

## The Training of the Physician Scientist

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**T**HERE is no longer any doubt that physicians with a major interest in medical research are essential members of clinical departments in university teaching hospitals. Most frequently these individuals combine careers in research with a limited clinical practice in a sub-specialty, and it is this combination of activities that is implied in the term "physician scientist". In discussing the training of such individuals a clear understanding of what role they fill in the teaching hospital is essential. The physician scientist is expected to be a competent consultant in a limited area and is asked to function at the bedside with at least the degree of clinical skill displayed by his colleagues in full-time practice. At the same time this individual is expected to be a competent scientist and is asked to produce research that is at least fundamentally oriented, if not basic in nature, and that is of the same quality as that developed by scientists whose major occupation is medical science.

It is evident that the physician scientist must lead a divided existence and the demands of this life are such that many who begin this career fail to develop satisfactorily. There are certain very evident reasons for these failures which should be examined before we proceed to discuss the training. In my experience the inadequate progress of the physician scientist is synonymous with a degeneration of his research into something trivial; it is rare for such an individual to allow his clinical talents to wane, for there is too much pressure from the clinical service and often too much at stake financially for this to be permitted. While in some situations inadequate development of the research worker may actually be caused by lack of time for investigation owing to an excessive clinical load, most often the unsuccessful clinical scientist who complains he has inadequate time for research has failed because of either of two more fundamental reasons. The first of these is that the individual has entered the field of clinical science not because of any particular love or talent for research but because he sees it as an avenue to inordinately rapid academic advancement. Fortunately the repeated disappointments and frequent periods of drudgery that inevitably accompany a research career rapidly discourage

this type of individual from further waste of public money. The second and much more common reason for failure lies in inadequate research training. The individual with a marginal research background can carry on for a year or two with the impetus he received from the laboratory in which he did his research training but cannot readily assimilate new concepts or master new techniques, and therefore cannot for long compete with the leaders in his field. Frustrated in the laboratory, he will turn increasingly to the ward and clinic to achieve professional satisfaction.

With these ideas in mind, I would like to state what I consider to be the most important aspect of the training program of a physician scientist. An individual aiming for such a career must receive a training in research as professional as the one we require in a clinical discipline for the person aspiring to specialty qualifications. Usually this means a research experience equivalent to that demanded of a Ph.D. candidate in a basic-science department. Excellent modern medical research requires this kind of background; the one- or two-year research stints that many of us experienced are no longer satisfactory; the developments in modern biology, both in concept and in instrumentation, are such that a full three- to four-year research program is usually required before an adequately trained scientist is produced. Obviously there are some who can gain the necessary expertise and knowledge in less than three to four years, but these are really very few and very brilliant. I do not believe that it is necessary that a formal Ph.D. program be entered into. Once the M.D. degree has been obtained, the granting of a further doctorate is not too meaningful. However, the essentials of the Ph.D. program, including, if necessary, course work as well as three years of solid, well-supervised experimentation, should be covered. It can also be pointed out that insistence on a minimum of three years of research training for a career in clinical science very effectively filters out the dilettantes and leaves a group whose motivation is beyond doubt.

The next question that arises is the type of research training that the aspiring physician scientist should obtain. Many of these individuals, having just left their residency training, feel insecure in non-medical institutions, and for this reason will choose to carry out their

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research training in hospital-based clinical investigation units. There, they feel, they will maintain a contact with patients, and at the same time develop a facility for research technique. I personally am very much opposed to the clinical investigation unit as a place for training research scientists. In many instances the kind of research that is performed in these units is superficial at best and the trainees in such units find their scope of inquiry limited, since the opportunity to pursue a problem from the patient down to the experimental animal and through to the isolated cell or subcellular preparation is often not available. There are, of course, a few exceptions to this statement. In North America there is a handful of superb groups that are active in true clinical investigation—groups in which abnormalities are meticulously documented at the bedside, and explanations for these abnormalities are assiduously sought in all types of whole animal and broken cell preparations. I would emphasize that to my knowledge the number of such units is very small indeed. For the individual planning to make research a major function of his professional life, it is, I believe, essential that he should obtain his training in a basically oriented laboratory. If, following the completion of his research training, he wishes to carry out clinical research, it is easy for him to extrapolate to the study of whole man the techniques and concepts that he has learned. It is much more difficult for a person whose research training has been entirely clinically oriented to proceed from that level of organization down to more basic experimentation.

Recently, and belatedly in Canada, we have seen the development of basically oriented laboratories in teaching hospitals, and these laboratories not only meet the demands of the good investigator for scope in his research but also permit the medically trained research fellow to carry on excellent basic research and at the same time to keep in contact with clinical medicine and occasionally to apply some of his acquired knowledge to the care of a patient. While this type of hospital atmosphere is desirable for some, it is, in my opinion, certainly not essential. The only indispensable feature is that the research trainee should obtain the best possible training at a basic level.

While it is not directly germane to the topic under discussion, I would like to make some remarks about the clinical training of a physician scientist. As this individual must function in the hospital as a consultant in a sub-specialty, it is evident that he will require a period of clinical training that will allow him to fill this role.

