



# Evaluation of the Special Emphasis Research Career Award (SERCA) Program (K01)

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# Evaluation of the Special Emphasis Research Career Award (SERCA) Program (K01)

## Executive Summary

The NIH Special Emphasis Research Career Award (SERCA) in Pathology and Comparative Medicine is a Mentored Research Scientist Development Award (K01) grant mechanism to assist graduate veterinarians with in-depth experience in laboratory animal science activities to become independent investigators in research related to comparative medicine. Awardees receive up to 5 years of support and protected time (i.e., time free from teaching and administrative responsibilities) from SERCA.

This is the first evaluation of the SERCA program, which was first announced in 1982. The following questions guided the evaluation:

1. Has the SERCA program been successful in increasing the scientific independence of veterinary scientists?
  - a. What were the career trajectories of SERCA trainees compared to individuals who applied for a SERCA but did not receive an award?
  - b. How does the NIH funding track record of SERCA trainees compare to that of individuals who applied for a SERCA but did not receive an award?
  - c. How do the publications of SERCA trainees compare to those of individuals who applied for a SERCA but did not receive an award?
  - d. What aspects of SERCA were most helpful in enabling the trainees to conduct independent research?
2. What facilitators and barriers does SERCA pose in pursuing a career as a veterinary scientist?
3. How do SERCA trainees assess the program?
  - a. How satisfied were the SERCA trainees with the program?
  - b. How effective were the mentors according to the trainees?
  - c. What changes would the trainees recommend for the SERCA program?
  - d. How do the trainees perceive the impact of SERCA on their careers?

All SERCA participants who had completed the 5-year program by 2009 were included in the treatment group, which totaled 72 individuals. The comparison group consisted of the 82 individuals who had applied for a SERCA grant between 1983 and 2004 but never received one. Three data sources were used in this evaluation: the NIH IMPAC II database, which includes data on NIH grant applications, NIH grant awards, and publications; Internet searches to examine the careers of SERCA participants and the comparison group; and two focus groups of SERCA participants—one that examined the career trajectory of early participants from the first two decades of the program and the second of recent participants (individuals who had completed the program between 2003 and 2009) that examined their experiences in the program.

Participants said that their SERCA programs concentrated on research experience, experimental design, statistical analyses, preparing and writing grants proposals, writing manuscripts for publication, and attending meetings. Protected time and mentoring were important components of the program.

SERCA has had a major impact on the careers of grantees. According to recent participants, the most valuable feature of the grant was that it provided independent funding, which enabled them to obtain or transition into their first faculty position. For early participants, SERCA was important in obtaining additional funding, receiving promotion and tenure, and conducting research at a senior level. Early participants have been recognized for their scientific work in a variety of ways, and they attributed some of this recognition to their SERCA awards.

A greater percentage of SERCA participants than individuals in the comparison group submitted NIH grant applications (76 percent versus 54 percent). SERCA participants submitted a considerably greater number of applications (383 versus 273) and received more awards (83 versus 58), but the overall award rate for all grants for SERCA participants and the comparison group was about the same (21.7 percent for SERCA participants versus 21.2 percent for the comparison group). However, for the R01, which was the specific type of grant receiving the greatest number of applications from both groups, the SERCA participants were more successful than the comparison group in obtaining them (18 percent versus 12 percent).

An academic institution was by far the most common employer for both SERCA participants and the comparison group, but SERCA participants were more frequently located in medical schools. SERCA participants had substantially more publications than the comparison group (712 versus 267), and the overall average impact factor for the publications by SERCA participants was higher than the average for the comparison group (5.30 versus 4.35).

A barrier for veterinary scientists, particularly those working in medical schools, is that they are not well understood by other scientists. There is limited understanding of the field and the skills and talents that are involved. To address this barrier, several of the early SERCA participants had been proactive in identifying other scientists with complementary areas of research and found those scientists to be welcoming once they were made aware of what the veterinarians could contribute to the work. Having a SERCA award from NIH gave the veterinarians credibility as scientists. This strategy should be encouraged for future SERCA participants working in medical schools.

Some recent participants have moved away from research to clinical or administrative positions or are considering doing so because of limited funding opportunities for their research.

## 1. Introduction

### Background of the SERCA Program

The NIH Special Emphasis Research Career Award (SERCA) in Pathology and Comparative Medicine is a Mentored Research Scientist Development Award (K01) to assist graduate veterinarians with in-depth experience in laboratory animal science activities to become independent investigators in research related to comparative medicine. Awardees receive up to 5 years of financial support and protected time (i.e., time free from teaching and administrative responsibilities) from SERCA, which emphasizes in-depth research in basic or clinical scientific disciplines in an academic or institutional setting. Their overall program must be centered on a hypothesis-driven research question. Possible research areas include but are not limited to animal models, reproductive biology, fundamental biology of animal systems, regenerative medicine, animal disease, and animal welfare.

During the first 3 years of support, awardees are expected to develop and/or improve their capabilities in basic, applied, or clinical biomedical research. Their scientific projects, which are guided by a primary mentor, may encompass more than one area of research.

During the final 2 years of support, awardees must demonstrate that they are becoming increasingly independent in planning, designing, and conducting research. The SERCA is not intended to be a mechanism for obtaining a Ph.D., but the research conducted under the SERCA may be used toward the Ph.D. thesis requirement.

Requirements for a SERCA candidate include the following:

- Hold a Doctor of Veterinary Medicine (D.V.M. or V.M.D.) or equivalent degree in veterinary medicine from an institution that is recognized by the American Veterinary Medical Association (AVMA).
- Have completed his/her clinical training, including specialty training in a relevant discipline, prior to receiving an award.
- May not concurrently apply for any other NIH career development award nor have another submitted application pending.
- Not have been previously designated as principal investigator on any research project supported by federal sources.
- Be nominated by an institution on the basis of his/her personal qualifications, interests, accomplishments, motivation, and potential for a research career.
- Receive appropriate mentoring throughout the duration of the program.

Approximately five new applicants are funded each year. Thus far, about 100 veterinarians have been funded by the program since its inception in 1982 as a SERCA in Laboratory Animal Science. Formerly a program of the National Center for Research Resources (NCRR), SERCA is currently housed in the Division of Comparative Medicine, Office of Research Infrastructure Programs, Division of Program Coordination, Planning, and Strategic Initiatives (DPCPS), which is in the office of the NIH director.

## **Relationship of SERCA to Other NIH Grants**

NIH Career Development Awards, a series of grant mechanisms sometimes called the K-series because of their activity code, have been used since 1957 to guide and sustain the careers of individuals who have already completed various kinds of professional and research training. The awards fall into two major classes—those in which the candidate has a mentor, and those in which the candidate has reached independence as a researcher and no longer needs additional mentoring.

In existence since 1968, the Mentored Research Scientist Development Award (K01) supports the career development of scientists in the biomedical, behavioral, and clinical science fields. The program aims to help investigators achieve independent status by providing salary support for protected time so that awardees can focus on building their research skills. Ultimately, the program is intended to give researchers the tools they need to be competitive for research grants (such as the NIH R01 awards) and pursue crucial avenues of scientific inquiry. The SERCA K01 program is targeted specifically at the development of veterinary scientists.

## **2. Evaluation Overview**

This is the first evaluation of the SERCA program, which has been operating since 1982. The following questions guided the evaluation:

1. Has the SERCA program been successful in increasing the scientific independence of veterinary scientists?
  - a. What were the career trajectories of SERCA trainees compared to individuals who applied for a SERCA but did not receive an award?
  - b. How does the NIH funding track record of SERCA trainees compare to that of individuals who applied for a SERCA but did not receive an award?
  - c. How do the publications of SERCA trainees compare to those of individuals who applied for a SERCA but did not receive an award?
  - d. What aspects of SERCA were most helpful in enabling the trainees to conduct independent research?
2. What facilitators and barriers does SERCA pose in pursuing a career as a veterinary scientist?
3. How do SERCA trainees assess the program?
  - a. How satisfied were the SERCA trainees with the program?
  - b. How effective were the mentors according to the trainees?
  - c. What changes would the trainees recommend for the SERCA program?
  - d. How do the trainees perceive the impact of SERCA on their careers?

