

# Tracking Veterinary Students Who Aspire to Careers in Science

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## ABSTRACT

The Cornell Leadership Program for Veterinary Students is an intensive 10-week learning experience intended to guide competitively selected scholars into careers in science and public health. It features independent research, vocational counseling, and student-directed learning modules. Program scholars are encouraged to objectively evaluate graduate training as preparation for careers promoted by the program. Prominence is given to experiential learning through research, participation in program enrichment modules, and inspirational experiences achieved through group meetings and individual interactions with established scientists. Program alumni are monitored to determine how the careers they pursue relate to their earlier-stated ambitions. In addition, subjective assessments are made of the quality of graduate training and its impact on alumni career paths. The influence of mentors, vocational counseling, and inspirational experiences on subsequent training is also subjectively assessed. Information is obtained from students' anonymous responses to questionnaires and recorded interviews. Program alumni are contacted annually to determine their current activities and career aspirations. The Leadership Program encourages program graduates to undertake careers in science and public health, yet an unanticipated number of alumni enter private veterinary practice. A factor relevant to that outcome is that many students destined for practice lack a definitive career plan. Persuading veterinary students to consider careers in research or public service is challenging but worth the effort. Critical to that connection is the need for veterinary students to objectively evaluate graduate training options because the vocations they follow appear to be strongly influenced by the experiences they choose.

**Key words:** advising, graduate education, leadership, statistics, veterinary teaching hospital

## INTRODUCTION

Veterinary students are frequently ill informed about contributions made by veterinarians to biomedical science and public health and the opportunities those careers afford to improve the health and well-being of animals and people.<sup>1-4</sup>

Government organizations have documented the need for qualified veterinary scientists in biomedical research and the public health arena.<sup>5,6</sup> The Cornell Leadership Program for Veterinary Students has responded to this challenge by engaging competitively selected scholars in a 10-week initiative that combines experiential research, vocational counseling, and professional enrichment modules that encourage creativity, critical thinking, and the development of communication and teamwork skills. Also featured are inspirational experiences realized by field visits to federal institutions and by workshops that foster close working relationships between participating scholars and distinguished facilitators.<sup>7-10</sup>

A database compiled from annual tracking records has been used to monitor the career progression of program scholars. We drew three conclusions from the data: (a) Alumni who objectively evaluate their graduate training options and make informed choices have a competitive advantage over similarly qualified individuals who do not; (b) inspirational experiences can crystalize students' commitment to careers in science; and (c) mentoring can positively influence graduate training choices.

## METHODS

In this study, we used two data sets. The first was compiled from anonymous questionnaires completed by Leadership Program scholars from 2004 through 2017. The questionnaires documented respondents' career aspirations at the beginning of the program and again toward its close. The second data set was the annual collection of career tracking information.

An effort was made to contact all alumni by email or telephone. Respondents were assigned to 1 of 30 preselected categories that by agreement of two authors (DRF and DDM) reflected their professional activity at that point in time. The categories were as follows:

- Intern,
- Resident,
- Graduate research scholar (MS),
- Graduate research scholar (PhD),
- Graduate research scholar (MPH or EIS),
- Postdoctoral research fellow,
- Clinical fellow,
- Faculty (tenured),
- Faculty (non-tenured),
- Academic clinician,
- Academic tutor,
- Academic service specialist,
- Government epidemiologist,

- Government research scientist,
- Government service specialist,
- Industrial epidemiologist,
- Industrial research scientist,
- Industrial service specialist,
- Other (epidemiologist, research scientist, or service specialist),
- US or Canadian general veterinary practice,
- US or Canadian veterinary specialty practice,
- International general veterinary practice,
- International veterinary specialty practice,
- Exotic animal veterinarian,
- Aquatic animal veterinarian,
- Avian veterinarian,
- Non-veterinary trainee,
- Other non-veterinary activity,
- University administration, and
- Foundation administration.

In each case, we independently verified the assigned category by means of online databases such as LinkedIn, institutional directories, Facebook entries, or input from other sources. Information compiled in this way was compared with the career ambitions expressed by students in recorded interviews while participating in the Leadership Program.

