, the research administrator will be able to protect the university's investment and intellectual property return, while not saddling the researcher with processes that are detrimental to furthering research goals.

CONCLUSION

For a research administrator and other technology transfer professionals, the challenge of meeting a plethora of different interests while still adhering to the intricacies of the law is certainly not an easy one. But with careful planning, constant communication, and the implementation of a detailed protocol that governs proper procedures from the very beginning stages of research to the very end of an issued patent's term, research administrators have the tools to assist the university in making inventions from research available under conditions that will promote their effective development and utilization in the public interest while still protecting the underlying intellectual property.

ENDNOTES

1. A version of this section appeared in *The Chronicle of Higher Education* (May 27, 2005).
2. See *In re Cronyn*, 890 F.2d 1158, 1159 (Fed. Cir., 1989).
3. See 35 U.S.C. §102(b) (Lexis, 2006).
4. See, e.g., *In re Cronyn*, 890 F.2d 1158 (Fed. Cir., 1989) (circumstances that constitute publication).
5. See, e.g., *In re Klopfenstein*, 380 F.3d 1345, 1349 (Fed. Cir., 2004).
6. 781 F.2d 897 (Fed. Cir., 1986).
7. See, *In re Hall*, 781 F.2d 897, 899 (Fed. Cir., 1986) (finding single copy of thesis available to the public as sufficient to trigger the printed publication bar).
8. See, e.g., *In re Klopfenstein*, 380 F.3d 1345, 1351 (Fed. Cir., 2004).
9. 35 U.S.C. 103(a) (Lexis, 2006).
10. 35 U.S.C. 103(c) (Lexis, 2006).
11. 122 F.3d 1396, 43 U.S.P.Q. 2d 1641 (Fed. Cir., 1997).
12. See *OddzOn Products, Inc. v. Just Toys, Inc.*, 122 F.3d 1396, 43 U.S.P.Q. 2d 1641 (Fed. Cir., 1997).
13. 35 U.S.C. 103(c)(2).
14. 37 CFR 1.321.
15. <http://www.uspto.gov/web/offices/pac/dapp/opla/presentation/createtext.html>

16. 35 U.S.C. §200, et. seq. (Lexis, 2006).
 17. See 35 U.S.C. §200, et. seq. (Lexis, 2006) (establishing federal policy to use the patent system to “promote the utilization of inventions arising from federally supported research or development . . . [and] to promote collaboration between commercial concerns and nonprofit organizations, including universities”); 35 U.S.C. §202 (Lexis, 2006) (providing for disposition of rights to inventions made in the performance of work under a federal contract).
 18. See 35 U.S.C. §201(g) (Lexis, 2006).
 19. See 35 U.S.C. §201(a–c) (Lexis, 2006).
 20. See 35 U.S.C. §201(c)(1) (Lexis, 2006).
 21. See *Campbell Plastics Eng.’g & Mfg. v. Brownlee*, 389 F.3d 1243 (Fed. Cir., 2004).
 22. See, e.g., *TM Patents L.P. v. Int’l Bus. Machines Corp.*, 58 U.S.P.Q.2d 1171 (S.D.N.Y., 2000) (holding that because plaintiff failed to perfect title and government subsequently acquired rights to patent in issue, plaintiff lacked standing to bring an infringement action).
 23. See 35 U.S.C. §203(a) (Lexis, 2006).
 24. See 35 U.S.C. §204 (Lexis, 2006). Note: this requirement may be waived by the contracting federal agency “upon a showing by the small business firm, nonprofit organization, or assignee that reasonable but unsuccessful efforts have been made to grant licenses on similar terms to potential licensees that would be likely to manufacture substantially in the United States or that under the circumstances domestic manufacture is not commercially feasible.” *Id.*
 25. *Mahurkar v. C.R. Bard, Inc.*, 79 .3d 1572, 1577–79 (Fed. Cir., 1996).
 26. *Brown v. Barbacid*, 436 .3d 1376, 1378 (Fed. Cir., 1996).
 27. *Mahurkar v. C.R. Bard, Inc.*, 79 .3d 1572, 1577–79 (Fed. Cir., 1996).
 28. Note: Proving the date of invention for chemical or biological compounds may require a slightly different analysis under U.S. Patent Law. Depending on the compound involved, proper conception may not truly be possible until a reduction to practice has occurred. See generally *Amgen, Inc. v. Chugai Pharmaceutical Co., Ltd.*, 927 F.2d 1200 (Fed. Cir., 1991).
 29. *Mahurkar v. C.R. Bard, Inc.*, 79 .3d 1572, 1577–79 (Fed. Cir., 1996).
 30. *Brown v. Barbacid*, 436 .3d 1376, 1378 (Fed. Cir., 1996).
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Researcher Behavior that Leads to Success in Obtaining Grant Funding: A Model for Success

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ABSTRACT

The purpose of this study was to examine a previous funding success model for its use across disciplines in order to identify the significant behaviors, networking activities, and demographic profile that contributed to the successful receipt of federal grant awards. A comprehensive model of funding success was identified.

INTRODUCTION

Researchers have investigated what determines the capacity or ability to obtain grant awards and indicated that developing a behavioral profile of faculty who are persistent in getting funding is possible and desirable (Ebong, 1999). The ability to participate in grant-funded research can be critical to new faculty seeking tenure and to institutions seeking funding to support research activities. Only a few recent studies have attempted to systematically investigate the behaviors that lead to federal grant awards (Boyer & Cockriel, 1998; Campbell, 2000; Ebong, 1999; Thornley, Spence, Taylor, & Magnan, 2002). The investment in academic research is great, with the federal government alone investing \$15 billion annually in academic research (Executive Office of the President of the United States, 2000). This causes fierce competition among research universities, who attempt to increase income and intellectual gain to students (Stigler, 1993). Several key, prominent issues might influence faculty's success in receiving federal funding: (a) the perspectives and needs of research faculty (Boyer & Cockriel, 1998; McMillin, 2004; Porter, 2004); (b) incentives that could influence faculty to pursue funded research (Beier,

2002; McMillin, 2004); (c) institutional processes and behavior that could impact faculty who seek funded research (Ebong, 1999; McMillin, 2004; Thornley et al., 2002); (d) the balance between teaching and research (Daly, 1994; Fairweather, 2002; Marsh & Hattie, 2002; Tang & Chamberlain, 1997); and (e) the competitive nature of federal funding (Stigler, 1993).

Boyer and Cockriel (1998) showed that the key to pursuing grant funding lies in discovering the motivators that attract faculty. McMillin (2004) reported that becoming a complete scholar is traditionally identified as behavior associated with preparing proposals, participating in research projects, and publishing research results. Competition for support could seriously hinder new researchers' efforts. Data from the National Institutes of Health (NIH) showed that only 13.5% of its proposals were submitted from investigators between the ages of 36 and 40, while 20.4% were submitted from investigators over 50 years of age (National Institutes of Health, 2005).

This study was conducted because of the lack of a systemic process to identify the behaviors that contribute to improving the success rate of proposal submissions and the factors that encourage faculty to pursue federal funding. For this study, the number of awards and dollar value of awards measure success. This article attempts to extend existing research performed by Campbell (2000) by examining a comprehensive funding success model for its use across disciplines in order to identify the significant behaviors and to obtain a demographic profile that contributed to successfully receiving federal grant awards. This article expands the Campbell (2000) conceptual model by adding: (a) two more disciplines, (b) more categories of institutional support, (c) demographic data to obtain a successful researcher profile, and (d) networking activities. Research performed by Ebong (1999) indicated that developing a profile of faculty who are persistent in getting funding is possible. Ebong (1999) clarified that literature on grant activity over the last two decades showed that early experience was critical in individuals' and institutions' success in receiving external support. Competition does take place among research universities and faculty. The competition focuses on the need to increase the intellectual gains to students and for faculty to derive economic gain from new ideas that advance science and human well-being. Faculty compete for higher salaries, larger offices, and recognition. Universities compete for prestige and income, and competition determines which are successful (Stigler, 1993).

Campbell (2000) recommended replicating this research to verify the models and to add other disciplines. A survey was designed based on the federal agencies' funding criteria and administered to university faculty. The researcher selected full-time faculty for the study to determine if a generic model may be developed to be used across disciplines. The conceptual model used for this article is depicted in Figure 1.

CONCEPTUAL FRAMEWORK AND HYPOTHESES

Specifically, this article answers the following research questions: (a) What are the behaviors that contribute to success in competing for federal funding? (b) Can the conceptual model be used across disciplines? (c) What factors encourage faculty to pursue federal funding? A review of the literature showed such knowledge was of value to new researchers and to universities.

Hypothesis 1: The total dollar value of the awards received will be negatively related to faculty behavior.

Fountain (2004) reported that during the fifty years following World War II, changes occurred that called for major adjustments in the strategy for funding scientific research. The two most important changes were the “end of the Cold War and the emergence of a global technological marketplace” (Fountain, 2004, p. 1). The extent of the federal government’s participation in research is clearly visible when reviewing the history of congressional appropriations to academic research. Universities and colleges reported that R&D funding grew by 13.7% in FY2002 and 2003, reaching \$24.7 billion. The federal government’s share of this growth totaled 61.7%, or \$15 billion, which was at its highest level since FY1985 (NSF, 2005).

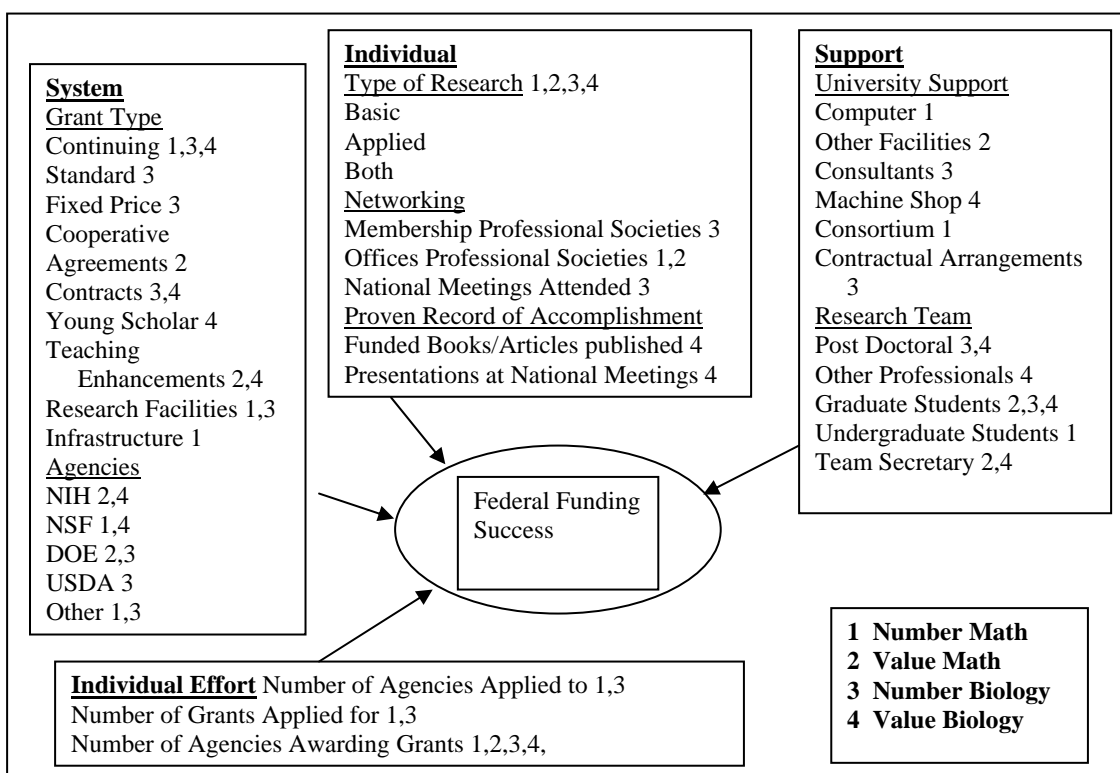


Figure 1. Composite Federal Funding Success Model. Used as the conceptual model for this study. The justification for the components of the model was taken from federal agency review requirements in place at the time of the study and the review of research literature discussed in chapter 2. From *Federal Funding Success Factors in Biology and Mathematics* by E. D. Campbell (2000, p. 3). Permission granted by Dr. Campbell on January 28, 2006.