### 3. Evaluation Approach and Methodology

#### Logic Model

The development of the SERCA evaluation approach began with the construction of a logic model, which depicts the theory of change underlying the full range of program activities (Figure 1). This visual display of the SERCA components and the connections among them includes the following elements:

- **Contextual** factors are the special characteristics of a project setting that need to be considered in understanding how a set of interventions has played out. These factors can help clarify the nature of the setting in which the project has occurred and can play a role in determining where findings might and might not be generalizable.
- **Activities** are the components of the treatments that a project is providing. They are the actions that will be taken to move toward the project's goals and outcomes.
- **Outcomes** are results of changes in behavior or learning. Outcomes reflect the goals and objectives of the project.

#### Treatment and Comparison Groups

All SERCA participants who had completed the 5-year program between 1983 and 2009 were included in the treatment group, which totaled 72 individuals. The 17 people who had received 3 or 4 years of SERCA support were included as well, but those with less than 3 years of support were excluded. One participant who died in the 1990s was excluded, but a SERCA participant who was recently deceased was included in the analysis.

The comparison group consisted of the 82 individuals who had applied for a SERCA grant between 1983 and 2004 but were never awarded one. This group was chosen because it was closest in background to the SERCA awardees. That is, the individuals met the SERCA program requirements, including holding a D.V.M. or equivalent degree, and they wanted to develop or improve their research capabilities as demonstrated by their application. The year 2004 was used as the cutoff because it was when the SERCA participants who completed their programs in 2009 had applied for their SERCA grants. Individuals whose applications were not scored were excluded from the analysis.

The total populations of both the treatment and comparison groups were included in this study. Therefore, tests for statistical significance of differences, which are performed when sampling is done, did not need to be conducted in this evaluation (Loether and McTavish, 1993).

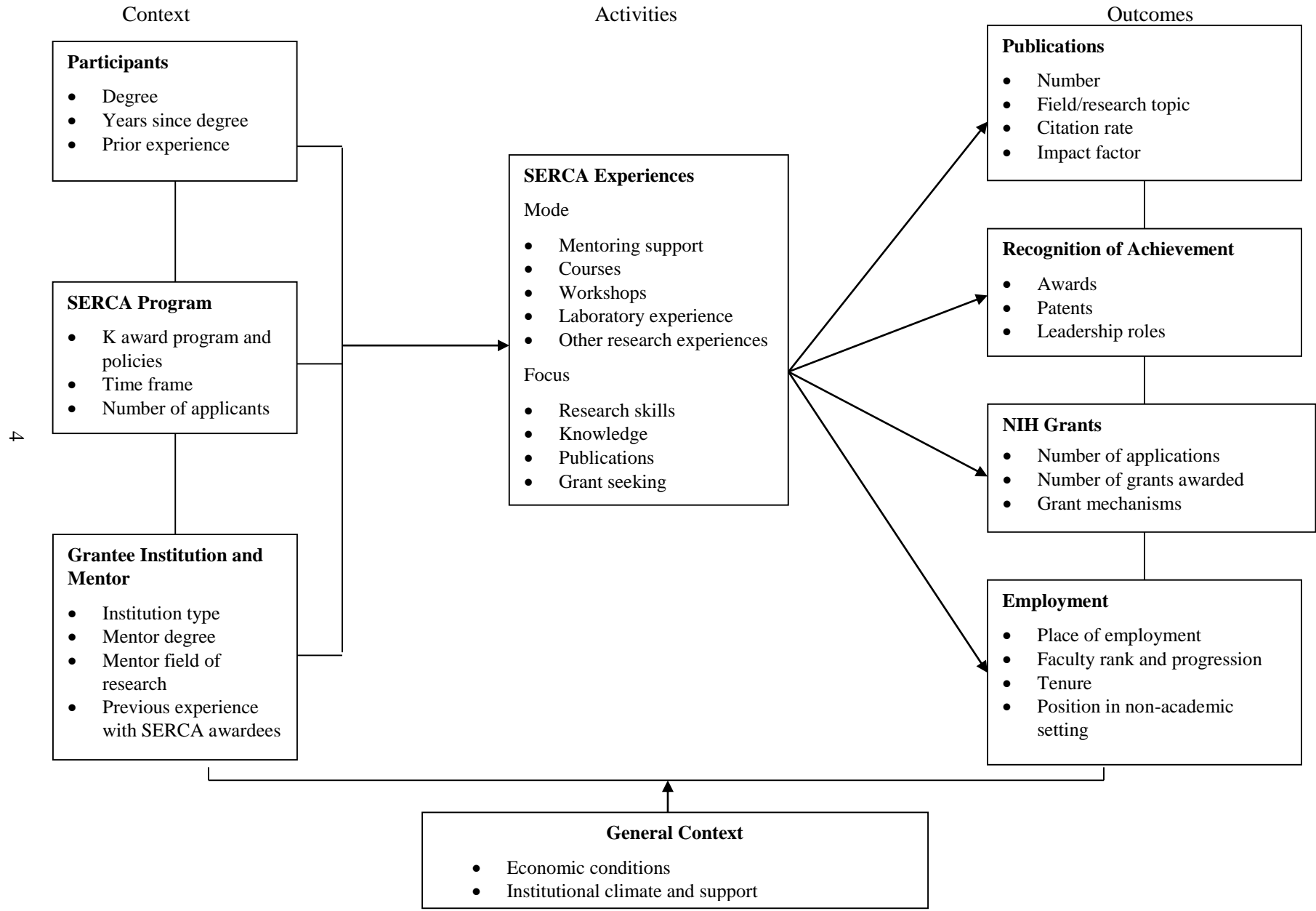
#### Data Sources

Three data sources were used in this evaluation: the NIH IMPAC II database, Internet searches, and two focus groups.

The NIH IMPAC II database contains a wealth of information about all grant applications and the individuals who apply for them. Variables used in this evaluation involved the number of NIH grant applications, number of NIH grant awards, and number of scientific publications. For the treatment group, grant history since the completion of the SERCA award was examined; for the comparison group, grant history from the first time the SERCA application was not funded was examined. For both the treatment



**Figure 1. Logic model for the SERCA program evaluation**



and comparison groups, the full population was included in the NIH IMPAC II database analyses as indicated above; therefore, there were no sampling errors and tests of statistical significance were not necessary.

Internet searches were conducted for all members of the treatment and comparison groups to examine their careers. Not everyone was found in the Internet searches, and the amount and types of information obtained varied considerably from person to person. The most consistent data obtained were the employer and whether or not the individual had a Ph.D. degree, which were the primary variables used in the analysis.

Two focus groups of SERCA participants were conducted. One focus group examined the career trajectory of participants from the first two decades of the program. This group had sufficient time for their career to develop since they participated in SERCA. Topics addressed in this focus group were the impact of SERCA on their career, how SERCA may have served as a facilitator for pursuing a career as a veterinary scientist, and ways in which individuals have been recognized for their achievements in their careers. While most of the nine members of this group came from academic institutions, the most common employer for SERCA participants, other types of placements were also represented. Members of this group are referred to as early participants in this report.

The second focus group examined the SERCA experiences of seven individuals who had completed the program between 2003 and 2009 and therefore had recent experience in the program. Topics in this group included components of the program that were considered most valuable, effectiveness of the mentor, how the participants first learned about the program, and any recommended changes to improve the program. Members of this group are called recent participants in this report.

## **4. Outcomes**

This section presents the outcomes of the evaluation, following the steps in the careers of the SERCA participants and the comparison group. It begins with SERCA applications followed by the experiences of those who received an award, which address evaluation questions 1d, 2, 3a, and 3b. Next, the careers of SERCA participants are presented, including the current or most recent employment of SERCA participants and the comparison group; this section addresses evaluation questions 1a and 3d. Then, NIH grant applications and awards and publications are provided for SERCA participants and the comparison group, which address evaluation questions 1b and 1c. The final topics presented are recognition received by SERCA participants (evaluation question 1a), barriers to pursuing a career as a veterinary scientist and how they may be addressed (evaluation question 2), speculation about the careers of awardees if they had not received a SERCA (evaluation question 3d), and perceptions of the future (evaluation question 3c).

### **SERCA Applications**

When they first applied for a SERCA grant, recent participants were often in doctoral or postdoctoral programs or faculty position in departments that had great familiarity with SERCA. Members of their departments had previously served as mentors or had been former grantees.