In a previously published study,<sup>11</sup> questionnaire respondents were asked to assess their likelihood of entering a research career, a career in industry, government service, military service, or private practice in the first 5 years after they obtained their veterinary degree. The data from that study were updated to include respondents who participated in the program in 2016 and 2017, and the aggregate data were re-analyzed. The null hypothesis tested was that the ranking of preferences for career options after graduation

would be the same at the beginning and the end of the program. The data were ordinal, and the paired before and after responses for each career option were analyzed using the Wilcoxon signed-rank test. Values of  $p < .01$  were considered significant. We chose this cut-off value to control for experiment-wide error with multiple testing. Statistical testing was performed with R Version 3.4.0 (R Foundation for Statistical Computing, Vienna, Austria).

## RESULTS

We reviewed questionnaires compiled by 207 students. At the time of their enrollment 59.7, 21.7, and 15.2 percent indicated a greater than 50% likelihood that they would pursue a discovery-based career, one in government, or one in industry, respectively. Approximately 10 weeks later, toward the close of the program, the proportion expressing those preferences rose to 80.5, 27.0, and 39.1 percent, respectively. By comparison, the proportion of respondents who contemplated at least a year in private practice declined from 53.9 percent to 41.5 percent. All changes were statistically significant ( $p < .01$ ).

These results were reflected in formally structured interviews with individual students. Although none disclosed practice-based intentions, all who became involved in clinical practice indicated that they were undecided about their career goals.

Career decisions made by program alumni were recorded in a second data set compiled from annual follow-up surveys. Interest in a career in science or public health was reflected in the academic degrees awarded to these individuals (Table 1).

Alumni who completed a clinical or service residency ( $n = 170$ ) were more inclined to enter private practice (Table 2).

**Table 1:** Academic qualifications of Leadership Program alumni 1990–2016

Degree	Academia*	Industry*	Government agencies*	Private practice	Still completing degree	Total	% of total alumni (N = 628)
PhD	81	37	17	18	55	208	33.1
Dr Med Vet†	7	4	2	6	6	25	4.0
MPH	4	5	4	1	6	20	3.2
Other‡	7	2	4	6	2	21	3.3
Total	99	48	27	31	69	274	
%		63.5		11.3	25.2		

Note: Data were obtained from the 2017 alumni survey.

\*Careers advocated by the Leadership Program

†Research degrees awarded by universities in Germany, Austria, or Switzerland

‡MS or MD degrees

**Table 2:** Careers pursued by residency-trained Leadership Program alumni

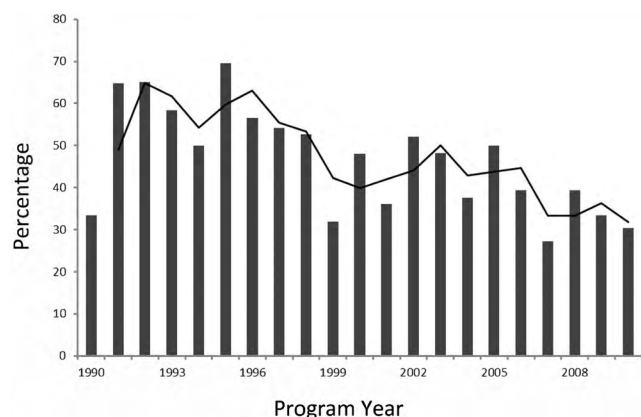
n (%)					Total (% of total alumni; N = 628)
Academia*	Industry*	Government agencies*	Private practice	Current residents In training	
62 (36.5)	22 (12.9)	9 (5.3)	66 (38.8)	11 (6.5)	170 (27.1)

\* Residency-trained alumni in careers advocated by the Leadership Program (54.7%).

That finding was explored in greater depth by comparing the selection of a practice-based career by individuals who obtained advanced training in science or a residency only and those who completed both. Residency-trained alumni entered practice more frequently than did individuals whose training was limited to scientific pursuits.

