An *Academia* exclusive

Working Together To Revitalize the Physician-Scientist Workforce of Tomorrow

International efforts should be initiated to address the problem of the threatened physician--scientist career path. Comparative study should be undertaken to understand differences amongst countries in terms of the current issues that confront physician-scientists – says Andrew I. Schafer

Academia: Can you briefly define the notion of the "vanishing physician-scientist" to our readers? Is this a worldwide problem, or is it more local, for instance due to the specific way science is managed in specific countries?

Andrew I. Schafer: *There is some disagreement about the definition of a "physician-scientist." In fact, very interestingly and importantly, there are striking differences in how the notion is defined between the current generation of leading physician-scientists and the next generation, which includes those just beginning their careers or finishing their research training. Separate and independent opinion polls among these two groups in the US were recently published within just one year of each other. The current generation of established clinical investigators felt that a "physician-scientist" should be a someone is committing a minimum of 50 percent of his or her total professional effort to research, whereas most of the younger people did not think this amount was necessary.*

In either case, however, most of us define the "physician-scientist" broadly to encompass individuals with medical doctorates (the MD degree in the United States), with or without other doctorates like PhD degrees, who conduct research anywhere along the entire continuum of medical investigation, ranging from basic laboratory research to translational and clinical (patient-oriented) research to population-based research like outcomes studies, comparative effectiveness research and epidemiological work.

The basic problem, which has been perhaps more quantitatively analyzed in the US than in most countries in Europe or elsewhere in the developed world, is that the number of physician-scientists has not increased in over 30 years, has been steadily aging, and now is showing signs of actual decline. This is in sharp contrast to PhD-holding biomedical scientists in the US, whose numbers have been rising dramatically; so much so, in fact, that a very large percentage of them are finding themselves without jobs in research.

For the past two or three decades, not only has there been a relative decline in physician-scientists successfully competing for National Institutes of Health grants (which are the "gold standard" for high quality research funding in the US), but we have found that: (a) one-third of them who have obtained initial NIH support for so-called "mentored" (transition to independence) grants do not even make an attempt to apply for a subsequent independent NIH grant; (b) those who fail to get funding on their first attempt are much less likely than their PhD-holding counterparts to try again; and (c) those who have been successful in securing a first independent NIH grant are much less likely than their PhD-holding biomedical researcher colleagues to apply for subsequent NIH grants.

What these data suggest is that not only do we have an aging and declining "pipeline" of physician-scientists, but in fact that "pipeline" is badly leaking. In other words, a very distressing number of young physician-scientists are dropping out of research careers! We must try to understand WHY this is happening. Perhaps too many of them were never fully committed to research careers even from the outset. Perhaps economic pressures have forced them to switch to higher-paying careers in clinical practice. Perhaps the increasing uncertainties of future prospects of governmental or private research support have led them to turn to more secure career pathways. Whatever the reason, I believe the problem of "attrition" of physician-scientists who are abandoning research careers is even greater than the problem of attracting young people into research careers to begin with. Possibly, we are not selecting them carefully enough at the outset.

These factors certainly describe the current situation in North America, but I believe they are similar in Europe and elsewhere in the world. However, as I said, the actual data to document the problem outside North America are not quite as robust. I believe it would be very important and highly instructive for future health policy planning to analyze the problem of the "vanishing" physician-scientist in a comparative way in different parts of the developed world, especially in Europe.

How can physicians contribute to advancing medical research? There are numerous scientists studying biomedical problems at universities and institutes, aren't they enough?

Physicians bring to medical research a unique and vital perspective. Their research is usually inspired by the patients they have cared for. This does not mean, of course, that PhD-holding biomedical scientists are less important. In fact, they are equally important to the overall medical research enterprise. Physicians and non-physicians bring complementary perspectives and strengths to medical research.

The lay public has come to believe that "translational research" is equivalent to "bench-to-bedside" research. This is a misguided view. It fails to take into account the opposite direction of "translation," which is the more classical "bedside-to-bench" research. "Bedside-to-bench" research is what the great physician-scientists of generations past practiced. They made keen observations about their patients that they could not understand, and then took those questions into the laboratory to test hypotheses they formed about mechanisms of disease based on those clinical observations. That is certainly the way I have approached my own research efforts. "Translational research" must be recognized to be a dynamic, bi-directional pathway, like two-way traffic on a street. PhD investigators tend to start out with the development of new methodologies, new technologies, perhaps new drugs – and then they look for ways they might be able to apply those breakthroughs to human health and disease. In contrast, physician-investigators tend to start out with a clinical patient

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problem and then look for methods and technologies to solve those problems. Perhaps this view is too simplistic, but it does highlight the vital need for both directions. So, PhD-holding scientists cannot simply replace physicians in medical research. The essential principle of the constant and dynamic two-way translational pathways to discovery means that removing physicians (in other words amputating the "bedside-to-bench" direction of translational research) would, in my opinion, completely cripple the medical research enterprise.

Our understanding of the human body is constantly growing, and we are seeing rapid development in novel therapies and medical technologies. As a consequence, the way the medical students are taught has also changed. How this will evolve?

It is inconceivable to me that physician-scientists will actually vanish. However, I do think physician-scientists will have to change. Physicians who want to do meaningful, high-impact research in the future will have to be able to adapt to contemporary realities. The first of these is that the dazzling pace of growth of medical science, as well as the equally dazzling pace of growth of medical practice, has made it simply impossible for any one individual to keep abreast of progress in both arenas. The age of the solo physician-scientist is therefore long past. Meaningful medical research has become a "team sport." This is something which makes many in my generation very uncomfortable because they have been accustomed to being able to control all aspects of their research programs. We have to learn to be able to accept shared credit. In the parlance of football (soccer), we cannot always play the position of striker. We cannot want to score all the goals. The more important aim is for our team to win.

Therefore, we will have to increasingly teach research to our students as a collaborative enterprise. Physicians and non-physicians will have to learn to understand and respect the different cultures and perspectives of each other's worlds. And that process must begin as early as possible in the educational process. Future physician-scientists and future PhD scientists have a lot to learn from each other and a lot to teach other, so why not begin early with their research education and training together? We will also have to acknowledge and embrace the idea that the old model of training physician-scientists, which was a rigidly uniform system, is no longer viable. The current and future generations of medical school graduates have very different life priorities and live within very different family structures than the almost exclusively male physician-scientists of generations past who had stay-at-home wives. In the US there has been a dramatic increase in women medical students. Whereas only a couple of decades ago less than one-quarter of all medical students were women, it is now at 50 percent (and rising). At the same time, young women physician-scientists and potential physician-scientists are telling us that they are looking at research careers as being incompatible with raising families, and they do not see any way they could effectively rejoin the full-time physician-scientist workforce if they temporarily tried to reduce their professional efforts to even part-time wwhile having young children. Therefore, they are choosing in large numbers to not even begin research careers. We must be open-minded about the possibilities of different pathways and different roles to success in medical research. We must begin now to individualize and personalize the training of physician-scientists.

International efforts should be initiated to address the problem of the threatened physician-scientist career path. Comparative study should be undertaken to understand differences amongst countries in terms of the current issues that confront physician-scientists. While we all share common challenges, like inadequate support and resources for medical research and research training, we can learn much from each other's experiences and even develop cooperative novel initiatives to revitalize the physician-scientist workforce of tomorrow.

Interview by **Agnieszka Kloch**