Some of the recent participants said that they applied to SERCA because it was restricted only to veterinarians and they thought they would have a better chance of receiving it than of receiving other grants to which individuals with a variety of advanced degrees could apply. Others believed that the rate of funding SERCA applications was less than the rate for some of the other NIH grant types but that they considered SERCA to be valuable because it was specifically supporting veterinarians.

Although all applicants to SERCA must be veterinarians, they may apply for a SERCA grant through a wide variety of institutional departments. Table 1 shows that while veterinary sciences was the most common department for both the SERCA participants (26 percent) and the comparison group (17 percent), applications of both groups came from many different departments.

**Table 1. Institutional department of SERCA (K01) grant application**

Institutional department	Grand total (N=154)		SERCA participants (N=72)		Comparison (N=82)	
	Number	Percent	Number	Percent	Number	Percent
Veterinary sciences.....	33	21.4	19	26.4	14	17.1
Pathology.....	12	7.8	5	6.9	7	8.5
Internal medicine/medicine.....	6	3.9	3	4.2	3	3.7
Microbiology/immune/virology.....	4	2.6	3	4.2	1	1.2
Genetics.....	3	1.9	1	1.4	2	2.4
Anesthesiology.....	2	1.3	2	2.8	0	0.0
Biochemistry.....	2	1.3	2	2.8	0	0.0
Obstetrics & gynecology.....	2	1.3	1	1.4	1	1.2
Other basic sciences*.....	2	1.3	1	1.4	1	1.2
Pharmacology.....	2	1.3	1	1.4	1	1.2
Social sciences.....	2	1.3	1	1.4	1	1.2
Surgery.....	2	1.3	1	1.4	1	1.2
Public health & preventative medicine.....	2	1.3	0	0.0	2	2.4
Pediatrics.....	1	0.6	0	0.0	1	1.2
Urology.....	1	0.6	0	0.0	1	1.2
Other**.....	2	1.3	0	0.0	2	2.4
None.....	6	3.9	1	1.4	5	6.1
Not specified in IMPAC II database.....	70	45.5	31	43.1	39	47.6

\*Including molecular medicine and biomedical sciences.

\*\*Including clinical sciences and comprehensive cancer center.

SOURCE: IMPAC II.

Prior to being considered for funding, NIH grant applications are peer reviewed and given a priority score. The lower the score, the stronger the proposal and the greater the likelihood of being funded. As expected, the overall average of the priority scores for the SERCA participants (152) was considerably lower than the average score for the comparison group (272) (Table 2).

**Table 2. Average priority score of SERCA (K01) grant application**

Year	Grand total (N=154)	SERCA participants (N=72)	Comparison (N=82)
<b>Overall average.....</b>	<b>215.7</b>	<b>152.0</b>	<b>271.6</b>
1982–1990 (N=15).....	246.9	153.9	310.3
1991–1995 (N=18).....	193.8	149.7	231.7
1996–2000 (N=17).....	228.4	151.2	278.8
2001–2005 (N=22).....	191.5	153.3	256.2

NOTE: Year groupings are based on the year of the K01 grant application. Standard deviations for this table are provided in the appendix.

SOURCE: IMPAC II.

The average SERCA award almost doubled since the program was established (\$56,000 during the 1980s to \$106,000 during the first half of the 2000s) (Table 3).

**Table 3. Average award of funded SERCA (K01) grants**

Year	Average total cost
<b>Overall average</b> .....	<b>\$ 79,592.89</b>
1982–1990 (N=15) .....	55,861.47
1991–1995 (N=18) .....	69,178.22
1996–2000 (N=17) .....	77,514.06
2001–2005 (N=22) .....	105,900.86

NOTE: Year groupings are based on the year of the SERCA grant application. Only SERCA awardees, i.e., the treatment group, are included. Standard deviations for this table are provided in the appendix.

SOURCE: IMPAC II.

### SERCA Experiences

Focus group participants were asked about their SERCA experiences, especially about aspects of their programs that had helped them to become independent researchers and that had an impact on their careers. Participants said that their SERCA programs concentrated on research experience, experimental design, statistical analyses, preparing and writing grants proposals, writing manuscripts for publication, and attending meetings. One of the early participants summarized the value of this research experience as follow:

*It's a big gap between where I was and where my science was before the SERCA and where it was afterwards. And there weren't a lot of other mechanisms to bridge that gap. I can't think of any. So the SERCA provided a really important step in a pathway towards a career in research for me.*

Protected time was considered to be a valuable program component by some early participants.

*SERCA protected my time so that I could pursue basic science research papers and collaborations with scientists that wrote strong letters of support [for promotion].*

*SERCA provided the protected time that I needed to develop in my first tenured academic position to become an independent scientist. I came into a clinical department, and if I wasn't funded to do research through SERCA, I would have been seeing cases. And you know, that would have consumed my time and sent my career in a very different direction. So being able to split my case time and have the majority of my time for the research really was instrumental to me ending up with a research-focused career.*

A feature of SERCA that recent participants considered to be particularly attractive compared to other training grants was that it paid toward supplies and indirect costs. Another was that SERCA required a minimum of 75 percent effort compared to 100 percent effort on other training grants, thus providing the participants with flexibility to engage in other opportunities such as clinical work or an administrative component.

Mentors were considered an important component of the SERCA experience.

*Mentors are absolutely essential. Not only do they guide you in helping you, preventing you from going on tangents. But probably the one thing that I found most valuable is they taught me how to write papers. And if you don't publish, nobody knows about your work.*

*[The mentor] introduced me to people in the field. She got me networked into program officials, which is pretty important for different funding mechanisms. She made me aware of different opportunities to give presentations. She also made me aware of alternative funding opportunities. She was very proactive in helping me become established and independent.*

*I basically was in a laboratory as a post-doc and like a lot of us that used the SERCA program as a pathway to independent research and our own funding, the mentor basically helped me design the studies.*

As part of their SERCA experience, participants learned about NIH and other funding mechanisms and what type of grants to apply for immediately after a K01 grant. The mentor of one participant also emphasized participation in peer review; toward the end of the SERCA, this grantee did peer reviews for scientific journals. One topic that one participant would have wanted to be included was resource management and logistics.

### **Careers of SERCA Participants**

SERCA has had a major impact on the careers of grantees.

*Without [SERCA] I don't think I would have been able to stay funded by NIH over the last almost 30 years, because it gave me the last research training time that I needed past the residency and DVM. No doubt in my mind, it really changed my life.*

One recent participant described a very clear career path that a mentor had laid out beginning with post-doctoral work with expectations for publications and lab experience to attaining a first faculty position, which was facilitated by a SERCA grant to eventually work toward a first R01 grant.

*[The mentor] had a very clear development plan for me and the SERCA was the first step.*

**Career at the time of SERCA.** For recent SERCA participants, the most valuable feature of the grant was that it provided independent funding, which enabled them to obtain or transition into their first faculty position. Early program participants also reported that SERCA had enabled them to bridge the transition between a postdoc and getting a faculty position.

*I had my residency and Ph.D. already funded by the department I was in and by external NIH funding, and I submitted my SERCA award application in preparation for a new faculty appointment.*

*The funding gave me some credibility, and allowed me to get the faculty appointment, so it was essential.*

Recent SERCA participants were frequently engaged in comparative medicine at the time of their application to SERCA, and many of them used the grant to continue the research they had been doing.

*I came into my training program already having completed a Ph.D., and I had already identified a research method for my research interests, and that formed the basis and foundation for where I ultimately went with the K award and what research I described in that. So the department supported me doing research I already wanted to do before coming in.*

However, some recent participants spoke of changes in their research with the receipt of SERCA. One switched from working with one specific animal model to others; a second went from studying young adults to adults and began looking at completely different mechanisms. A third used SERCA as an opportunity to train in a slightly different area of research in order to take his research in a different direction with more application to humans.

Transitioning to new types of research as a part of their SERCA experience was more frequently mentioned by the early program participants. Several changed from a veterinary environment to a medical school environment; others changed fields or areas of specialization or added to their areas of research.

*It allowed me to move from a clinical [position] to be a trained veterinarian that works in primary medical research in a medical school primarily.*

*SERCA got me training in the new discipline, and then got me going in immunology.*

**Employment of SERCA participants and the comparison group.** The general expectation is that SERCA program participants will stay in a scientific career. An academic institution was by far the most common employer for both SERCA participants (64 percent) and the comparison group (57 percent) (Table 4). For both groups, about half of those at academic institutions worked in a veterinary school. A greater percentage of SERCA participants worked at medical schools (37 percent) than did individuals in the comparison group (21 percent). About the same percentage of both groups worked at private companies, which included pharmaceutical and biotechnical entities.

