Dermatology's Researchers of the Future: Our Workforce Pipeline and Richest Opportunities

Dermatology offers impressive opportunities for innovation and investigation. The skin is the body's largest organ and plays critical roles in immunologic surveillance, protection from infection, thermal regulation, and tactile sensation (Hay and Fuller, 2015). Skin diseases are widespread, affecting nearly one-third of the global population and accounting for a significant portion of the global nonfatal disease burden (Hay et al., 2014). Because the skin is easily accessible, both basic science study outcomes and clinical trial end points can be assessed in a timely and straightforward fashion.

Although skin disease is a commonly encountered chief complaint in primary care, there has historically been a tendency to trivialize dermatologic diseases because of their nonfatal nature, and as a result, less research funding has been devoted to them. Indeed, the discrepancy between disease burden and research funding can be quite large in dermatology with diseases such as acne vulgaris and decubitus ulcers receiving little funding despite their significant morbidity (Karimkhani et al., 2014a). However, the high prevalence of skin diseases, their substantial impact on health and well-being, and the cost of their treatments justify ongoing investigation in dermatology. Moreover, the payoff from research in dermatology is outstanding. Recent progress in biologic drug development has revolutionized treatment for psoriasis (Leonardi et al., 2015) and advanced melanoma (Karimkhani et al., 2014b), and in the process, has illustrated that skin diseases provide a powerful opportunity to demonstrate proof of principle. Unfortunately, today's financially austere research climate presents unprecedented regulatory and funding threats to both junior and senior researchers. To continue to conduct high-quality research that advances patient care, the field of dermatology must identify the dermatologic researchers of tomorrow and prepare them to tackle the challenges that lay ahead.

The ingredients for a robust scientific pipeline

To create a strong research community within a field, there must be a critical mass of interested and qualified investigators and the available supervisors and mentors to provide guidance to the next generation. Mechanisms for research funding must be in place to both sponsor early research activities and sustain mature investigators. And finally, young investigators need models of successful career pathways to either emulate or modify.

The qualified critical mass

There are a plethora of qualified medical students interested in dermatology. As one of the most competitive residencies in the country, more than 25% of the qualified US medical school graduates who seek a dermatology residency are denied entrance initially (National Residency Matching Program, 2014). These dermatology residency applicants often engage in research early in their careers, producing more publications and accruing more research experiences than their peers (National Residency Matching Program, 2014). However, our residency programs find it challenging to sustain this early interest in research, given the appeal of a clinical career in dermatology, which rates among the highest across the medical disciplines in terms of satisfaction (Leigh et al., 2009).

Even among trainees who desire careers in academics, most prefer a teacher-clinician track to a track in basic science or clinical research (Reck et al., 2006). Residents cite multiple reasons behind their declining interest in academics, including bureaucracy, lack of adequate mentorship, fear of not meeting academic requirements, and salary (although salary discrepancies are often less than rumored, especially over time) (Reck et al., 2006; Tierney and Kimball, 2006). Young dermatologic surgical faculty who start their careers in academia often depart for private practice because of similar concerns (Tierney et al., 2011). Our current and evolving demographics also predict several trends that will likely affect the dermatology research workforce. Residents today on average are older than in the past and have amassed substantial debt at graduation, factors that over time may affect their willingness to take financial risks in research careers when income for clinicians is all but assured, given the continued robust demand for dermatologic services (Sung and Kimball, 2014).

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Nevertheless, although academic departments experienced increased rates of attrition in the early 2000s, this trend may be reversing as changes in health care policy and delivery make solo practices less sustainable, especially for new physicians (Loo et al., 2007). Among graduating residents, the percentage pursuing academic careers has increased substantially over the past decade, from 13% in 2005 to 19.5% in 2012 (Sung et al., 2015). However, these trends must not be taken in isolation because employment in academic practice does not necessarily correlate with scholarly productivity. The role of the academic medical center has evolved to require a larger workforce, much of which is not focused on research.

Interestingly, although undersupply may be an issue in the MD workforce, the opposite may be true in the PhD workforce, where traditional academic jobs are in short supply. A 2009 National Science Foundation survey found that only 14% of those with a PhD in biology and the life sciences are recruited into academic positions within 5 years (National Science Foundation, 2012). As a result there have been several national calls to reevaluate the training of the PhD workforce, which has in part grown to accommodate an increasing need for a less expensive while still well-trained labor force.

