

NEUROSCIENCE

Myths and facts about getting an academic faculty position in neuroscience

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We at the National Institute of Neurological Disorders and Stroke routinely receive questions and statements from trainees and faculty that suggest widespread beliefs about the necessity of a National Institutes of Health K99/R00 award, other prior funding, and/or specific types of publications for obtaining one's first tenure-track position in neuroscience. To address these beliefs, we examined the funding and publication history of a cohort of investigators who began their first academic faculty position between 2009 and 2019, and we interviewed several senior academic leaders with extensive experience in hiring new faculty. Our data show that <11% of newly hired faculty had a K99/R00 award and that neither prior funding nor papers in prestigious journals were necessary to obtain a tenure-track faculty position. Interviews with academic leaders almost uniformly referred to critically important factors that were considered to be more important in the hiring process than funding or publishing in high-profile journals.

INTRODUCTION

At the National Institute of Neurological Disorders and Stroke (NINDS), we hear many rumors and myths about funding from the extramural community. One of the most pervasive myths relates to the role of funding in obtaining a tenure-track or equivalent academic faculty position. Clearly, in many faculty positions, scientists must obtain funding to be considered successful researchers, and oftentimes, to obtain tenure. The number of opportunities for trainees to write grants and obtain funding, combined with the success of many individuals who obtain funding as a postdoctoral fellow, has led to the widespread belief that obtaining research funding while in a postdoctoral position, and even while in a predoctoral position, is critical to career success. Similarly, myths abound regarding the importance of certain kinds of publications, numbers of publications, and the requirements for moving from temporary, junior faculty positions to a tenure-track faculty position. It must be noted that belief in these myths is not confined to trainees; we hear from many established faculty members about the need for their trainees to have a grant or a certain kind of paper to be competitive for an academic faculty position. These beliefs place a great deal of stress on postdocs and students and often drive trainees to pursue research projects that are not to their advantage. For example, the belief that one needs to have a publication in a *Cell*, *Science*, or *Nature* (CSN) journal can lead to the pursuit of very large, complex, and/or difficult projects and could prolong time in training because of a primary goal of obtaining a publication in one of these “high-profile” journals. These beliefs lack solid evidence to support them. For example, an observation that many postdoctoral fellows who have individual funding or publications in high-profile journals obtain faculty positions does not translate into these metrics of accomplishment being necessary for success. The pursuit of unnecessary accomplishments, which often require an extensive focus on data collection, could result in trainees missing opportunities to develop critical skills

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and gain broader and deeper knowledge that could have major long-term benefits to their careers and their ability to innovate in their field.

As junior scientists prepare for the academic job market, they often face anxiety and uncertainty about their readiness to compete for a tenure-track faculty position. There is a dearth of publicized, factual information on what institutions value in academic faculty job candidates. Many believe that there is a narrow, archetypical set of qualifications that are required to obtain one of these coveted positions. In this study, we have obtained data to address the veracity of these myths. In part I of this paper, we present data using an “early-stage investigator” [ESI; without a National Institutes of Health (NIH) R01 and <10 years from obtaining their doctorate] cohort, composed of individuals who successfully obtained tenure-track faculty positions over a 10-year period to address five specific myths about the requirements for success. Then, in part II, we present qualitative information obtained from interviews with six individuals who have extensive experience in hiring new faculty members to find out what they and their search committees look for when hiring individuals into their first, tenure-track, assistant professor positions. These individuals represent six well-funded, research intensive institutions of different sizes and characteristics, and together, these interviews provide a compelling description of what a broad array of hirers are looking for.

Part I of this paper describes data that addresses the following five myths:

1) One needs a K99/R00 to obtain an academic faculty position. This myth is perhaps the most common we hear and the cause of enormous stress among the postdoctoral community. We constantly hear from postdocs how critical it is for their career to obtain a K99/R00 and expressions of the disastrous results that await them if they do not get one.

2) One needs to have research funding to be competitive for an academic faculty position. When we have presented data to an individual showing that it is not necessary to have a K99/R00 to obtain a faculty position, a common response is, “Well, you need funding of some sort.”

3) One needs an NIH F32 to be competitive for an academic faculty position. The F32 is a long-standing, widespread NIH-sponsored fellowship for postdoctoral fellows. NIH success rates for obtaining

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F32 support have ranged from 25 to 30% over the past 10 years, and it is believed by many to be a critical stepping-stone to obtaining an academic faculty position.

4) One needs to publish a CSN paper to obtain an academic faculty position. This is commonly heard among both established faculty and trainees as a reason for trainees to pursue very complex problems and often as a justification for prolonging predoctoral or postdoctoral training.

5) If one takes an “intermediate” position (a position between postdoctoral fellowship and tenure-track faculty), then subsequent transition to a tenure-track faculty position requires funding or publication of a CSN paper during that intermediate position. Historically, it was unusual for individuals to obtain a tenure-track position subsequent to taking a junior faculty position with titles such as “research assistant professor.” However, over the past decade, intermediate positions between postdoctoral fellow and tenure-track assistant professor have proliferated (see Materials and Methods for academic titles we defined as intermediate positions). So we asked two questions: (i) Are there many individuals hired into tenure-track positions from intermediate positions and (ii) for those who transition from a postdoctoral fellowship position to an intermediate position, must they have a “big accomplishment” in the intermediate position, such as obtaining competitive funding or publishing in a CSN journal, to transition to the tenure-track position?

RESULTS

Part I: Data that address the five myths

The approach and cohort

There is no database that we know of that lists all of the individuals hired into neuroscience-focused tenure-track or equivalent positions. Therefore, we examined a defined cohort of research scientists hired into assistant professor positions during the “K99 era” (between 2009 and the present) and asked, “what were their accomplishments prior to being hired?”

The cohort for this study included 344 individuals who occupied assistant professor or equivalent academic faculty positions. The cohort was defined by the following requirements: First, we identified all individuals who applied as principal investigator (PI) for an NINDS R01 and were designated as an ESI, between fiscal years 2015 and 2017 (inclusive; thus, three fiscal years or nine R01 due dates). There were 592 unique ESIs who applied for an NINDS R01 at one of these nine due dates. Because clinician-scientists are subject to very different hiring considerations than individuals with PhD degrees only, we confined the cohort to those with a research doctorate (e.g., PhD) who did not have a clinical degree (i.e., we eliminated all individuals from the cohort who had, for example, an MD or a PhD in a field that includes a license to practice clinically). Last, because this study originated to address the myth regarding the need for a K99/R00 to obtain a faculty position, we limited the cohort to those individuals who were hired between 1 January 2009 and the present (the K99 was initiated in late 2007, with the first transitions to an R00 at NINDS occurring after 1 January 2009).

Characteristics of the cohort

The 344 members of this cohort were hired into their tenure-track positions at 133 different institutions, with 22 of these 133 institutions hiring five or more of these individuals. The mean time to completion of their PhD training was 5.0 ± 1.0 years (SD; median = 4.8 years), with 91% of the cohort completing the PhD training within 6 years.

All members of the cohort transitioned into postdoctoral positions. The mean and median duration of postdoctoral training were 4.5 ± 1.7 (SD) and 4.6 years, respectively, with 79% of the cohort completing postdoctoral training within 6 years and 93% finishing their postdoctoral training in 7 years or less. The average time from completion of the PhD to start of tenure-track position for the entire cohort was 5.9 ± 2.1 years (SD; median = 6.1 years), with 73% obtaining their position within 7 years of degree and 98% within 10 years of degree. Before beginning their faculty positions, members of the cohort published, on average, 13 ± 8 papers (SD) and were listed as first author on 6 ± 3 (SD) of those papers.

Important note: Our cohort consists of individuals who successfully began a tenure-track, academic faculty position. We did not obtain information on a comparison cohort of individuals who did not begin a tenure-track position. Thus, we have not addressed, and are not describing in this paper, what makes the difference between success and failure in obtaining an academic position. The data below specifically address the myths described above, in the form of the question, “do you need [something] to obtain a tenure-track or equivalent position?”

Myth 1: One needs a K99/R00 to obtain an academic faculty position

Perhaps the number one myth that we hear at NINDS is that you need a K99/R00 to get an academic faculty position. We hear this not only from postdocs but also from experienced faculty and even occasionally from NIH staff. To address this myth, we determined how many individuals in our cohort were successfully awarded NIH K99/R00 grants. Of the 344 individuals in the cohort, only 14% (48 of 344) had a K99 award (Fig. 1).