Hypothesis 2: The number of awards received will be negatively related to faculty behavior.

During the Society for Research Administrators’ Annual Meeting in 2003, it was reported that less than 50% of the combined research and teaching faculty submitted proposals in 2003 (Porter,

2004). Porter mentioned that new faculty often have little awareness of how to receive federal funds or how to become a Principal Investigator (P.I.). In addition, Porter explained new faculty are overwhelmed by their teaching responsibilities, advising students, adjusting to a new environment, and the need to publish to get tenure. Boyer and Cockriel (1998) stated, "Research universities [were] judged by others based on research productivity and the dollar amount of acquired grants" (p. 61). Furthermore, being "scholarly" was traditionally defined as "engaging in research, writing articles for publication, and sharing research findings with students" (Boyer & Cockriel, 1998, p. 61).

METHOD

Participants

Participants were 286 full-time faculty located at comprehensive and master's degree universities in Texas and California. These states were selected due to the high concentration of universities meeting the established selection criteria. The majority of the participants (86%) represented the fields of biological sciences, mathematics, physical science, and computer science. The average number of years as a P.I. was 13.8 years. The majority of respondents were males (66%) and most held the rank of full professor (49%). The average age of the sample was 55 years.

Procedures

From the universities' faculty directories, contact information was abstracted to generate a list of possible participants. The universities were selected with a stratified random multistage sampling process. This sample was selected first based on the criteria of the Carnegie Foundation's classification of comprehensive doctoral and master's degree-granting universities. Second, these universities in the states of Texas and California were selected based on receipt of \$1 million of federal awards as reported by the National Science Foundation (*Survey of Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions*, 2002). The survey was prepared in electronic format and included a cover letter that contained a brief description of the study, instructions for completion of the survey, and thanks to faculty for agreeing to participate. The letter stressed that the information would remain anonymous. The university classifications were verified by the Carnegie Foundation for the Advancement of Teaching database. All participants were verified as full-time faculty in the selected universities.

From this process, 4,152 faculty names and corresponding contact information were generated. The goal of this study was to obtain 250 participants; 286 responses were received ($N = 123$ from California and $N = 163$ from Texas). The data were collected electronically and a record of the number of surveys returned and the survey question answered for each response was maintained. All participants were asked to respond to the survey with profile data and information about their federal award experiences. The electronic survey consisted of closed-ended and open-ended questions. This provided the respondents with an opportunity to define responses and to give yes-and-no answers.

Measures

Multiple regression analysis was selected because it offers a reliable method for exploring the predictive ability of a set of independent variables to more than one dependent variable. Some open-ended questions required a numerical answer such as age or years as a P.I. and led easily to

coding; however, other open-ended questions required a response, and yes/no questions were assigned a value of 0 = no and 1 = yes. Cronbach’s alpha correlation, a numerical coefficient of reliability, was calculated to determine survey reliability. “Computation of alpha is based on the reliability of a test relative to other tests with the same number of items, and measuring the same construct of interest” (Santos, 1999, p. 1). A score of 0.70 is said to be an acceptable reliability coefficient, but lower thresholds are sometimes accepted (Santos, 1999). Not all questions in the study were included because they did not generate yes-or-no answers and were not Likert-scale questions. However, using the standardized variable, the overall alpha was 0.713545 and was thus an acceptable score for survey reliability.

Analysis

The statistical analysis determined which factors were significant predictors of funding success. For the continuous variables, the mean, median, and standard deviation were calculated. The normality of the distribution was assessed using the descriptive statistics process. The faculty were only excluded due to missing data if the missing data were required for the analysis. They were still in the analyses for questions for which they had supplied the needed information. A linear regression was used for the analysis of the dollar value of awards. The Poisson regression analysis was used to analyze the number of awards. The Poisson regression is more appropriate for count data (*Oxford Journals*, 2006).

The evidence for acceptance or rejection of the null hypotheses was provided by a significant relationship between the dependent and independent variables of faculty behaviors. Univariate regression was used to identify variables that had significant individual correlation with the dependent variables. Multiple regression analysis and backward elimination were used to identify behaviors with significant independent correlation with the dependent variables. Variables included in the multiple regression were the significant individual behaviors plus additional behaviors deemed to have important relevance based on the literature review. Biographical, profile, institutional support, record of accomplishment, number of proposals submitted, dollar value of awards, institutional support, other networking behaviors, and research team data were self-reported and not subject to validation.

Descriptive statistics were used to provide the basic features of the data in the study. One of the goals of this research was to provide an understanding of researcher demographics to develop a profile of behaviors that contribute to the success in receiving federal funding, and what factors encourage faculty to pursue federal funding. Such a profile is provided by descriptive statistics (number of observations, mean, and standard deviation) as shown in Table 1.

Table 1. Researcher Profile Factors—Basic Statistical Measure of Quantitative Variables

Variable	N	Mean	Std Dev
Age	255	50.396	11.980
Education	213	0.526	0.501
Number of proposals	227	6.595	7.572
Number of publications	215	17.270	27.146
Number of years as P.I.	227	15.173	13.199
Association officer	225	0.933	0.250
Research team size	280	5.902	11.014

Note: Education means training in grant writing.

Respondents reported on professional relationships or other networking behaviors that contributed to success in receiving federal funding. The most frequently reported networking behaviors were collaborative arrangements and talking with federal program officers. Some noted that they performed no networking activities, but instead relied on quality research to get the respect of their peers. A summary of the reported networking activities and behavior is listed in Table 2.

ANALYSIS OF DEPENDENT VARIABLE—DOLLAR VALUE OF AWARDS

For the dependent variable, dollar value of awards, a univariate regression analysis was performed on all variables. The result of the univariate regression analysis is shown in Table 3.

“The level of significance actually obtained after the data [were] collected and analyzed [was] called the probability value, and [was] indicated by the symbol *p-value*” (Gall et al., 2003, p. 138). For the univariate regressions, the value $p < .10$ was considered to be significant. The variables from the univariate analysis with a significant *p* value of $< .10$ were number of proposals, research team size, number of publications, association meetings attended, and funding from NIH, NSF, DOD, and other funding agencies. The discipline or field of study of the participants showed no significant relationship, as proposed by Campbell (2000). A multiple regression analysis with a backward elimination was then performed on these variables, and with

Table 2. Summary Table of Networking Behaviors

Other Networking Activities/Behavior	<i>N</i>
	1
Attend NSF sponsored program specific workshops	
Collaborative arrangements	126
Looked at old proposals	1
Have other scientist read proposal before submission	2
Meet with colleagues/peers	5
Meet with legislative representatives	11
Meet with persons who have problems to be solved	1
No networking activities	68
Participate on review panels	1
Talk with federal program officers	142
Talk with successful grantees	1

Note: Other networking activities/behavior are in addition to attending association meetings.

the inclusion of number of years, education, tenured, gender, institutional support, and reduced teaching load that were considered important based on the review of literature. From the backward elimination, three important variables were identified as significant at the $p < 0.05$ levels and were shown in Table 3. Attending association meetings was identified as nearly significant with a $p = .062$.

The identified significant variables or behaviors, including the addition of the variable, attending association meetings, for dollar value of awards are described as follows:

1. Education was the data code for any type of grant writing training in which the P.I. had participated. This behavior included obtaining mentor instruction, attending college courses, participating in continuing education courses, and participating on-the-job-training. Obtaining education in grant writing was selected as a significant variable with a 0.018 p value as related to the dollar value of awards.
2. Association meetings attended were the data code for the number of professional association meetings attended. This represents the actual annual count as reported by the P.I. Attending association meetings was selected with a 0.0623 p value as related to the dollar value of awards.
3. Number of proposals was the data code for number of proposals submitted. This represents the actual count of proposals submitted to any number of the six federal funding agencies included in the study: DOD, DOE, NASA, USDA, NIH, and NSF, or other agencies. The number of proposals submitted was selected as a significant variable with a $<.0001$ p value as related to the dollar value of awards.
4. Research team size was the data code for the number of persons assigned to the research team. The research team represents a variety of personnel hired by the researcher such as postdoctoral associates, graduate research assistants, project managers, secretarial assistance, and other professional personnel. The number of persons on the research team was selected as a significant variable with a 0.0052 p value as related to the dollar value of awards.

Table 3. Results of Univariate Regression Analysis-Dollar Value of Awards

Variable	Estimate	Standard Error	P-Value
Age	-0.014	0.018	0.458
Assistant Professor	0.050	0.621	0.936
Associate Professor	-0.242	0.513	0.637
Biological Sciences	-0.401	0.457	0.382
Computer Science	-0.099	0.629	0.875
Consortium	1.565	1.108	0.159
DOD	0.943	0.527	0.075
DOE	0.253	0.531	0.634
Education	-0.689	0.476	0.149
Facilities	0.035	0.150	0.814
Full Professor	0.473	0.458	0.303
Gender	-0.105	0.526	0.842
Mathematics	0.316	0.688	0.646
Association meetings	0.086	0.028	0.002
Association membership	0.102	0.088	0.247
Monetary rewards	0.193	0.221	0.383
NASA	0.928	0.582	0.113
NIH	0.758	0.452	0.095
No. of proposals	0.104	0.029	0.001
No. of publications	0.017	0.009	0.045
NSF	1.144	0.566	0.044
No. years as P.I.	0.009	0.017	0.602
Association offices	0.178	0.258	0.491
Other agencies	-0.895	0.457	0.052
People support	0.076	0.114	0.506
Reduced teaching Load	0.592	0.512	0.249
Research team size	0.065	0.018	0.001
Tenured	0.055	0.576	0.924
USDA	0.537	0.712	0.452

Note: Education means training in grant writing. Other agencies means agencies reported other than NIH, NSF, NASA, DOE, USDA, and DOD. *P* = probability.

