

Article

Alumni Perspectives on Career Preparation during a Postdoctoral Training Program: A Qualitative Study

Jessica M. Faupel-Badger,^{*} Kimberley Raue,[†] David E. Nelson,^{*}
and Sophia Tsakraklides[†]

^{*}Cancer Prevention Fellowship Program, Division of Cancer Prevention, National Cancer Institute, National Institutes of Health, Bethesda, MD 20892-9712; [†]Westat, Inc., Rockville, MD 20850

Submitted July 1, 2014; Revised September 18, 2014; Accepted September 21, 2014
Monitoring Editor: Debra Tomanek

Published evaluations of career preparation of alumni from long-standing postdoctoral fellowship programs in the biomedical sciences are limited and often focus on quantitative analysis of data from extant publicly available sources. Qualitative methods provide the opportunity to gather robust information about specific program elements from structured postdoctoral training programs and the influence of this training on subsequent career paths of alumni. In-depth interviews with a subset of the National Cancer Institute's Cancer Prevention Fellowship Program (CPFP) alumni ($n = 27$), representing more than 25 years of the program's history and multiple career sectors, were conducted to assess alumni reflections on the training environment and career preparation during their time in the CPFP. NVivo software was used to analyze data and identify major themes. Four main themes emerged from these interviews, including: the value of structured training curriculum, mentorship, transdisciplinary environment, and professional identity. Even when reflecting on training that occurred one to two decades earlier, alumni were able to highlight specific components of a structured postdoctoral training program as influencing their research and career trajectories. These results may have relevance for those interested in assessing how postdoctoral training can influence fellows throughout their careers and understanding salient features of structured programs.

INTRODUCTION

There is growing interest in evaluating the experiences and impacts of postdoctoral or other postgraduate training programs on trainees in science, technology, engineering, and mathematics fields (National Institutes of Health [NIH], 2012; Committee on Science, Engineering, and Public Policy, 2012). Yet despite an estimated 37,000–68,000 persons with PhDs in postdoctoral biomedical research training positions

in the United States (NIH, 2012), there are few published evaluations of such programs.

In 2005, Sigma Xi published results from a survey of ~7600 postdoctoral fellows working in the United States. The survey questions focused on a variety of areas, including employment, benefits, advisor interactions, and training. A notable finding is that fellows who reported more structure to their postdoctoral fellowship also reported higher satisfaction with their training, lower conflicts, and higher productivity than those reporting less structure, even when controlling for other factors such as gender, citizenship, funding, field, and institution (Davis, 2005). These data are important for thinking about the design of postdoctoral training programs and are informing current efforts regarding career preparation for those in the biomedical workforce (NIH, 2014).

To complement these data, studies focused on alumni from well-defined, structured postdoctoral training programs would provide the opportunity to gather more in-depth information about the impact of the specific structure or components of a training program on career preparation. Published quantitative studies focused on defined postdoctoral training programs in the biomedical sciences

CBE Life Sci Educ March 2, 2015 14:ar1

DOI: 10.1187/cbe.14-06-0102

Address correspondence to: Jessica M. Faupel-Badger (badgerje@mail.nih.gov).

© 2015 J. M. Faupel-Badger *et al.* CBE—Life Sciences Education © 2015 The American Society for Cell Biology. This article is distributed by The American Society for Cell Biology under license from the author(s). It is available to the public under an Attribution–Non-commercial–Share Alike 3.0 Unported Creative Commons License (<http://creativecommons.org/licenses/by-nc-sa/3.0>).

“ASCB®” and “The American Society for Cell Biology®” are registered trademarks of The American Society for Cell Biology.

are limited. A 2013 review identified only 13 studies with quantitative data published from 1995 to 2012 (e.g., scientific publications, grants, professional advancement) on career outcomes of former trainees in structured, full-time public health or biomedical postgraduate training programs of at least 12-month duration (Faupel-Badger *et al.*, 2013).