We have subsequently completed the same analysis for an identically defined cohort from the years 2018 to 2019 (i.e., the two fiscal years subsequent to those from which the main cohort was drawn). There were 258 unique individuals in this cohort. Of these 258 individuals, 35 (13.5%) had a K99. Together, over the 5-year period from 2015 to 2019, 14% of the 602 individuals who were hired into assistant professor positions since 2009 and applied for an NIH R01 as an ESI had a K99 award.

These analyses put an upper limit on the number of individuals being hired who had a K99/R00 award at 14%. However, this is an overestimate. Our cohort does not include the many individuals

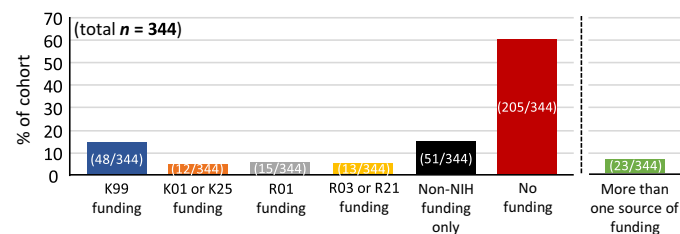


Fig. 1. The percentage of individuals in the cohort who had different categories of research funding before their tenure-track faculty position. To the left of the dashed line, individuals are listed in only one category. The binning priority for the few individuals who obtained multiple awards was K99 funding, R01 funding, non-NIH funding, K01/K25 funding, and R03 or R21 funding. The bar to the right of the dashed line indicates the number that obtained multiple competitive grants before obtaining their tenure-track faculty position. Fellowship funding, including the F32, was excluded from this analysis.

hired into tenure-track positions who do not apply for R01 funding within the first few years of starting their faculty position. For example, over the 5-year period from 2015 to 2019, there were 351 unique individuals designated as “new investigator” (NI; defined as somebody who never obtained a NIH R01 and is >10 years from obtaining their doctorate) who met all other criteria of our cohort with no overlap of individuals. Only 19 (5%) of these NIs had a K99/R00 award. If we then combine both ESI and NI populations, then only 11% of these 953 (602 plus 351) individuals had a K99 award before obtaining their faculty position.

Even this figure of 11% must be an overestimate of the number of K99 awardees among those hired. Most K99 awardees apply for an R01 during or shortly after completion of their R00 award (96% of individuals with an NINDS R00 have applied for an R01 by the end of the R00 period; such individuals populate the numerator) and will thus be accounted for. However, there will be a large number of individuals hired into tenure-track faculty positions that have not applied for an NINDS R01 early in their faculty careers (e.g., those who applied for other NIH grant mechanisms, such as an R21 or R15, or those who receive funding from other agencies, such as the National Science Foundation, or from private foundations). For example, we identified all of the individuals who applied for an NIH R15 between 2015 and 2019 and were hired in the K99 era. None (more than 200 individuals) had a K99/R00 award. These individuals would add to the denominator (total number hired into faculty positions) and thus make the percentage of those hired who had a K99 even smaller. Similarly, there are the many individuals hired into tenure-track positions that have not applied to NIH for funding. It is highly likely that very few or none of these would have had a K99 award; all of these individuals would add to the denominator and further reduce the percentage of K99 awardees among those hired into tenure-track positions.

Myth 2: One needs to have research funding to be competitive for an academic faculty position

In our experience, this myth is the broader issue for those who believe you must have a K99 to obtain a tenure-track faculty position. The K99/R00 has a lot of visibility with respect to its value in helping postdocs obtain faculty positions, but there are many other opportunities for postdocs to obtain funding, both from private foundations and from NIH. We hear repeatedly not only from postdocs (and often their mentors) but also even from students that trainees must obtain competitive funding to obtain a faculty position.

To examine this myth, we determined how many individuals in our cohort had research funding as PI before obtaining their tenure-track position. We envisioned this myth as being related to an individual having an active grant to take to the position. However, for this analysis, we did not consider whether the grant was active at the transition point of taking the position. We simply determined whether the individual had obtained funding at any time before obtaining the faculty position.

In addition to the 14% of our cohort who obtained a K99/R00 award, another 3% of the cohort obtained non-K99, K-series funding, 8% obtained R-series funding, and 15% obtained non-NIH funding before the start of their faculty position (Fig. 1, left of dashed line). Thus, 40% of the cohort obtained competitive funding before being hired. Twenty-three individuals obtained two grants before their tenure-track position (Fig. 1, right of dashed line). Most critical to addressing the myth, however, is that 60% of individuals in

this cohort who obtained a tenure-track faculty position had no funding before obtaining that position.

To examine this another way, we asked how many of the institutions represented in this study hired an individual into their tenure-track position when that individual had not received competitive funding. Eighty-two percent (109 of 133) of the institutions represented in this study hired individuals into tenure-track positions who had not obtained competitive funding before being hired.

Myth 3: One needs an NIH F32 to be competitive for an academic faculty position

Another myth that we encounter from trainees and many mentors is that an F32 is a necessary stepping-stone for a successful career in academic research. Applying for, and even getting, an F32 has many scientific and training benefits. However, the data (Fig. 2) indicate that the vast majority of those hired into a tenure-track position did not have an F32 as a postdoc. Only 17% (58 of 344) of our cohort that held tenure-track positions were supported by an F32 during their postdoctoral research period (Fig. 2). Twenty of these fifty-eight individuals secured more substantial individual funding (e.g., K99/R00 or R-series grants) before their faculty appointments. Consequently, only 11% (38 of 344) of our cohort were awarded an F32 and no other funding before obtaining their faculty position. Perhaps more directly to the point, if one subtracts out all of the individuals from the cohort who had funding other than an F32 (to determine the prevalence of F32 funding among the 60% of the tenure-track faculty who were hired without a K99/R00, R-series grant or foundation funding), then only 19% of those hired had an F32.

Although it is reasonable to assume that obtaining competitive funding would increase the competitiveness of an applicant for a faculty position, the data above clearly demonstrate that it is not needed for success. Our information derived from interviews with individuals who hire faculty (part II below) was remarkably consistent with this conclusion. As described below, two of six institutions we talked to considered funding to be essentially irrelevant to their hiring decisions, and only one institution used funding as a screening tool.

Myth 4: One needs to publish a CSN paper to obtain an academic faculty position

The CSN family of journals (i.e., includes *Nature Neuroscience*, *Neuron*, etc.; collectively termed CSN below) are often held as the gold standard of scientific journals. Consequently, many trainees, often encouraged by their supervising faculty, strive to publish in these journals and often believe that their success hinges on publications in these journals.

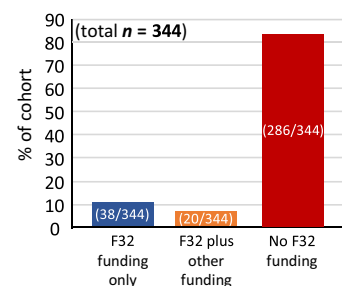


Fig. 2. The percentage of the cohort who had NIH F32 postdoctoral fellowships.

To address this myth, we examined the cohort's publication record before beginning their tenure-track position. We identified all peer-reviewed research articles (i.e., we did not include reviews, book chapters, abstracts, etc.) published in each career stage (pre-doc, postdoc, and intermediate position) by members of the cohort and whether the individual appeared as first (including co-first) author or middle author.

Figure 3 illustrates how many first-author CSN papers were published by the individuals in the cohort. Fifty-nine percent of those hired into tenure-track positions did not have a first-author publication in a CSN journal before obtaining their position. In addition to the 41% of the cohort that had published a first-author paper in a CSN journal, an additional 11% held a middle author position on a CSN journal article. Thus, approximately half of the population in this cohort did not have a CSN paper on their curriculum vitae (CV).

Myth 5: If one takes an intermediate position (a position between postdoctoral fellowship and tenure-track faculty), then subsequent transition to a tenure-track faculty position requires funding or publication of a CSN paper during that intermediate position

Historically, the vast majority of individuals in tenure-track or equivalent positions transitioned directly from postdoctoral positions. It was rare for an individual to transition to a non-tenure-track faculty position, such as one that might have a title of research assistant professor, and subsequently transition to a tenure-track position. In recent years, however, the number and kind of positions intermediate between postdoctoral fellow and tenure-track faculty has proliferated and the number of individuals taking them has similarly grown.

