SYMPOSIUM

Physician-Scientists: Preparation, Opportunities, and National Need

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Physician-scientists are persons with medical training who spend most or all of their time performing basic, disease-oriented, or patient-oriented research.

Physician-scientists are critical members of the medical research community as the scientific questions they ask derive from their experience taking care of patients. Although there are countless examples of outstanding contributions to recent and remote medical and scientific advances made by physician-scientists, including many meriting the Nobel Prize in Medicine or Physiology, for the past two decades the future of the physician-scientist in Medical School Faculties and Industry has been considered at risk, not for a questioning of their perceived need, but rather because their numbers that are dwindling due to hurdles to training and retention are becoming ever more daunting. This review attempts to identify several of the obstacles and suggest remedies that might alleviate these difficulties.

To illustrate the statement that physician-scientists are falling behind one only need look at the supply of physicians in the United States. Over the past two decades the number of US physicians has increased from under 400,000 to over 600,000 (1); however, during this same period the number of research and teaching-oriented physicians has increased by a mere 2000, from 22,000 to 24,000. One major reason for this dilemma is a reduced number of graduating physicians committed to a career in research and academic medicine. In 1987, 14% of undergraduates entering Medical School planned a career in research; 10 years later this number had fallen to 10% (1). Although this trend might represent a shifting of societal attitudes in general, it is also possible that the reduced representation of physician-scientists on medical school admission committees is contributing to the problem. The lesson for physician-scientists concerned by this "pipeline" problem is clear: we need to volunteer more readily for these difficult but critical committee assignments to represent a strong voice in valuing scientific training and goals in applicants to Medical School.

One approach to addressing the "pipeline" problem in supplying well-trained nascent physician-scientists is the Medical Scientist Training Program, begun in 1964 by the NIH. Through this program and others, 66 US medical schools currently offer a combined M.D./Ph.D. training opportunity; nationally, the program has grown by 22% over the past 15 years, presently supporting a combined M.D./Ph.D. degree for over 900 students in the US (approximately 120 graduates per year). Graduates of this program are highly successful in beginning careers in academic medicine and garnering research support, but it has been estimated that M.D./Ph.D.s comprise only about 10% to 20% of the physician-scientists in the US. By far the most common route to academic medicine has been the path of the "late-bloomer", the physician-scientist who discovers or consummates his or her interest in the science of medicine during or after medical school, attaining the requisite training in science most often while undergoing post-doctoral training in a medical subspecialty. It has been estimated that the number of such late bloomer physician-scientists has decreased by approximately 50% over the past two decades. A large number of reasons for this trend have come to light, including: (i) the increased time necessary for completion of clinical training and decreased perceived adequacy of research training for M.D.s [the latter termed by Brown and Goldstein the "Paralyzed Academic Investigator's Syndrome" (2)]; (ii) economic disincentives for physician-scientists, including low stipends during training in the face of a large debt burden left over from medical school; (iii)

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large income disparities between physicians in private practice and academia; (iv) a perceived instability of NIH-supported research careers; (v) the explosive growth of managed care and increasing demand for physicians to see more patients in academic settings; (vi) declining departmental revenues that can be used to support research through intramural sources; (vii) an increased emphasis on primary care mediated by legislation capping the number of medical specialists, and (viii) poor mentoring and independence issues leading to defection of physician-scientists from academic positions.

The debt burden of the physician-scientist is growing (1). In 1985 the average debt for graduating physicians was $25,000 to $30,000–the difference was whether the student attended public or private medical school; in 1998 this average debt had climbed to $75,000 to $100,000. It is not uncommon for a graduating cardiologist, gastroenterologist, or oncologist to command a salary of $300,000 to $350,000 per year in private practice, compared to a starting salary of $125,000 to $150,000 for an Assistant Professor of the same level of training. One attempted remedy is the NIH Loan Repayment Program, in which up to $35,000 per year of debt is forgiven in exchange for a commitment to academic medicine for a minimum of two years. While a laudable start, some controversy currently surrounds the program in whether eligibility should be restricted to individuals seeking careers in patient-oriented research or should also include physician-scientists engaged in disease-oriented or basic research (3, 4).

An additional growing concern is that medical students and resident physicians are not being exposed to physician-scientists during their training. With residency work hours shrinking by legislated mandate, and the need for practical training increasing with the increasing complexity of clinical medicine, the time available for bringing together the pathophysiological aspects of a patient's disease with attempts to devise targeted therapies has become scarce. Moreover, with increased competition for research grants, and dwindling time for teaching available to physician-scientists because of increased demands for clinical productivity, physician-scientists have begun to drop out of the ranks of our teaching faculty. If we are to continue to attract physicians in training into the ranks of science, as Don Foster has said, "*physician-scientists must become more visible to the medical students and to convey the excitement of the discovery of new knowledge*".

The explosive growth of managed care in the US has generated a major change in the way physicians and hospitals practice medicine, not only in the private sector but also leading to increasing demands for physicians in academic settings to see more patients. This situation has created two dilemmas for the physician-scientist: first, there is less time for teaching, allowing less opportunity to favorably impact the next generation of nascent physician-scientists, and second, reducing time for research. George Brewer has stated, "*medical schools should expect these* [physician-scientist] *faculty to see patients as a means of gathering new knowledge, not as a means of generating new income*" (5). If a School of Medicine is serious about generating physician-scientists they will need to heed these words and work to protect the time of junior faculty embarking upon a career as a physician-scientist.

Many or most of the above considerations have been raised in many venues, mostly as an argument to augment the pipeline of nascent physician-scientists (6–8). This author believes there is an equally important drain on our supply of physician-scientists, one that is more pernicious in nature: the dropping out of well-trained physician-scientist candidates for reasons of poor mentoring and dissatisfaction with the state of academic medicine. As the Chair of a research-intense Department of Medicine I have come to appreciate several factors that lead to the dissatisfaction of our junior faculty. Mostly, these can be traced to less-than-ideal mentoring, often surrounding the issue of independence. Although it has been argued that science today is practiced differently than in the past, it is more collaborative, and consequently fewer opportunities to function and be recognized as an "independent investigator" will arise. Again, this author believes this view is nonsense. Junior faculty should be encouraged to develop independent research niches, in which after a short period they are encouraged to publish independently of their mentor. A mentor need not hold the junior faculty member hostage in exchange for helpful input into a project; sometimes, intellectual input can be provided "gratis". Drs. Brown and Goldstein had published 216 papers when they received their Nobel Prize in 1985 (9). There is little need in this author's opinion for senior authors to accumulate CVs listing 500 papers; granting license to their junior faculty members to publish independently will not reduce their career luster for having published only 400 papers.

Given all of these hurdles, why should a new graduate embark upon a career as a physician-scientist? The sense of satisfaction, from seeing a medical student merge their understanding of the biochemistry of protein tyrosine phosphorylation, the genesis of chronic myelogenous leukemia, and a targeted therapy called Gleevec®, or the moving from a basic understanding of cholesterol metabolism, to the generation of a small molecule to inhibit its formation, to our realization of a significant impact on the mortality from hyperlipidemia, are rewards that extend far beyond the moment. Why become a physician-scientist? Because it is needed, rewarding, and meaningful. Although I hesitate to state this publicly, I often am amazed I get paid for practicing the art on science of a physician-scientist.

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