Qualitative studies focused on the career development of alumni from postdoctoral training programs are even less common. Yet qualitative methods provide the opportunity to capture robust information from program participants that can enhance understanding of the quantitative data and inform future program development. For example, Ali Zeilani and colleagues studied Jordanian doctoral nursing school alumni from several programs in the United Kingdom using semistructured in-depth interviews (Ali Zeilani *et al.*, 2011). They found that, although alumni reported a positive impact of their mentors on their careers, many had limited use for some skills learned during their training. Cherry and coworkers collected in-depth interview data from alumni of the Columbia University Psychoanalytic Training Institute (Cherry *et al.*, 2012). Although most alumni reported positive program experiences that benefited their professional development, some alumni also had program improvement suggestions that led to curricular modifications. Qualitative studies based on interviews with postdoctoral scholars in the biomedical sciences who were funded by philanthropic organizations found that early recognition for one's research ideas and being part of a community of scholars were often mentioned as major benefits by alumni (National Research Council [NRC], 2006). These results would be difficult to discern from quantitative survey data alone.

Recently, the Cancer Prevention Fellowship Program (CPFP) at the National Cancer Institute (NCI) conducted an independent, qualitative research study based on in-depth alumni interviews to more fully explore how CPFP alumni across a range of cohorts and life stages perceived the impact of fellowship training on their careers and professional identities. The overall goal of this fellowship is to train early-career scientists from a variety of disciplines (e.g., basic biomedical, epidemiology/public health, social and behavioral, and clinical sciences) to be researchers and leaders in the field of cancer prevention. A subset of alumni from three major career sectors (academia, government, and private/nonprofit/other) were interviewed, and they represented different scientific disciplines and length of time since completing postdoctoral training. Given the variety of disciplines and career paths represented here, these results are not only informative for the future design of the CPFP program but also provide insightful data that may be more broadly applicable to understanding how postdoctoral fellowship training in the biomedical sciences influences subsequent career preparation.

METHODS

Overview of the NCI CPFP

The CPFP is a competitive, multidisciplinary postdoctoral training program established more than 25 years ago that now has more than 200 alumni (Husten *et al.*, 1993). Applications from individuals in a variety of different backgrounds in the biomedical and behavioral sciences (e.g., laboratory, epidemiology/public health, biostatistics, clinical, and social

and behavioral sciences) are reviewed once per year and 10–15 fellows are selected, although this number has fluctuated over time. To be eligible for the program, applicants must have a doctoral degree (e.g., PhD, MD, JD), be within 5 years of receipt of the doctoral degree, and be citizens or permanent residents of the United States. Fellows are supported for up to 4 years to conduct their postdoctoral research in the intramural laboratories of the NCI or the Food and Drug Administration. The CPFP allows fellows substantial independence to select their preceptors and develop their own research studies, supplemented with a structured training curriculum that includes formal instruction in public health (including financial support for a master's in public health [MPH] degree), grant writing, leadership skills, communication, and other areas.

Selection of Study Participants

At the time of the interviews (December 2012–January 2013), 211 alumni were eligible to be included in the sampling frame based on having completed at least one full year of training in the CPFP. They were sampled from three broad career sectors based on their current place of employment—government (primarily NIH), academic institutions, and private sector/other, which included for-profit companies, nonprofit organizations, medical practices, and cancer centers. Alumni for whom no current place of employment was listed were traced on the Internet through websites such as Google and LinkedIn. The current place of employment for alumni was then confirmed during recruitment.

A random number was assigned to each alumnus through use of the Excel RAND function. These random numbers were then reviewed to ensure that Excel had assigned each alumnus a unique number. Within each career sector, 18 alumni were randomly selected for recruitment. As a result, a total of 54 alumni were sampled, with the goal of interviewing 27 alumni equally distributed across the three career sectors. Oversampling in this way was used to facilitate recruitment, with interviews scheduled with the first nine alumni in a career sector who agreed to participate.

Interviews and Data Analysis

Interview protocols were informed by discussions of the history, structure, and goals of the CPFP with program staff. Particular emphasis was placed on salient features of the program that were thought to be necessary for the comprehensive training of individuals in the fields of cancer prevention and control and that have been in place from or near the beginning of the program (Husten *et al.*, 1993). These included the requirement for attaining an MPH degree, creating a transdisciplinary environment through admitting individuals from a diverse array of scientific backgrounds, and funding independent from the research mentor. Alumni experiences during the program and the influence of participation in the program on their work and career were assessed; specific topics and question examples are provided in Table 1.

