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COMMENTARY

Toward revitalizing the role of physician-scientists in academic medicine

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There has been a growing recognition over the past 25 years that it is increasingly difficult for physicians to develop careers as physician-scientists. This commentary reviews the traditional culture of academic medicine, factors that are altering that culture, and several grassroots suggestions for revitalizing academic medicine in our departmental programs. It is based on a presentation, "Basic Scientist or Translational Scientist? Changing Roles of Physician-Scientists in Biomedical Research," delivered in the President's Symposium at the Thirty-First Midwinter Meeting of the Association for Research in Otolaryngology on February 17, 2008.

Since antiquity, Western medicine has been a hybrid of empiricism and scientifically (or rationally) based practice. Outcome-based medicine is a modern descendant of the empirical school in ancient medicine. The empirical school contended that it was sufficient to recognize symptom patterns and provide recommended treatments and prognoses. Modern academic medicine, on the other hand, has its roots in views of the dogmatic school. The dogmatic school argued that rational (in modern terms, scientific) principles for health and disease are the essential underpinning of medical practice. They contended that physiologic and pathophysiologic knowledge provided a rational basis for prescribing the treatment. More importantly, broad scholarship was a central and guiding value for dogmatic medical training. In this context, Isadore of Seville (ca 560-636) characterized medicine as a "second philosophy," which applied knowledge from all of the 'liberal disciplines' to cure the body and soul.[1]

The goal of linking science to clinical observations is an enduring influence of the dogmatic medical tradition. Claude Bernard's 1875 foreword to *Lectures on Anesthetics and on Asphyxia*[2] stated succinctly that "Physiology is the foundation of scientific medicine." He also recognized that the physician must be able to translate from bench to bedside and from bedside to bench in order to apply physiology to medical practice, stating "Physiological laboratory data are now abundant enough to threaten to overload and obscure medical science, unless the laws that link them to clinical observation are investigated and an attempt is made to sketch the first outlines of experimental medicine." The result of this process is an "experimental medicine" "that claims knowledge of the laws of healthy and diseased organisms, not only as to foresee phenomena, but also so as to be able to regulate and alter them within certain limits. Accordingly, we easily perceive that medicine tends to become experimental, and that every physician who gives his patients active medicine cooperates in building up experimental medicine."[3] The physician-scientist is the translator and reverse translator between the laboratory and clinical practice.

Physician-scientists during the first half of the twentieth century tended to pursue patient-oriented research and disease-oriented research.[4] Patient-oriented research focuses on issues that are important for analysis, observation, and management of individual patients, such as syndrome delineation and identifying genetic or biochemical markers for diseases. Disease-oriented research uses patient materials or tissues to delineate biological processes in disease pathogenesis and treatment. This translational emphasis was the product of the medical training model from Abraham Flexner's 1910 Carnegie Foundation report,[5] 2 years of coursework in basic science and physical diagnosis, and 2 years of clinical instruction. Medical pedagogy was intended to integrate rigorous basic science and medical knowledge through activity in the laboratory and clinic. "On the pedagogic side, modern medicine, like all scientific teaching, is characterized by activity. The student no longer merely watches, listens, memorizes: he *does*. His own activities in the laboratory and in the clinic are the main factors in his instruction and discipline. An education in medicine nowadays involves both learning and learning how; the student cannot effectively know, unless he knows how to."

Throughout much of the twentieth century, physician-scientists trained by the Flexner paradigm participated in professional societies with peers in academic medicine. Attendance at meetings of the Association of American Physicians, American Society for Clinical Investigation, and American Federation for Clinical Research was very robust through the mid-1980s.[4,6] However, institutional training grants (beginning in the 1950s) and the National

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Institutes of Health Medical Scientist Training Program (beginning in 1964) introduced a new physician-scientist model, a clinician trained for a career in basic scientific research. Although patient-oriented or disease-oriented research are linked closely to clinical interests, the pursuit of a basic science career has created a dynamic tension between the role of physician and the role of basic scientist.[7] By the 1990s, this tension was reflected in a shift of professional affiliations of physician-scientists to a new peer group, basic scientific research societies.[4] The traditional model was also undermined by the evolution of distinct career tracks in schools of medicine for clinicians, clinician-basic scientists, clinician-clinical investigators, and clinician-educators.

In a landmark 1979 article, James Wyngaarden[8] recognized the early warning signs of the "endangered species" status of integrative physician-scientists. This change in academic medicine was viewed as a response to social, economic, public policy, and educational changes, which included (1) a post-Vietnam reevaluation of societal and individual career and lifestyle goals, (2) a prolonged career path from trainee to independent investigator, (3) instability of federal support for research and training, and (4) medical curriculum revision. He noted specifically that a hallmark of revised curricula was the loss of simulated research laboratory experiences, which deprived trainees of "firsthand knowledge of the excitement of working in the laboratory." With more that 25 years of hindsight, we appreciate Wyngaarden's recognition that changes in contemporary medical education would initiate a widening cultural gap between clinicians and researchers.

