

# Enhancing the Development and Retention of Physician-Scientists in Academic Pediatrics: Strategies for Success

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The physician-scientist, defined as an individual with a doctor of medicine (MD) degree who devotes significant effort to biomedical inquiry, plays an essential role in the translation of laboratory discoveries into novel therapies to improve outcomes of human disease, yet the “vanishing physician-scientist” remains a persistent problem.<sup>1-5</sup> Despite much discussion on approaches to enhance the development, recruitment, and retention of physician-scientists, decreasing numbers in this vital group continue to be a major challenge within academic medicine. This decrease continues in an era in which there is an increasing need for physician-scientists to provide a critical bridge to link the goals of improving health outcomes and disease prevention with the dramatic acceleration of scientific and technologic advances in wide-ranging fields such as molecular biology, genetics, genomics, proteomics, metabolomics, bioengineering, imaging, physics, and precision medicine.<sup>6</sup>

The steady decrease in physician-scientists is related to diverse issues, such as generational changes in career goals and expectations, financial pressures, lifestyle considerations, limited exposure to academic role models who are active in research, an increasing burden of administrative oversight, balancing demands of sustaining clinical skills with learning new research methods, the increased complexity of biomedical technologies, and the challenge of mastering an exponentially increasing body of scientific knowledge. Changes in the nature of academics in the current era of corporate medicine, with shifting priorities of medical centers and intense economic forces, have impacted personal choices at each career stage, further contributing to a persistent “leakiness” of the pipeline.<sup>1</sup> Low funding rates of grants sponsored by the National Institutes of Health (NIH) and fewer opportunities from foundation sources are discouraging trainees and junior faculty from selecting careers as physician-scientists. Unclear expectations, competing demands, and the qualitative metrics often used in promotion and tenure processes in many institutions further add to the perception of the physician-scientist path as a risky career choice.<sup>7</sup> These factors have led to fewer and older physician-scientists, as reflected by the steady decrease in the number of physician-scientists aged younger than 60 years.<sup>2,3</sup>

This report summarizes presentations at the 4th Annual Neonatal Cardiopulmonary Biology Young Investigators Forum held

in Chicago in the fall of 2017. This symposium brings together advanced postdoctoral trainees and junior faculty from diverse subspecialties that are investigating basic, clinical, or epidemiologic aspects of neonatal cardiopulmonary biology. Senior faculty from each of these disciplines were invited to discuss career-related issues and to provide advice on such topics as mentorship, career development, grant writing, manuscript publication, and related academic topics. Their presentations provided the basis for this report, which is a melding of several key topics on the theme of successful career development for physician-scientists with broad relevance to faculty in all disciplines of academic pediatrics.

## Mentorship and Successful Transition to Junior Faculty

As aptly described by Joseph Goldstein, the struggle of the junior physician-scientist can perhaps be best depicted as an upside-down version of a wooden ladder sculpture created by artist Martin Puryear.<sup>8</sup> In the original sculpture, the rungs of the ladder are wide at the bottom, but become increasingly narrow as the ladder extends, representing diminishing opportunities as one reaches higher levels of success. For junior physician-scientists, however, this ladder is upside-down, highlighting the great difficulty in getting a foot on the narrowest rungs at the early career stages.

One of the most important determinants of success for the junior physician-scientist is the development of an excellent mentor-mentee relationship. Strong mentorship increases mentee career satisfaction, retention in academic medicine, productivity, and grant funding.<sup>9,10</sup> Successful mentorship entails not only scientific research training, but also fostering the

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transition to independence and actively promoting the mentee's career development (eg, "sponsorship"). It requires a mentor with adequate interest and influence to aid in the career advancement of the junior physician-scientist by increasing their national visibility and recognition.<sup>11</sup> The mentor must also be able to evaluate and critique findings on a timely basis, encourage strategic and creative thinking, and, most important, exemplify and uphold professional standards of integrity. Mentor selection should be based on the prospective mentor's enthusiasm and interest in developing the mentee's career, ability to provide support and training in the field, national or international reputation, track record with prior trainees, funding, and personal character.