The interview guides were reviewed by the NIH Office of Human Subjects Research and Protection and deemed exempt from review by the Institutional Review Board. Interviews were conducted in December 2012 and January 2013 by K.R. and S.T. Interviews were conducted by telephone and lasted, on average, a little more than 30 min.

Table 1. In-depth interview questions

Domain(s)	In-depth interview questions
Perception of training program curriculum	What parts of the curriculum have been most valuable to you? Could you please provide some examples?
Mentorship	What effect has the MPH had on your research interests and career plans? The centerpiece of CFPF is mentored research. Tell me about the mentorship you received during the program. How would you describe the balance between the guidance you received from your mentors and the autonomy you had to conduct your research? How did this mentorship affect your research during the program? How has it affected your career since completing the program?
Career vision and preparation	Do you remember your expectations for your career prior to participating in the program? If so, please describe those expectations. Did the fellowship make you rethink your career? If so, how? Do you feel the program prepared you differently from professionals who did not participate in the fellowship? How so?
Professional identity and community	To what extent did the fellowship foster your participation in a community of cancer or cancer prevention researchers? How did participation in the program prepare you for a career as a researcher or leader in cancer prevention or cancer prevention research? How did it prepare you for a career as a researcher or leader more generally? How has the fellowship affected your sense of yourself as a change agent or a leader in cancer prevention?
Perceived benefits of CFPF program	In your opinion, what has been the greatest impact of the fellowship on your career so far? Do you think that you have been presented with career opportunities that would not have been available to you had you not participated in the fellowship? If so, in what ways?
Recommendations for improvement of the CFPF	What general comments and reflections do you have on the overall experience of the fellowship? What recommendations about the fellowship do you have for NCI as they develop the program for future years? What features of the program are important to keep?

Each interview began with a reminder that participation in the interviews was voluntary and that data from the interviews would be confidential. Interview protocols were structured but allowed for prompts and follow-up questions to invite more detailed and comprehensive responses.

After five interviews were conducted, the coauthors (K.R. and S.T.) discussed the findings, the average length of the interviews, whether the protocols were working as intended, and recruitment progress. Because major themes from alumni's fellowship experience were woven throughout the interviews (e.g., the value of the MPH, the importance of mentoring), several questions were found to elicit similar information but from different viewpoints. The study investigators decided that no modifications to the interview protocols were needed, and data collection proceeded with the remaining 22 alumni.

Interviews were recorded with participant consent, but not transcribed in their entirety. Analysis relied on interviewers' detailed notes, with digital recordings used to confirm the accuracy of notes, provide additional detail and context, and transcribe quotes. Responses were anonymized. NVivo 9 qualitative data analysis software was used to analyze the interview data. Framework analysis was used to allow the analysts to work both deductively (i.e., beginning with the program's theory of change) and inductively (i.e., exploring the interviews for data-driven emergent themes; Ritchie and Spencer, 1994). Analyses began with the development of a set of broad descriptive coding categories aligned with the topics noted in Table 1. Initial questionnaire themes were developed, in large part, to help evaluate how well CFPF met its stated program goals, which include supporting

early-career scientists from a diversity of disciplines to conduct cancer prevention research with guidance from NCI mentors; providing structured education and training on scientific research and leadership, especially as they pertain to transdisciplinarity and team science; and facilitating fellows' transition to career independence as researchers and leaders.

As is typical of in-depth interviews, we also drew upon additional information offered by alumni that related to the specific questions asked. Additional codes were then developed to reflect more detailed themes or constructs, thereby creating levels of specificity beyond the initial descriptive coding categories. Two senior researchers (K.R. and S.T.) coded the interviews and conducted the analysis. Coding was done independently, with each analyst examining a subset of questions to ensure uniformity in the analysis of a topic. Frequent discussions between the analysts ensured consistency in analytical methods applied across the data. Quotes from alumni are used to illustrate themes that emerged from the interviews and were sometimes edited slightly for clarity and readability without modifying the speaker's point of view.