It was instructive to us how common and complex the transition to an intermediate position had become. The nature of these positions varies not only by title but also even within title across institutions. For example, a research assistant professor in one institution might have independent space and be expected to bring in major research funding, whereas an individual in an identically titled position in another institution might be working in a senior faculty member's laboratory and conducting research funded by that faculty member's grant. The most common titles were "instructor," research assistant professor, and "research associate," which in some institutions were positions to which postdocs were promoted after a period of time (while maintaining the essential component of being in a mentored training position) but in other institutions appeared to be a junior faculty position. These positions carried privileges such as the ability to apply for an NIH R01 and, importantly, provided fringe benefits not available to postdoctoral fellows. However, in the former cases, individuals were not independent and were still functioning as advanced postdoctoral fellows (i.e., working in a

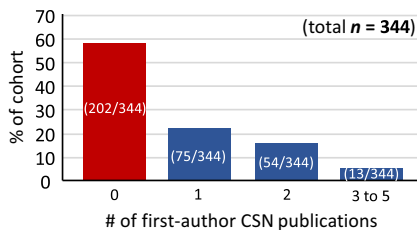


Fig. 3. The percentage of the cohort who had first-author CSN publications before obtaining their tenure-track faculty position.

mentor's space, working on a mentor's project, and funded by the mentor), whereas in the latter they were functionally independent. In our analysis, we considered all "intermediate positions" identically; when parsed out into different position titles, the results we will present below were qualitatively identical.

The different pathways to a tenure-track position represented in our cohort

Upon completion of a period of postdoctoral training, roughly half of our cohort transitioned directly into a tenure-track position and roughly half transitioned into an intermediate position before obtaining a tenure-track faculty position (Fig. 4A). As expected, the time between obtaining one's doctorate and starting in a tenure-track position was quite different for the two groups, with those spending time in an intermediate position taking approximately 2 years longer post-degree to obtain their tenure-track position (Fig. 4B).

Transitions directly from postdoc to tenure-track faculty position Publications

Figure 5 presents histograms of the number of first-author predoctoral and postdoctoral research articles for individuals who transitioned directly from postdoctoral to tenure-track faculty positions. The mean and median number of pre- and postdoctoral first-author papers for this group was 3 and 2, respectively. Twenty-three individuals did not have a first-author postdoctoral publication before starting their faculty position and approximately half had either 0 or 1. Figure 5C illustrates the total number of first-author papers for those who transitioned straight from postdoctoral to faculty position. Whereas the mean and median number of publications were both approximately 5 before obtaining their tenure-track position, 24% had three or fewer first-author publications when they were hired onto the faculty. Although we have not attempted to evaluate papers for significance or quality, these data indicate that one can obtain a faculty position with a small number of first-author publications.

Funding

Figure 6 illustrates the funding and CSN publication status of the group of individuals who transitioned directly from a postdoctoral

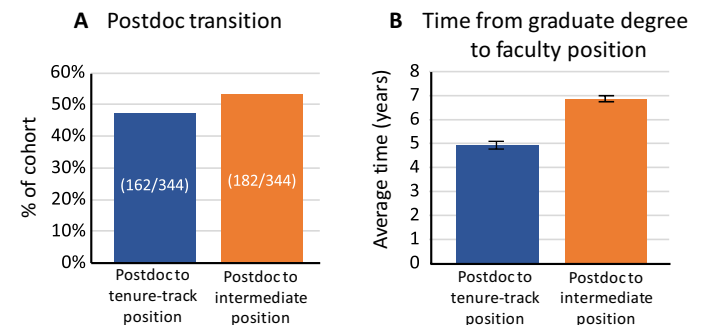


Fig. 4. Transition to faculty position. (A) The number of individuals who transitioned directly from postdoc to faculty (blue) or transitioned from postdoc to an intermediate position before obtaining a faculty position (orange). (B) The average time from degree to tenure-track faculty position for the two career trajectories. The median and range in (B) were as follows: blue (median: 5.2 years; range = 0.5 to 9.8 years) and orange (median: 6.8 years; range = 2.7 to 17.0 years).

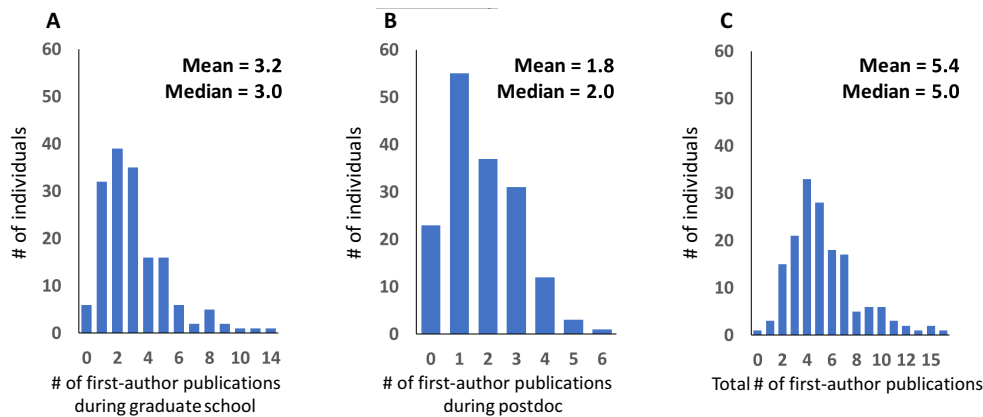


Fig. 5. Number of first-author publications before obtaining a tenure-track faculty position for those who transitioned straight from their postdoc into the faculty position. (A) During graduate school, (B) during the post-doctoral period, and (C) in total ($n = 162$). Only peer-reviewed research articles are included; reviews, book chapters, and other types of publications are not included.

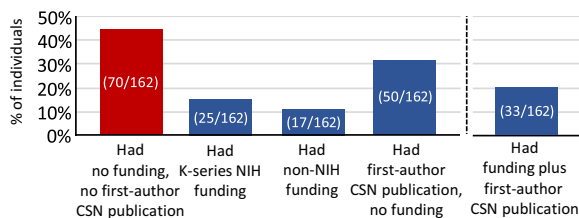


Fig. 6. Funding and CSN publication status before tenure-track faculty position for those who transitioned directly from their postdoc into the faculty position ($n = 162$). On the left side of the dashed line, individuals are listed in only one category and were binned first based on funding and second based on CSN publication status. The bar on the right side of the dashed line indicates the number of individuals who had both funding and a first-author CSN publication before obtaining their tenure-track faculty position.

position into a tenure-track position. Only 15% of the individuals in this group had an NIH career development (K-series) award before obtaining their faculty position. Another 11% had competitive funding from a non-NIH source (e.g., foundation). Of the 120 individuals (74% of the group) who did not have funding, 50 (31% of the group) had a first-author CSN paper. Thirty-three individuals in this group had both funding and a first-author CSN paper before obtaining their faculty position, with 23 individuals having NIH funding and 10 individuals having non-NIH funding. Together, 57% of the individuals who transitioned directly from their post-doctoral fellow position to a tenure-track position had either some sort of competitive funding or a first-author CSN paper. Critically, 43% transitioned to a tenure-track position without having obtained research funding or a first-author CSN paper.

Transitions to an intermediate position before obtaining a tenure-track faculty position

Publications

For those who took an intermediate position before moving into a tenure-track position, the outcome was similar. Figure 7 shows histograms that illustrate the number of first-author papers from their predoctoral work (Fig. 7A), postdoctoral fellowship period (Fig. 7B), intermediate period (Fig. 7C), and total before obtaining tenure-track position (Fig. 7D). The total publication record of this group was only marginally different (~1 more first-author paper) than that of

the individuals who transitioned straight from a postdoc to faculty position. Moreover, 33% of these individuals published no additional first-author papers from the intermediate position before obtaining a tenure-track position and approximately half of these individuals added either 0 or 1 first-author papers during this period. Thus, adding any publication during this period, not to mention a high-profile publication, was not a requirement for obtaining a tenure-track position.

Funding

Figure 8 illustrates the funding and CSN publication status of the group of individuals who transitioned from an intermediate position to a tenure-track faculty position. Fifty-three percent of this group had competitive funding of some sort before obtaining their faculty position, and thus, critical to addressing the myth, approximately half of this group obtained a tenure-track position having obtained no competitive funding. Of the 85 individuals who did not have funding, 34 had a first-author CSN paper. Of the 25 individuals that had both funding and a first-author CSN paper before obtaining their faculty position (right side of Fig. 8), 18 had NIH funding and 7 had non-NIH funding. Together, 72% of the individuals who transitioned from their intermediate position to a tenure-track position had either some sort of competitive funding or a first-author CSN paper. Twenty-eight percent of these individuals, who had been in training for over 11 years on average, had neither research funding nor a first-author CSN paper before their transition to a tenure-track position.