Table 4. Summary of Backward Elimination for Dependent Variable-Dollar Value of Awards

Variable	Parameter Estimate	Standard Error	P-Value
Education	-1.01035	0.420	0.017
Association meetings	0.04923	0.026	0.062
Number of proposals	0.06442	0.028	0.023
Research team size	0.05008	0.018	0.005

Note: Education means training in grant writing. *P* = probability.

To further test the robustness of the selection, all original 30 variables were analyzed in a stepwise regression model, and the same variables were identified as significant with $p < .05$.

ANALYSIS OF DEPENDENT VARIABLE—NUMBER OF AWARDS

For the dependent variable, number of awards, a univariate regression analysis was performed on all variables. The variables with p values $< .10$ from the univariate regression were then selected for a Poisson multiple regression analysis. The results of the univariate regression analysis are shown in Table 5, and the results of the Poisson regression analysis are shown in Table 6.

The identified significant variables for number of awards were defined as follows:

1. Consortium was described as two or more individuals, companies, organizations or government agencies associating and participating in a common activity or pooling their resources for achieving a common goal. Involvement in consortium activities was selected as a significant variable or behavior with a 0.0001 p value as related to the number of grant awards.
2. DOD is the Department of Defense, a federal agency that was charged with ensuring that the U.S. military has superior resources to support its missions. The funding agency DOD was selected as a significant variable or behavior with a 0.005 p value as related to the number of grant awards.
3. Number of proposals was the data code for number of proposals submitted. This represents the actual count of proposals submitted to any number of the six federal funding agencies included in the study—DOD, DOE, NASA, USDA, NIH, and NSF and other agencies. The number of proposals submitted was selected as a significant variable or behavior with a $< .0001$ p value as related to the number of grant awards.
4. Association officer is the data code for the number of officer positions held by the P.I. in professional organizations. This represents the actual count as reported by the P.I. The number of offices held was selected as a significant variable or behavior with a 0.003 p value as related to the number of grant awards.
5. Reduced teaching load was the data code for time released from teaching duties. This represents whether the P.I. receives release time from teaching to perform research. Obtaining release time was selected as a significant variable or behavior with a 0.004 p value as related to the number of grant awards.

Table 5. Results of Univariate Regression Analysis—Number of Awards

Variable	Parameter Estimate	Standard Error	P-Value
Age	-0.004	0.012	0.7070
Assistant Professor	-0.276	0.397	0.4880
Associate Professor	0.059	0.329	0.8580
Biological Sciences	-0.144	0.293	0.6230
Computer Science	0.149	0.402	0.7120
Consortium	3.053	0.750	<.0001
DOD	1.167	0.332	0.0001
DOE	0.892	0.336	0.0080
Education	0.107	0.297	0.7190
Facilities	0.262	0.104	0.0120
Full Professor	0.184	0.293	0.5300
Gender	-0.201	0.337	0.5520
Institutional support	0.188	0.459	<.0001
Mathematics	-0.717	0.435	0.1010
Association meetings	0.071	0.018	<.0001
Association membership	0.104	0.056	0.0630
Cash incentives	0.519	0.150	0.0010
NASA	0.798	0.372	0.0330
NIH	0.421	0.290	0.1480
Number of proposals	0.190	0.014	<.0001
Number of publications	0.014	0.005	0.0120
NSF	0.576	0.364	0.1150
Number of years as P.I.	0.003	0.011	0.8090
Association officer	0.476	0.161	0.0030
Other agencies	0.651	0.293	0.0270
People support	0.292	0.077	0.0001
Physical Sciences	0.504	0.318	0.1140
Reduced teaching load	0.766	0.355	0.0320
Research team size	0.064	0.011	<.0001
Tenured	0.282	0.369	0.4450
USDA	1.266	0.450	0.0050

Note: Education means training in grant writing. Other agencies means agencies reported other than NIH, NSF, NASA, DOE, USDA, and DOD. *P* = probability.

Table 6. Summary of Poisson Regression Analysis for Dependent Variable-Number of Awards

Variable	Estimate	Standard Error	P-value
Consortium	0.588	0.155	0.0001
DOD	0.249	0.090	0.0050
Number of proposals	0.032	0.003	<.0001
Association officer	0.121	0.041	0.0030
Reduced teaching load	0.272	0.095	0.0040

Note: P = probability.

RESULTS

The regression analysis shows statistically significant relationships between the faculty behavior as represented by the independent variables and the dollar value of awards; the number of awards shows that the null hypotheses may be rejected for certain significant variables:

Reject the Null Hypotheses:

1. There is a relationship between the total dollar value of the awards (dependent variable) and the independent variables ($p < .05$) education, number of proposals, research team size, and association meetings with a $p < .062$.
2. There is a relationship between the number of awards (dependent variable) and the independent variables ($p < .05$) consortium, DOD, number of proposals, association officer, and reduced teaching load.

The variable, number of proposals submitted, is significant to both dependent variables. Other significant variables for dollar value of awards and number of awards are not identical. Thus, the behaviors that encourage faculty to pursue federal funding were identified. A demographic profile was identified using the mean value of the population. The study population was described as: age 50, has not obtained training in grant writing (fewer than 1%), has submitted six proposals, has published 17 articles, has 15 years of experience in submitting grant proposals, has not served as an officer of a professional association (1%), and has a six-member research team. Most respondents were from the biological sciences—42.97%. The NSF was the most frequently reported agency applied to—63.89%. Basic research was performed most frequently—86.57%. Full professors more frequently responded—54.94%—while 81.08% of respondents were tenured. The categorical analysis showed that 88.32% of respondents were motivated to get grant funding to build a professional reputation, and 27.83% were motivated by institutional financial incentives. Specialized training in grant writing was reported by 52.58% of respondents, and a reduced teaching load was reported by 20.44%. The other networking data showed that talking with federal program officers ($N = 142$) and collaborative arrangements ($N = 126$) were the two most frequent activities. No networking activities were reported by many of the respondents ($N = 68$).

The relationship between the dependent and independent variables is reported based on a backward elimination regression analysis for dollar value of awards and a Poisson regression analysis for number of awards. The results show significant variables ($p < .05$) that influenced the

receipt and the dollar value of grant awards. For dollar value of awards, the significant variables identified were: (a) education, (b) association meetings, (c) number of proposals, and (d) research team size. For number of awards, the significant variables identified were: (a) consortium, (b) DOD, (c) number of proposals, (d) association officer, and (e) reduced teaching load.

This study resulted in new funding success models that can be applied across disciplines. Discipline or field of study was included as an independent variable in the regression analysis, and the results for all four disciplines showed $p > .05$; discipline was thus determined to not be a significant variable for inclusion in the funding model. Two separate funding models were generated as shown in Figures 2 and 3. The two models were then combined to achieve a consolidated model for federal funding success (Figure 4).

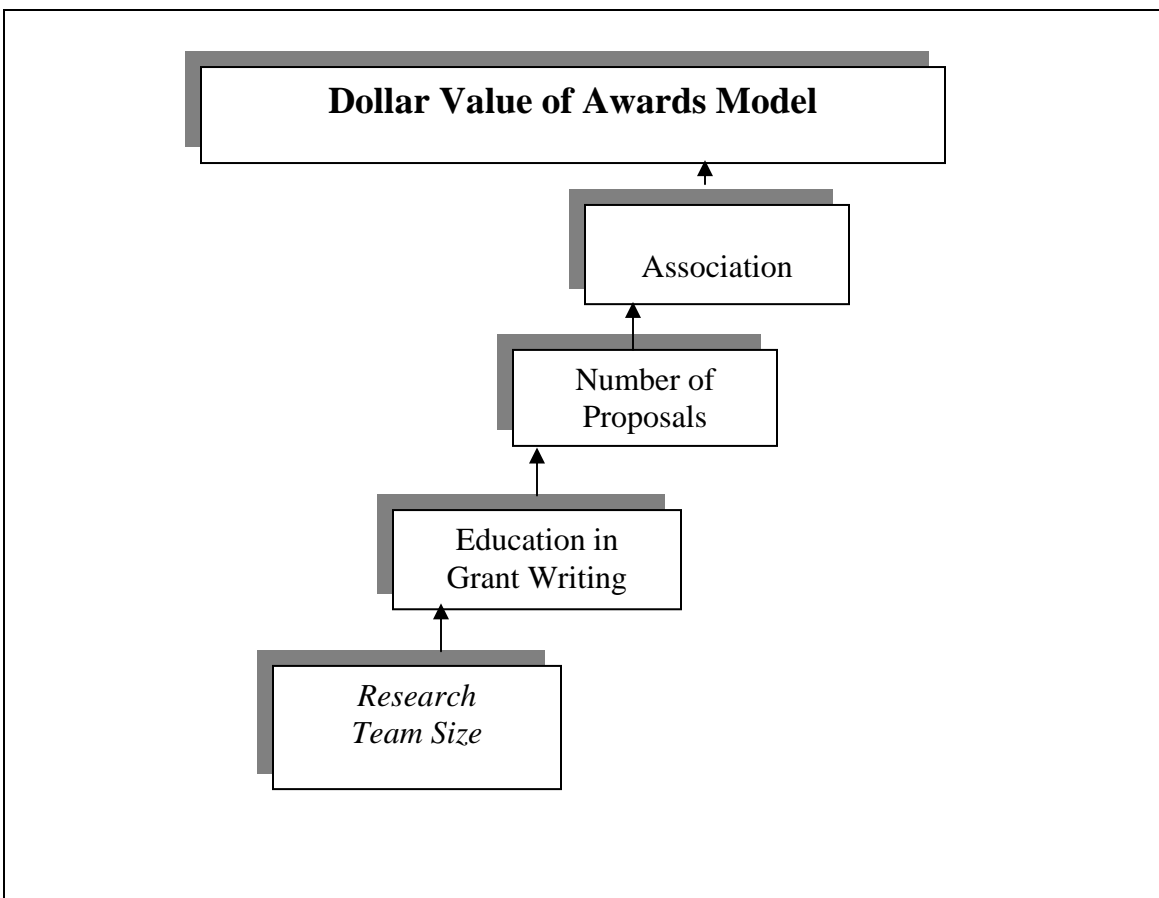


Figure 2. The Dollar Value Model for Federal Funding Success. The significant variables ($p < .05$), including association meetings at $p < .062$ for dollar value of awards are listed in order from bottom to top. Research team size was the most significant variable for dollar value of awards.