RESULTS

Demographics of CFPF Alumni Overall and Subset Interviewed

The 27 alumni who were interviewed are predominantly female (67%) and Caucasian (70%), and approximately half entered the CFPF before 2000. These statistics are reflective of the overall alumni population. In addition, alumni

Table 2. Demographic characteristics of interview participants and overall alumni population

Characteristic	Interviewed alumni		Alumni population	
	Number (<i>n</i> = 27)	Percent	Number (<i>n</i> = 211)	Percent
Gender				
Female	18	67	152	72
Male	9	33	59	28
Race/ethnicity				
White	19	70	144	68
Asian	5	19	32	15
Black/Hispanic/Other (combined due to small numbers among those interviewed)	3	11	33	16
Missing	0	0	2	1
Current career sector				
Government	9	33	103	50
Academic	9	33	54	26
Private industry/other	9	33	49	24
Scientific discipline (of PhD degree)				
Laboratory-focused (bench) science	14	52	61	29
Clinical	5	19	45	21
Epidemiology/public health/biostatistics	3	11	49	23
Social and behavioral sciences	3	11	33	16
Other	2	7	23	11
Program entry date				
1985–1989	0	0	13	6
1990–1994	6	22	34	16
1995–1999	7	26	42	20
2000–2004	11	41	74	35
2005–2009	2	7	45	21
2010–2012	1	4	3	1

research areas were broadly categorized based on the scientific discipline in which the doctoral degree was attained. Owing to the random sampling of alumni with an emphasis only on career sector, laboratory-focused (bench) science as a broad area in which doctoral degree was attained is more represented among the subset of alumni interviewed than the overall population. These demographic data for both the subset of alumni interviewed and the overall population can be found in Table 2.

Interview Themes

Postdoctoral training is a dynamic and critical career stage for biomedical and behavioral scientists. The additional science and career skills acquired and professional experiences gained during this time frame strongly shape next career steps. When alumni were asked about their experiences in the NCI CPFP, the major themes emerging from their responses focused on 1) the structured training curriculum as determined by comments focused on specific training components, such as the MPH or other training provided by the CPFP; 2) the mentorship from the primary research mentor and CPFP and NCI staff; 3) professional identity or identifying oneself as being a cancer or cancer prevention researcher; and 4) the transdisciplinary environment across the fellowship program as represented by the fellows who were recruited from diverse scientific backgrounds and their research projects. As noted in the *Methods* section, some of these themes emerged from questions focused on the specific topic, but often these themes recurred throughout the interview and across responses to different questions.

The topics of structured training curriculum, mentorship, transdisciplinary environment, and professional identity are explored in the subsections below.

Structured Training Curriculum

The CPFP was designed to provide fellows with a solid foundation in cancer prevention and control through a structured approach of formal course work and regular meetings and to facilitate their interaction with a broad array of professionals while affording them more autonomy than traditional postdoctoral fellows. Several alumni cited this design as a distinctive feature of the program. Among the program’s foundational training experiences is an introductory summer curriculum focused on the principles and practice of cancer prevention and control. NCI offers this 5-week curriculum annually, and it is attended by individuals interested in cancer prevention research and practice from across the globe. This curriculum is a comprehensive introduction and presents the current state of the science in the many different facets of cancer prevention research ranging from molecular components to epidemiology to health services research and communication and policy. More details on the history, goals, syllabus, and attendees of this curriculum can be found in an earlier publication (Faupel-Badger *et al.*, 2011). Attendance at this course is required for incoming NCI Cancer Prevention Fellows before they begin their research projects at NCI.

“The summer course] was pretty intensive. It was all we did for about a month or two and it provided a general introduction to several aspects of cancer and

cancer prevention. I remember thinking at the time that it was more than I wanted, but as I look back, it was perfect."

Similarly, the MPH provided alumni with a strong underpinning in epidemiology and a broad perspective on research and methods in the field of public health. Since 1991, all fellows without significant training in epidemiology or biostatistics have been required to attain an MPH degree in the first year of the fellowship program (Husten *et al.*, 1993). All but two of the alumni who were asked about the MPH had received this degree through the fellowship. These alumni described the effect of the MPH on their work and career as "critical," "profound," and "transformative." For some alumni, the degree filled a gap in their skill set and enabled them to transition from one area of research—often laboratory benchwork—to population studies.

"[The MPH] definitely gave me a different view of how research could be done.... It was definitely a huge motivation for me to want to go into public health because at least, I thought, well, if I do any kind of research, I want it to be something where it's relevant to human health. So I think that's the biggest change in direction for me and the MPH definitely helped with that."