In my view, an individual who has or will acquire a firm knowledge of the basic science upon which his specialty is based should require no more than three years of clinical training to develop into a reasonable sub-specialist. Any clinical gloss that he lacks at the outset will be rapidly acquired and will be more than compensated for by his depth and detailed understanding of the basic science that underlies his specialty.

Hence it is evident that the length of training a physician scientist should be prepared to undertake is at least six years and more likely seven years after obtaining the M.D. degree. The development of combined M.D.-Ph.D. programs may shorten this period somewhat; none the less, to be trained for two careers in medicine will obviously require a long preceptorship.

I would now like to turn to the more general problem of the role of research training in the education of the medical undergraduate and of the resident physician. In many medical schools and in a number of residency training programs, *all* students and residents are urged, if not required, to spend a portion of their time in medical research. This is done for a variety of reasons, chief among which is the widely held opinion that research experience is essential for the development of the process of critical thinking that is required if continuing self-education is to be successful. Other reasons for insisting that students and residents undergo a period of research training are that this type of training compels them to explore in depth an area of interest and that this exposure is likely to turn up a few individuals with a heretofore unrecognized talent for research.

I do not feel that any of these goals are sufficient reason for compelling students and residents to enter research laboratories unless they are truly desirous of doing so. While research experience does promote critical thought, it is equally true that the latter demands some knowledge of the subject one is critically evaluating. It is my belief that it takes a research fellow at least six months to begin to understand the literature in his field and that he is able to look at this literature in a critical way only after he has had considerable personal experience in methodology and in the design of experiments. To expect a medical student in a summer of work, or a resident in a year of laboratory exposure, when he is often preparing for specialty examinations, to advance significantly his ability to appraise the literature critically, is, I believe, unreasonable. There is, of course, another approach to the development of discriminating thought and that is to insist

upon this kind of thinking in the ward or in the clinic. It is remarkable how infrequently, even in our own institution and in this age, this is done, and how often the students or residents are allowed to base diagnostic and therapeutic programs on data that cannot stand careful scrutiny. The repeated requirement of a meticulous review of the literature relevant to clinical problems would provide a meaningful method of inculcating a pattern of critical thought in our clinical students and residents. If clinical services were to insist upon this rigorous approach, there would be no need to clutter research laboratories with a large group of questionably motivated students and residents who are sent to the laboratory to learn scientific thinking.

While a few months or a year in research during an undergraduate or graduate training program undoubtedly permits a student or resident to expand appreciably the depth of his knowledge in a particular area, attainment of this goal is by no means assured. It is evident that the amount of knowledge that is gained during a given period is directly proportional to the individual's desire or need to acquire this knowledge. Most medical students and most residents have only a passing interest in, and even less talent for, medical research and to compel them to spend a summer or a basic science year in a research laboratory as a compulsory part of their program, is to ensure the frustration of many. While the aim of the exercise, acquisition of knowledge in depth in a specific area, is a laudable one, it can certainly be accomplished in other ways. It would be much more realistic for most students and residents to achieve this objective as members of a clinical rather than a research unit. The acquisition of the basic science fundamentals of the subject or specialty can be assured by appropriate organization of conferences and reading lists and does not demand that each involved individual attempt to advance knowledge personally. Finally, the argument that by compelling all students and residents to spend a portion of their time in research, a handful of individuals with a heretofore unrecognized talent for research will be uncovered is unsound.

Proper motivation is such an important prerequisite for success in medical science that it is, I believe, essential that the student or resident at least profess an interest in medical research before being directed into the laboratory. If all students are included in research programs, the meagre returns to be expected do not justify the cost in terms of space occupied, equipment used, etc.

Finally, I would like to express an opinion about a problem that is closely related to the question of research in postgraduate training, and that is the role of the non-medical scientist in the training of clinicians. It is my belief that this individual has a function in this respect quite beyond that which he fulfils in directing selected residents and graduate students in his laboratory. Further, if research is accepted as a *bona fide* component of a clinical department, those whose sole occupation is medical research, and whose training has been entirely in the basic sciences, should be eligible for full membership in clinical teaching departments and not given a secondary status because they do not possess the M.D. degree. There is a variety of ways by which the non-medical scientist can be made an integral part of the teaching program of the clinical years and of the residency training programs, and I believe that not only should these individuals participate in the teaching program but they should also be called upon to assist in organizing it. Many clinicians who set up clinical curricula have simply no idea of what basic scientists can offer to clinical training and are apt to ignore their potential contribution.

**Summary** I have attempted to outline some personal ideas concerning the role of research in the training of physicians in general and physician scientists in particular. I believe that some ill-considered notions have accumulated concerning the place of research in undergraduate and graduate education which have led to an inordinate emphasis on research training during these years. Concomitantly and paradoxically, we in Canada have failed to insist on a professional level of research training for all who wish to become physician scientists. I would submit that the paucity of our national efforts in clinical science stems as much from this failure as from government parsimony.

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