Dynamics of taking an intermediate position

As described earlier, we found that the meaning of intermediate position titles varied considerably, not only across institutions but also occasionally within institutions. As a result of this ambiguity, we treated all “intermediate” positions identically in our analysis. This was less than satisfying, as we were grouping individuals into one category who ranged from advanced postdoctoral fellows to junior faculty. However, when we removed certain groups from our analysis on the basis of a particular intermediate position title, the results were qualitatively identical.

Taking an intermediate position outside of the postdoctoral institution

Figure 9A summarizes the various paths taken by those who transitioned to an intermediate position. Only 27 individuals (8%) in the

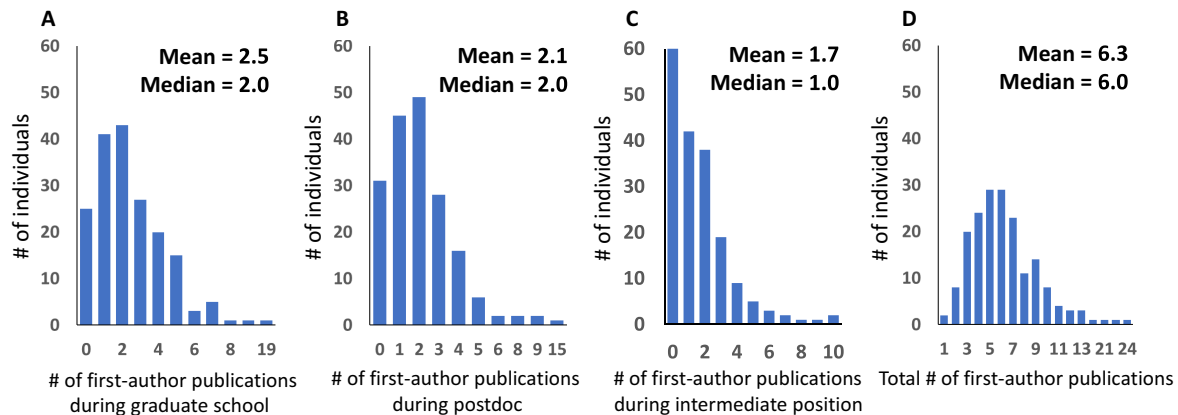


Fig. 7. Number of first-author publications before obtaining a tenure-track faculty position for those who transitioned to an intermediate position before obtaining a tenure-track position. (A) during graduate school, (B) during the post-doctoral period, (C) during the intermediate position, and (D) in total ($n = 182$). Only peer-reviewed research articles are included; reviews, book chapters, and other types of publications are not included.

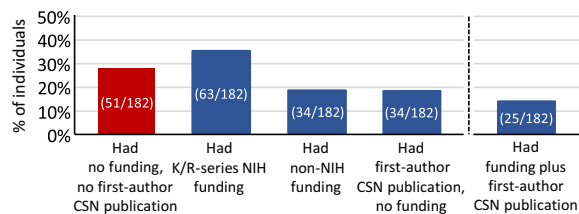


Fig. 8. Funding and CSN publication status before tenure-track faculty position for those who transitioned from an intermediate position ($n = 182$). To the left of the dashed line, individuals are listed only in one category and were binned first based on funding and second based on CSN publication status. The bar on the right side of the dashed line indicates the number of individuals who had both funding and a first-author CSN publication before obtaining their tenure-track faculty position.

entire cohort obtained a tenure-track or equivalent position after transitioning to an intermediate position outside of their postdoctoral fellowship institution. Most telling was that only 7 individuals (2% of our entire cohort) transitioned to an intermediate position at an institution outside of their postdoc institution and subsequently obtained a tenure-track position at a different institution than that of their intermediate position. Thus, inasmuch as the lack of control group prevents us from evaluating the wisdom of pursuing this pathway, our data suggest that this is a rare pathway to a tenure-track position.

Despite the small number of individuals, it was still of interest to know whether individuals who followed this pathway had to obtain funding or publish a CSN paper to obtain a tenure-track position. Of the 27 individuals who obtained a tenure-track position after taking an intermediate position outside of their postdoctoral institution, 15 (56%) obtained funding or published a first-author CSN paper while in their intermediate position (Fig. 9B, top two rows combined). Thus, nearly half obtained tenure-track positions without them. Unexpectedly to us, only one of the seven individuals who transitioned to a faculty position in a new institution after a prior transition to a new institution for an intermediate position obtained one of these major accomplishments before obtaining the faculty position.

Taking an intermediate position within the postdoctoral institution

Of the 182 individuals who transitioned to an intermediate position, 85% did so within their postdoctoral institution (Fig. 9A). Of the 155 individuals in this group, approximately half (55%) were promoted to tenure-track positions within their postdoctoral institution and nearly half (45%) were hired at an institution different from their postdoctoral institution (Fig. 9A). Overall, approximately half (55%) of those in an intermediate position obtained funding or a first-author CSN paper while in the intermediate position (Fig. 9B, rows 3 and 4 combined). Conversely, approximately half transitioned to a tenure-track position without having obtained funding or publishing a first-author CSN paper in the intermediate position. Although the numbers are small, it is of interest that obtaining funding or publishing a CSN paper appeared to be less important for being hired into a new institution (Fig. 9B, row 3) than to be hired by the current institution (Fig. 9B, row 4).

The apparent importance of being a “known quantity”

The data in Fig. 9 were notable in another regard. Of the 182 individuals who transitioned to an intermediate position, 105 (58%) were hired into a tenure-track position at the institution where they were currently working. When one considers both those who transitioned to an intermediate position and those who transitioned to a faculty position directly from a postdoctoral position, 41% of the 344 individuals in the entire cohort were hired into a tenure-track position at an institution in which they trained or were previously employed (i.e., where they were “known”).

We next examined how common this practice was across institutions. Table 1 lists all of the institutions that hired five or more individuals in this cohort. Eighty-two percent of these institutions hired at least one individual with whom they had previous experience, either as a trainee or employee. At 10 of the 22 institutions on this list, 50% or more of the hires were known to the institution as a previous trainee or employee. Across the entire cohort of 133 hiring institutions, 55% hired one or more individuals that were known to it by previous training or employment. Thus, it is clear that many institutions show a preference for hiring individuals that they “know.”

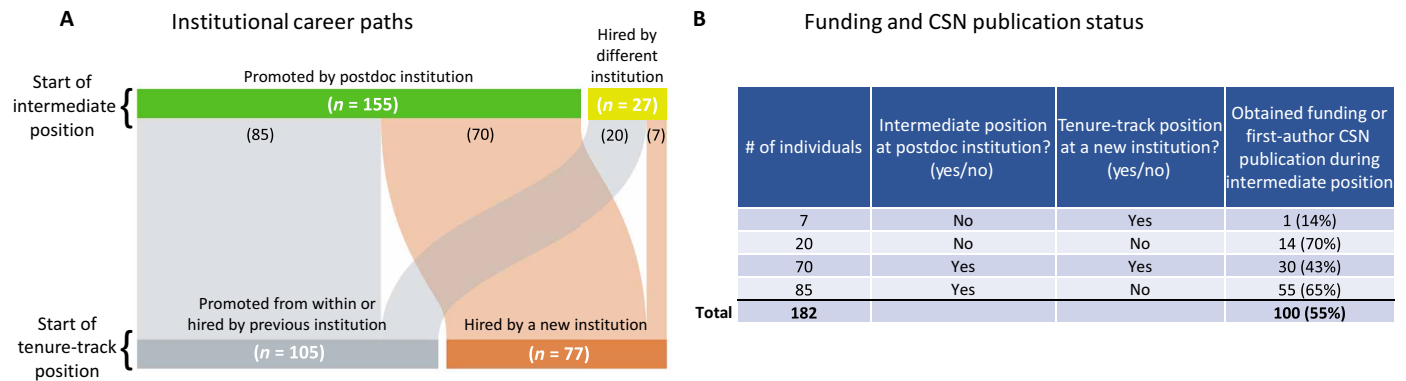


Fig. 9. Transition to faculty position from an intermediate position. (A) The career paths of individuals who transitioned from an intermediate position to tenure-track faculty (n = 182). The green bar at the top represents the number of individuals who obtained an intermediate position at the same institution as their postdoctoral position. The yellow bar at the top represents the number of individuals who moved to an intermediate position outside of their postdoctoral institution. The bottom bars represent those who were hired by an institution where they had been during a training career phase (gray) or an institution where they had never worked (orange). (B) The funding and CSN publication status before tenure-track faculty position for those who transitioned from an intermediate position to their faculty position (binned by career path).