"Profound. Profound effect. I think [the MPH is] one of the most important things not only during the fellowship, but in my life. That MPH degree gave me the opportunity to really understand public health and to really understand that there is much more than just treating one patient, one person. That for me was extremely important. I would say it's one of the nicest features of the fellowship program."

The fellowship also offered carefully designed professional development and leadership training opportunities that affected alumni's career trajectory and still benefit them in their careers today.

"There is such a focus on leadership and career development; not just in the work you do, which naturally helps prepare you, but also in the different workshops and events."

"One of the things required in the fellowship program was that we had to take public speaking ... Being able to speak in front of people as a professional is something that I benefit from all the time."

Mentorship

The cornerstone of CFPF is mentored research. While it was clear from the interviews that each mentoring relationship was a keenly personal one, several overall themes emerged. First, the vast majority of alumni interviewed were mentored by multiple individuals as a result of both the collegial atmosphere at NCI and the structure of the CFPF program. Surrounded by so many researchers with different areas of technical expertise, fellows could work with a variety of different experts and direct their questions to individuals in the best position to answer them.

"When you went into a group there, you kind of took on the whole group and everyone mentored you."

"I think that the mentorship during the program just supported me to be more productive than I think

I ever thought I could have been. And since then [the mentoring] has given me a focus, or a sense of focus, or a sense of mission in my work."

"I think that part of the program was excellent because it brought in individuals with diverse backgrounds who had training in other areas or other areas of cancer research, and then brought them all together under a common umbrella of cancer prevention. So we were both exposed to the other fellows, as well as their mentors who were working at the NCI in different areas of cancer prevention."

"It was without a doubt, many, many people providing input, even other fellows. There were a couple [of alumni] who had stayed on as staff at NCI and they would come and have lunch with us and talk about opportunities. I think it was just an incredible situation."

"To me, the thing that I value the most about [my mentor], he did a really good job of bringing me into the branch ... He was always supportive of my interests in kind of bringing a new focus to the work that the branch had been doing more broadly. And so he's a very generous mentor in a lot of ways and I think that that's one way that he's been a generous mentor. He was really generous in his flexibility around letting me say well, this is what I want to do."

Almost all interviewed alumni described having a great deal of latitude to forge their own path while still having the benefit of the expertise of their mentors and colleagues. Alumni were given considerable freedom to select a mentor they thought would be a good fit, identify a topic of interest with which they thought they could make a contribution to the field, and conduct their own research. Some alumni noted that autonomy results from fellows being funded directly through the CFPF rather than the mentor.

"It was very much a supportive environment overall, with experts from all different disciplines in cancer prevention looking at all different types of exposures and angles within sort of the broad field of cancer prevention. So there were way more opportunities than I could take advantage of to participate in a community of cancer prevention researchers."

"[The program director at the time] really encouraged people that this should be their only postdoc, that people coming out of this fellowship should be relatively independent and ready to go."

"Since I was a Cancer Prevention Fellow, I think I was given more flexibility to kind of craft my own research with my mentor versus ones he hired and was paying out of his own pocket. You're kind of like free fellows for a lot of the people—they don't have to pay your salary—so that gave you a lot more flexibility to do the work you wanted."

For a few alumni transitioning from one discipline to another, guidance from their colleagues was particularly valuable.

"I did this really unique thing where I transitioned from a laboratory scientist to an epidemiologist/biostatistician; I mean, that's a pretty big leap in your career. And I don't think I would be able to do that without the Cancer Prevention Fellowship colleagues."

Several alumni indicated their time in the program began a lasting professional relationship with their mentors. Many

alumni have kept in frequent touch with their former mentors, seeking career and technical advice, and some have ongoing collaborations.

“I still think of [my mentor] as my mentor ... I really consider [my mentor] someone whose advice I always seek out and I trust and absolutely rely on.”

Transdisciplinary Environment

CPFP leadership have recognized the increasing demand for applying interdisciplinary approaches to complex problems in public health research and the need for postdoctoral training to expose early-career scientists to knowledge outside their own discipline and facilitate their ability to communicate and collaborate with professionals from other disciplines (Chang *et al.*, 2005). Alumni were overwhelmingly positive in their assessment of the way in which the fellowship brought them into the fold of a diverse community of cancer prevention professionals, often describing it as a hallmark feature of the program. More than half of the interviewed alumni noted exposure to many types of research and researchers during the fellowship gave them the background to be able to participate in a variety of scientific discussions outside their own narrow field of expertise, a recurring theme throughout the interviews.

