highly interesting to himself and decidedly useful to our science.

Let us do our best to stimulate this intensive examination of particular groups. We *must* do so if we are not to be chiefly dependent upon foreign works of reference. Much as we owe to these foreign treatments—and I am most humble in my respect for many of them—I am convinced that were similar activity to be fostered in America it would have certain merits of its own. There are some prevailing defects in monographs. Many of them lack clarity. Many reach a tedious degree of detail and in their ultimate subdivisions border on the artificial. One reason why I greatly hope that more of my compatriots will engage in monographic work lies just in the fact that there will be limits to their patience, that they will seek the practical, and will in general stop subdivision at the point where distinction becomes inadequate or where further classification would pass the bounds of probable utility.

B. L. ROBINSON

UNIVERSITY CAREERS IN MEDICINE AND SURGERY[1]

A SHORT time ago when the opportunity arose to talk informally with some of you and your classmates, I presented as a general subject, "The selection of a career in medicine." This is an almost impossible topic for anyone to give you final advice upon, since, in order to justly appreciate a given student's abilities and possibilities would necessitate a far wider acquaintance of the individual student's upbringing, environment, and character than is possible for any of your present instructors. However, it does seem as if the possibilities of choice might well be laid before you from time to time in order that you yourselves should fully understand what fields of endeavor are open to you, and that you yourselves may begin to sift out of the many walks in life that particular career to which you find yourselves attracted and by nature better fitted to fulfill. In view of the present dilemma the graduating class finds itself in, it seemed possible that a further discussion of this topic might not be amiss. And since my own life has given me most experience in but a single direction, I have chosen as a title for this occasion, "University careers in medicine and surgery."

As I pointed out on the former occasion, the student may choose broadly between practice and a university career. In the field of practice, he may be physician, surgeon, take up a surgical specialty, restrict his field to internal medicine, X-ray, metabolism, or do everything in that most honorable rôle, the country practitioner. Likewise, if he chooses a university career, he has an equally wide choice varying from any one of the multitudinous laboratory posts to a career in the clinical branches of medicine and surgery.

You will see that I have made the art and science of teaching the dividing line. That is really the great dividing line. Do you want to, are you able to, and will you spend the time necessary to equip yourself for the task of teaching? It is by no means a simple task. In fact, in addition to the difficulties attendant on obtaining a good training and developing one's inborn characteristics, there are many pitfalls for the teacher. The same dangers confront all teachers. The worst of these is self-satisfaction. Many a teacher has, to put it brutally, heard himself deliver hypotheses so often that finally he actually comes to believe ideas that are not entirely supported by facts; he then becomes narrow, dictatorial, and pompous. Such an attitude is less common among instructors in the preclinical sciences and those untrained in laboratory methods. Such men are not real teachers; they are but go-betweens. The real teachers often talk but little and teach to a great part by precept and example coupled with a spoken idea, a suggestion, and a little encouragement. Their methods are to develop the student, not to propound their own views; to lead rather than to drive.

I make some diversion here, since, unless you are endowed with certain qualities and realize what teaching is, you can easily go astray in your choice. But I have especially emphasized teaching as the dividing line because in the last score of years the words research and laboratory have become coupled in medicine with the words success and training. And the impression has been given that the great dividing line in medicine is whether or no one is a researcher or has had a laboratory

[1] Presidential address, Boylston Medical Society, Harvard Medical School, December 15, 1922.

training. Indeed, the phrase "he is an untrained man," meaning untrained in laboratory methods, has been used almost as an opprobrium. This has driven many into laboratory efforts who are neither able nor eager to frequent this field. A true researcher is more a born man than a made product. And so, much time, much precious effort has gone astray. And an immense amount of published effort has appeared that is of no value either to the worker or his readers.

As a further objection to research as the dividing line, I need only point out to you that research can be carried out whether or no one is a teacher. Moreover, it is carried on, and to a large extent by those in no connection with universities. Much, too, of the best sort, for I need only recall to you Sir James MacKenzie's work on the heart as a single example of such extramural effort.

To some extent, teaching also may be criticized as the great dividing line, since medicine is inherently a profession acquired by apprenticeship, a profession for centuries descending regularly in families, where father was the teacher and son the pupil. To such an extent, indeed, all doctors are teachers, and not only of their assistants and colleagues, but of the community at large in which they live. For this latter burden is a part of their very ethics which makes it incumbent upon all medical men to help alleviate suffering whether by prevention and public education, or by dispensing medicine and care when actual disease is present.

