Introduction: Physician-Scientists in the Evolving Landscape of Biomedical Research

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The seed of this supplement was a physician-scientist symposium held in April 2017, cosponsored by the Ragon Institute and the Harvard University Center for AIDS Research. The goals of the symposium were to highlight excellent work by physician-scientists from around the country, to explore the variety of ways in which clinical training influence research, and to develop ideas of how to more completely support the careers of physician-scientists. To achieve these goals, we asked Catherine Blish, MD, PhD (Stanford University, Stanford, CA), Victor Nizet, MD (University of California–San Diego), Michael Glickman, MD (Memorial Sloan Kettering Cancer Center, New York, NY), Ramnik Xavier, MD (Massachusetts General Hospital, Boston), Oren Rosenberg, MD, PhD (University of California–San Francisco [UCSF]), Andrea Cox, MD, PhD (Johns Hopkins Medical Institute), Liise-anne Pirofski, MD (Albert Einstein College of Medicine/Montefiore Health System, Bronx, NY), Peter Hunt, MD (UCSF), and Don Ganem, MD (Novartis), to offer their individual and institutional perspectives on these issues. We found the day to be thought-provoking and a welcome recognition that many of the challenges we face are indeed shared by others walking this path. In this supplement, we hope to bring the insights and perspectives provided by this outstanding group of physician-scientists to a larger audience.

What has been echoed repeatedly in discussions and these articles is the critical importance of physician-scientists to medicine, science, and society. Michael Glickman writes that the physician-scientist is an individual in whom clinical problems provide an inspirational spark, and Peter Hunt continues by describing the physician-scientist as someone who then uses that spark to inform research involving human subjects. Many remarkable examples show how physician-scientists in the field of infectious diseases influence the practice of clinical medicine

and the development of academic science. In this supplement, Tom Merigan writes about developing pivotal antiretrovirals to control the human immunodeficiency virus epidemic, Don Ganem provides insight into the process of converting basic research ideas to clinical products in industry, and Liise-anne Pirofski and Arturo Casadevall describe their work challenging paradigms of inflammation. These physician-scientists illustrate examples of the impact that this career path can have on translational research and clinical practice.

Despite these contributions, the number of infectious diseases clinicians who choose to pursue a physician-scientist career path is steadily dwindling. The driving forces behind this trend are a combination of financial, career, and social obstacles, as described by Andrea Cox, Catherine Blish, Upinder Singh, Michael Glickman, and Jay Vyas, among others. Strategies to overcome barriers at various points in the career track are suggested by the authors, as well as in a contribution from the Infectious Diseases Society of America. Common themes include the need for enhanced mentorship networks that explicitly value both mentor and mentee, academic tracks that support research during periods of clinical training, and funding for protected research time during training and early faculty years. An additional challenge, which is explicitly discussed less often, involves the need to maintain the confidence and clinical skill set to continue to practice medicine. As addressed by Nesli Basgoz, institutional supports and expectations that facilitate clinical excellence by all practitioners merit consideration for inclusion in a comprehensive approach to aid the physician-scientist along their career path.

Ultimately, developing effective mechanisms to nurture the pipeline of physician-scientists returns to the definition of a physician-scientist. As described by Cindy Sears, this definition is both complex and necessarily evolving, as both clinical medicine and basic science adapt to new discoveries and clinical needs. Several fundamental questions regarding this career path remain. How are individuals at the intersection of research and clinical care evaluated in comparison to their counterparts who spend their time completely in one world or the other? How do we appropriately balance the variables of effort spent with patient care, teaching, grants, and publications in both facilitating and judging success? What are the tangible individual

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outcomes regarding the ability to translate from bench to bedside and vice versa?

Although society has realized many of the benefits of physician-scientists as a group, maintaining a robust and diverse community begins with identifying individuals with early potential and developing strategies to support them throughout their careers. Our aim in bringing together the articles in this supplement is to elicit thought and discourse about how to successfully overcome obstacles in the evolving landscape of biomedical research for the generations of new minds drawn to this career path by the tremendous potential of the synergy between science and medicine.

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