DEVELOPING THE CLINICAL INVESTIGATOR WORKFORCE:
CLINICAL RESEARCH ROUNDTABLE SYMPOSIUM I

The dramatic advances in molecular and genomic science that have been made in recent years provide new and exciting opportunities for clinical translation of discoveries into improved diagnosis and more effective therapies. Never before has medicine been faced with so much new information. Most of the common diseases under study today are complex, multi-etiologic disorders in which many genes interact with each other and with environmental factors, revealing subtle variations in DNA and among humans as a species. In time, laboratory scientists will be able to identify all of the common genetic variants, paving the way for others to sort out the relative roles of genes, behavior, and environment in the initiation and progression of disease. Clinical scientists will be the ultimate translators, making the connections between what is found in the laboratory and what is observed in the patient.

In the words of William Crowley of Massachusetts General Hospital, “it will be the ‘phenotypers,’ those who have the ability to see differences that are subtle in patients, who will drive laboratory investigation and genomics in the future.”

But clinical advances will not emerge from today’s science without trained clinical investigators, and an adequate supply of these investigators will be needed to take advantage of the wealth of data being generated in basic sci-

Summary:
The Institute of Medicine’s Clinical Research Roundtable convened a symposium in June 2000 to explore issues surrounding the status of the clinical investigator workforce. Amidst great optimism about the dividends that will come from advances in basic science and the human genome project, symposium participants warned that an undercurrent of concern permeates discussions about the future of clinical research. At issue is whether sufficient numbers of individuals are choosing clinical research careers and whether the infrastructure and resources at hand can support the mission of preparing adequately trained clinical investigators. The Roundtable will continue to discuss ways to recruit, train, and sustain clinical scientists to meet these challenges.
ence laboratories around the world. Yet, the average age of the physician-scientist is rising, signaling that there may be insufficient numbers of such investigators in the future, as well as a dearth of mentors for the next generation. In addition, academic health centers are not offering the most hospitable environments to clinical investigation as financial pressures take time and resources away from the research activities of staff.

**Obstacles to Careers in Clinical Investigation**

The forces working against developing and sustaining clinical investigators have been present for many years; over time and in combination, these negative forces have created a dynamic that influences the choices of those who are contemplating a clinical science career. As they weight the costs and benefits of a possible career in clinical research, these individuals ask, “can I afford it? How long will it take? In what kind of place will I work? What are the rewards?”

Over the past twenty years, the answers to these questions have not been encouraging, symposium participants noted. Young clinical researchers often face high hurdles: large debts upon completing professional training; a late start in research because of the length of clinical training; the low prestige of clinical research in some of the nation’s medical schools; a lack of extensive systematic training in research techniques; and ever-increasing requirements for research oversight and monitoring.

**Debt**

For years, the specter of carrying large amounts of debt upon completion of a medical education has been a major deterrent to those who otherwise might consider a career in clinical research. Medical school graduates emerge from school burdened, on average, with debts of $70,000 to $100,000, and the debt of one in four graduates exceeds $100,000. In addition, there is great pressure for these students to earn money after graduation, and becoming a clinical investigator may not be the most effective way of responding to that pressure. Several speakers said that programs and funds are needed to allow physician-scientists to conduct research while paying off their debt. They acknowledged that fortunately, voluntary health agencies and private philanthropies are paving the way for new and innovative programs - even though they can serve only a fraction of the need.

**Length of Training and Retention**

The length of time that a clinical scientist must train is another disincentive for prospective clinical researchers, reported participants. Typically, clinical investigators are late entrants into the research arena because of the time spent in medical school, house officer training, and subspecialty training, which is often followed by a military or federal service obligation. Moreover, in addition to entering late, clinical scientists frequently leave the research setting early to become deans, department heads, pharmaceutical executives, and government administrators.
The Culture of Academic Medicine

Some clinical scientists report that in medical school there is an unspoken belief that clinical research is less prestigious than basic science. It is true that clinical investigators often find themselves with less recognition and fewer promotions than their peers, and it can be more difficult for them to obtain grants.

This poses problems in encouraging students to enter the field. Daniel Foster of the University of Texas Southwestern Medical Center discussed the problem of “plausibility structure.” According to this view, people who require social confirmation of their orientations and choices can obtain it through “plausibility structures,” which are institutions, organizations, individuals, or actions that provide a plausible and valid reason to retain a minority viewpoint in the face of an overwhelming majority that holds a different view. In academic health centers, these structures can take the forms of role models or a nurturing climate. Foster believes that a serious plausibility structure problem exists in academic medicine and that successful scientists and physician-scientists are largely unavailable to medical students and residents. Worse still, those that are available often do not convey a sense that they enjoy what they do.

The fact that clinical investigators demonstrate a lack of enjoyment in their work should come as no surprise to those in clinical science. In previous surveys, clinical investigators have noted that they lack time for research, have inadequate space and personnel, and have difficulty recruiting patients. They have also noted that they suffer when competing with basic scientists for peer-reviewed funding, and are frustrated by high institutional costs. Some even regret having chosen a clinical research path because they feel it is not the best route to advancement.

Foster also describes a phenomenon in which a vast majority of students who are in medical school are pre-differentiated—that is, they know they want to be physicians, which is why they have entered medical school. Thus, their mindset is predetermined and difficult to change. On the other hand, the M.D.- Ph.D. subset of medical students - which is always small - is different, because these students know upon entering school that they want to do science. Importantly, these individuals have chosen an M.D.-Ph.D. program over a Ph.D. program because they are inherently interested in the ultimate application of biomedical research - better patient care. However, Foster commented that even members of this group must still be nurtured, or they will drift away.