**Table 4. Current or most recent known employer**

Employment type	All (N=154)		SERCA participants (N=72)		Comparison (N=82)	
	Number	Percent	Number	Percent	Number	Percent
Academic institution .....	93	60.4	46	63.9	47	57.3
Veterinary school* .....	48	51.6	24	52.2	24	51.1
Medical school* .....	27	29.0	17	37.0	10	21.3
Other*, ** .....	18	19.4	5	10.9	13	27.7
Private company.....	25	16.2	12	16.7	13	15.9
Private practice.....	11	7.1	5	6.9	6	7.3
Federal government .....	7	4.5	3	4.2	4	4.9
Other*** .....	5	3.2	3	4.2	2	2.4
Deceased.....	1	0.6	1	1.4	0	0.0
Unknown .....	12	7.8	2	2.8	10	12.2

\*Percentages were calculated within academic institution.

\*\*Including School of Science and Engineering; Basic Science Division, Institute of Virology; Research Animal Resources Center; and Laboratory Animal Resources.

\*\*\*Including zoological park and law firm.

NOTE: If the employer could not be confirmed after 2008, employment type was considered to be unknown.

SOURCE: Internet searches.

The academic rank of those employed by academic institutions was generally similar for the SERCA participants and the comparison group (Table 5). However, five comparison group members served as veterinarians at a postsecondary institution and none of the SERCA participants served in this role. Several individuals in both groups have attained very senior positions, including university president and associate dean.

**Table 5. Current or most recent academic rank for individuals employed by academic institutions**

Academic rank	All (N=93)		SERCA participants (N=46)		Comparison (N=47)	
	Number	Percent	Number	Percent	Number	Percent
Senior administrative staff*	5	5.4	2	4.3	3	6.4
Professor	26	28.0	13	28.3	13	27.7
Associate professor	26	28.0	13	28.3	13	27.7
Assistant professor	15	16.1	9	19.6	6	12.8
Instructor	2	2.2	1	2.2	1	2.1
Director	6	6.5	5	10.9	1	2.1
Researcher/scientist	6	6.5	3	6.5	3	6.4
Veterinarian	5	5.4	0	0.0	5	10.6
Other**	2	2.2	0	0.0	2	4.3

\*Including university president, associate dean, and assistant vice chancellor/director.

\*\*Including comparative ophthalmology resident and an adjunct position.

SOURCE: Internet searches.

SERCA participants and members of the comparison group who have gone into the pharmaceutical industry serve in similar roles (Table 6). The most frequent position for both groups is director, a position held by 50 percent of the SERCA participants and 29 percent of the comparison group.

**Table 6. Positions of individuals employed by private companies**

Position	All (N=25)		SERCA participants (N=12)		Comparison (N=13)	
	Number	Percent	Number	Percent	Number	Percent
Director	10	40.0	6	50.0	4	30.8
Pathologist	6	24.0	3	25.0	3	23.1
Veterinarian	2	8.0	1	8.3	1	7.7
Other*	3	12.0	0	0.0	3	23.1
Unknown	4	16.0	2	16.7	2	15.4

\*Including manager of quality assurance and senior research specialist.

SOURCE: Internet searches.

**Doctoral degree.** A Ph.D. degree is generally a necessity for employment as a professor in a postsecondary institution. The SERCA program is not designed to be a mechanism for obtaining a Ph.D., but activities done as a part of the program may be used toward attaining the degree. At the time of applying for a SERCA grant, almost half of program participants already had a Ph.D., as did about a third of the comparison group (Table 7). Eventually, at least 79 percent of the SERCA participants obtained a Ph.D., compared to at least 69 percent of the nonparticipants.

**Table 7. Stage of program participation when Ph.D. degree was received**

When Ph.D. was received	All (N=155)		SERCA participants (N=72)		Comparison (N=82)	
	Number	Percent	Number	Percent	Number	Percent
Prior to SERCA application	60	38.7	35	48.6	25	30.5
After individual applied for SERCA grant	29	18.7	14	19.4	15	18.3
Year in which Ph.D. was received is unknown	26	16.8	8	11.1	17	20.7
Unknown if Ph.D. was received	40	25.8	15	20.8	25	30.5

SOURCE: IMPAC II and Internet searches.

**Later phases of the career.** For the early participants, SERCA served as a facilitator in their careers in a variety of ways:

*The SERCA award provided a pathway for me as a veterinarian to be deeply immersed in basic science in the school of medicine that took the science to a whole new level to which I had no other exposure.*

*It gave quite a measure of independence and autonomy for my own research direction.*

*It allowed me to become familiar on a first name basis with the program people at NIH, and you wouldn't believe the benefits not only in writing for your grants but in seeing these people at meetings and knowing what's going on.*

SERCA was very important in receiving promotion and tenure.

*I've been tenured at three different universities, and I think particularly the first two, the SERCA had a significant impact on that because of my ROIs that I was able to obtain from the training.*

*Having a SERCA award did significantly increase my movement from assistant to associate to full professor in a medical school.*

Some of the early participants have attained senior positions such as Associate Vice President, Associate Dean for Research in a veterinary school, and Department Chair.

*I was a department head for 12 years and I think the SERCA helped me get there.*

### **NIH Grant Applications**

Obtaining outside funding is a critical factor in the careers of academics as well as those in other types of employment situations. Several federal government agencies provide grant programs that might be used to fund research and other scientific activities done by SERCA participants and applicants; however, in this evaluation the focus was exclusively on NIH grants. Table 8 provides an overview of the grant applications submitted by both groups. For the SERCA participants, all grant applications submitted after the completion of the SERCA program were included. For the comparison group, all grant applications submitted after the first time the SERCA application was not funded were included except for subsequent K01 applications.

Although the number of SERCA participants was somewhat smaller than the number of individuals in the comparison group (72 versus 82), more SERCA participants submitted grant applications (55 versus 44) (Table 8). Thus, about three-fourths (76 percent) of the SERCA participants submitted grant applications, while about half (54 percent) of the individuals in the comparison group did. SERCA participants also submitted a higher number of NIH grant applications than did the comparison group (total of 383 versus 273).



**Table 8. NIH grant applications submitted by SERCA participants and the comparison group**

NIH grant history	All (N=154)	SERCA participants (N=72)	Comparison (N=82)
Researchers who submitted NIH grant applications .....	99	55	44
Total NIH grant applications submitted.....	656	383	273
Average number per researcher.....	6.6	7.0	6.2
Maximum number of grant applications submitted by a researcher .	57	57	40

NOTE: K01 grant applications were excluded.

SOURCE: IMPAC II.

Research grants, also known as the R series, were the most common type of NIH applications, accounting for at least three-quarters of the applications from SERCA participants (83 percent) and the comparison group (76 percent) (Table 9). The R01 was the specific type of grant for which both groups submitted the greatest number of applications, accounting for half (50 percent) of all applications by SERCA participants and about two-fifths (42 percent) of all applications by the comparison group (Table 10).

The G series for resource programs was the second most common type of grant application for both groups, although a higher percentage of comparison group applications were submitted for this type of grant (Table 9). All G series applications were specifically for G20 grants, which provide funds for repair, renovation, and modernization of existing research facilities (Table 10).

**Table 9. Categories of the NIH grant applications submitted by SERCA participants and the comparison group**

General type of NIH grant	All (N=656 applications)		SERCA (N=383 applications)		Comparison (N=273 applications)	
	Number	Percent	Number	Percent	Number	Percent
Research construction programs (C06).....	9	1.4	7	1.8	2	0.7
Resource programs (G20) .....	43	6.6	16	4.2	27	9.9
Research career programs (K08, K11, K18, K26) .....	30	4.6	11	2.9	19	7.0
Loan repayment programs (L30, L40) .....	7	1.1	5	1.3	2	0.7
Research program projects and centers (P01, P20, P40)..	11	1.7	7	1.8	4	1.5
Research projects (R01, R03, R15, R21, R24, R25, R29, R41, R43, R44, R55, R56, RC1, RC2, RC3, RC4) .....	527	80.3	319	83.3	208	76.2
Research related programs (S10, S15).....	13	2.0	8	2.1	5	1.8
Cooperative agreements (U01, U42, UC6, UH2).....	13	2.0	9	2.3	4	1.5
Formula grants (X02) .....	1	0.2	1	0.3	0	0.0
Support for conferences and scientific meetings (R13).....	2	0.3	0	0.0	2	0.7

NOTE: K01 grant applications were excluded.