Table 1. Tenure-track faculty hiring of known individuals at institutions that hired ≥5 cohort members.

Institutions hiring ≥5 cohort members into tenure-track positions January 2009– June 2019	% of hires that were prior trainees or employees
Institution 1	100% (6/6)
Institution 2	89% (17/19)
Institution 3	83% (5/6)
Institution 4	80% (4/5)
Institution 5	73% (8/11)
Institution 6	71% (5/7)
Institution 7	67% (4/6)
Institution 8	60% (3/5)
Institution 9	50% (3/6)
Institution 10	50% (4/8)
Institution 11	40% (2/5)
Institution 12	40% (2/5)
Institution 13	40% (2/5)
Institution 14	40% (2/5)
Institution 15	40% (2/5)
Institution 16	33% (3/6)
Institution 17	29% (2/7)
Institution 18	20% (1/5)
Institution 19	17% (1/6)
Institution 20	0% (0/5)
Institution 21	0% (0/5)
Institution 22	0% (0/5)
All institutions (133)	41% (141/344)

Summary of part I

The first four myths pertain to the belief that one needs funding or a CSN paper to be competitive for a tenure-track faculty position. We examined three categories of funding: the K99/R00 award, which, in our experience, is the award that many postdocs feel is the key to obtaining a faculty position, other types of NIH or non-NIH funding, and the F32.

Without a doubt, a K99/R00 award has many benefits both from the K99 phase of funding and the R00 phase of funding. Discussions of these benefits are beyond the scope of this paper and will be addressed elsewhere. Our data clearly demonstrate, however, that a very small percentage of individuals hired into tenure-track positions had a K99/R00. For individuals conducting research in the NINDS mission who were hired into a tenure-track academic position at an institution that has an expectation of R01 submission, our data indicate that 11% or fewer had a K99 award; and for those hired by the many institutions that do not have an expectation of R01 funding but who were running a research program as evidenced by seeking NIH funding for their research, none had a K99 award.

Equally clear from our data is that major funding of any sort is not needed to obtain a tenure-track faculty position. When one combines all sources of competitive research and non-“fellowship” career development funding, 60% of individuals hired into tenure-track faculty positions had no funding before obtaining their tenure-track position. Moreover, the willingness to hire an individual who had not received prior competitive funding was widespread. Of the 133 institutions in this study who hired an individual into a tenure-track position, 82% hired an individual who had not received prior competitive funding.

The data also clearly demonstrate that the F32 is not a critical factor in one’s ability to obtain a faculty position. A total of 464 postdoctoral neuroscientists received F32 awards from NINDS between 2007 and 2016 (individuals funded during these years would have had time to transition to faculty positions in the time relevant for this study), yet only 58 individuals in our cohort had obtained an F32. One would certainly imagine that some individuals who are

hired into faculty positions would have had an F32 as a postdoc. Consequently, our data that only 11% of our faculty cohort had an F32 and no other funding, and only 17% of the cohort overall had an F32, suggest that having an F32 has a relatively unimportant role (and perhaps even no impact) in enhancing one's ability to obtain a faculty position.

Our data also demonstrate that CSN papers are not necessary to obtain an academic faculty position; approximately half of the population in the cohort did not have a CSN paper on their CV. This leaves the possibility that one must have either funding or a CSN paper to obtain a faculty position. Within the entire cohort of the 344 individuals who obtained tenure-track or equivalent positions, 35% had neither postfellowship funding nor a first-author CSN paper. Certainly, one can look at this from two perspectives. On the one hand, 65% of those hired had obtained either a competitive grant or published a first-author CSN paper before being hired. Conversely, over one-third of the cohort had neither funding nor a CSN paper before obtaining a tenure-track faculty position. Although undoubtedly beneficial, these data argue that neither one of these two accomplishments are necessary for one to transition to a tenure-track position. Moreover, as we demonstrate below in the qualitative section of this paper, many research-intensive institutions consider other factors to be much more important than these metrics of accomplishment.

Any reasoning that is applied to these results is a bit circular. It is students and postdocs who do the experiments that generate most or all CSN papers, and there is a substantial amount of NIH and non-NIH funding that is targeted specifically to those in pretenure-track (training) career stages. Consequently, one would expect that individuals who have the training and research excellence to obtain competitive funding or publish in a CSN journal to be the same as those who have the training and research excellence to be competitive for an academic faculty position; and in a circular fashion, it would be expected that many of the individuals who have the research and training excellence to obtain a faculty position would be the same as those who have the research and training excellence to publish in a CSN journal or obtain competitive funding. Our conclusion is not that these funding or publication accomplishments are unrelated to obtaining an academic faculty position nor that these accomplishments are not looked upon favorably in the hiring process. What the data above clearly demonstrate, however, is that neither funding nor a CSN paper are necessary to obtain a tenure-track faculty position. In part II below, we provide insight gained from interviews with six individuals at a diverse set of institutions as to what is the most important for obtaining a tenure-track faculty position.

The fifth myth pertains to the belief that one needs to obtain funding or a CSN paper to transition out of an intermediate position into a tenure-track faculty position. Of the 182 individuals in this group, 55% obtained funding and/or published a first-author CSN paper during their intermediate position (i.e., after completing their postdoctoral fellowship period). Conversely, 45% did not. Thus, inasmuch as 72% of individuals who transitioned from an intermediate position had funding or a CSN paper before obtaining a faculty position, almost half got their position without obtaining one of these major accomplishments during the intermediate position and more than a quarter of this population transitioned to a faculty position without having obtained competitive funding or a first-author CSN paper at any time. These data demonstrate that one need not obtain one of these accomplishments during the intermediate period, or indeed, at all, to obtain a tenure-track position.

Although not in direct response to addressing the myths, additional interesting information emerged from the data. We found it remarkable how many institutions represented by our cohort hired individuals into tenure-track positions that had previously been trained or employed at that institution. Across the entire cohort of 133 hiring institutions, 55% hired one or more individuals that were known to it by previous training or employment. Among the individuals hired, however, this behavior was markedly more apparent for those who transitioned to an intermediate position between their postdoctoral fellowship and tenure-track position. Whereas 58% of those hired out of intermediate positions were hired by an institution where they had previously trained or worked, only 23% of those who transitioned to a faculty position directly from their postdoctoral position were hired by an institution where they had previously trained or worked.

Another interesting finding was that, of the 344 members of the entire cohort, only 27 individuals were hired into tenure-track positions after transitioning to a non-tenure-track position outside of their postdoctoral institution. With the usual caveat that we do not have a control group to evaluate the success of individuals who pursue this pathway, these data indicate that taking an intermediate position outside of the postdoctoral institution is not a common route to a tenure-track position.

Part II: Statements by six individuals who have overseen much hiring regarding what they and their search committees look for during the hiring process

The data in part I demonstrated that, although undoubtedly a beneficial addition to a CV, one does not need a K99/R00 award, funding of any sort, or a paper published in the CSN journal family to obtain a first tenure-track faculty position. Given that none of these specific prefaculty accomplishments are necessary for obtaining a faculty position, we sought to determine factors that were. To address this, we interviewed six individuals who have a long history of being involved in, and overseeing, the hiring process. We selected these individuals on the basis of their stature at their institutions, their extensive experience in hiring faculty, and their being at six different types of institutions. We posed two general questions to these individuals: (i) "What characteristics are you looking for in order to invite somebody for an interview?" and (ii) "what factors lead you to hire somebody, and what issues lead you to not hire somebody after you've interviewed them?" After posing these questions, we did not ask for discrete answers to these specific questions but rather asked those interviewed to talk to us about the factors that are most important in the hiring process. Below, we have used either direct quotations or paraphrased answers to provide a brief, descriptive answer. Before submission of this paper for publication, we sent it to each of these individuals to confirm the accuracy of the statements or thoughts that we attributed to them (bolding was added by us for emphasis, and confirmed by the individual interviewed as appropriately applied).

Diane Lipscombe, Ph.D.