“It was very much a supportive environment overall, with experts from all different disciplines in cancer prevention looking at all different types of exposures and angles within sort of the broad field of cancer prevention.”

Interviewed alumni discussed the ability to speak “a common language” with researchers from different backgrounds and engage in conversations about public health and participate in collaborative activities across disciplines. A high value is placed on having a broad understanding of complex, real-world issues and approaching problems from multiple perspectives.

“I now have the background and the language needed to communicate my work to scientists from various disciplines and even the general public.”

“[The community of cancer prevention scientists] is an enormous help for any scientist, particularly one who is looking to bridge different fields ... So every which way that cross-training of individuals occurs, occurred [in the fellowship].”

For many alumni, the emphasis on transdisciplinary science during the fellowship had a lasting effect on their professional identity, their understanding of what it means to do cancer research, and their approach to their work and career.

“But it wasn’t until the Cancer Prevention Fellowship where I started to see our work can span from the lab to the computer to a person ... It’s a totally different perspective on cancer and really, biomedical research, in general.”

Professional Identity

Because CPFP fellows enter the fellowship from a variety of backgrounds, alumni were asked to discuss the extent to which the fellowship affected their sense of identity as a professional in the cancer prevention field, as well as their sense of identity as a leader or change agent in cancer prevention. Alumni frequently entered the fellowship already identifying themselves as cancer researchers, but many of these alumni indicated that the fellowship further strengthened their professional identity. These alumni described developing a greater sense of confidence in cancer prevention and cancer research, a greater awareness of work being done in the field, and a better sense of the contributions they could make. The training and education alumni received during the fellowship (e.g., through the MPH and introductory summer course) gave them foundational skills and knowledge that alumni still find important to their work today. Alumni commonly spoke of the way that the wide-ranging exposure to diverse and high-quality research and researchers and complete immersion in cancer prevention research broadened their understanding of the field and deepened their commitment to cancer prevention.

“So, for me, I always identified myself as a cancer researcher, but now I have a much broader sense of what that means—a different definition, a broader definition of that.”

“The program has made my identity as a cancer researcher stronger than before. I had some idea before, but the program helped solidify it.”

“I’d say [the fellowship] definitely moved me from [being] what I considered a researcher in statistics to a researcher in cancer because that’s how I would describe myself now.”

“I think it’s contributed greatly [to my sense of identity as a cancer researcher]. I think without that fellowship, I don’t know that I would identify as much with it. I mean, forever, I am a cancer prevention fellow. I can’t even imagine what other path I would have taken ... I think you very quickly started to identify with the field and feel to be part of the field [after entering the program].”

“I’m sure throughout my career it will impact [my professional identity] in different ways and sometimes I’ll know it and sometimes I won’t recognize it because there’s just this process of osmosis when you’re around great people.”

DISCUSSION

The in-depth interviews conducted with CPFP alumni provided rich data for understanding how past participants in a postdoctoral training program viewed the influence of the program, including specific elements of the training, in shaping their future careers. The qualitative data presented here complement earlier quantitative findings from others suggesting that more structure leads to greater satisfaction (Davis, 2005). The alumni interviewed for this study reflected on specific training elements that were required pieces of the program as being helpful, if not essential, to their current careers. The themes from the in-depth interviews provided more insight into which elements the postdoctoral fellowship alumni found most helpful or noteworthy, even when

reflecting back on their training 10 or more years previously. The richness of the responses and connections between them would not have been possible to ascertain from review of alumni curriculum vitae or most survey instruments, which tend to use rating scales rather than open-ended questions. In addition, the interview responses provided an opportunity to assess whether the perceptions of alumni echoed the overall intent of the training program.