SOURCE: IMPAC II.

**Table 10. Specific type of NIH grant applications submitted by SERCA participants and the comparison group**

Grant type	All (N=656 applications)		SERCA (N=383 applications)		Comparison (N=273 applications)	
	Number	Percent	Number	Percent	Number	Percent
C06.....	9	1.4	7	1.8	2	0.7
G20.....	43	6.6	16	4.2	27	9.9
K08.....	18	2.7	4	1.0	14	5.1
K11.....	1	0.2	1	0.3	0	0.0
K18.....	1	0.2	0	0.0	1	0.4
K26.....	10	1.5	6	1.6	4	1.5
L30.....	2	0.3	0	0.0	2	0.7
L40.....	5	0.8	5	1.3	0	0.0
P01.....	8	1.2	6	1.6	2	0.7
P20.....	1	0.2	0	0.0	1	0.4
P40.....	2	0.3	1	0.3	1	0.4
R01.....	307	46.8	193	50.4	114	41.8
R03.....	27	4.1	10	2.6	17	6.2
R13.....	2	0.3	0	0.0	2	0.7
R15.....	7	1.1	5	1.3	2	0.7
R21.....	108	16.5	71	18.5	37	13.6
R24.....	24	3.7	12	3.1	12	4.4
R25.....	4	0.6	2	0.5	2	0.7
R29.....	26	4.0	13	3.4	13	4.8
R41.....	1	0.2	0	0.0	1	0.4
R43.....	3	0.5	0	0.0	3	1.1
R44.....	1	0.2	0	0.0	1	0.4
R55.....	1	0.2	0	0.0	1	0.4
R56.....	1	0.2	1	0.3	0	0.0
RC1.....	13	2.0	9	2.3	4	1.5
RC2.....	2	0.3	1	0.3	1	0.4
RC3.....	1	0.2	1	0.3	0	0.0
RC4.....	1	0.2	1	0.3	0	0.0
S10.....	11	1.7	7	1.8	4	1.5
S15.....	2	0.3	1	0.3	1	0.4
U01.....	9	1.4	7	1.8	2	0.7
U42.....	2	0.3	1	0.3	1	0.4
UC6.....	1	0.2	1	0.3	0	0.0
UH2.....	1	0.2	0	0.0	1	0.4
X02.....	1	0.2	1	0.3	0	0.0

NOTE: K01 grant applications were excluded.

SOURCE: IMPAC II.

## NIH Grant Awards

SERCA participants submitted more grant applications to NIH than the comparison group (383 applications versus 273 applications) (Table 11), and the SERCA participants were awarded a greater number of grants (83 versus 58). However, the overall percentage of grants that were awarded was about the same (21.7 percent for SERCA participants versus 21.2 percent for the comparison group) for the two groups. The SERCA participants were more successful than the comparison group in the percentage of applications funded in the resource programs grant series (56 percent versus 33 percent) but only slightly more successful for research projects (17 percent versus 15 percent) and research career programs other than K01 (27 percent versus 26 percent).

**Table 11. Number and award rate of the most frequent categories of NIH grant applications submitted by SERCA participants and the comparison group**

Type of grant application	Number and award rate of grant applications								
	All			SERCA participants			Comparison		
	Number submitted	Number awarded	Percent awarded	Number submitted	Number awarded	Percent awarded	Number submitted	Number awarded	Percent awarded
All types of NIH grants.....	656	141	21.5	383	83	21.7	273	58	21.2
Resource programs (G20) ..	43	18	41.9	16	9	56.3	27	9	33.3
Research career programs (K08, K11, K18, K26).....	30	8	26.7	11	3	27.3	19	5	26.3
Research projects (R01, R03, R15, R21, R24, R25, R29, R41, R43, R44, R55, R56, RC1, RC2, RC3, RC4)* .....	527	87	16.5	319	55	17.2	208	32	15.4

\*Excludes R13.

NOTE: Includes only the general grant types with at least 4 percent of all applications.

SOURCE: IMPAC II.

For the grant mechanisms receiving the most total applications (R01, R21, G20, and R29), the SERCA participants were more successful than the comparison group in having their grants awarded (Table 12). For example, for the R01, SERCA participants submitted more applications than the comparison group (193 versus 114), were awarded a greater number of grants (35 versus 14) and had a higher award rate (18 percent versus 12 percent).

**Table 12. Number and award rate of each type of NIH grant application submitted by SERCA participants and the comparison group**

Grant application	Number and award rate of grant applications								
	All (N= 99)			SERCA participants (N= 55)			Comparison (N= 44)		
	Number submitted	Number awarded	Percent awarded	Number submitted	Number awarded	Percent awarded	Number submitted	Number awarded	Percent awarded
All grants .....	656	141	21.5	383	83	21.7	273	58	21.2
C06 .....	9	6	66.7	7	6	85.7	2	0	0.0
G20 .....	43	18	41.9	16	9	56.3	27	9	33.3
K08.....	18	4	22.2	4	0	0.0	14	4	28.6
K11.....	1	0	0.0	1	0	0.0	0	NA	NA
K18.....	1	0	0.0	0	NA	NA	1	0	0.0
K26.....	10	4	40.0	6	3	50.0	4	1	25.0
L30.....	2	2	100.0	0	NA	NA	2	2	100.0
L40.....	5	3	60.0	5	3	60.0	0	NA	NA
P01.....	8	2	25.0	6	1	16.7	2	1	50.0
P20.....	1	1	100.0	0	NA	NA	1	1	100.0
P40.....	2	1	50.0	1	1	100.0	1	0	0.0
R01 .....	307	49	16.0	193	35	18.1	114	14	12.3
R03 .....	27	6	22.2	10	2	20.0	17	4	23.5
R13 .....	2	2	100.0	0	NA	NA	2	2	100.0
R15 .....	7	1	14.3	5	0	0.0	2	1	50.0
R21 .....	108	16	14.8	71	11	15.5	37	5	13.5
R24 .....	24	7	29.2	12	3	25.0	12	4	33.3
R25 .....	4	3	75.0	2	1	50.0	2	2	100.0
R29 .....	26	2	7.7	13	2	15.4	13	0	0.0
R41 .....	1	1	100.0	0	NA	NA	1	1	100.0
R43 .....	3	1	33.3	0	NA	NA	3	1	33.3
R44 .....	1	0	0.0	0	NA	NA	1	0	0.0
R55 .....	1	0	0.0	0	NA	NA	1	0	0.0
R56 .....	1	1	100.0	1	1	100.0	0	NA	NA
RC1.....	13	0	0.0	9	0	0.0	4	0	0.0
RC2.....	2	0	0.0	1	0	0.0	1	0	0.0
RC3.....	1	0	0.0	1	0	0.0	0	NA	NA
RC4.....	1	0	0.0	1	0	0.0	0	NA	NA
S10.....	11	4	36.4	7	2	28.6	4	2	50.0
S15.....	2	2	100.0	1	1	100.0	1	1	100.0
U01 .....	9	2	22.2	7	1	14.3	2	1	50.0
U42 .....	2	1	50.0	1	0	50.0	1	1	100.0
UC6.....	1	1	100.0	1	1	100.0	0	NA	NA
UH2.....	1	1	100.0	0	NA	NA	1	1	100.0
X02.....	1	0	0.0	1	0	100.0	0	NA	NA

NA = not applicable.

SOURCE: IMPAC II.

The distribution of awarded grant applications between SERCA participants and the comparison groups is shown in Table 13. Almost three-fourths of the R01 (71 percent) and the R21 (69 percent) awards went to SERCA participants. In contrast, the 18 G20 awards were evenly split between the SERCA participants and the comparison group.