In Figure 3, the number of awards success model is shown as a step process with number of proposals being the foundation or first step in the success model. Other significant variables, such as consortiums, association officer, reduced teaching load, and DOD, were added to complete the steps of the success model.

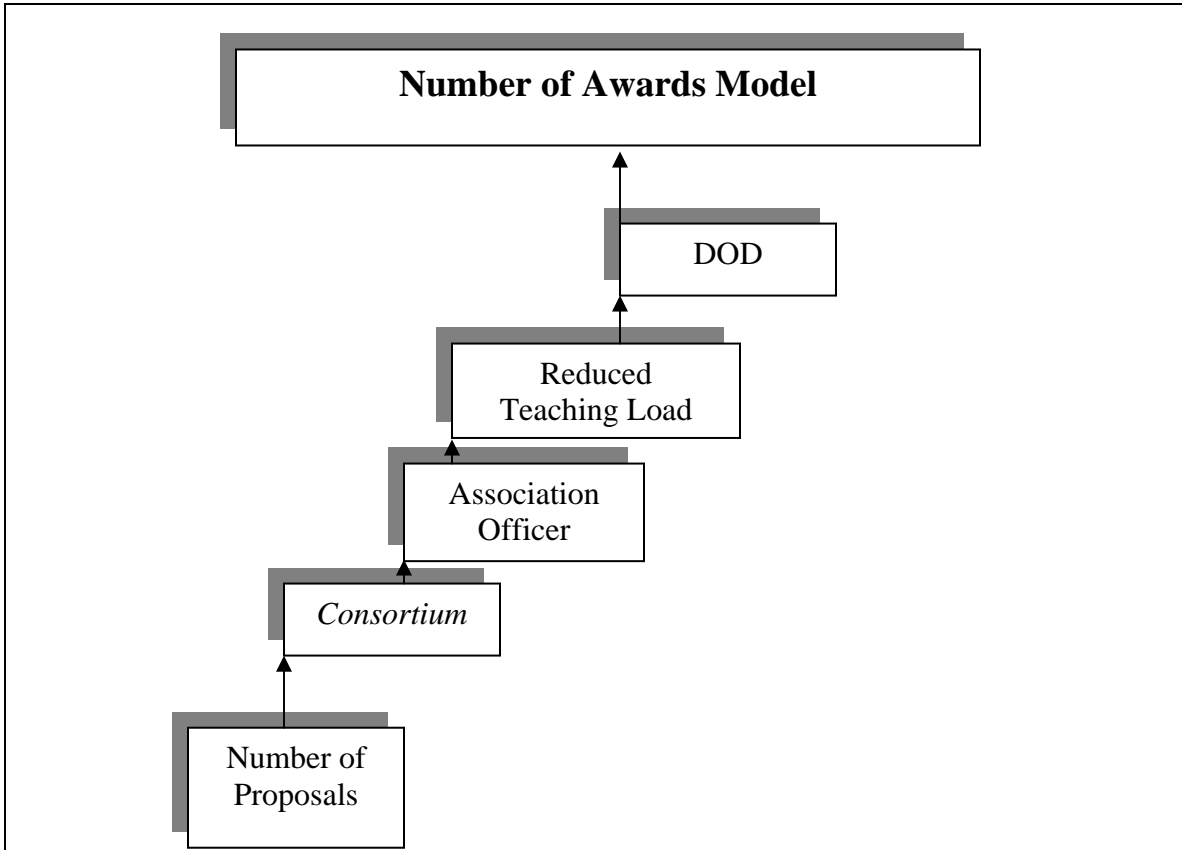


Figure 3. The Number of Awards Model for Federal Funding Success. The variables are listed in order of significance ($p < .05$) from bottom to top. Number of proposals is the most significant variable for number of awards.

The two models, dollar value of awards and number of awards, can be combined to determine the model or strategy for achieving overall success in getting federal funding in order to achieve a comprehensive model for funding success. This comprehensive model (Figure 4) incorporates all significant variables.

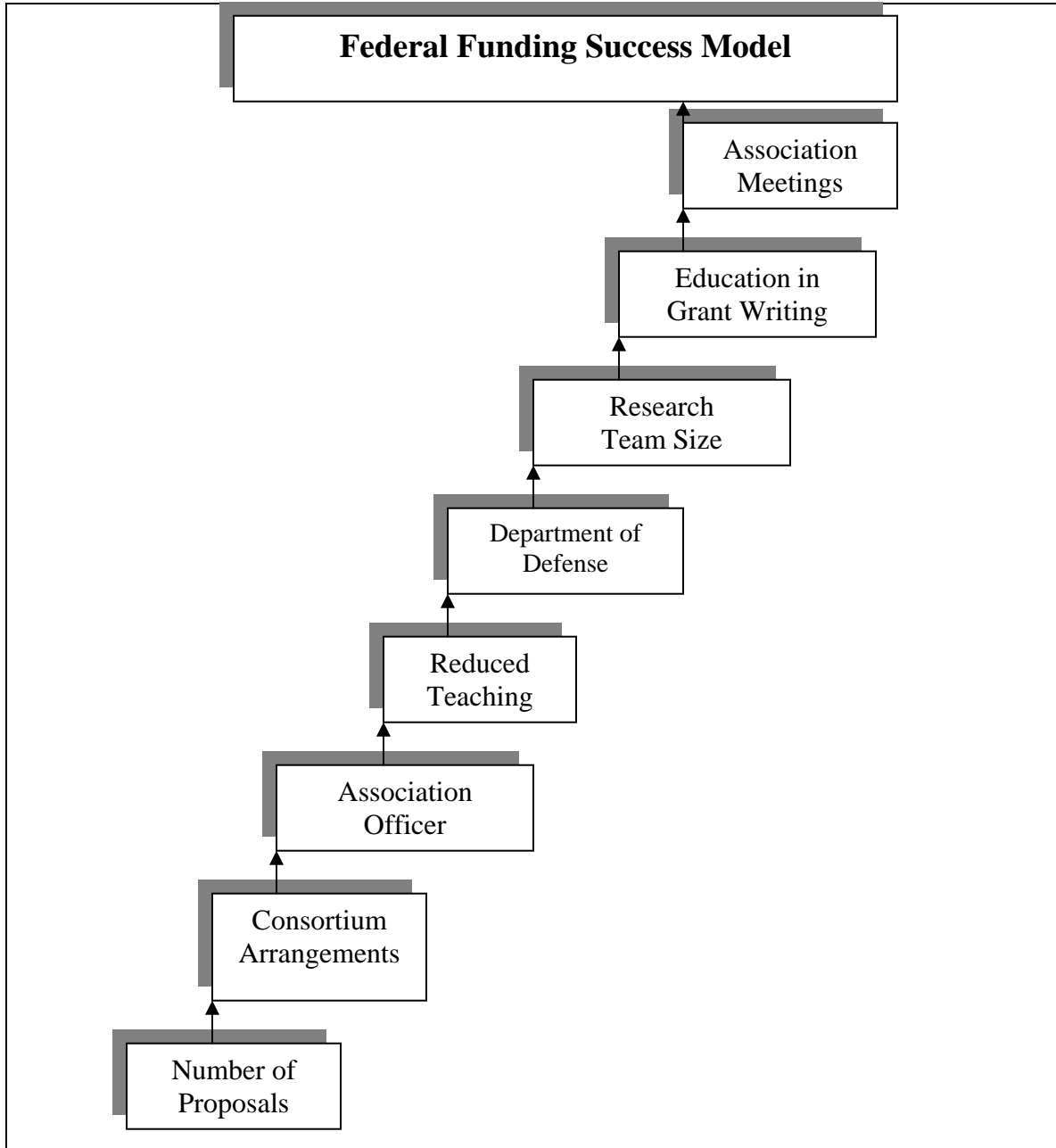


Figure 4. The Comprehensive Federal Funding Success Model. The significant variables for both dollar value of awards and number of awards are combined from the most significant variable number of proposals submitted to the least significant variable, attendance at association meetings.

DISCUSSION

These models could be used to obtain an understanding of the behaviors that lead to successful federal funding in other disciplines. The anticipated results of applying these models are an increase in the dollar value of awards and an increase in the number of awards. The literature review supported several significant variables identified in this study. Ebong (1999) suggested that a model could be developed based on a measurement of research activity. Subsequently, the model generated by this study could be used to create generic strategies for developing research projects. Boyer and Cockriel (1998) stated that the key to pursuing grant funding lies in discovering the individual motivators that attract faculty. This identification would reduce barriers and stimulate the grant funding efforts. Demographic or profile data with significant frequencies for the respondent population was identified in this study. Porter (2004) stated that junior faculty often have little awareness of how to receive federal funds or how to become a P.I. Porter suggested that too few mentors were available to help new faculty in becoming successful and suggested that a training program would help. Mentor was not a significant variable in this study but training in grant writing was a significant variable for the study population. Beir (2002) and McMillin (2004) suggested that university incentive programs and facilities would help build faculty research capacity. Many institutions “invest in faculty research by providing funding for start-up costs, research grants, travel support, sabbaticals, and pre-tenure leaves [of absence]” (McMillin, 2004, p. 2). Research universities’ reputations seem to follow research productivity; thus, such support is fair and needed (McMillin, 2004). However, university incentive programs and facilities were not significant variables for this study population. Ebong (1999) noted that previous experience with funding programs is directly related to activity in seeking external funds. Ebong attempted to relate faculty capacity for research to a persistence profile of funds-seeking. He noted that research development requires the input of resources to produce consistent research goals and to accomplish the mission of the university. Ebong suggested that to measure capacity, a model could be developed based on a measurement of research activity. The results of this study support Ebong’s theory and generated a generic model for developing research behavior. Hu and Gill (2000) reported that tenure status and academic rank had no significant correlation to faculty research productivity. Also, tenure and academic rank are not significant variables for this study population in obtaining grants. Thornley et al. (2002) noted the need for peer review processes to provide applicants with feedback. For this study, few survey respondents ($N = 5$) reported the use of peer review as behavior to gain success in obtaining grant awards.

Daly (1994) reviewed the results of a Carnegie Foundation study and found that “half of the respondents publications were merely counted and never read even by those who insisted that these publications were needed for tenure or promotion” (p. 2). Likewise, publication was not a significant variable in getting funding for this study population. Marsh and Hattie (2002) attempted to determine the relationship between teaching and research with a meta-analysis and correlation. They found a zero relation across disciplines among various measures of productivity and measures of teaching quality. For this study, a reduction in teaching load was a significant factor in obtaining funding and was correlated with obtaining grant funding.

In light of the findings, the research community could benefit from applying the funding success models represented in this study. The success model as determined by this study can be applied across disciplines, and this study offers a systematic approach to determining the significant behaviors that can be applied to similar populations. To apply this model to other disciplines, the agencies selected as independent variables should be those who usually fund programs in the

disciplines under study. This model can be applied to colleges and universities that focus on other objectives, such as student support, operating expenses, or program costs, by replacing the research-related variables with those related to other objectives.