A growing literature has considered the issues and challenges related to the roles and career development of physician-scientists (http://meded.ucsd.edu/adpst/media_ps.html). Economic factors, lifestyle choices, academic career development demands, subspecialization in the basic sciences, and medical curriculum revision are enduring themes. Perhaps most telling is the perception of a growing cultural divide between basic researchers and physicians. In many institutions, the interdisciplinary nature of biomedical research has produced a reorganization of basic science departments and administrative and disciplinary boundaries,[9] which, in turn, has spawned a revision and streamlining of didactic course requirements in the biomedical sciences. One influential change has been the reorganization of postgraduate curricula into segregated medical and basic research streams, which has produced a growing dissociation between the training and disciplinary expertise of basic scientists and the requirements of medical education. Mallon et al[9] predicted that "[t]his trend will widen the gap between the scientific research of basic science faculty members and what they perceive should be taught to medical students." These factors obviously undermine the unification of scientific and medical knowledge that was institutionalized in the earlier academic tradition. More significantly, though, they exacerbate the perception that physician-scientists straddle the increasing disparate career paths of physicians and basic scientists.

The MD-PhD model for training physician-scientists has introduced new factors into the career development track that simultaneously segregate basic science and medical practice and retard scientific career development. For example, while their PhD peers aggressively pursue research career development as postdoctoral fellows, the MD-PhD trainee returns to medical training to gain clinical skills. In rapidly developing fields, the extended years of clinical training in medical school, residency, and fellowship can create a research career development lag that is a significant impediment to competing effectively for outside grant support.

These circumstances do not improve appreciably for young faculty in academic medicine. The decoupling of clinical and laboratory responsibilities, combined with the demands of establishing a clinical practice and a basic research program, present them simultaneously with the challenges of achieving two sets of career benchmarks, often against the limits of a tenure clock. The challenges of establishing a clinical practice have been exacerbated by increasing economic pressure to maximize clinical revenues, which affects the balance of allocation of time and effort. The challenges of establishing independent investigator status have been exacerbated by difficult competition for intramural and extramural support, limited time for additional training, and financial pressures to justify time and effort in the laboratory. It is hardly surprising that these changes in the workplace have curtailed the time and opportunity to develop clinical scientific wisdom and insight.

The suggestion that we are nearing the end of the era of the physician-scientist is based on the unstated but insidious assumption that clinical knowledge and wisdom are secondary to basic scientific knowledge for conducting translational research. To the contrary, the unification of scientific and medical knowledge from patient-oriented, disease-oriented, and basic research remains as an essential (but nearly forgotten) role for a cadre of physician-scientists in our biomedical infrastructure. If we agree that this unifying role of physician-investigators is integral to the mission of academic medicine, then we have agreed implicitly that reclaiming the scholarly roots of the medical profession is a core value of our programs. One palpable step is desegregation of clinical and basic scientific curricula and conferences, with a common emphasis on approaches to problem solving and intellectual inquiry. Let us not forget that the impetus for advancing biomedical knowledge is the critical examination of deficiencies of current hypotheses and textbook explanations.

In a commentary reminiscent of Claude Bernard, Floyd Bloom[10] identified information synthesis (or data fusion from clinical and basic research) as a skill central to the mission of the physician-scientist: "Synthesis of information can be as important as data itself [sic]: Wisdom and insight today are being lost in a sea of overwhelming knowl-

edge . . . We do not have sufficient capacity to incorporate new knowledge, let alone new ways of using that knowledge for the diagnosis of treatment of disease . . .” In the traditional curriculum, these skills were developed by learning medicine as an intellectual discipline, as apposed to a process of pattern matching. They were honed by a culture of medical scholarship that encouraged a merger of critical approaches of basic science with the practice of scientific or experimental medicine. This scholarly triad of a knowledge base, heuristics, and problem-solving skills was (and remains) a prerequisite for the interactive translation of science from the laboratory bench to bedside and bedside to the laboratory bench. At its most basic level, the restoration of a scholarly culture in academic medicine requires dedication to transcend our self-imposed disciplinary silos. Three straightforward steps toward this goal are (1) modification of curricula and training to increase breadth and depth of scholarship medicine and basic sciences, (2) a desegregation of clinical and basic research activities to foster clinical literacy among basic scientists and scientific literacy among clinicians, and (3) exploration of creative methods of intellectual and scientific inquiry that are as relevant to the patient as to cells in a culture dish. However, this effort cannot be imposed from above; it must emerge from shared values at the level of divisions, departments, and programs. In the final analysis, scientific medical insight and wisdom are not found in teams; they reside in the individual physician-scientist.

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