In 1990–2010, 174 alumni pursued careers advocated by the program. Figure 1 shows that many ( $n = 225$ ) established themselves in general or veterinary specialty practice. To further assess this phenomenon, we compared the professional aspirations of students in 1990–2003 ( $n = 120$ ) with their vocational choices. The smaller population in this instance is explained by the need to allow sufficient time, arbitrarily set at 8 years, for alumni to complete their graduate training. The career ambitions expressed by students while participating in the program differed from actual outcomes. For instance, 35% ( $n = 42$ ) of this cohort aspired to an academic career, but only 45.2% ( $n = 19$ ) achieved their stated ambition (Figure 2). In contrast, 61.7% of those who had no clear career ambition ( $n = 60$ ) established themselves in private practice

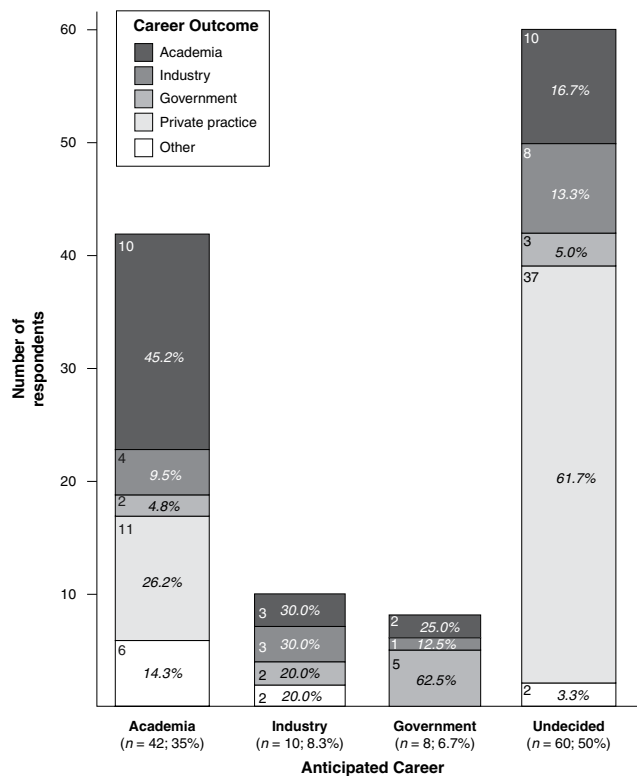
Table 3 lists inspirational experiences calculated to encourage students to consider careers in science. Two events



**Figure 1:** Percentage of alumni ( $N = 511$ ) who became general or specialty practitioners, 1990–2010. The moving average trend line is superimposed on the annual percentages. The proportion of alumni who entered practice declined from 1999 onward but still remained higher than 30%.

are especially relevant. First, arrangements are made for students to take part in annual conferences organized by the National Institutes of Health (NIH) and other federal agencies in Washington, DC. The host institutions draw on senior scientists to discuss their research. Students prepare for the visits by conducting Internet searches on the agenda topics, which empowers them to actively participate in discussions after each presentation.

Other inspiring experiences are realized by arranging for students to assume a prominent role in workshops that explore creativity in science. The workshops have a tripartite structure. The first part is organized as a panel



**Figure 2:** Career ambitions of students from 1999 to 2003 compared with vocational status in 2017. Some scholars followed unanticipated career trajectories, but 60 (74% percent) who were undecided ultimately entered private practice.

**Table 3:** Inspirational experiences fostered by the Cornell Leadership Program

Group experiences	Individual experiences	Contributing factors
<ul style="list-style-type: none"> <li>• NIH conferences</li> <li>• Creativity workshops</li> <li>• Vocational counseling</li> <li>• Professional enrichment modules</li> <li>• In-residence student housing</li> </ul>	<ul style="list-style-type: none"> <li>• Personal guidance</li> <li>• Interactions with program facilitators</li> <li>• Influence of student-selected mentor(s)</li> </ul>	<ul style="list-style-type: none"> <li>• Experiential learning</li> <li>• Career planning</li> <li>• Realizing one's full potential</li> <li>• Professional and lifestyle ambitions</li> <li>• Curiosity</li> <li>• Work ethic</li> <li>• Sustained mentoring</li> </ul>