CONCLUSION

Findings from this study may increase understanding of the federal funding process by offering models for funding success. Two strategies should be considered (dollar value of awards and number of awards), but these strategies may be combined into one model for funding success. Such an understanding is critical to the success of research faculty and institutions that want to support new research, to comply with university research missions, to help federal agencies in meeting their goals and objectives, and to expand the knowledge of science in society as a whole.

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The Scope of Social Responsibility in the University Research Environment

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ABSTRACT

The scope of social responsibility for university research administration has grown since the first grants were first allotted to universities. We have become more organized. We have expanded our boundaries. We have become less of a single-standing organization and more of a node in a larger network of universities and research organizations. The synthesis that follows connects this notion to the literature in higher education and organizational behavior and to society at large. A research administrator should think about the impact of his or her decisions on this system. In the end, this article's contents only scratch the surface of discovering the complexities within this vast system and encourage us to continue to define it.

UNIVERSITIES AS ORGANIZATIONS

Research administrators are concerned with both internal and external publics, and they belong to a complex organizational environment. Contributing to the complexities of this environment is the university organization itself. The university is often characterized in the literature as dysfunctional and fragmented (Duryea, 1973/2000), ambiguous and anarchical (Birnbaum, 1988; Cohen & March, 1986, 2000), loosely coupled (Birnbaum, 1988; Weick, 1976) and loosely coordinated (Mintzberg, 1979). What, then, is the scope of a research administrator's responsibility in this kind of environment?

Duryea (1973/2000), in an historical analysis of the history of higher education, noted decreases in the power of central governing boards, such as a board of trustees or board of directors. The direct powers or influence of the board's control over daily university activities lessened as the board delegated its authority to executives and staff, so the university gradually lost one of its local but formal normalizing bodies. The increase in external controlling bodies like the federal government, on the other hand, increased the demand for some "law and order" within the university organization (Duryea, 2000, p. 14). The university operates in a research arena in which practically all productive research takes place with funding tied to the wishes of a grantor (Barber, 1952; Kalas, 1987). Taking on the coercive requirements of the federal government, such as enacting federal cost controls in state-run institutions in exchange for research dollars, can affect the operating structure of an organizational system.

Cohen and March (1974/2000) conducted a large case study of universities and university presidents and contended that choice and rationality in the university system involves a clash of many cultures. From this point of view, university leadership often finds the organization hard to manage because the organization itself is fraught with ambiguities of purpose, power, experience, and success. Cohen and March called for consistent modes of behavior, such as spending more time with complex problems and persisting through to better understanding and better solutions. Consistency is considered a prerequisite for normative behavior.

Consistency, however, is often rare in universities and depends largely on the organizational models. Birnbaum (1988) and Cohen and March (1974) characterized research universities as "anarchical" and loosely coupled, having "problematic goals," "unclear technology," and "fluid participation." These characteristics require thinking about universities outside the closed, rational, bureaucratic models. Birnbaum noted that "fluid participation" is characterized by formal and informal groups at all levels, all interacting at various levels of the organization, all increasing various levels of complexity. He also noted that loose coupling increases uncertainty about just how good or bad a particular problem is, with these levels often only understood in retrospect or in hindsight.

Weick (1976) is perhaps the foremost scholar in studying organizational behavior in terms of the retrospective or hindsight nature of individual understanding, noting a number of dysfunctions associated with loosely coupled educational systems. Weick contended that loose coupling allows the isolation of problems within an organization so that the most pressing problems sometimes do not affect other subgroups in the university. Autonomy seems to fuel isolation of subgroups overall (Weick, 1976), and it is here that scientists are blamed for most of what happens in the research environment. Vaughn (1990, 1998) and Kurtz (2003) supported these findings, noting that federal agencies that have to work together often do not communicate across professional lines, leading to lower levels of cooperation and underachievement of goals. Within the university structure, the separation of faculty, administrators, staff, and board, departments, colleges and schools serves to promote the professional development of these subgroups independently of the rest of the organization (Mintzberg, 1979/2000). Professional groups often do not communicate in the same language (Vaughn, 1990, 1998), leading to further separation and fragmentation within the broader post-secondary context. These groups then become almost solely responsible for the actions and reactions in their particular realm. These conditions also increase the need for a normative model of behavior. Weick contended that organizational researchers must study the hidden worlds of these subgroups in terms of how the actors make sense of their world, leading to better understanding of how the rest of the complex organization will respond and adapt to

changes. It is the loose coupling of organizations that make outcomes unpredictable and difficult to study.

Mintzberg (1979/2000) noted the difficulties of a loosely coordinated organization as well. In the professional bureaucracy, such as the university, the professionals within the organization “seek control of their own work, but seek control of the administrative decisions that affect them” (p. 56). For example, university faculty members successfully bypass the bureaucratic human resource system established by the organization in order to offer a more collegial recruitment system to their colleagues.

Mintzberg further outlined the complexities of the university organization by noting that university organizations operate under a system of “parallel hierarchies”, meaning that the faculty often carry out both administrative functions and collegial functions at the same time. Chairpersons, for instance, are members of both systems. These differing administrative perspectives are a paradox because the perspectives often clash, rarely inform one another, and often fail altogether. Mintzberg called for mutual adjustment and coordination of both hierarchies through the acts of the professional administrator, and did not have much tolerance for deviation. The professional administrator, according to Mintzberg, seems to be a bureaucratically necessary means of policing deviance, or better yet, infusing some semblance of normalcy into conflict and confusion.

After much deliberation about the existing literature in the latter part of the century, Dill (1984/2000) confirmed that ambiguity in the higher education organization was unchanged, and emphasized the importance of studying behavior in universities. Dill asserted that the study of human behavior from sociological and psychological standpoints was valuable in understanding how organizations may respond to change and uncertainty, and this notion seems to hold true because many of the individuals within academia stake claims to the professional attributes of autonomy and creativity. More recently, Fincher (1998) believed that ambiguities and confusion in higher education were due to a lack of “norms, standards and criteria” (p. 5). The research function, however, does not operate in isolation from other organizations. It is often found as a node in a more complex system of organizations with indefinable or confusing boundaries.

THE COMPLEX AMERICAN RESEARCH SYSTEM

Several scholars have characterized the research system in the United States as a complex organizational system (e.g., Birnbaum, 1988; Boulding, 1973; Kalas, 1987; Martinson et al., 2005; IOM, 2002). Kalas (1987) cited Kenneth Boulding’s (1973) model of economic transaction, and argued that the grant is a complicated mechanism of economic exchange due to the difficulties in determining reciprocity in the exchange of goods and services between actors or organizations. Science is a process of discovery that may not result in tangibles and deliverables with a direct monetary value. The result of research is new knowledge that has value for the common good in the long run. By receiving a grant or money in exchange for this information, the grantee takes on a high level of fiduciary responsibility (Kalas, 1987).

The National Academies of Science, Institute on Medicine (IOM), a prestigious independent policy think tank for the federal government, considered research in the U.S. to be part of a complex system as well. The problem with complex environmental systems, as Montgomery (2005) noted, is that these environments are continually changing due to organizational actors

shifting in and out of the environment, creating difficulties for vertical, horizontal, formal and informal norm diffusion.

Pfeffer and Salancik (1978/2003) noted that the organizational environment affects organizational structure by creating limitations and increasing the ambiguity of decision making. Ambiguity in decision making gives some bureaucratic units, such as research administration, greater decision-making power than others, which has been demonstrated to result in inconsistencies in interpretation or over-interpretation of rules and regulations that could stifle research productivity (IRB Advisor, 2004a, 2004b, 2005).

The IOM's Committee on Assessing Integrity in Research Environments (2002) encountered difficulty in determining how the "research environment" functions. The IOM study group had a limited amount of data on the components that comprise the research environment and system, and little or no data were presented concerning the research administrator. As discussed, the university organization is a loosely coupled entity that does not have much tolerance for grouping. Administrative units can be as loosely coupled as faculty units are loosely coupled.

Buckley (1967) noted that an organizational environment cannot be understood by breaking down its component parts, because each part will carry with it another set of complex variables. To resolve this issue, it is necessary to consider the influence of the system and professionalization as an approach to analyzing an organizational field within a complex research environment (DiMaggio & Powell, 1983; Scott, 2003).

The grant and funding system of the United States has grown so extensively that it depends on the university and the research administrator to carry out these functions in an efficient manner (Kalas, 1987). Barber (1952) asserted that science is primarily conducted in universities due to the funding system. Some experts believe that the breakdown in consistency in the grant system could cause economic repercussions that extend beyond the university and local scholarly activity (Hensley, 1992; Kalas, 1987). General systems theory supports this notion (Buckley, 1967; Scott, 2003). History has illustrated that scholarly productivity is the linchpin of the academic enterprise, and removal of this pin would be devastating. University research administrators exist in most universities to monitor the business of research both internally and externally because the university has become the cradle of scholarly activity in the United States (Barber, 1952; Kalas, 1987). These forms of organization are due in part to the large appropriation of funds both from the federal government and private industry to the university (Barber, 1952; Kalas, 1987). As federal and private funding increases, the administrative burden increases, the connectivity with external organizations increases, and the complexities extend beyond the walls of the university (Mitroff, 1983).

Establishing these external relationships is often referred to as boundary spanning (Meyer & Rowan, 1977). Boundaries are distorted when organizations interact with each other through contracts and agreements. The boundaries are extended, as is the client base both within and outside the university. An increased client base, or increased stakeholder realm, increases the probability of both individual and corporate harm. Understanding the self-regulatory aspects of research administrators is an important facet to understanding administrative life in the research university.

CRITICAL SUMMARY OF UNIVERSITIES AND THE RESEARCH ENVIRONMENT

University research administrative functions are integral to the scholarly processes at most research-related universities, yet these units remain understudied empirically. There are many calls for the study of social control and ethics in university units, but these studies are lacking in specific institutional focus, particularly in regard to the institutional pillar on which these studies should be placed (Scott, 2003). The university literature barely touches institutional theory-based explanations of behavior, balancing micro and macro organizational behavior for a somewhat myopic view of the university. New studies should begin to help fill this void and demonstrate how the organizational *system* is responsible for shaping behavior. For instance, as demonstrated in this review of universities, as components of a university-industry-government system that fuels the U.S. research economy, the overall economy and society (Barber, 1952; Kalas, 1987), university research administrators must make clear and ethical decisions concerning each transaction *in the environment*, not just in the university. The micro-analytical focus of the existing literature appears to be one-sided when viewed through the systems lens. From a systems perspective, organizational deviance from the normative professional behavior of university research administration could have ramifications that extend into the larger organizational environment or system (Kalas, 1987). Studies of research support personnel are also scarce (Hensley, 1986), but due to increased accountability measures enforced by the public (Altbach, 1994), research in this area continues to increase in importance at a national level (IOM, 2002). Accountability is a subset of a broader organizational and sociological concept called the norm. In order to study accountability and its mechanisms, it would be necessary to consider how norms function in complex social systems.