Thomas J. Watson Sr. Professor of Science
Reliance Dhirubhai Ambani Director,
Robert J. and Nancy D. Carney Institute for Brain Science
Department of Neuroscience
Brown University
Providence, RI

We are looking for the potential to succeed in research. We don't use a K99 as a way to triage anyone. A K99, or any other funding, is of secondary importance. We also don't look at numbers of papers, but at their quality. We do look at the journal name, but we also look at the paper itself. **A short paper in a high-profile journal is often less interesting, and less of a draw to us when hiring, than a solid scientific contribution.** We value this much more than many papers that are parts of studies—we are looking for solid research pieces that demonstrate independence and creativity by the candidate.

We like to see consistency in someone's CV. We're looking for high quality, consistent, rigorous research. We look closely at letters of recommendation. **And we look at the research statement quite deeply, which is a very important factor in choosing who to interview.**

We require a statement from applicants on diversity and inclusion. In recent hires, we've read that first. This doesn't mean that the person has to be an underrepresented minority. **We're looking for a sincere, demonstrated interest.**

We're looking for independence and passion, although that can be hard to define. **Someone who isn't passionate about education and mentorship won't be happy here.** This doesn't mean we require formal teaching experience or a teaching certificate. This teaching experience can show up in a multitude of ways, even as an interest outside of your research—for example, community outreach.

Things that are turn-offs? Lack of a particular interest in Brown. We want the applicant to have thought about how they'll interact in our community.

To get on the shortlist, the cover letter will tell you a lot about the effort they've put in. Do they know the faculty at Brown and how they would fit in? Video pre-screens also give us information about their interest in Brown, their understanding of their own work, how they view the impact of their work, the challenges they see in their research.

Networking does have an influence. A letter from a faculty member we know, whose opinions we value and who we know is completely honest in their assessments, counts.

At the interview, **their knowledge of their work can come through in a presentation, but the chalk talk is where we really learn about their understanding of their work and how they see their work intersecting with the faculty here.**

Ted Abel, Ph.D.

Director, Iowa Neuroscience Institute
Chair and DEO, Department of Neuroscience and Pharmacology
Roy J. Carver Chair in Neuroscience
Carver College of Medicine
University of Iowa
Iowa City, IA

We are looking for a colleague who is **intellectually curious.** This comes from an ability to ask insightful questions and to use techniques that are appropriate to answer those significant questions. Having a hot new technique is not sufficient without knowing important and interesting questions that can be addressed with these new approaches.

Funding and journals count but are not the key issue. We've known applicants with a K99 and a CSN paper who couldn't articulate the importance of their research, so we don't base decisions

solely on funding and the journals in which research is published. One aspect that is important is consistent productivity at a high level throughout a candidate's graduate and postdoctoral work.

We want to know that the candidate is driving their research project, and we seek individuals who understand the importance of their work, the strengths and weaknesses of their technical approaches, and have a sense of where the field is headed.

We're interested in people who have thought about what big questions they'd like to address and how they might study them in their own lab. What would they pursue that might make it into the textbooks? How would their research make a difference either in our fundamental knowledge of neuroscience or how we might better understand brain disorders.

The research statement is very important, and it should not read like it was copied from an NIH Biosketch or a Specific Aims page. The research statement should clearly and concisely describe the advances that the candidate has made in their research and outline where they are headed. A "graphical abstract" as a part of this statement can make things much clearer. The cover letter and CV can break an application but can't really make it. The research statement can make it.

Community matters. The best neuroscience is carried out by collaborative communities of faculty, fellows, and students. As faculty candidates look at potential institutions in which to launch their careers, it is important to look closely at the neuroscience community at the institutions you are considering. Are faculty appropriately mentored? Are students and fellows part of a collaborative community that supports their training? Find out about faculty whose research connects with yours and determine if there are appropriate resources to help you grow your research program. Our search committee looks for candidates who have sought answers to these questions.

We all focus too much on metrics. Just because we can measure things does not mean that they are important or significant. We seek to focus on the unique strengths of individuals to identify their potential to make discoveries in their lab in the future that will make a difference in how we understand how the brain works.

Joseph LoTurco, Ph.D.

Department Head and Professor
Physiology and Neurobiology
University of Connecticut
Storrs, CT

Out of 150-200 applications, we usually whittle down to 20-25 for a remote interview by grants and publications. We are mainly interested in 1) someone who wants to be in our department, wants to work with our people, in our kind of environment, and 2) someone who will be successful in getting tenure here. But we don't typically get to these issues until we get down to the 20-25.

We don't care too much about what graduate school or post-doctoral institutions people come from.

For the first cut, we look at where they've published as an indication of quality of work. **We do not require CSN publications. We are looking for top-field journals. We are also looking for a CV that is not filled with short papers.** Once the first cut is made, we will go back and read some of the papers. We have hired plenty of people who don't have CSN publications. In fact, we may actually be a bit suspicious about a CSN publication vs. a 2-3 author paper in

a really good field journal. We look for balance. Almost all of the applicants we look at have 8-10 papers minimum. Probably 3 of those will be first-author or communicating author papers. We are looking for at least 2 to be in really good field journals and at least one to be during their postdoc (recent).

The vision for their research is really critical. They need to prove that they have a real idea of what they want to do and that it is going to excite a group of 4-5 people, including people who aren't experts in their area.

There is typically a noticeable difference between a candidate who has at least written a research grant and those who have not. This becomes particularly evident in the chalk talk portion of the interview. You can also tell which applicants have written grants because their research statements are much more polished.

At the Skype interview, we get a general sense of whether the applicant knows what they are going to do. That probably whittles the pool down to about 10 people. They have to demonstrate that they own their research and have thought about it. People still answer questions factually wrong at this level—that will sink them. **The other critical thing we ask is, “why do you want to come to our institution and our department?”** Some people can't answer this; eliminates 2-3 people every round. A lot rides on this initial Skype interview.

Once we narrow applicants down to an interview list of 10 people, grants and publications become less important; we actually don't find that having a K99 is a huge predictor of success when they get here.

We are looking at how well they communicated in their talk—it's a diverse audience—undergrads, grad students, lots of people that aren't in their field. **They have to be able to communicate well.** The buzz in the hallway after a job talk takes on a life of its own. Then, we do a chalk talk. We also want to make sure that the applicant is conscientious about teaching.

Leslie C. Griffith, M.D., Ph.D.

Nancy Lurie Marks Professor of Neuroscience and
Director of the Volen National Center for Complex Systems
Department of Biology
Brandeis University
Waltham, MA

The people who have been successful here are people we chose because they fit us. This will be very different than a very large department, which looks for a different kind of fit. We are high quality but small. **We look for someone highly collaborative, who extends boundaries but isn't separate** from the core group. **People that are scientifically diverse end up having really good interactions, because they're imaginative.** Candidates need to do their homework, figure out what people work on, be interested, and collaborative. **We want to see that they will be able to get along with the department.**

We look really carefully at publication record as well. We value **someone who shows judgment in their publications as a postdoc.** An 8-year postdoc with 1 *Cell* paper with 10 authors—that is a red flag to us ... it shows terrible judgment. There are 4-5 papers worth of data in that *Cell* paper. **We look for someone who published in a distributed manner** with some high-profile papers (i.e., in “good” journals) but with also some solid work in what some people may consider “lesser” journals—but still good science.

My process is to look at the CV, papers, where they are publishing, what the topics are. Then, I look at the research statement. They have to **convince me in a 4-page research statement that what they did was important, sound, interesting. The research statement makes a really big difference and the letters of reference do, too.** If I'm really interested, I'll go back to the papers. I have confidence that if a paper is published in a reputable journal, it was adequately reviewed. **It's the person's plans, ideas, and way of expressing themselves that make a difference.**

They should have a strong letter from postdoc mentor, graduate mentor, and maybe a collaborator letter. You can tell when someone writes a letter and they don't really know the person. It's bad when somebody has a letter from someone who doesn't really know them. That rings false.

Communication matters. **The 5-minute pitch, the ability to respond to questions without panicking is important.** They have to **be able to give a good talk** that will not only engage neuroscientists but biologists, psychologists, biochemists, physicists, etc. **I would say, though, that the chalk talk is the major separator. Some people give beautiful presentations but go down in flames during the chalk talk.**

Marc Freeman, Ph.D.