Note: The speculations are anecdotal, depending as they do on student comments and students' performance individually or as members of a group.

discussion that has attracted capacity audiences of 300 comprised mainly of Cornell faculty, staff, and students. Workshops convened in 2012 and 2016 included four Nobel laureates, a former director of the NIH, the president of the Andrew Mellon Foundation, a Fellow of the Royal Society of London who is also a creative author, the Cornell University Provost, and two Howard Hughes medical investigators.

The remainder of each workshop focuses on Leadership Program scholars. The students meet with the facilitators for a working luncheon and subsequently in small groups with individual facilitators. Each meeting spans approximately 45 minutes, after which the students rotate to another facilitator. Close contact with these distinguished guests enables students to reflect on the creative process and receive constructive guidance in structuring their graduate education.

## DISCUSSION

### Outcome Analysis

Comments made on the anonymous questionnaires revealed a high level of student satisfaction with the Leadership Program. The responses were useful in modifying subsequent counseling sessions and program enrichment modules. Nevertheless, some respondents expressed concern regarding the program's focus on discovery and public health. The comments were unexpected because promotional materials for the program emphasize its science-based objectives. Prospective applicants who anticipate a practice-based career are advised to explore options more relevant to their ambitions. Why that cautionary note is insufficient is puzzling. Perhaps some regard the program as an interesting experience regardless of its relevance to the career they had in mind. Others may find that their introduction to research through the program is incompatible with their expectations or lifestyle preferences. Still another possibility is that students who are accustomed to functioning in a leadership capacity have difficulty accommodating to the program's concept of leadership as a shared responsibility.

However that may be, many students retained a strong vocational commitment to clinical practice. Several reasons could account for a decision not to embark on further graduate training. They include, but are not limited to, financial considerations, training fatigue, family responsibilities, or a desire to balance professional and personal interests. Insight came from alumni comments made during annual follow-up surveys. Persons who complete a clinical or service residency attain a high level of proficiency in their respective discipline. This may convince them that they were best suited to private practice. Although they might have enjoyed similar success in other careers, clinical practice remains a paramount preference for many.

Interviews with individual scholars affirmed their satisfaction with the program and clarified ambiguities in the written responses. Yet the reliability of information obtained in face-to-face meetings as opposed to anonymous surveys is questionable because students seem reluctant to admit to an ambition for private practice because that outcome conflicts with the program's goals. This may explain why so many who stated that they were undecided eventually established themselves in practice.

### Influence of Graduate Training on Vocational Choices

An impressive number of alumni ( $n = 243$ ) pursued advanced training in research or public health. Many are now faculty members of veterinary or medical schools, and others occupy positions of responsibility in government and industry. Still others are program officers of philanthropic institutions or full-time employees of prestigious consulting firms.<sup>11</sup> Together they comprise a leadership network. Network members are encouraged to assist more junior colleagues, and their responses have been swift and constructive.

### Conclusions Drawn from Tracking

Two conclusions were drawn from tracking. First, students who objectively evaluate graduate training options are more likely to realize their full potential and to achieve a higher level of professional proficiency than those who do not. Aspirations may change, and they often do, but individuals who make informed decisions are more likely to be successful regardless of the career pathway they elect to follow. Many are reluctant to accept that responsibility, although their capacity to make informed decisions has been repeatedly demonstrated in role-playing exercises featured in the Leadership Program.<sup>7</sup> Their reluctance to apply those skills to their own career decisions appears counterintuitive but is readily explained by their dependence on others who have guided their decisions from an early age.