Many university units may need further study, but given the interconnectivity of universities to other organizational units within the system, an institutional perspective aids in this understanding (DiMaggio & Powell, 1991). Universities and the research environment are vast systems with many components, each contributing some element to overall operations, behaviors, and organizational norms. Not all of these components have been studied from a social control perspective. Studying research administrators would provide an excellent understanding of how a university unit involved in one of the major aims of the research university mission operates from a normative perspective, addressing social control, appropriateness, and normativity.

CONCLUSION

Higher education institutions are the stewards of billions of dollars in research grants. Public trust, therefore, is associated not only with scientists, but also with the scientists' institutions. The United States is considered the leader in scientific knowledge and training, but if problems of integrity continue at the individual and systemic levels, higher education runs the risk of tainting its reputation as a leader and a trustworthy steward of taxpayer funds. Lack of control in this environment could have devastating financial and political implications. As Congress decides to disseminate funds to the higher education sector, and as states decide how to fund their higher education institutions, matters of integrity and reputation almost surely will be scrutinized. In addition, the world scientific community could begin to shun U.S. scientists, claiming that U.S. research institutions are unstable and untrustworthy, and lack the capacity to produce quality research results. The scope of responsibility, therefore, extends beyond the walls of a single institution and into the world.

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AUTHORS' STATEMENT

This literature critique and synthesis were taken directly from the author's dissertation, entitled, "The Institutional Construction of Professional and Corporate Norms in the United States University Research System." Dr. Atkinson felt that this particular synthesis stood alone as a scholarly article in defining the scope of research on research administration and shining some insight into how much work can be done to advance the research administration profession.

Results from the 2007 Research Administrator Stress Perception Survey (RASPerS)

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Authors' Note: This work is dedicated to our research administration colleague, Debra Ann Grandberry, M.A. (1964–2007)

ABSTRACT

Research administrators' work combines considerable intellectual demands with strict timelines—both potential contributors to job strain. We examined levels of perceived stress, health effects, and coping mechanisms in a sample of research administrators. The Research Administrator Stress Perception Survey (RASPerS) was administered anonymously to over 600 people in the field. We found that the greatest number of respondents perceived their levels of work-related stress as high (41.3%); work-related home stress as moderate (42.5%); and stress from competing demands of work and home as moderate (35.4%) or high (35.1%). Research administrators endorse working in a high-stress environment, often feel under-appreciated for their contributions, fail to maintain a healthy lifestyle, and often feel they have neglected other important aspects of their lives in deference to the demands of work. Sixty-six percent reported having inadequate resources to complete their job in a forty-hour work-week. When asked why they continue to work in research administration, the prevalent responses were the challenge, variety of tasks, working with intelligent colleagues, job security, and feeling a sense of purpose.

INTRODUCTION

Roberts and House (2006) described the profile of a typical research administrator as a female in her 40s, with an income between \$40–50,000 per year, holding a bachelor's degree in another field, with six to ten years of experience. Research administrators have to navigate changing and increasing regulations, new methods of grant submission, more frequent deadlines due to new policies at government agencies, more applications to obtain funding due to funding agency cutbacks and rising prices, and budget cuts that eliminate jobs and often create situations in which fewer people are managing an increased work-load. Available data indicate that job strain significantly affects research administrators' health and quality of life. It is interesting to note that according to qualitative data from this study, participants reported that improving the health and quality of life of others is the primary motivator for staying in this field.

High levels of stress have been shown to be associated with cardiovascular disease, hypertension, depression, digestive disorders, weight gain, insomnia, unhealthy behaviors, and a host of other maladies due to stress-related weakened immune system (DHHS, 2004; Mayo Clinic, 2006; WebMD, 2005). Smith et al. (2000) reported that professional and support management careers are among the highest stress-producing professions. Jobs were considered to be high stress if 19% or more of the sample from that job class reported feeling high or extremely high stress. In their sample of 17,000 workers, about 20% reported having high or extremely high levels of stress.

The purpose of this study was to look at a previously unstudied subset of professional and support management personnel working in the field of research administration. The Research Administration Stress Perception Survey (RASPerS) was designed with a two-fold purpose: to ask questions and to provoke self-examination as a health promotion tool for this population. If the survey was distilled to one over-arching query, it would be to determine if research administrators are benefiting from the findings of public health research in preventive medicine as it relates to very basic stress management. Additionally, it is hoped that by merely answering the questions, research administrators are increasing their awareness of their health-related lifestyle and moving along the stages of change toward adopting best practices for good health (Prochaska & DiClemente, 1983).

METHODOLOGY

The RASPerS instrument was developed specifically for the target population. The target population consisted of self-identified research administrators (RAs). The survey instrument was submitted to the Internal Review Board for Human Use in Research (IRB) at the Medical University of South Carolina. As it was being administered anonymously and the only identifiers were gender and years in service, it was categorized as being exempt from review of the full committee. It was approved by a subcommittee of the IRB and assigned protocol number HR 17440.

The RASPerS was administered online through SurveyMonkey® with an original small pilot group of 32 RAs. The original survey used in the pilot was modified in two respects. In one field of the original survey, those who were interested in receiving the survey results could enter their email address. This was eliminated in order to protect the anonymity of the participants. The second modification was to indicate that the last question, which required an essay-type qualitative response, was an *optional* question. This was done because only about half of the

original 32 replied to that question. The authors felt that by labeling this question as optional, the participants would have a greater feeling of satisfaction with their survey experience.

The authors expected fewer than 100 responses and had registered for that level with SurveyMonkey®. Email addresses of RAs that had been copied on email to the first author had been collected and collated into a direct contact list of approximately 40 RAs. A solicitation was sent to the RESADM-L list serve requesting that list serve members participate in the survey. A duplicate email was sent to the direct contact list. In less than five minutes, over 100 responses had been collected and additional participants were being rejected. It was necessary to upgrade the Survey Monkey® account to accommodate 1,000 responses. Another email was sent to the RESADM-L list serve to notify potential participants who had been unable to complete the survey after the first five minutes because it had reached maximum capacity without upgrade.

Within two hours, over 300 participants had completed the survey. Within three days, over 500 RAs had participated. After two weeks, when the survey was closed by the authors in order to begin writing the report of the results, 624 RAs had completed the survey. This high level of response could be taken as an indicator of the level of interest in the topic of profession-related stress by this population.

The 2007 RASPerS consisted of nine sections:

1. Perceived levels of stress due to:
 - a. Work
 - b. Home due to work
 - c. Competing demands of work and home
2. Priorities and appreciation
 - a. Self-efficacy in synchronization of time and priorities
 - b. Feelings of appreciation by non-administrative colleagues
3. Healthy lifestyle
 - a. Sleep
 - b. Exercise
 - c. Nutrition
 - d. Hydration
 - e. Break for lunch
4. Healthy weight
5. Likely response to a scenario of dealing with potentially life-threatening illness during a deadline
6. Perceptions of negligence due to work of:
 - a. Physical health
 - b. Spiritual and/or mental health
 - c. Family or social relationships
7. Adequate resources available to accomplish job in 40-hour work-week
8. Demographics
 - a. Number of years in RA
 - b. Gender
9. Optional qualitative response to explain why they continue to work in RA

Data were analyzed using data analysis tools included in the upgraded version of SurveyMonkey®. Composite data are shown in the results section, giving absolute numbers

and/or percentages and graphical representations. Graphical representations of data shown in all figures in the Results section were prepared using Microsoft Excel.

RESULTS

Demographic Information

Demographic questions were limited in order to keep the survey as brief as possible and to limit the personal information that might compromise anonymity. RASPerS participants were only asked to indicate their number of years in research administration and their gender. More than ten years of experience was the prevalent answer. Figure 1 shows the breakdown of years of service.

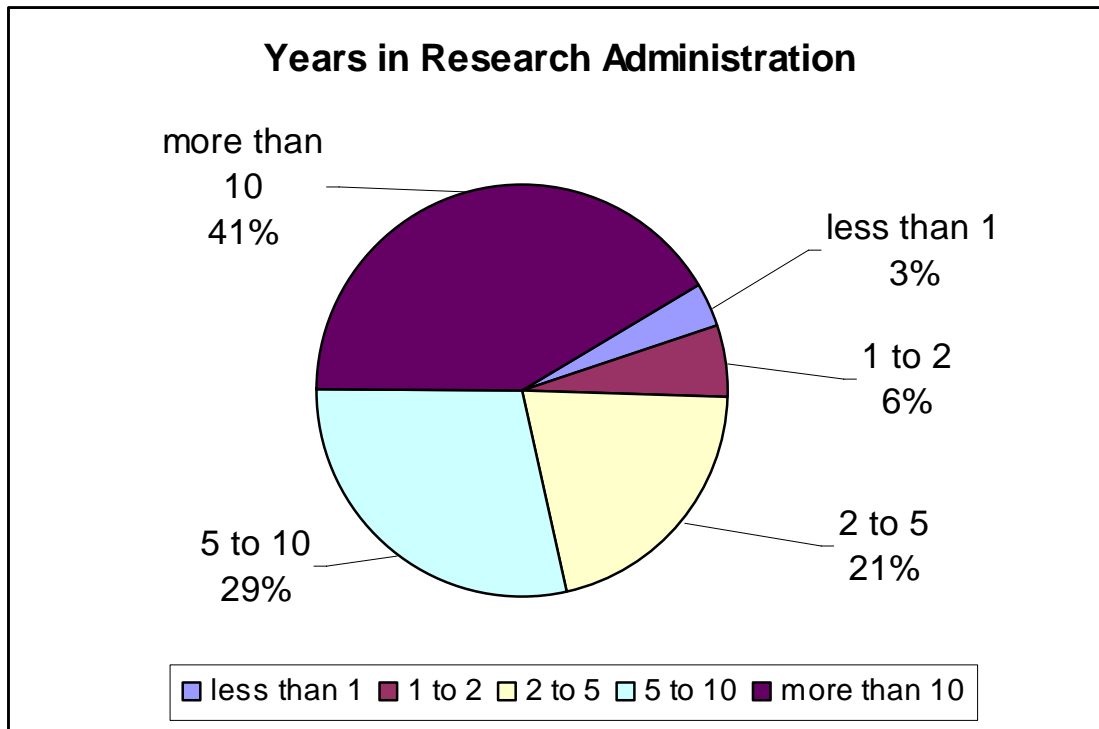


Figure 1. Years of Research Administration Service by RASPerS Participants

Gender distribution closely replicates the Roberts and House (2006) study, which showed that over 80% of the employees in this profession were females. Figure 2 shows the gender distribution as indicated in the RASPerS data.