A major recurring topic across the interviews was the mentorship the fellows received, including the ability to select a mentor after being accepted into the program and to develop a unique research program. It was not unexpected that this theme would emerge, since the CFPF deliberately fosters autonomy of fellows through the design of the program. Fellows are provided secure and independent stipend funding, allowing them to have more freedom to shape their ultimate research focus than if they were solely housed in and supported by one individual scientist or research group within the institute. They can choose with whom they work at the NCI as a research mentor or collaborator and can even establish multiple mentors to serve their best interests and the best interests of the research programs they are developing. Clearly this feature of the program resonated strongly with the alumni.

While the financial support provides freedom for fellows to pursue an independent research focus, the autonomy from this alone was not enough for them to become established in the field of cancer prevention research. Other aspects emerged as being important to the future careers of fellows, including the training elements within the CFPF curriculum and having access to a community of researchers. The importance of being able to interact with both peers and more established individuals in the fields of cancer prevention was echoed in several interviews.

The CFPF alumni perceptions largely reflected the stated goals of the training program, but they also provided several suggestions for areas of improvement. These included creating more opportunities for alumni to remain involved with the program and network with current fellows, providing a more structured approach to career assistance and helping fellows transition to their next job, and offering a broader range of placements outside the NCI and NIH, particularly in clinical settings. As noted by others, this type of feedback from interviews is important for future program-planning purposes and for ensuring the alignment of goals with outcomes (Ali Zeilani *et al.*, 2011; Cherry *et al.*, 2012). This feedback will be incorporated into future modifications to the training program.

Some of our findings have been affirmed by others evaluating postdoctoral and early-faculty training programs. The Searle Scholars Program, which supports faculty in areas of biology, chemistry, and medicine early in their careers, conducted an evaluation of the participants in this program from 1981 to 2005. One Searle scholar noted that “the single most important, and easily overlooked, benefit of the Searle scholar honor is early inclusion in a group that comprises many current and future scientific leaders” (Fambrough, 2006). Similarly, an evaluation of Markey scholars, from a program that provided funding to bridge the transition from postdoctoral fellow to independent faculty appointment, concluded, “Even for academic superstars, the supportive atmosphere was highly appreciated, and several scholars

mentioned that the ‘pat on the back’ they received at the meetings meant more than the funds” (Isaacs, 2006).

These acknowledgments of the value of additional mentoring and inclusion in a community of scholars are consistent with models of scientific success proposed by others (Bland and Schmitz, 1986; Mavis and Katz, 2003). These models note that other factors, such as having the opportunity to communicate with others in aligned disciplines and a network of peers for support, are contributors to success as a faculty member in addition to more measurable outcomes, such as publications and grants awarded. Awards such as being selected for a competitive postdoctoral training program or receiving individual funding for research at the postdoctoral level also increase one’s confidence in being able to have a successful research program and provide a measure of credibility within the community (Mavis and Katz, 2003).

The responses provided here are from CFPF alumni only; however, from reports of other evaluations, it is clear that trainees who receive competitive support or funding early in their postdoctoral or faculty careers credit this, at least in part, for their subsequent career success (NRC, 2006). The themes we found may reflect more generalizable characteristics of structured, competitive fellowship programs rather than being specific to the CFPF, and they provide data that should be broadly considered in postdoctoral research training in the biomedical sciences.

These results also reflect that alumni, who represented several different career sectors, were broadly prepared to take advantage of numerous career opportunities postfellowship. Given the recent and growing interest by many who are seeking examples of postdoctoral training in the biomedical sciences that successfully facilitate fellows transitioning to a variety of career paths (Fuhrmann *et al.*, 2011; Meyers *et al.*, 2012; Saueremann and Roach, 2012; NIH, 2013), these structured program elements and comments shared here about the CFPF may be of broad interest to others leading or evaluating training programs in the biomedical sciences. In addition, the methodology used here could be adapted for the evaluation of other training programs. With this interview format, alumni were able to provide detailed responses regarding the usefulness of specific program components both during the postdoctoral training period and the next career step. This level of insight is invaluable when considering future modifications to the training program and understanding the current aspects of the program that are most helpful for the subsequent career paths of the alumni.

ACKNOWLEDGMENTS

We thank the participants in this study for the time they dedicated to the interviews and the candid feedback they provided. This work was supported by the National Cancer Institute Cancer Prevention Fellowship Program, Division of Cancer Prevention, through a contract to Westat.