Consider the implications of not being an informed arbiter. Aside from the prospect of a suboptimal outcome, it places the individual at a competitive disadvantage as he or she ascends the training ladder. It is not uncommon for such persons to be blocked at some point, which obliges them to make decisions they had not previously contemplated. Default decisions of this sort often steer individuals into private practice.<sup>11</sup>

Several years can elapse before Leadership Program scholars are obliged to make decisions regarding graduate training. In the intervening period, the program's message can be diluted by clinical activities during the terminal years of veterinary school. As graduates, many are burdened with educational debt, have personal responsibilities, and are reluctant to accept a protracted period of deferred gratification. Still another concern—arguably the most important—is a deeply entrenched desire to become personally engaged in animal patient care.

Another conclusion drawn from tracking is that inspirational experiences can influence graduate training decisions. A conspicuous example is provided by day-long visits to NIH. These meetings have been popular with students and encouraged 10 of them to pursue graduate or postdoctoral training in that institution.

Participating in creativity workshops sponsored by the Leadership Program provided inspirational experiences that were realized as a group or on an individual basis. The latter were reflected in comments such as that the workshop was "a career-defining experience" or "the most influential aspect of my veterinary education." In the fullness of time, it will be instructive to learn whether the careers pursued by students who took part in these meetings differ from those who did not.



## Importance of Mentoring

An effort is made to offer guidance to students that is non-judgmental and geared toward aspirations that may change with time. Counseling is assertive but fair insofar as it adheres to the focus on science and public health without advocating a particular institution or graduate program. The fairness lies in the balance it strikes between the advantages and challenges those careers provide. To be fully effective, however, mentoring should continue through graduate education and beyond, until the beneficiaries become comfortably accommodated in a career of their choosing.

Mentoring begins while the program is in session. At this point, students are guided by their research supervisor and by facilitators who take part in professional enrichment modules and group counseling sessions. Scholars are advised to focus on research options that offer scope for inquiry. Emphasis is placed on hypotheses that can be tested definitively using methods most appropriate to the task.

Students who aspire to discovery-based careers are encouraged to seek advanced training in an enabling discipline such as biochemistry, genetics, or molecular biology and to select as a research supervisor an individual who is a successful scientist. Many have observed that in science success breeds success.<sup>12</sup> That adage is conspicuously revealed in the educational record of scientists who were awarded the Nobel Prize. Zuckerman reported that many persons so honored spent at least 1 year under the supervision of another Nobel laureate.<sup>13</sup>

Leadership Program scholars are encouraged to use Internet resources to determine how prospective trainers fund their research, their publication record, and how frequently those reports are cited in the scientific literature. They are also advised to discuss their plan with trusted advisors and prospective trainers. In addition to determining the scope of training, students should consider a prospective supervisor's record in guiding protégés whose career ambitions are similar to their own. Failure to do so places veterinary students at risk of making graduate training decisions based on advice they received during the clinical phase of their education. Such guidance is well meaning but is frequently influenced by considerations relevant to veterinary practice rather than the preparation required for a successful career in basic biomedical research or public health.

Another conclusion drawn from the Leadership Program is that mentoring should be an ongoing process rather than one driven by the immediate needs of mentees. Yet another related lesson is the importance of establishing enduring relationships with mentors who have the motivation to assist protégés proactively.<sup>14-16</sup> Relationships of this sort are not difficult to forge but require tact and effort. The challenge for protégés is to move beyond securing advice or a supporting letter. It can be achieved by keeping a mentor informed and by seeking guidance that does not require immediate action.

## One Medicine

Veterinary graduates can and should contribute to biomedical discovery in ways that extend beyond their traditional engagement in laboratory animal care, comparative pathology,

and the investigation of spontaneous diseases of animals that have their counterparts in humans. Their perspective on comparative biology prepares them well for advanced training leading to careers that span the full spectrum of biomedical inquiry. As public health professionals, they are well positioned to capitalize on their knowledge of animal diseases that exact an unacceptable toll in human suffering and economic loss.

The results have similar implications for other branches of the health professions. Pertinent to this is the need to document assumptions regarding quality considerations in graduate education, the importance of mentoring, and the utility of inspirational experiences in guiding biomedical graduates into careers in science and public health.

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## CONFLICT OF INTEREST

The authors have no conflicts of interest to report.

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