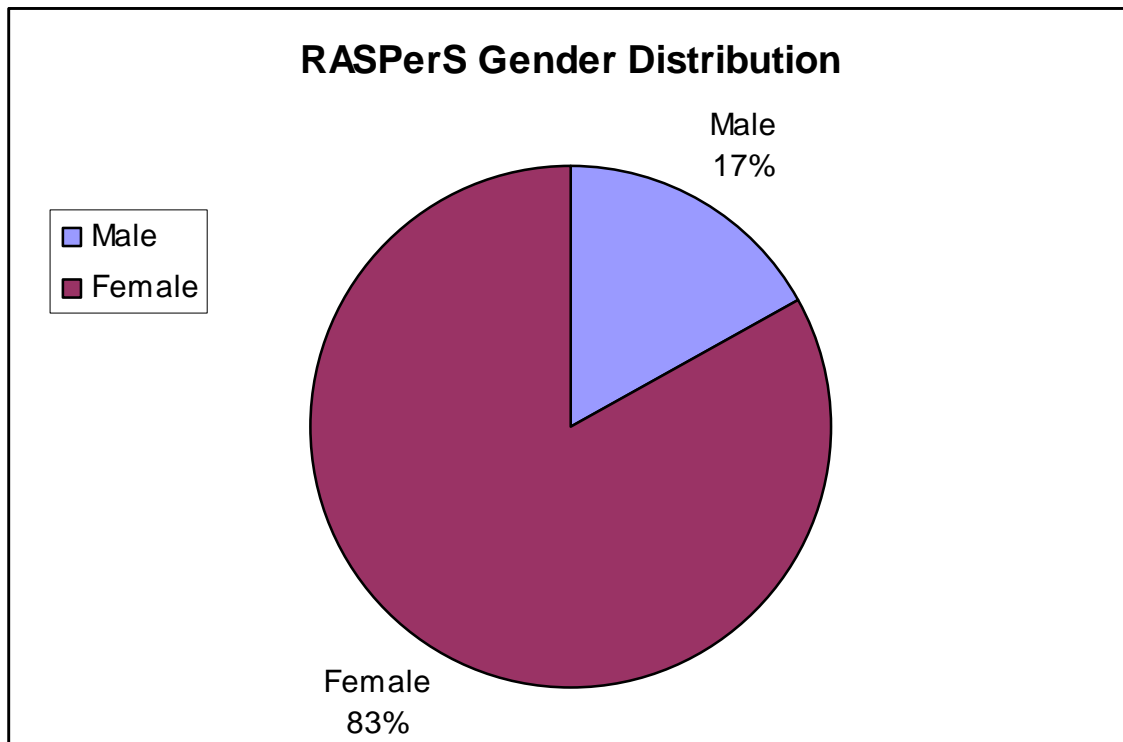


Figure 2. Gender Distribution of RASPerS Participants

Perceptions of Stress

Question 1 was designed to rate levels of stress at work, home due to work, and feelings of anxiety due to competing demands of home and work. As shown in both Table 1 and Figure 3, the prevailing answers were high work-related stress and moderate home stress due to work. For feelings of anxiety from competing demands of home and work, there was no significant difference between moderate (35.4%) and high (35.1%). Figure 4 combines the responses of minimal with moderate and high with extremely high.

Table 1. Perceived Levels of Stress as Shown by Percentage and Number of Responses

<i>Q1. Please rate your perceived levels of stress in the following areas</i>	Minimal	Moderate	High	Extremely High	Response Count
Your perceived level of work-related stress	6.1% (38)	36.4% (227)	41.3% (258)	16.2% (101)	624
Amount of stress at home due to demands of work	30.3% (189)	42.5% (265)	23.0% (143)	4.2% (26)	623
Feelings of anxiety due to competing demands of work and home	17.2% (107)	35.4% (220)	35.1% (218)	12.2% (76)	621

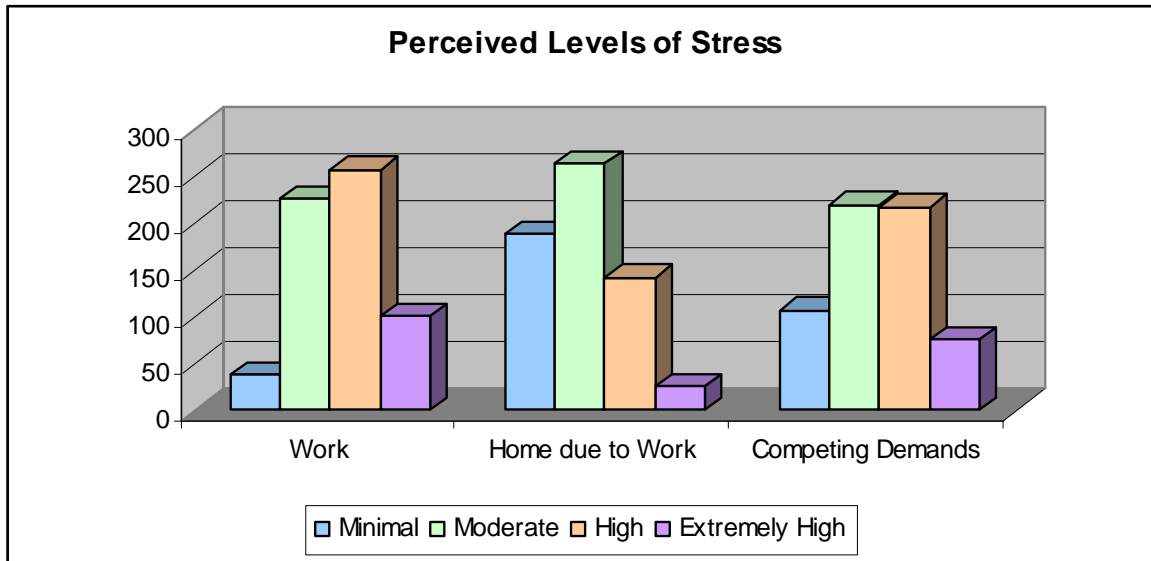


Figure 3. Perceived Levels of Stress as Shown by Number of Responses

Feelings of Control and Appreciation

Participants were asked in RASPerS Question 2 to choose responses from a standard Likert scale of Always, Often, Sometimes, Seldom and Never. The questions were worded as follows:

- Think of your top priorities and goals in life. Do you feel your priorities and the way you spend your time are well aligned with one another?
- Do you feel your non-administrative research colleagues appreciate your contributions to the research mission of your organization?

As is shown in Figure 4, there was a huge prevalence for the middle answer, “sometimes,” for both questions. However, the most significant information concerning differences can be seen by comparing the information that is on either side of the middle, or more neutral, selection (Albaum, 1997). For Question 2a, concerning synchronization of time and priorities, there is a similar distribution among RASPerS participants when comparing the Always/Often responses (160, 25.8%) to the Seldom/Never responses (149, 24.0%). The 50.2% in the Sometimes area felt that they were able to align time and priorities at least some of the time. Conversely, those same participants reported that at least some of the time, they were not able to align their time commitments with their priorities. All in all, this is fairly evenly distributed.

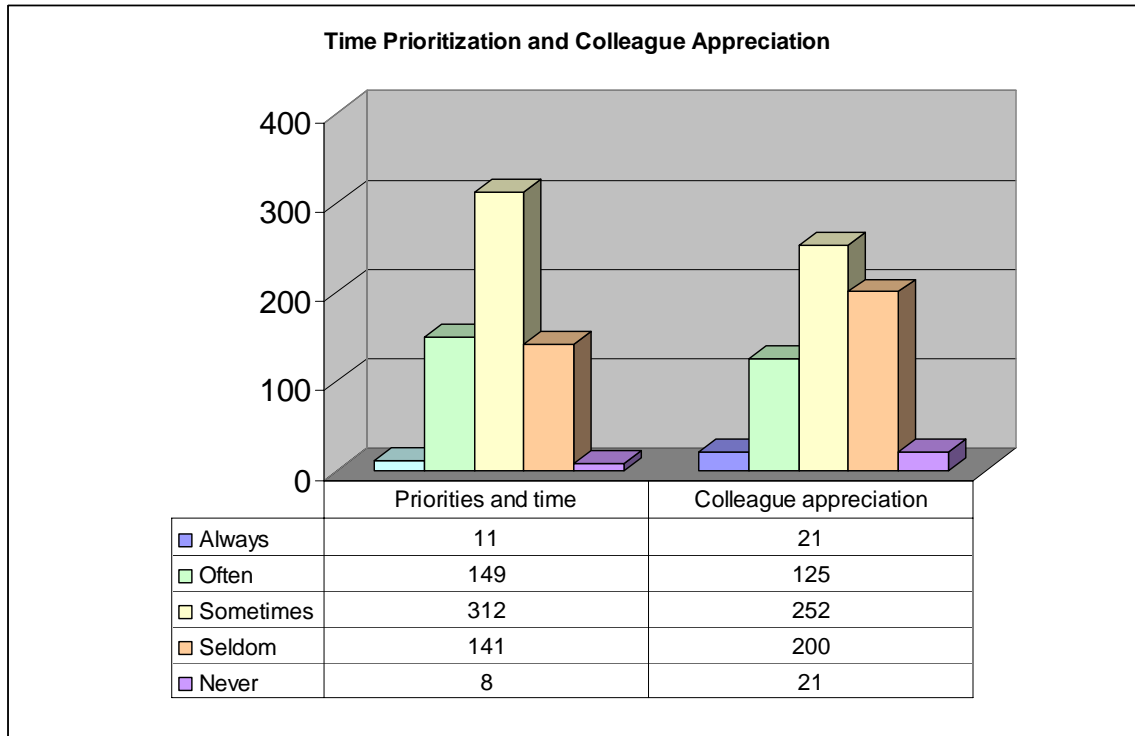


Figure 4. Synchronization of Personal Priorities with Time Commitments and Feelings of Non-Administrative Colleague Appreciation (Absolute Numbers Shown in Data Table)

Figure 4 also depicts the responses to Question 2b, which concerns feelings of appreciation from non-administrative colleagues for contributions to the research mission. Again, a majority were in the “sometimes” category at 40.7%. Unlike the previous question, however, there was a significant difference in percentage between those who felt they were appreciated either always or often (23.5%) and those who felt they were appreciated either seldom or never (33.6%).

Healthy Lifestyle

Question 3 addressed healthy lifestyle practices and Question 4 addressed one aspect of healthy lifestyle results. These practices were selected as identified as practices that can contribute to stress management (DHHS, 2004; Medline Plus, 2005; NIOSH, 1998). Question 3 asked participants to indicate the number of days per week they practiced the following healthy lifestyle behaviors:

- How many nights per week do you have 7 or more hours of uninterrupted sleep?
- How many days per week do you engage in leisure time physical activity for 20 minutes or more?
- How many days per week do you eat five or more ½ cup servings of fruits and vegetables?
- How many days per week do you consume at least eight 8-ounce glasses of water?