Mentors to guide the way

Young investigators early in their research careers will undoubtedly benefit from mentorship, which plays a critical role in academic medical career development. Studies from other specialties have identified a positive association between mentoring and choosing a career in academics (Sambunjak et al., 2006), and this trend appears to hold true in dermatology (Hill et al., 2010). Mentorship also appears to be associated with research productivity as mentees report more publications and grants than their counterparts without mentors (Sambunjak et al., 2006). Within dermatology, having a mentor as a young faculty member increases the likelihood of obtaining tenure track and grant funding (Sperduto et al., 2013). One advantage of dermatology's small size as a field is that young researchers may have unique opportunities to interact with well-known mentors. There appear to be key mentors in dermatology who guide many mentees. In a survey of 290 dermatologists asking them to name key mentors, 53 mentors were named by three or more survey respondents (Bergstresser, 2011). Such established mentors can provide invaluable guidance, and we must continue to foster their interactions with young researchers in dermatology.

Funding the journey

Even with a passion for research and strong mentors, a young investigator still needs a sustainable career path to follow. The Dermatology Foundation has played a critical role in launching early investigators and providing seed funding that later is leveraged into federal support (Boris et al., 2012). For basic science research, there is a well-defined funding pathway in place with T32 National Institutes of Health (NIH) institutional research training grants for trainees, followed by mentored K awards for young faculty, with the goal of ultimately reaching the R01 series. In contrast to basic science, the funding pathways for clinical and translational research are only well defined in the early stages. There are pathways in place for medical students to engage in clinical research, including a 1-year clinical research training program at NIH, and certain institutions, including Harvard and University of California San Francisco, have also created clinical research training programs for young faculty using funding from K30 awards (Teo, 2009). More than 20% of K awards are now dedicated to clinical research, including the K23 and K24 grants (Teo, 2009). However, the pathway for a clinical trialist beyond these awards remains unclear. Perhaps, this may explain why there are fewer applicants for these grants compared with other K awards and why the pipeline of clinical trialists has not grown significantly over the past few decades.

Despite the increasing diversity of opportunities, and perhaps exacerbated by them, the competition for funding is fierce. Investigators are facing the lowest success rates ever for grant applications to the NIH (Hromas et al., 2012). Cuts to NIH funding due to the economic recession in the late 2000s and the budget sequestration in 2013 have decreased NIH funding such that today's available NIH resources are at least 25% less than those in 2003 (Alberts et al., 2014). Equally if not more concerning, less and less funding is afforded to young scientists. The average age of a first R01 or equivalent grant for a physician researcher has increased from less than 38 years in 1980 to more than 45 years in 2013 (Daniels, 2015). In 2010, only 3% of R01 grant recipients were younger than 37 years compared with 18% in 1983 (Daniels, 2015). Clinical researchers may face additional barriers, ranging from regulatory burdens to scalability as even small clinical trials are very expensive to execute.

Preserving the legacy of research

Thus, the dermatology workforce possesses many of the necessary qualities for a strong investigative community, but the young dermatologic researcher faces numerous challenges. To address some of these challenges, the Society for Investigative Dermatology created the Resident Retreat for Future Academicians, and the European Society for Dermatological Research created an annual Academy for Future Leaders in Dermatology with a strong emphasis on research careers. One study found that those who attend the Society for Investigative Dermatology Retreat were more likely to enter a career in academics, although attendees comprise a self-selecting group (Hill et al., 2010). In addition to dedicated programs for interested trainees, there is a need for mentor training, especially because lack of effective mentorship may cause trainees to lose interest in academics. Half of dermatology residency program directors identify a need for more structured mentorship programs (Donovan, 2009). In 2007, University of California San Francisco created a Mentor Development Program to train mentors. Initial results have been promising as nearly all participants reported improvements in their mentoring skills and mentoring goals (Feldman et al., 2012). Such programs for both trainees and mentors in dermatology will undoubtedly strengthen the pipeline of future dermatologic researchers.

Given the impending funding challenges, we must continue to seek diverse sources of funding. There are federal organizations other than NIH that finance research. For example, wound research receives a substantial amount of