**Table 13. Distribution of NIH grants awarded to SERCA participants and the comparison group**

Grant type	Grand total (N=154)	SERCA participants	Comparison
		Percent awarded	Percent awarded
<b>All grants</b> .....	<b>141</b>	<b>58.9</b>	<b>41.1</b>
C06 .....	6	100.0	0.0
G20 .....	18	50.0	50.0
K08 .....	4	0.0	100.0
K26 .....	4	75.0	25.0
L30 .....	2	0.0	100.0
L40 .....	3	100.0	0.0
P01 .....	2	50.0	50.0
P20 .....	1	0.0	100.0
P40 .....	1	100.0	0.0
R01 .....	49	71.4	28.6
R03 .....	6	33.3	66.7
R13 .....	2	0.0	100.0
R15 .....	1	0.0	100.0
R21 .....	16	68.8	31.3
R24 .....	7	42.9	57.1
R25 .....	3	33.3	66.7
R29 .....	2	100.0	0.0
R41 .....	1	0.0	100.0
R43 .....	1	0.0	100.0
R56 .....	1	100.0	0.0
S10 .....	4	50.0	50.0
S15 .....	2	50.0	50.0
U01 .....	2	50.0	50.0
U42 .....	1	0.0	100.0
UC6 .....	1	100.0	0.0
UH2 .....	1	0.0	100.0

SOURCE: IMPAC II.

Although more SERCA participants who were employed by academic institutions worked in veterinary schools (52 percent) compared to medical schools (37 percent) (Table 4), those in medical schools submitted more applications for NIH grants overall (53 percent versus 38 percent) and for each of the three categories of grants examined (Table 14). The award rate, however, was higher for the applications submitted by those in veterinary schools compared to those in medical schools overall (21 percent versus 18 percent) and for the research projects (20 percent versus 15 percent) (Table 15). Those in medical schools had a higher percentage of their applications awarded for resource programs (67 percent versus 50 percent) and research career programs (50 percent versus 0 percent). The average number of awards per researcher was 2.4 for those in medical school compared to 2.1 for those in veterinary school.

**Table 14. NIH grant applications submitted by SERCA participants employed by academic institutions**

Type of grant application	Total number submitted	Percent of applications by type of academic institution		
		Veterinary school	Medical school	Other*
<b>All types of NIH grants</b> .....	<b>332</b>	<b>38.0</b>	<b>53.3</b>	<b>8.7</b>
Resource programs (G20).....	11	18.2	27.3	54.5
Research career programs (K08, K11, K26).....	11	36.4	54.5	9.1
Research projects (R01, R03, R15, R21, R24, R25, R29, R41, R43, R44, R55, R56, RC1, RC2, RC3, RC4).....	277	38.3	57.8	4.0

\*Including School of Science and Engineering; Basic Science Division, Institute of Virology; Research Animal Resources Center; and Laboratory Animal Resources.

NOTE: Only SERCA participants whose academic appointments could be confirmed for 2008 or later were included.

SOURCE: IMPAC II and Internet searches.

**Table 15. Award rate of the most frequent categories of NIH grant applications submitted by SERCA participants employed by academic institutions**

Type of grant application	Total number submitted	Type of academic institution		
		Veterinary school	Medical school	Other*
<b>All types of NIH grants</b>				
Number submitted.....	332	126	177	29
Number awarded.....	76	27	31	18
Percent awarded.....	22.9	21.4	17.5	62.1
<b>Research career programs (K08, K11, K26)</b>				
Number submitted.....	11	4	6	1
Number submitted.....	3	0	3	0
Percent awarded.....	27.3	0.0	50.0	0.0
<b>Research projects (R01, R03, R15, R21, R24, R25, R29, R41, R43, R44, R55, R56, RC1, RC2, RC3, RC4)</b>				
Number submitted.....	277	106	160	11
Number submitted.....	50	21	24	5
Percent awarded.....	18.1	19.8	15.0	45.5
<b>Resource programs (G20)</b>				
Number submitted.....	11	2	3	6
Number submitted.....	8	1	2	5
Percent awarded.....	72.7	50.0	66.7	83.3

\*Including School of Science and Engineering; Basic Science Division, Institute of Virology; Research Animal Resources Center; and Laboratory Animal Resources.

NOTE: Only SERCA participants whose academic appointments could be confirmed for 2008 or later were included.

SOURCE: IMPAC II and Internet searches.

Several early participants noted that SERCA enabled them to become principal investigators or to obtain preliminary data that were used in support of additional funding.

*Transition to a PI [principal investigator], that's a big hump to get over and the SERCA award was very useful to make that jump.*

*There was a significant component for research to allow me to make progress so that I was more competitive for future funding.*

However, receiving funding for an R01 research grant has been difficult for some SERCA participants. An early participant currently working in a school of medicine commented:

*It became clear towards the end of my SERCA award that I would be in competition directly with new, graduating Ph.D.s and post-docs who were trained to write R01s full time. And I was going to be part clinical veterinarian, and expected to conduct research to stay in an academic position. So I knew upon completion of the SERCA that I would probably not be competitive in writing multiple R01s and running a lab with 15 people. However, and this is a direct quote from the search committee that hired me into my current position, the SERCA award had trained me and given me enough credibility in the scientific realm that the basic scientists felt I was a credible scientist as a veterinarian. And that was what they told me, and one of the reasons why they felt I was a strong applicant for the position I currently hold.*

Recent participants expressed concern about transitioning from SERCA to an R01 grant. According to one focus group participant, SERCA grantees had not been competitive in applying for an R01.

*I have met a number of people, and it could just be the current funding environment, who have received SERCA awards, who have done very well, completed their program, were prolific in publications with respect to their research from the SERCA program, and then are encouraged to submit R01 as the next step, and have found that they are not competitive as new investigators in the R01 environment. So, I wonder if it would be helpful to have another transition step between K01 and R01. And I know we have the new investigator or early investigator status, but I have run into a number of people who even with those, with that leniency with early investigators, are still not successful in receiving R01 funding after the K awards.*

A review of R01 grant submissions and awards since 1991 provides some support for this perception (Table 16). In recent years (2009–2012), SERCA participants submitted between 10 and 19 R01 applications each year and up to two were awarded each year. This contrasts with earlier years (1991–1993) when one SERCA participant submitted an R01 grant application each year and all were awarded. Between 1993 and 2009, the number of R01 submissions by SERCA participants generally increased, but the number of awards was typically one or two awards per year and was never higher than four in any given year. SERCA participants have submitted a substantially greater number of applications for R01 grants than the comparison group (193 versus 114) and have a better award rate (18 percent versus 12 percent). R01 submissions by the comparison group have shown only a slight increase from 1991 to 2012.

**Table 16. Number of R01 grants submitted and awarded to SERCA participants and the comparison group**

Year	All		SERCA participants		Comparison	
	Submitted	Awarded	Submitted	Awarded	Submitted	Awarded
<b>Overall total .....</b>	<b>295</b>	<b>47</b>	<b>184</b>	<b>34</b>	<b>111</b>	<b>13</b>
1991.....	2	1	1	1	1	0
1992.....	3	1	1	1	2	0
1993.....	4	1	1	1	3	0
1994.....	3	0	0	0	3	0
1995.....	7	1	5	1	2	0
1996.....	14	2	7	1	7	1
1997.....	18	3	9	2	9	1
1998.....	11	3	6	1	5	2
1999.....	16	3	9	2	7	1
2000.....	14	5	10	4	4	1
2001.....	10	1	7	1	3	0
2002.....	20	7	11	4	9	3
2003.....	20	0	14	0	6	0
2004.....	15	2	9	2	6	0
2005.....	12	3	8	2	4	1
2006.....	18	4	13	4	5	0
2007.....	20	2	15	2	5	0
2008.....	15	2	4	0	11	2
2009.....	15	0	11	0	4	0
2010.....	25	2	19	2	6	0
2011.....	18	2	14	2	4	0
2012.....	15	2	10	1	5	1

SOURCE: IMPAC II.

One recent participant commented that she had to wait until almost the end of her SERCA funding before being able to apply for an R01, which meant that she had a gap in funding. In contrast, another participant had 2 years of simultaneous funding from SERCA and an R01. Focus group participants suggested that their institutions may have made the decisions about who was eligible to submit the applications or perhaps had interpreted NIH requirements in different ways. They recommended that the SERCA program provide some clarification.

### **Publications**

While the SERCA program itself does not specifically emphasize publications, the academic institutions in which the participants were located placed substantial emphasis on publications. As one recent participant elaborated, “Papers were emphasized because they’re the currency of promotion and they’re also the currency of productivity when grant applications are being reviewed, especially for transition awards and early-investigator awards.” This participant was encouraged to get out at least two papers a year and was offered a number of co-authorships in order to build up a publication record. Furthermore, this grantee was first author during the SERCA funding period, but when the participant started being senior author, she considered this to be an indicator of being an independent researcher, a shift that occurred shortly after SERCA ended and the individual received a first R award.