- How many days per week do you leave your desk and take a break from work during lunch?

The prevalent answers for practicing each of the five health promotion behaviors were between zero and two days per week. For sleep and hydration, the prevalent answer was zero. For leisure time physical exercise, nutrition, and taking a break at lunchtime, the prevalent response was two days per week. Thus, as a group, RAs were not actively practicing these basic health promotion behaviors. Table 2 shows the responses for each category by day.

Table 2. Number of Days per Week Engaging in Healthy Lifestyle Practices

Days per Week	0	1	2	3	4	5	6	7	Response Count
7 hours sleep	121	75	107	84	83	66	47	32	615
20 min. or more exercise	72	80	141	102	78	64	29	48	614
5 or more fruits or veggies	95	55	105	100	77	71	44	66	613
8 8-oz. glasses water	152	48	69	57	56	72	45	115	614
Break for lunch	119	119	122	79	51	109	3	10	612

In Figure 5, a stacked area chart is used to depict the frequency of engaging in the healthy behaviors measured more often than not (four or more days per week). The stacked area chart represents 100% of the respondents for each item and corrects for the difference in the number of respondents in the separate items. The total group of participants was divided to show the percentage who participated in each healthy behavior zero to three days per week; those are compared to those who practiced the healthy behaviors four to seven days per week. As shown in Figure 5, more often than not (4–7 days per week) scored lower in every category as follows: 28%, taking a break at lunch; 36%, exercise; 37%, sleep; 42%, nutrition; and 47%, hydration.

As a measure of the healthy lifestyle outcomes, perceived body mass index (BMI) was measured. The Body Mass Index Scale is a tool used by the National Heart Lung and Blood Institute as an indicator of healthy body weight (NHLBI). Respondents were given the web address of the BMI scale, or were allowed to just give their estimate of whether their BMI was in the healthy range. The question asked was: Are you at a healthy weight according to recommended standards of the Body Mass Index? Their answer choices were yes, probably, don't know, probably not, and definitely not. The most prevalent answer was probably not (34.4%). Among respondents, 57% indicated that they either were not or probably were not within the recommended BMI range, while 3.9% indicated that they did not know if they were or were not within the recommended BMI range. A total of 39.5% indicated that they either were or probably were within the recommended BMI range.

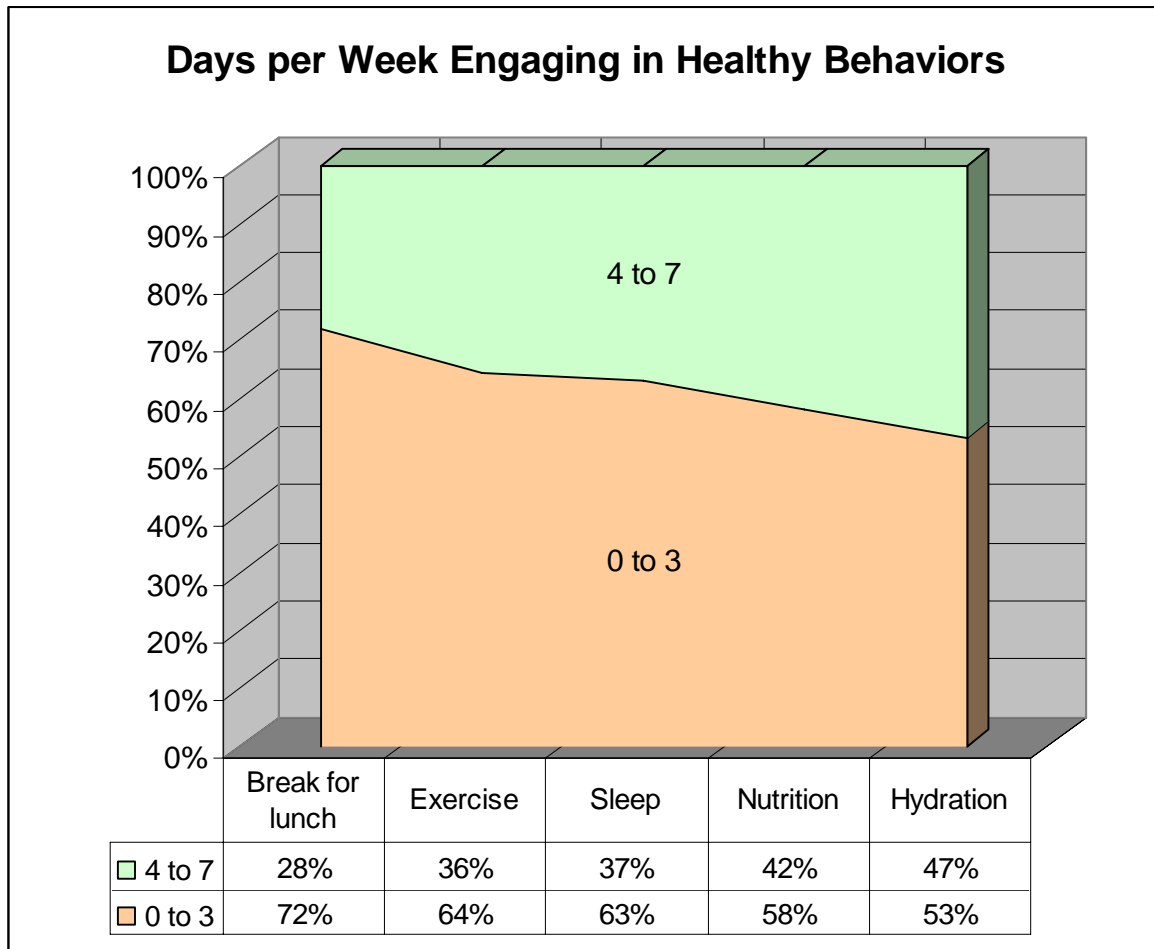


Figure 5. Comparison of Low Frequency or High Frequency of Engaging in Healthy Behaviors. Stacked Area Chart Depicts 100% of Responses for Each Category and Compares 0–3 Days per Week (Less Frequency) to 4–7 Days per Week (High Frequency)

Work-related Health Promotion Scenario

Participants were asked to select the best answer for their possible response to the following situation: “If you had pneumonia during a major deadline, what would you most likely do?” Possible choices are shown below:

1. Work through the deadline and rest afterward.
2. Work at home during the day and possibly come in at night.
3. Work at home.
4. Make arrangements for someone else to manage my desk, call me if needed, and stay home in bed.
5. Expect my colleagues to manage without me while I recover.

The prevalent answer was choice 1, work through the deadline and rest afterward, at 34.4%. Among other participants, 5.0% said they would work at home and come in at night; and 20.5% said they would work at home. The second most popular answer was to have someone else cover their desk and call if needed, at 32.7%, while 7.4% said they would expect their colleagues to manage without them while they recover. Taken together, 59.9% said they would work through pneumonia and 41.1% said they would go to bed.

Perceived Feelings of Negligence

Participants were asked if they felt they had frequently neglected their physical health, mental or spiritual health, and/or family or social relationships in order to meet the demands of their job. The response was overwhelmingly “yes” in each of the three areas. Table 3 shows percentages and number of respondents for each of the possible choices of “yes,” “no,” or “maybe, I’m not sure.”

Table 3. Perceived Feelings of Negligence in Other Areas of Life in Deference to Work

In order to meet the demands of your job, do you feel you have:				
	Yes	Maybe, I’m not sure	No	Response Count
Frequently neglected your physical health?	51.6% (308)	19.4% (116)	29.0% (173)	597
Frequently neglected your mental or spiritual health?	56.4% (336)	19.0% (113)	24.7% (147)	596
Frequently neglected your family or social relationships?	45.0% (268)	21.0% (125)	33.9% (202)	595

Adequacy of Resources

When asked if they felt they currently had adequate support and resources to accomplish their job in a satisfactory manner in a 40-hour work-week, RASPerS participants were allowed to select “yes”, “no”, or “other.” The “other” category had a comment box in which they could respond in more detail if needed. Among participants, 29.6% (177) selected “yes,” indicating that they had sufficient resources to complete their job satisfactorily in a 40-hour work-week. Another 65.6% (393) selected “no,” indicating they did not have sufficient resources to complete their job in a 40-hour work-week. Finally, 4.8% (29) selected “other.” Of these, two wrote yes with comment, and seven wrote no, with comment. Twenty essentially said they did not have 40-hour work-weeks now, but plans were in place for that to be alleviated through new hires or redistribution of duties, or that there were wide fluctuations in their schedules depending on the time of year. So, after adjustment for comment responses, 179 (29.8%) indicated that they had adequate resources for a 40-hour work-week, while 400 (66.8%) indicated they did not have adequate resources to successfully complete their work in a 40-hour week.

DISCUSSION

To our knowledge, this is the first survey presenting a detailed profile of a research administrator’s stress perception and health behavior profile. We observed that the majority of survey participants endorsed the following characteristics:

- Work-related stress: high
- Work-related home stress: moderate
- Stress due to competing demands of home and work: moderate/high
- Sometimes able to align personal goals with time commitments
- Sometimes, but usually not, feels appreciated by non-administrative colleagues
- Never gets 7 hours of sleep or drinks enough water
- Exercises, eats right, and takes a lunch break 2 days a week
- Unhealthy weight status
- Would work during a deadline, even if they are very sick
- Feels they have neglected physical health, mental or spiritual health, and friends or family in deference to work
- Works in an environment where there are not adequate resources to accomplish the job adequately in a 40-hour work-week
- Served the profession for more than five years
- Female

Recommendations

In looking at the prevalent description above, this does not epitomize best practices from what has been learned and published in biomedical research over the ten-plus years that most of these dedicated people have been serving the research community. Hansen and Moreland (2004) described the need for the research administrator to be Janus-faced, looking both forward and backward, to perform due diligence while embracing the principles and values of research administration. Research administrators must also be encouraged to look in the mirror and consider their lives holistically in the present. Are we practicing the sermons we are enabling the researchers to preach through their research? If not, what can we do to change our behaviors or environment to facilitate the adoption of healthier behaviors and ultimate likely health outcomes?

Limitations of the Study

This survey did not collect extensive demographic data that may have some association with stress. As described above, this was done in the interest of keeping the time commitment of the participants at a minimum and reducing personal identification information as much as possible in order to maintain anonymity. Future studies, however, may collect age and marital status, as other studies have shown an association between professional stress and these demographic factors (Smith et al., 2000).

Recommendations for Further Study

Further study is needed to compare the RASPerS participants in the extreme groups (minimal stress vs. extremely high stress) to see what, if any, differences may exist that could be associated with lower levels of stress. Are there differences in stress perception between long-term and newly entered research administrators? Is there an association between gender and perceived levels of stress? Further study is also needed for qualitative analysis of the optional essay question, which asks why participants remain in research administration, to determine if there is any association between professional motivation and perceived levels of occupational stress.

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