Director
Vollum Institute, OHSU
Portland, OR

Creativity is an invaluable commodity that can serve a person in science their whole life. I personally gravitate toward applicants where I read their package and learn something new and interesting, and I get convinced that there's room for a lot of exciting and important questions to be explored. With the assumption that the science will be high quality, **novelty is a big deal. Even before looking at the papers, we want to know whether an applicant is looking at a really interesting biological question.** The good science always wins out. Usually that means the funding follows.

One doesn't need a paper in a so-called “high-profile” journal to be competitive, but having papers only in lower tier journals probably won't cut it. **Very interesting, well-done science that appears in highly respected journals will do it.** It is important to see that the candidate has been successful at each career stage—history will repeat itself when they are PIs.

Grants and papers are nice, but certainly don't guarantee anything. One gets the interview based on what they've done and how they've presented it to us in their application. Did we get excited enough to offer them one of a limited number of slots to visit? **Having funding is unimportant.** If somebody is doing novel, interesting, important research, we can then help them get funding. It's our job to mentor them to help them get funding. I don't see a lack of current grant funding as a problem at all. In fact, many people that get funding like K awards do so because their PI basically writes it with them. It's not necessarily a reflection of the candidate's ability to get funding.

We want to be convinced that the person is excited to join us. Would they look forward to being here and why? Does their reasoning make sense? Not all people are a great fit for us, nor our environment a great fit for them. The match is key.

One ultimately gets hired by convincing us that they'll do something interesting and that **the ideas are the applicant's (not just fed**

to them by their boss). **The chalk talk is the most important part of the visit.** Anybody can give a polished presentation given enough practice. The chalk talk is where we see their understanding of their work, creativity, and ability to make a compelling argument.

We're looking for the kind of person who has the disposition to run a lab; some don't, so we're also looking at management potential. You want someone who's going to be comfortable working with a whole lot of people and personality types and can inspire them to work hard. **If someone comes into an interview and has bad interactions with faculty or doesn't interact well with trainees, that's a red flag.**

Networking is important. An applicant will be helped if someone on our faculty knew them, heard them give a talk, or met them somewhere. It can really help. It will help get them through the door. It's important to be known in your field even before you are a PI. **You can get a lot of credit in your application if people who are outside your immediate orbit and who have no vested interest in your success are vouching for you in recommendation letters.** I encourage my postdocs to get to know PIs at other places and build relationships. These types of references indicate that you have started to gain the respect of your field.

Matthew N. Rasband, Ph.D.

Professor and Vivian L. Smith Endowed Chair in Neuroscience
Baylor College of Medicine
Houston, TX

We do not use funding as a litmus test for any applicant that we're interested in, it's simply not one of the major criteria. If a person has a K99, great—we view it as a bonus—but it is not considered as a requirement.

I am interested in applicants who can demonstrate continued and sustained high productivity, regular publishing of papers. In the neuroscience field—if I saw one applicant with 1 CSN paper and another applicant who had 3 papers in a top tier journal, I would go for the one with three papers in a heartbeat. I am far more interested in people who show and demonstrate that they know how to “walk the walk” and “talk the talk” again and again. That is **the most important criterion—continuous, sustained productivity. I want to see that they've climbed the mountain, gotten to the top, and started to climb another mountain, over and over.** Some mountains will be higher, and some lower. But I want to see that hungry to climb mountains.

In fact, it is a bit of red flag if I see only CSN papers—because I wonder whether their perception is that early on in their faculty position they have to publish in big name journals. That may be their personality or possibly their experience in their prior labs. My impression is that, as faculty, they **often waste time spinning their wheels going through reviews only to be rejected by the vanity journal and then they go to their perceived lower journal. They could have spent that time starting another project** (“climbing up another mountain”).

During the hiring process, we ask the committee to come up with their top 6-10 applicants and then **we look at their research statement. What is their vision for what they want to do? How would they fit in the department?** We are interested in looking for the very best scientists and people who have the best vision and ideas, who can clearly articulate what they want to do, and why they want to do it. It is a subjective evaluation, but **if somebody can**

write a really compelling vision in their research statement, that puts them way ahead.

There should be at least a couple of labs that a candidate can work synergistically with and collaborate with. I want someone who I could talk with to bounce ideas off of each other.

Frequently, many of the top candidates we get are from colleagues who we know through previous interactions. The best cases are where there are outstanding people, who are reaching out, and their mentors are reaching out—mentors reaching out is very important, maybe more important—it **does matter who the letters are from. If the letter is from someone who we know and trust, the letter carries more weight.**

Applicants can cold-call, but a more effective strategy is if you have a mentor that has relationships with chairs and deans that can reach out. The mentor can have much more of an impact than the applicant cold calling themselves.

The most important component of the interview for me is the chalk talk—it is the thing that always sells it. Candidates have spent years thinking about their particular projects, so if they can't knock their presentation out of the park, that is an obvious problem. But can they stand up at a chalkboard, respond to faculty questions and defend their ideas? We want to know what it is that they cannot wait to get into the lab to do: we want to know their vision. **The chalk talk is the deciding factor.**

Summary of senior academic faculty interviews on hiring new faculty

The six individuals selected for these interviews represented a variety of types of research institutions. The institutions ranged in size from large to small; some were affiliated with medical schools and some were not; some were public institutions and some private. A common feature among all, however, was excellence in research and a high expectation on faculty to obtain major grants to support their research as faculty. Our interviews suggested that, whereas funding and papers in prestigious journals can play a role in hiring, individuals doing the hiring are fundamentally looking for thoughtful, highly creative, and well-trained individuals who are in pursuit of novel discoveries, fit well into their departments, and are well-suited to personal interactions with people that have different perspective and experiences. Critically, all of those interviewed placed a high value on an individual being the driver of their research, a person with a vision for where their work will go in the future, and a sense that the work will be important. All stated that one of the most important components of an interview was the chalk talk in which the applicant needs to be able to discuss their research ideas and answer potentially unexpected questions from faculty that may be experts or may know nothing about their field. A clear negative is where the applicant is perceived to have been working on the mentor's research, with a lack of clear vision of how they themselves will contribute something new.

DISCUSSION

In the current paper, we set out to address some of the frequent myths that we hear at NINDS about perceived metrics of success to obtain a tenure-track faculty position. We used a data-driven approach that examined the funding history and publication record of NINDS ESI R01 applicants who obtained their first tenure-track faculty position during the K99 era. We found that, whereas a history

of funding and publication in high-profile journals may be beneficial to an applicant, these factors are not necessary to be successful in the academic job market. Comments by some of those we interviewed suggest that caution should be applied to the pursuit of a CSN paper. Certainly, there may be individual departments that require applicants to have funding, or potentially a CSN publication, to be considered for hiring. J. LoTurco at the University of Connecticut stated that this was an important factor in an initial screen of applicants. Overall, however, 82% of the institutions that hired an individual in our cohort hired somebody who did not have funding before being hired, and 60% of the individuals hired did not have prior funding.

On the necessity for funding and/or CSN publications to obtain a tenure-track faculty position

Trainees with transition funding receive more job offers (1) and virtually all NINDS K99/R00 awardees obtain independent research positions. However, the number of K99/R00 awards is very small relative to the number of research positions available. The key point, however, is that inasmuch as most K99/R00 awardees obtain independent research positions, few who obtain academic positions had a K99/R00 award.

Similarly, whereas just over half of the individuals in our cohort had a first-author CSN paper before obtaining a faculty position, nearly half did not. Consistent with our data, a survey study by Fernandes *et al.* (1) suggested that neither funding nor publication metrics were able to distinguish between those who were hired into faculty positions and those who were not. A study by van Dijk *et al.* (2) suggested that publications in high impact factor journals could be used to predict success in becoming an academic PI. These findings are not inconsistent with ours based on a similar distinction as that made between K99/R00 awardees getting positions and needing a K99/R00 award to get a position. It is not unusual that individuals with one or more outstanding publications in a high impact factor or high visibility journal are highly competitive for academic positions. Our data support this conclusion, in that approximately half of our cohort had first-author CSN publications. Our data demonstrate, however, that such publications are not necessary to obtain a faculty position in that approximately half of those hired did not have one. Similarly, a survey study by Martinez *et al.* (3) suggested that publication in a high impact journal was relatively unimportant relative to other factors in the success of underrepresented minorities obtaining faculty positions.