Modern medicine is an exciting enticement for premedical students; therefore, it is possible that many of those who are considering a scientific career will back away if they think they will have to abandon their plans to be a physician. “There is a mantra in academic medicine now,” said Foster. “It says you can only do one thing well, so if you’re good in science, you can’t teach or do clinical care. I think that what we ought to be saying over and over is that you do not have to cease being a physician to become a physician-scientist. You may even be a better phy-
...bedside-to-bench interactions can be nurtured by encouraging medical institutions to build time into medical school faculty schedules for innovative thinking that goes beyond the narrow and prescriptive confines of research protocols.

Once students are attracted to the physician-scientist path, they must be assured that the right setting will be available for them when they emerge from training. **Jules Hirsch of Rockefeller University** emphasized the importance of creating environments for “bedside inquiry” as a critical means for retaining the physician in the physician-scientist. He espouses a continuum of therapy through research, in which information gathered by patient interactions supports and guides bench research and vice versa. In recent years, the emphasis has been on the path from laboratory to bedside, while the equally important reverse path from bedside to laboratory has not received the attention it deserves. Hirsch believes that bedside-to-bench interactions can be nurtured by encouraging medical institutions to build time into medical school faculty schedules for innovative thinking that goes beyond the narrow and prescriptive confines of research protocols.

**The Challenge to Training Programs**

Clinical research involving human subjects requires a different kind of training than basic science. The investigator must accumulate not only sufficient knowledge of basic biology but also clinical acumen. In addition, he or she must also be familiar with the ethical and regulatory issues that accompany human research. For example, to design and conduct clinical trials, the investigator must understand the Food and Drug Administration protocol requirements for Phase I through IV drug studies, and population-based research requires an understanding of the limits of data collection and the subtleties of outcomes research.

In industry, clinical scientists are needed for drug discovery, and technology transfer. The growing focus in recent years on specific biological targets - whether enzymes, receptors, genes, or channels - calls for investigators who are conversant in both bench and bedside science, said many symposium participants. Advances in technology, such as molecular modeling, high-throughput screening, and combinatorial chemistry, have moved the drug development field forward while posing new challenges to translational research, requiring investigators who are skilled in research and evidence-based medicine.

The size and complexity of the drug development process demands a different model of research, and possibly a different type of clinical scientist, said **Louis Sherwood of Merck & Co., Inc.** In industry, tightly integrated project teams of physicians and scientists tend to be more focused on common goals and the overarching need for efficiency than on individual interests. Expertise is shared across groups, and a multidisciplinary approach is expected, with teamwork being the norm. Although searching for research funding does not consume the industrial scientist’s time in the same way as that of his or her academic peers, aggressive timetables and cost control are expected.
Harold Slavkin, Dean of the School of Dentistry at the University of Southern California, remarked that he sees the research environment moving toward the industrial model rather than away from it. Much of the current cutting-edge research involves new technologies that depend on physicists, engineers, and computer scientists. Even years of training and practice do not sufficiently prepare clinical researchers for this dependency, nor do they address the need for flexibility demanded by the speed with which information and technology becomes obsolete. Multidisciplinary and collaborative research is becoming the norm rather than the exception, said Slavkin, and training programs need to accommodate this trend.

At issue is whether existing training programs for clinical investigators are sufficient. The National Institute of Health’s Medical Scientist Training Program supports the integrated medical and graduate research training that is required for clinical investigation and is widely considered the best model for training. The vast majority of graduates of the program remain active in research, although concerns remain regarding whether the research they are conducting is more basic than clinical.

Following up on the recommendations of the “Nathan Report” on clinical research, NIH has recently expanded its K series training grants programs for young and midlevel career faculty and medical students. For example, the Mentored Patient-Oriented Research Career Development Award (K23) aims to support the career development of investigators who have made a commitment to focus their research on patient-oriented research. The Midcareer Investigator Award in Patient-Oriented Research (K24) relieves clinical investigators from patient care duties and administrative responsibilities to increase opportunities to conduct research. These opportunities are critical in order to maintain momentum in translational research because they provide stability at midcareer that can help to stem the early departure of clinical scientists from the research setting.

Increasingly, private philanthropies are establishing funding programs for clinical investigators with innovative approaches that complement and supplement programs in the public sector; however, stated several speakers, greater effort must be made to create collaborations between the government, philanthropy, and industry.

About the Clinical Research Roundtable

The IOM’s Clinical Research Roundtable (CRR) was established in response to the expressed needs of a spectrum of clinical research interests, as described in the 1998 Graylyn Consensus Development Conference report. The purpose of the CRR is to provide a forum for discussing pressing issues facing clinical research in the 21st century. The CRR membership includes individuals from the academic health community, federal agencies sponsoring and regulating clinical research, private sector sponsors of clinical research, foundations, public and private sector insurance programs, health plans and insurance companies, corporate pur-
chasers of health care, and representatives of patient interests. The CRR meets quarterly to discuss the challenges facing clinical research and to explore and develop strategies for enhancing the awareness and understanding of clinical research in order to sustain a more supportive environment for high-quality clinical research.


For More Information…

Please visit the project web site at www.iom.edu/crr.

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Clinical Research Roundtable

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