The mentor-mentee relationship can be complicated and is not a passive process. Successful mentorship is greatly dependent on mutual trust, respect, and clear communication regarding expectations and roles. Truthfulness and recognition of differences in communication styles are necessary for success and for resolving the occasional difficulties that can occur in creative and intense research settings. Too often, this relationship is viewed as unidirectional. The mentee's responsibilities include recognition and appreciation for the mentor's commitments, willingness to work hard without a sense of self-entitlement, taking an active role in planning meetings, performing experiments and analyzing and presenting findings, respecting others in the laboratory, and displaying high levels of personal and scientific integrity.<sup>12,13</sup> The mentee must actively exhibit commitment and enthusiasm for research and a strong sense of professionalism to develop a successful academic career.

A particularly vulnerable period for physician-scientist attrition is related to the challenge of attaining independent R-level funding in an increasingly competitive funding climate. MD applicants continue to have lower first-time R01 success rates compared with doctor of philosophy (PhD) and MD/PhD applicants, and are older at the time of attaining their first R01.<sup>1,3,14</sup> The importance of persistence and resilience as key determinants of success cannot be overemphasized. MD applicants who did not attain R01 funding on the first attempt, but later apply for a subsequent, distinct R01 award, continue to have lower success rates than PhD or MD/PhD applicants, in part owing to lower rates of resubmission.<sup>14</sup> It is imperative to depersonalize the peer review process, to interpret an unfunded grant application as an opportunity for improvement and not as a failure, and to recognize that even the most established investigators have grant submissions that are poorly scored or not discussed. Fortunately, the NIH recognizes these challenges and has instituted policies and programs that help to support young investigators. These include the Early Career Reviewer Program, which allows junior investigators the opportunity to participate in the Center for Scientific Review to both provide training in peer review and insight into how to improve future applications, and the Early Stage Investigator designation. In addition, the increasingly competitive funding climate may indirectly affect junior faculty, because even senior investigators struggle to maintain funding, further limiting the availability of role

models, mentors, and additional resources to support young physician-scientists.

Given these challenges, the success of the young physician-scientist requires substantial and sustained institutional support. Traditional startup packages intended to provide funds for 3-5 years are likely to be insufficient, particularly with the increasing costs of biomedical research. Ensuring success will often require multiple years of hard salary support from the institution to allow protected research time, and opportunities for bridge funding to allow physician-scientists to maintain momentum and grow their research programs during lapses in NIH funding.<sup>3</sup> Academic institutions should consider revising and modernizing appointment and promotion policies to ensure that team science is appropriately rewarded and that junior faculty are not discouraged from collaborating with senior faculty for fear that such collaborations will hinder the perception of their independence, and to de-emphasize the importance of metrics such as publication number and journal impact factor, which may not correlate well with the work's scientific impact or its contribution to societal needs.<sup>15,16</sup>

### **Building a Foundation for Career Development—The Division Chief's Perspective**

Supporting the successful development of physician-scientists is integral to the mission of academic divisions and an important focus for division leaders. Fellows and junior faculty require clear guidance relative to the nature of organizational infrastructure, the roles of academic leadership at their specific institution, expectations of support for career advancement, and the optimal balance of clinical and research responsibilities. Although most medical schools maintain the tripartite mission of research, education, and clinical care, the number of physicians with careers spanning all areas is decreasing. As such, division chiefs are often central to the challenge of reversing trends within academic departments that threaten the physician-scientist model. Although specific obstacles vary between institutions and across specialties, sharing strategies for the successful career development of physician-scientists may be valuable.

Although the development of successful physician-scientists often begins before fellowship training, fellowship remains an important period of career development for physician-scientists. To optimize success, research time should be protected from clinical duties, including a schedule that permits multiple consecutive research blocks, particularly in the latter one-half of the fellowship. Furthermore, mechanisms to extend fellow research training, such as NIH-funded T32 and K12 awards are valuable opportunities with proven success that should be pursued actively and supported by both the division and department. For example, fellows and junior faculty who were supported by either the National Institute of Child Health and Human Development Pediatric Scientist Development Program, or by Child Health Research Career Development Awards (K12 awards) have greater success rates for attaining R01 funding.<sup>17,18</sup>

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