REFERENCES

- Ali Zeilani RS, Al-Nawafleh AH, Evans C (2011). Looking back at the doctorate: a qualitative study of Jordanian graduates from PhD programs in the UK. *Nurs Health Sci* 13, 360–365.
- Bland CJ, Schmitz CC (1986). Characteristics of the successful researcher and implications for faculty development. *J Med Educ* 61, 22–31.

- Chang S, Hursting SD, Perkins SN, Dores GM, Weed DL (2005). Adapting postdoctoral training to interdisciplinary science in the 21st century: the Cancer Prevention Fellowship Program at the National Cancer Institute. *Acad Med* 80, 261–265.
- Cherry S, Meyer J, Hodge L, Terry M, Roose SP (2012). A prospective study of psychoanalytic practice and professional development: early career interviews. *J Am Psychoanal Assoc* 60, 969–994.
- Committee on Science, Engineering, and Public Policy (2012). *Enhancing the Postdoctoral Experience for Scientists and Engineers*. Washington, DC: National Academy of Sciences. <http://sites.nationalacademies.org/PGA/COSEPUP/Postdoc-2011/#meetings> (accessed 17 June 2014).
- Davis G (2005). Doctors without orders. *American Scientist* 93(3, supplement). <http://postdoc.sigmaxi.org/results/>.
- Fambrough DM (2006). Searle Scholars Program: selection and evaluation of Searle scholars. In: *Enhancing Philanthropy's Support of Biomedical Scientists: Proceedings of a Workshop on Evaluation*, Washington, DC: National Research Council, 43–51.
- Faupel-Badger J, Nelson DE, Marcus S, Kudura A, Nghiem E (2013). Evaluating postgraduate public health and biomedical training program outcomes: lost opportunities and renewed interest. *J Cancer Educ* 28, 18–26.
- Faupel-Badger JM, van Bommel DM, Wiest JS, Nelson DE (2011). Expanding cancer prevention education to national and international audiences: the National Cancer Institute's Principles and Practice of Cancer Prevention and Control annual summer course. *J Cancer Educ* 26, 619–625.
- Fuhrmann CN, Halme DG, O'Sullivan PS, Lindstaedt B (2011). Improving graduate education to support a branching career pipeline: recommendations based on a survey of doctoral students in the basic biomedical sciences. *CBE Life Sci Educ* 10, 239–249.
- Husten CG, Weed DL, Kaluzny AD (1993). Training researchers in cancer prevention and control: a description and evaluation of NCI's Cancer Prevention Fellowship Program. *J Cancer Educ* 8, 281–290.
- Isaacs KR (2006). The Lucille P. Markey Charitable Trust Scholars Program. In: *Enhancing Philanthropy's Support of Biomedical Scientists: Proceedings of a Workshop on Evaluation*, Washington, DC: National Research Council, 1–10.
- Mavis B, Katz M (2003). Evaluation of a program supporting scholarly productivity for new investigators. *Acad Med* 78, 757–765.
- Meyers FJ, Begg MD, Fleming M, Merchant C (2012). Strengthening the career development of clinical translational scientist trainees: a consensus statement of the Clinical Translational Science Award (CTSA) Research Education and Career Development Committees. *Clin Transl Sci* 5, 132–137.
- National Institutes of Health (NIH) (2012). *Biomedical Research Workforce Working Group Report*. Bethesda, MD: http://acd.od.nih.gov/Biomedical_research_wgreport.pdf (accessed 17 June 2014).
- NIH (2013). NIH Announces Awards to Strengthen the Biomedical Research Workforce. www.nih.gov/news/health/sep2013/od-23.htm (accessed 17 June 2014).
- NIH (2014). Strengthening the Biomedical Research Workforce. <http://commonfund.nih.gov/workforce/index> (accessed 17 June 2014).
- National Research Council (2006). *Enhancing Philanthropy's Support of Biomedical Scientists: Proceedings of a Workshop on Evaluation*, Washington, DC.
- Ritchie J, Spencer L (1994). Qualitative data analysis for applied policy research. In: *Analyzing Qualitative Data*, ed. A Bryman and R Burgess, London: Sage, 173–194.
- Saueremann H, Roach M (2012). Science PhD career preferences: levels, changes, and advisor encouragement. *PLoS One* 7, e36307.