SERCA participants have substantially more publications than the comparison group. While four-fifths of the SERCA participants (81 percent) had publications, only about a fourth of the comparison group (27 percent) had published (Table 17). SERCA participants had more than 2.5 times the numbers of publications than the comparison group. Individuals who had received their SERCA award in the 1980s



produced about a third (37 percent) of all publications by SERCA participants, while few (10 percent) of the comparison group publications were produced by individuals who applied during the 1980s.

### Overview of Publications by Group

For those who had published, the overall average number of publications per person was about the same for SERCA participants (12.3) and the comparison group (12.1) (Table 17). Generally, the average number of publications increased with the amount of time since the individual applied for or received a SERCA award, and the average was similar for both SERCA participants and the comparison group for each of the year groupings. However, for the early 2000s grouping, the comparison group had twice as many publications on average than the SERCA participants (9.3 versus 4.3) but a considerably smaller number of individuals who had published (3 versus 15).

**Table 17. Volume of publications by SERCA participants and the comparison group**

Year and number of researchers	All (N=154)		SERCA participants (N=72)		Comparison (N=82)	
Number of researchers with publications .....	80		58		22	
Total number of publications .....	979		712		267	
<b>Publications by researchers</b>	<b>Number</b>	<b>Percent</b>	<b>Number</b>	<b>Percent</b>	<b>Number</b>	<b>Percent</b>
1982–1990 (N=10, 9, 1) .....	288	29.4	261	36.7	27	10.1
1991–1995 (N=22, 12, 10) .....	241	24.6	141	19.8	100	37.5
1996–2000 (N=30, 22, 8) .....	358	36.6	246	34.6	112	41.9
2001–2005 (N=18, 15, 3) .....	92	9.4	64	9.0	28	10.5
<b>Overall average publications per person*</b> .....	12.2		12.3		12.1	
1982–1990 (N=10, 9, 1) .....	28.8		29.0		27.0	
1991–1995 (N=22, 12, 10) .....	11.1		11.8		10.0	
1996–2000 (N=30, 22, 8) .....	11.9		11.2		14.0	
2001–2005 (N=18, 15, 3) .....	5.1		4.3		9.3	

\* Averages were based on those who had published.

NOTE: Year groupings are based on K01 grant application year.

SOURCE: IMPAC II.

The impact factor<sup>1</sup> of a journal reflects the number of citations to articles published in it and is often used as a proxy for the importance of the journal. The overall average impact factor for publications by SERCA participants (5.30) was higher than the average for the comparison group (4.35) (Table 18). Differences were particularly strong for those who applied to SERCA during the 1980s and early 1990s. SERCA participants who applied for the program during the first half of the 2000s have had more publications than the comparison group (15 versus 3 publications), and the average impact factor for them has been somewhat higher (4.30 versus 3.91). The range of impact factors was virtually the same for the two groups, 0.39 to 34.28 for the SERCA participants and 0.52 to 34.48 for the comparison group.

<sup>1</sup> The impact factor of a journal is the average number of times that articles published in the previous 2 years in the journal have been cited in the year being examined. If none of the articles were cited, the impact factor is 0.0. Impact factor does not have an upper limit. The impact factors in this report correspond to those listed by *Journal Citation Reports* (Thompson Reuters) at the time of publication and were obtained from the IMPACT II database.

**Table 18. Average impact factor of publications by SERCA participants and the comparison group**

Year and number of researchers	Impact factor		
	All (N=979 publications)	SERCA participants (N=712 publications)	Comparison (N=267 publications)
<b>Total number of publications with impact factor available</b> .....	<b>826</b>	<b>603</b>	<b>223</b>
<b>Overall average impact factor</b> .....	<b>5.04</b>	<b>5.30</b>	<b>4.35</b>
1982–1990 (N=9, 8, 1) .....	5.76	6.15	2.38
1991–1995 (N=22, 12, 10) .....	5.65	6.11	4.98
1996–2000 (N=30, 22, 8) .....	4.31	4.26	4.42
2001–2005 (N=18, 15, 3) .....	4.19	4.30	3.91

NOTE: Year groupings are based on K01 grant application year. Standard deviations for this table are provided in the appendix.  
SOURCE: IMPAC II.

The journals in which the SERCA participants have published most frequently have higher impact factors than the journals in which the comparison group members have published most frequently. The average impact factor for the top 10 journals in which SERCA participants have published is 5.10 compared to an impact factor of 3.38 for the top 10 journals in which the comparison group members have published (Tables 19 and 20).

**Table 19. Top 10 journals in which SERCA participants have published, by publication count and impact factor**

Journal	Number of publications	Impact factor for the most recent publication year
<i>Journal of Virology</i> .....	31	5.15
<i>The Journal of Infectious Diseases</i> .....	27	5.87
<i>AIDS</i> .....	24	4.91
<i>The American Journal of Pathology</i> .....	17	5.67
<i>Journal of Medical Primatology</i> .....	16	1.11
<i>Journal of Acquired Immune Deficiency Syndromes</i> .....	15	4.21
<i>Journal of Immunology</i> .....	15	5.65
<i>Proceedings of the National Academy of Sciences of the United States of America</i> .....	13	9.60
<i>Cancer Research</i> .....	12	7.54
<i>Comparative Medicine</i> .....	11	1.09
<b>Average impact factor</b> .....	<b>NA</b>	<b>5.10</b>

NA = not applicable.  
SOURCE: IMPAC II.

**Table 20. Top 10 journals in which comparison group members have published, by publication count and impact factor**

Journal	Number of publications	Impact factor for the most recent publication year
<i>Journal of Virology</i> .....	21	5.15
<i>Comparative Medicine</i> .....	21	1.09
<i>Journal of Medical Primatology</i> .....	9	1.11
<i>The Journal of Infectious Diseases</i> .....	8	5.87
<i>Veterinary Pathology</i> .....	7	1.34
<i>Journal of Andrology</i> .....	6	2.33
<i>Stem Cells</i> .....	6	7.75
<i>Biology of Reproduction</i> .....	5	3.30
<i>PloS ONE</i> .....	5	4.35
<i>American Journal of Veterinary Research</i> .....	5	1.53
<b>Average impact factor</b> .....	NA	3.38

NA = not applicable.

SOURCE: IMPAC II.

### Recognition

Early participants have been recognized for their work in a variety of ways, and they attribute some of this recognition to their SERCA awards. For example, one had received a distinguished alumni award from her veterinary school, and SERCA was cited as one of the participant’s achievements. This individual had also received a scientific achievement award from a national organization. Another participant is editor in chief of a scientific journal.

Many of the early participants have been recognized at the national level by being invited to serve on study sections at NIH or a research foundation. They have served on review committees, on advisory committees for projects at other institutions, and on panels on challenges in research in their areas. Because of one participant’s SERCA work, she was called on to address some issues with another federal government agency.

Being contacted for research collaboration was another form of recognition.

*Another way that you can be recognized for your achievement, and I have to say that this only happened to me later in my career, is the number of people that will contact you based on your publications and want to collaborate.*

### Barriers to Pursuing a Career as a Veterinary Scientist

SERCA participants reported that a barrier to becoming a veterinary scientist is the amount of time it takes to have the credentials to be competitive for an R01. First the individual must attend veterinary school and complete a traditional residency and board certification. Then, additional training is needed to be a researcher, with SERCA being a main avenue for the training. Also, most veterinary school graduates have large loans to pay off.

In addition, there are so few people in comparative medicine who work with animal models for human disease. Therefore, few individuals are available who can train others in this field.

*There are so few basic science trained veterinarians to act as mentors to which young veterinarians can be exposed.*

Veterinary scientists are not well understood by other scientists. There is limited understanding of the field and the skills and talents that are involved.

*During veterinary school, you don't get trained as a researcher. So if you go into a position at a medical school or a veterinary school where you're expected to bring in or contribute to collaborative or primary research, you really aren't trained to, there's really no mechanism to, other than something like SERCA, to get the funding to support research training for veterinary scientists.*

To address this barrier of lack of understanding regarding veterinary scientists, several of the early SERCA participants had been proactive in connecting with other scientists, particularly when they switched from a veterinary school to a medical school. They identified scientists and labs with complementary areas of research and found them to be welcoming once these other scientists were educated regarding what veterinarians could contribute. Having a SERCA award from NIH gave them credibility as scientists. One participant suggested having more recognition that veterinary science is a recognized field of biomedical research would help to address this situation.