Knowing you and your work firsthand appears to play an important role

Our data suggest that there are other factors beyond the scientific accomplishments of the individual that can also play a role in obtaining a faculty position. For example, 41% of our cohort was hired into an institution at which they had previously conducted research (i.e., where they were known). This was apparently more important for individuals who took an intermediate position between the postdoctoral fellowship and the tenure-track faculty position than for those who transitioned directly from postdoctoral position to the faculty position. The basis for this latter distinction is beyond our ability to explain with our data, as most of the individuals who took intermediate positions did so at their postdoctoral institution. Perhaps related to this, previous studies have shown that the doctoral institution at which individuals train is a factor that influences the competitiveness of an applicant for an academic position (4, 5).

Previous studies also found a relationship between the career support a postdoctoral advisor provides and the likelihood that an individual would obtain a tenure-track position (3, 5). One might surmise that this support can go hand-in-hand with providing strong recommendations and even proactively promoting candidates for faculty positions, which some hirers we interviewed stated as strong indicators for selecting candidates for interviews.

The focus on scientific vision, quality, and potential for collaboration

The results of our study are consistent with an opinion piece by Martin (6) on tips for obtaining a faculty position. To summarize, a broad set of factors is involved in obtaining a faculty position. There is no question that publication of high-quality science is important. Moreover, one can surmise that publications in high-profile journals and obtaining funding can be beneficial (but see caveats suggested in part II above). However, our data clearly demonstrate that neither publishing in high-profile journals nor obtaining funding during training periods are required. Moreover, the faculty interviewed in our study indicated that they valued a few significant papers (significance relating to the science, not to the prestige of the journal) over many shorter, less important papers. Our data, together with the information gained from interviews, indicates that doing high quality science, being able to articulate a vision for your science, owning a project that serves as a starting point to realize your vision, communication skills, and personal fit within an environment are all key factors in obtaining a faculty position. On the basis of both our data and interviews with hirers, accomplishments such as competitive funding or publication in a CSN journal, although likely beneficial, are not necessary.

Last, there is a growing understanding of the importance of diverse viewpoints and perspectives to scientific progress, such as the benefits of bringing diverse perspectives to innovation and problem solving (7–9). In line with these findings, several of the hirers we interviewed described an increased emphasis in the hiring process of seeking individuals who valued and/or provided a larger diversity of perspectives.

Confidence in the approach we used to answer the questions asked

Ideally, to do the analyses in part I of this paper, we would have had a list of all neuroscientists hired into tenure-track positions in a given year. To our knowledge, such a list does not exist. We created a cohort from a complete, defined group of individuals who recently obtained tenure-track positions and asked what accomplishments they had before being hired. Although our cohort creation did not depend upon any assumptions, our approach benefited from the knowledge that virtually all individuals who were supported by a K99/R00 award and transitioned into tenure-track assistant professor positions applied for an R01 within a few years of starting their faculty position. Of course, our cohort included only a subset of those hired during the specified time period, but this limitation likely led to an overestimate of the role of funding and publishing in high-profile journals in obtaining a faculty position. For example, many are hired into tenure-track faculty positions that do not have an expectation of applying for an NIH R01 or equivalent. These might include individuals who took faculty positions at smaller institutions, such as liberal arts institutions, who would not frequently be applying for R01s. Similarly, we did not include individuals who

have applied for smaller NIH awards (e.g., R21, R03) or individuals whose work is well suited to nonbiomedical research funding. We consider it is unlikely that these individuals have a higher rate of pre-hire funding or CSN journal publications than our cohort. These assumptions are supported by the fact that 96% of NINDS R00 awardees apply for an R01 by the end of their 3-year R00 grant period; we would not have missed a lot of individuals who had K99/R00 funding by not including these other groups.

Our cohort was limited to a 3-year window of application to NINDS and did not include individuals who applied to other NIH institutes for their funding. However, there is no basis for believing that the results would be fundamentally different had we chosen a different set of grant application deadlines or included neuroscience applicants to other NIH institutes. Moreover, because of the ease of collecting the information, we expanded our K99/R00 analysis to both a 5-year window of applicants for an NINDS R01 and to include NIs and ESIs. Even with this expansion to almost 1000 individuals who applied for their first NINDS R01 over a 5-year period, the upper limit of the percentage of tenure track faculty hired during the K99 era remained at 11%.

We chose the six faculty members to interview on the basis of their experience in hiring individuals into neuroscience faculty positions at different types of institutions. One can reasonably ask whether these six institutions represent a larger number of hiring institutions in the country. Two observations suggest to us that the answer is yes. First, the six hirers we interviewed independently provided remarkably consistent descriptions of critical issues for hiring an individual into a tenure-track position. Second, the expressed lack of importance placed on funding by five of six of these individuals is supported by our data that 82% of institutions in our study hired an individual who did not have prior competitive funding.

Our approach was intended to directly address the myths that we framed. We did not seek to determine what accomplishments provide a competitive advantage for obtaining a faculty position nor did we address whether one accomplishment was more important than another. Our goal was to address the very pervasive myths that we hear almost daily that relate to whether certain accomplishments are needed to obtain an academic faculty position. Postdoctoral fellows often feel quite stressed about the perceived need for a K99 to obtain a faculty position. We at NINDS have known since the initiation of the K99 award, simply by knowing who is applying for NIH grants, that this myth was not true. The pervasiveness of these myths is potentially damaging in several ways: (i) It might cause trainees to focus on these metrics of accomplishment rather than their training and the pursuit of important scientific questions that might not quickly turn into publications in prestige journals or funding opportunities, (ii) it may discourage trainees from pursuing academic faculty positions because they feel they have not fulfilled these perceived requirements, (iii) it can mislead trainees regarding their understanding of what is important for their future, and (iv) it can put undue, and unnecessary, stress on trainees who believe they must achieve these specific metrics of accomplishment. Equally damaging, in our view, is the potential for prolongation of time in graduate school or postdoctoral training that occurs for some based on the belief that their work must be published in a very prestigious journal to be competitive for a faculty position. This focus on journal prestige or, similarly, on the importance of obtaining competitive funding during training, can lead trainees to miss

opportunities to obtain critical skills and broad education that their time in a training position allows them the time to explore and that will benefit them greatly in the long run. This was reinforced through our interviews with hirers, all of which placed great emphasis on applicants having a clear vision and passion for their science, a detailed understanding of both the technical aspects and significance of their project, and an understanding of how they might fit into a new scientific environment. Not only were funding and publications in prestigious journals not critical factors for obtaining first faculty positions at five of six of the institutions we interviewed, but it was also pointed out quite clearly that excessive pursuit of a very high-profile paper at the expense of steady publication of important work may be viewed by some as a negative.

MATERIALS AND METHODS

Data sources

Data were obtained from the Information for Management, Planning, Analysis, and Coordination (IMPAC II) database, which is used by NIH staff to track and manage grant applications and awards. Most of the data were manually extracted from the NIH biosketches included with grant application submissions. When biosketches did not contain key information or lacked adequate detail, data were sourced from other repositories of publicly available information including departmental and laboratory websites, PubMed, LinkedIn, and Twitter.

From these collective sources, we were able to ascertain the following for all individuals in the study cohort:

- 1) The positions held and the time spent in each position from matriculation into graduate school to the start of the tenure-track or equivalent position. The positions considered were graduate student, “postdoctoral positions” (positions that start immediately after obtaining a doctorate, often called “postdoctoral fellows”), and what we termed intermediate positions before beginning the assistant professor (or equivalent) position (see below for definition of intermediate positions).

- 2) Funding history (including NIH F32, K-series and R-series grants, and non-NIH grants).

- 3) Authored publications before the start of the faculty position. For each publication, we identified the journal, whether the individual was listed as first author (including co-first author) and whether the paper was published from work performed during graduate school, postdoctoral training, or the period identified as within an intermediate position (papers that included the predoctoral advisor as an author were considered to have been associated with graduate school and papers that included the postdoctoral advisor were considered to have been associated with the postdoctoral period).

Data analysis

Data were organized in Excel for the basic descriptive statistics performed in the study. No inferential statistics were performed as the intent of our study was to determine whether certain accomplishments are required to obtain an academic faculty position, not to ascertain statistical differences in the prevalence of accomplishments by different groups of individuals nor to determine what accomplishments might make one more competitive for a position.

Intermediate positions

We defined intermediate positions as those that occur subsequent to a postdoctoral fellow position and before starting the tenure-track

or equivalent position. Titles in our cohort included: research assistant professor, instructor, research associate, adjunct assistant professor, assistant professional researcher, assistant project scientist, assistant scientist, lecturer, research investigator, research scientist, and staff scientist.

[View/request a protocol for this paper from Bio-protocol.](#)

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