Teaching in the university sense, however, has a larger aspect, and it requires a special training and special qualifications. For it involves not only the handing on of known facts, but an ability to stimulate students with a desire to further enlarge the known facts in regard to their profession, and further, a training that can advise and direct such ideas as the student acquires into workable and productive fields. You must realize the vast differences among your own instructors and must recognize that certain of these have added qualities, either naturally or by virtue of special training, that make them both better able to hand on knowledge to you, and more stimulating as regards the breadth of knowledge you are to acquire.

We have, however, a peculiar anomaly occurring in our own time, that though a great teacher is great for the most part through inborn, natural characteristics, and though such a man must be of the greatest value to any school, the schools themselves in the last score of years have not always made appointments with this in mind. As outlined above, research qualities have often appeared to be the potent factor in the choice of faculty incumbents. That is, teaching *per se* does not seem to be looked upon as a prime factor in making appointments to university medical faculties.

Before discussing requisite characteristics for a university position in medicine or surgery, let us define what such a position may be. In the first place, by a university position I mean one wherein teaching and the hospital claim all the efforts of the individual. Practice becomes a secondary factor. The extension of the so-called full time plan of teaching to the clinical branches is something that in this country is still in its infancy. In Germany it has long been a fact, and the division there is based, as I have depicted it to you here tonight, on a teaching position. The German plan, however, does not demand all the clinical teacher's time, as is demanded of a professor of physiology or pathology, which is the modern "American" concept of full time clinical positions, but embraces the underlying principle that the university work is of first importance. The full time plan recognizes the value of education as well as of practice to the community. It is based on the assumption that a great educator in clinical medicine is equally great as a great practitioner of medicine. And the use of preventive as opposed to palliative medicine has been a great incentive. The actual dealing with the sick is an ancient and honorable profession, but the science of preventive medicine is a profession on a still higher plane. That should be the aim of those holding university positions. The full time scheme in clinical medicine substitutes research to be associated with teaching instead of the practice of medicine alone. There are those who claim that men thus devoting all their time to hospital practice can not properly teach students who are to practice by themselves in small, remote communities. These men, however, fail to be convincing, if only

through inconsistency, for they are the very ones who most fully praise Osler's text-book, "The practice of medicine," a work written by a man more than any other an exemplar of this idea.

The fundamental principles are often beclouded. The full time scheme means nothing more than that the incumbents of such positions devote their entire time to teaching and to the hospital. It does not of itself preclude private practice. Indeed, it would appear that there are certain advantages, sufficient indeed to offset obvious disadvantages, should the incumbents of such positions be allowed to have the responsibility and opportunity to see private cases in moderation. The experience and stimulus resulting from this is invaluable, and it is a fatal error to think that a professor of medicine or surgery should only be appointed from those individuals who have already acquired all of the benefits that do accrue from such work.

From the above considerations, it is obvious that the qualities of a teacher and of an investigator are prime requisites for entering upon a university career in medicine or surgery. As has been already stated, a great value has been placed on research, and university posts have, in several instances, been awarded to those whose chief and often only attribute, in so far as eligibility for the position goes, has been that the individual has completed a valuable piece of laboratory work. Such men have naturally not always proved good teachers, and yet even this method of selection has advantages over the older method of choosing the man whose only attribute was his success in the practice of medicine, because in the former case we have a man who at least devotes his entire time to his job. In the latter case, teaching and school work were and often are taken on as incidentals. And yet I must warn you that faculties of reputable schools are still filling important positions with this latter type of individual, so that even should you perfect your training as a teacher, clinician, and laboratory worker, you may still find a man whose chief claim is that he is a successful practitioner as your colleague or chief.

Of course, there is room for all, and the part-time men, as this latter group has been designated, are invaluable in a faculty. Indeed, this type of teacher is not only a valuable asset, but a prime necessity. In the first place, they keep the hospitals and schools in close touch with the community, and they diffuse the knowledge and facts gained by those men in university life best trained to develop such knowledge.