### **If a SERCA Award Had Not Been Received**

The early SERCA participants were asked to speculate about what their career path would have been if they had not received a SERCA award. Several thought that they would have pursued the same career direction but that it would have taken much longer.

*The biggest value [of SERCA] was the time factor. I think everybody has mentioned that in one way or another and so without that, obviously my research career probably would have been delayed, but I'm not sure it would've altered the path that I had been on. So, I would just say it was a major factor in facilitating my research effort and boosting it in the direction that I wanted to go.*

Some participants thought without SERCA they may not have been able to do research at a high level or have an extra advantage in looking for a faculty position.

*I'm not sure I would've ever gotten to the point where I could get an R21 or an R01 because I would have had too much in the way of clinical responsibilities and I wouldn't have had the training that I got with the SERCA to be competitive for NIH funds. So, I think I would have continued to do research, but it would've been on a much lower level, just collaborative rather than a PI.*

*[SERCA] gave me a K01 instead of a training grant. So it was a far more prestigious award than a post-doc fellowship that others were getting. So it elevated me a little bit when looking to the faculty position.*

Other participants thought they would have gone into laboratory animal management, the business of the facility with occasional research, or served as a large animal clinician working at a veterinary school.

## The Future

When recent participants asked about changes they would recommend for SERCA, the immediate response was concern that the program would continue since NCRR no longer exists. They were pleased to learn that the program was continuing, and their recommendation was to fund more individuals. They did not provide any suggestions for changes to SERCA but were concerned about the transition from SERCA to an R01.

Some recent participants have moved away from research to other types of positions or are considering doing so because of the perception of limited funding opportunities.

*I actually moved from research into a more clinical and now a more administrative position actually before I completed my K award....The funding environment is very poor, and honestly, I saw that the opportunities were much better on the clinical side. And much more secure.*

At the same time, some of the focus group participants are heads of training programs that help the DVMs with their Ph.D.s before they are ready for their SERCA. They are mentoring these students for possible future SERCA applications and thus helping to build a pipeline for veterinary scientists.

## 5. Conclusions

SERCA participants were found to differ from the comparison group in a number of ways. A greater percentage of SERCA participants submitted NIH grant applications. They submitted a considerably greater number of applications and received more awards. However, the overall award rate for the SERCA participants and the comparison group was about the same. For the research R01 mechanism, which was the specific type of grant receiving the greatest number of applications from both groups, the SERCA participants were more successful than the comparison group.

While academic institution was by far the most common employer for both SERCA participants and the comparison group, a greater percentage of the SERCA participants worked at medical schools. SERCA participants were more likely to have subsequent research publications, and the average impact factor of the journals in which the SERCA participants published was higher than that of the comparison group.

The results of the SERCA evaluation had both similarities to and differences with the results of Discovery Logic's (2011) evaluation of individual mentored career development awards. The Discovery Logic evaluation included a sample of applicants to K01, K08, and K23 programs across multiple NIH Institutes and Centers; however, SERCA applicants were not included. The evaluation examined K01 applicants from fiscal year 2000 through 2005, and the outcome analysis examined funded and unfunded applicants with similar priority scores.

SERCA participants and other K01 awardees in the Discovery Logic evaluation were similar in that they had a higher rate of subsequent NIH grant applications than their comparison groups and about the same rate of receiving subsequent NIH grants as their comparison groups. Both SERCA participants and the other K01 awardees were more likely to have subsequent research publications than comparable unfunded applicants. However, SERCA participants had a higher average impact factor than the comparison group, while funded and unfunded applicants to other K01 awards had similar average impact factors.

SERCA applicants had different backgrounds compared to other K01 applicants. The obvious difference is that all SERCA applicants must hold a D.V.M. or equivalent degree, while less than 5 percent of the

applicants in the Discovery Logic study held a D.V.M. In addition, about half of the SERCA participants and a third of the comparison group had Ph.D.s at the time of application, while most of the other K01 applicants had a Ph.D. at the time of application.

## 6. Recommendations

Recent participants considered it to be a big step from a K01 to an R01 and thought that they were not as competitive as individuals in other programs. There was some confusion about whether an individual could have an R01 and SERCA simultaneously. Having to wait until SERCA is at the end of the final year before applying for an R01 leads to a 1-year gap in funding. The SERCA program should provide clarification regarding when an individual is eligible for an R01 and work with mentors to determine ways to enable participants to become more competitive for future funding.

A barrier for veterinary scientists, particularly those working in medical schools, is that they are not well understood by other scientists, particularly those in medical schools. There is limited understanding of the field and what skills and talents are involved. To address this barrier, several of the early SERCA participants had been proactive in identifying other scientists with complementary areas of research and found these other scientists to be welcoming once they were made aware of what the veterinarians could contribute to the work. Current and future mentors should be encouraged to make participants aware of this situation and provide recommendations for how to connect with other researchers. Translational research offers many opportunities for collaboration between researchers in veterinary and human medicine.

An additional concern of SERCA participants was future funding for the field of comparative medicine. As a result, some recent participants have moved away from research to more clinical or administrative positions or are considering making this transition. Thus, the government investment in training them to be veterinary scientists will not be fully realized. While funding for the field of comparative medicine is beyond the scope of SERCA, it does provide a context in which the program operates and needs to be considered as the program moves forward.

## References

- Discovery Logic. (2011). *National Institutes of Health Mentored Career Development Awards Program*. Rockville, MD: Author.
- Loether, Herman, J., and McTavish, Donald G. (1993). *Descriptive and Inferential Statistics: An Introduction*, 4<sup>th</sup> ed. Boston: Allyn and Bacon.

## Appendix Standard Deviation Tables

**Table 2SD. Average priority score of SERCA (K01) grant application with standard deviations**

Year	Grand total (N=154)		SERCA participants (N=72)		Comparison (N=82)	
	Average score	Standard deviation	Average score	Standard deviation	Average score	Standard deviation
<b>Overall average</b> .....	<b>215.7</b>	<b>82.6</b>	<b>152.0</b>	<b>19.6</b>	<b>271.6</b>	<b>76.1</b>
1982–1990 (N=15) .....	246.9	97.3	153.9	18.5	310.3	76.1
1991–1995 (N=18) .....	193.8	70.3	149.7	28.3	231.7	73.4
1996–2000 (N=17) .....	228.4	81.9	151.2	11.5	278.8	67.7
2001–2005 (N=22) .....	191.5	62.4	153.3	16.1	256.2	58.2

NOTE: Year groupings are based on K01 grant application year.

**Table 3SD. Average award of funded SERCA (K01) grant with standard deviations**

Year	Average total cost	Standard deviation
<b>Overall average</b> .....	<b>\$ 79,592.89</b>	<b>\$2,6413.86</b>
1982–1990 (N=15) .....	55,861.47	7,465.84
1991–1995 (N=18) .....	69,178.22	11,451.20
1996–2000 (N=17) .....	77,514.06	27,737.84
2001–2005 (N=22) .....	105,900.86	19,374.14

NOTE: Year groupings are based on K01 grant application year. Includes only awarded K01, i.e., treatment group.

**Table 18SD. Average impact factor of publications by SERCA participants and the comparison group with standard deviations**

Year and number of researchers	All (N=979 publications)		SERCA participants (N=712 publications)		Comparison (N=267 publications)	
	Average impact score	Standard deviation	Average impact score	Standard deviation	Average impact score	Standard deviation
<b>Total number of publications with impact factor available.....</b>	<b>826</b>		<b>603</b>		<b>223</b>	
<b>Overall average impact factor .....</b>	<b>5.04</b>	<b>4.58</b>	<b>5.30</b>	<b>4.52</b>	<b>4.35</b>	<b>4.68</b>
1982–1990 (N=9, 8, 1) .....	5.76	5.22	6.15	5.36	2.38	1.35
1991–1995 (N=22, 12, 10).....	5.65	4.94	6.11	4.70	4.98	5.21
1996–2000 (N=30, 22, 8).....	4.31	3.63	4.26	2.78	4.42	5.03
2001–2005 (N=18, 15, 3).....	4.19	4.35	4.30	5.03	3.91	1.51

NOTE: Year groupings are based on K01 grant application year.