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EDITORIAL

Molecules, Cancer, and the Surgeon

IN THIS ISSUE OF *Annals of Surgery*, Dr. Jeffrey Arbeit contributed an excellent overview of the molecular genetics of cancer. This review emphasizes the importance of the new era of recombinant DNA technology to the surgeon and the surgical laboratory. Recent advances using the techniques of genetic engineering have involved every field of biomedical research, including those areas of greatest interest to the surgeon. The result of these advances has been the realization that the human body is now a truly accessible genetic system for study, and recently at the first annual meeting of the Human Genome Project, leaders estimated that the DNA sequence of the entire human genome may be known within 15 years.

While Dr. Arbeit's review focuses on cancer as a disease involving genetic damage, essentially all areas of surgical investigation are driven by the desire to better understand the mechanisms of both extracellular and intracellular signal transduction in states of normal and abnormal function. Molecular biology allows us to clarify these events at the most fundamental level. As a result, academic surgery is entering a new era of laboratory investigation and, as a major clinical discipline, it is imperative that we determine if we are adequately prepared and how we can ensure that surgeons will continue to be leaders in the science of medicine.

Perhaps the most important concern to address is the role of the clinician–scientist in academic medicine. Many academicians have suggested that such an individual can no longer be competitive because of heavy clinical demands and the decreasing availability of research support. The argument is heightened by today's highly sophisticated, rapidly advancing research involving gene cloning, gene regulation, gene transfer, protein biochemistry, and the biophysics of protein structure–function analysis. These are significant arguments against the existence of clinician–scientists and, while they are directed at all clinical specialties, they are targeted especially at academic surgery.

I believe that in this era of recombinant DNA technology the clinician–scientist is more than ever essential to biomedical research. There is no substitute for experiencing daily the problems of diagnosis and the inadequacies of therapy to sharpen one's awareness of the research problems that must be addressed. The daily encounter with the patient's struggle is the greatest incentive behind discovery in medicine and is the stimulus for communication with other investigators, including our colleagues in the basic sciences. This is what drives the transfer of new discoveries from the laboratory to the patient.

Those individuals with training in both clinical medicine and basic laboratory research are vital in forming meaningful scientific collaborations between clinicians and laboratory scientists. These are the individuals who bridge the disciplinary gap. It seems clear that in this new era of molecules and genes, the clinician–scientist more than ever will be positioned to facilitate the clinical application of these discoveries and to be on the forefront of genetic therapy. While these may seem to be difficult times, with heavier clinical demands and fewer dollars for research support, academic surgery must make an even greater effort to continue to be among the leaders in research.

To reach our goals will mean significant changes in our training programs and in the structure of our academic departments. The first issue, I believe, concerns our ability to recruit the very best of medical students to careers in academic surgery. Medical students in our M.D./Ph.D. training programs are truly committed to research; and at The Johns Hopkins School of Medicine, 80% are training in molecular biology. These M.D/Ph.D. students are excited about careers in academic medicine and many, after serving clerkships in surgery, have expressed their enthusiasm for surgery as a clinical discipline. Unfortunately the discipline they embrace is rarely surgery, and what they confide is that they are not convinced that surgery will allow them to be competitive scientists as well as excellent surgeons.

To compete for students trained in molecular genetics, biochemistry, and biophysics, we need to present a surgical training program more balanced between research instruction and clinical preparation. In addition we cannot expect individuals who have already invested 7 or 8 years obtaining the M.D./Ph.D. degrees to commit to another 8 years of surgical training. We must find ways to streamline our surgical programs and the means to decrease the constraint of service requirements in structuring this training. Also it must be clear to potential trainees that our departments have the resources and the environments in which they can develop their academic careers as junior faculty members.

Thus, for those surgical trainees who want to be competitive in the future biomedical research environment, there needs to be a serious long-term commitment by both the trainee and the surgery department to ensure a period of research training comparable in length and effort to that devoted to attaining clinical skills. For those surgical trainees who possess the Ph.D. degree, a limited 2-year postdoctoral experience is appropriate and desirable, but for those surgery trainees with little previous research experience, a 2-year laboratory exposure in the middle of residency training is not sufficient to produce the desired level of competence or the needed competitiveness. In this latter group there is a subset of individuals who clearly desire the option of obtaining a Ph.D. degree but who are frustrated by training programs with little flexibility for extended absences from clinical duties.

Restructuring our surgical programs to address our future needs is not an impossible task, and the rewards for the efforts to develop a balanced training experience will pay great dividends for the individuals involved and for our academic surgery departments. It will, however, require more flexible training programs than are now common in most academic departments. Failing to make these changes will guarantee that we will not be competitive for the student–scientist or able to adequately train the novice surgeon–investigator for a competitive and credible research career. Without such individuals it is difficult to foresee academic surgeons as scientific partners who are equal to our colleagues in the other major clinical disciplines of medicine.

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