The ideal man for such a position, however, must devote his entire time to his school work. He must, in the first place, have had a broad, general training. Whether he specializes later or not is of only relative importance. He must be acquainted with laboratory methods, not only because he can thereby stimulate his students to, and aid them in solving such problems as come before them, but because of the mental training involved. A training in experimentation involves a training in accuracy. It involves accurate observation, logical deduction, and the bringing forth of conclusions based on fact. It tends to do away with conjecture, ideas based on supposition, hearsay and single isolated observations. And it finally teaches the value of controls. This is a training in thoroughness which no amount of clinical training can equal, partly because in clinical work there is always that "hoodoo" of routine. Certain disconnected things must be done, and then if there is time, the problem which interests the individual can be studied. But how rarely is there time! It is only the very exceptional man who has the physique alone to tackle painstaking investigation on top of the routine of a day's work in a clinic. This is especially true of surgeons whose therapy means hard labor as opposed to the medical man's therapy which in many instances the flourish of a pen leaves to a nurse.

But finally, given a man with a broad clinical training, and one whose published work proves his laboratory training, we still lack something. That something is what makes him a teacher; it is an intangible quality that our language still lacks a proper word to describe. The French call it *l'esprit* and the Germans *geist,* words that now mean one thing and the next another. It is, however, present in all teachers. It is a quality that makes others want to do the same, a certain form of mag-

netism, of stimulus, of optimism. Teachers as well as leaders often work more influence by precept, example, and their own actions than by the spoken word. It is an indescribable quality, and a perfectly worded discourse in which every step rests on proven and established facts may leave the class busy with pencil and paper, whereas another teacher using imperfect diction and presenting his facts in a less orderly fashion may keep every eye and ear so busy that note-books remain untouched. The latter is the real teacher.

These, then, are the essential qualities for the ideal man in university medicine. One does not expect to see them all in full bloom in any individual; but to those of you who contemplate a university career in medicine or surgery, it is well to depict what may be expected of you.

The varied training necessitated will encompass roughly eight to ten years. These years may be divided in the ratio of three to the laboratory and seven to the clinic, and it is my impression that part of the clinical training should come first and part last. It is customary to advise first an interneship, then a resident's post using up perhaps three years; next comes the laboratory. Here the choice must be very wide. It might well be divided into a further training in one of the basic medical sciences followed by two years of experimental endeavor. These years completed, the man steps into the higher resident or assistants' posts in some clinic. From this time on, his mind having been trained in investigative methods, and a greater opportunity for clinical research both as regard material and time being offered, his publications should become true reflections of his value, tendencies, and promise. He now has greater occasion to teach and can well spend a large part of the next few years perfecting what qualities he has in this field. Such a person should now be ready for a high university post.

This is a long span of time, and we may well recollect that life is short. Moreover, the pecuniary reward is small. Still, such posts as those described, except for that of interneship, pay small stipends from five hundred dollars to fifteen hundred dollars. It is not, indeed, the easy task imagined by some of the great group of practitioners who look upon such people as peculiar individuals. But I can tell you that it has high rewards. In the first place, it is always a joy to do work well, and such a training almost insures this. In the next place, to find out the truth by an investigation is a tremendous stimulus. And lastly, it leads to a position in life that keeps one always in contact with vigorous, fresh, inquisitive minds; a position that both keeps one's own mind young as well as gives one the great happiness of seeing other minds grow under a little stimulus, a word of encouragement, or a proper example.

I have, as many of you must know, given much of my own ideas and experiences in this talk; and yet as I wrote it, I had piled on my desk clippings, books, and quotations covering most of the contributions on this subject during the past twenty years. In reading them, I found always the same undercurrent, a feeling that the teachers of medicine must be better trained. What I have written of the ideal man, of his qualities and abilities, is but a summary of the views of others also. It is a description of a field of endeavor for medical men that has been slow to arrive in this country, but which will certainly be in full swing before your generation has passed on.

I beg of you to remember that what I have said is purely from an idealistic point of view. No criticisms have been made. Do not for a moment carry away the idea that I belittle the practice of medicine as opposed to the field of medicine described. I would only have you remember that a university career should require a definite training, if we are to raise medicine to higher levels. Something of what that training must be, and that that training is necessary and logical, I have tried to show you to-night.

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IONIZATION AND RESONANCE POTENTIALS[1]

THE phenomena connected with luminous discharge in gases at low pressures have received a great deal of attention during the past twenty years. Many theories have been

1 Address presented at the Boston meeting of the American Association for the Advancement of Science, Section C.