of the emanations of radium, it will be possible to apply these rays to the seat of the disease. I have found reports of the following cases:

MacIntire of Glasgow reports two cases of lupus—one of the hand, one of the nostril and nose—both of which were healed by the radium ray. MacIntire also reports favorably of its use in rodent ulcer.

Gussenbauer of Vienna reports good results and some cures in twenty cases of cancer treated by him.

Lunder of Berlin claims to have had good results in cases of blindness from the stimulating effect of the radiations on the eye. It may be that this new agent will prove valuable in these hopeless cases of optic nerve atrophy.

Tracy also reports a case of epithelioma improving under the influence of a tube of radium of 300,000 activity containing ten milligrams. The same physician has also tried this tube on a case of optic atrophy in a man 52 years old. Some improvement has taken place, though the patient is still under treatment. Dr. Blaudamour, using a tube of radium with an activity of 5,200, reports the cure of lupus.

Dr. Meyer and William J. Hammer improved a large axillary cancer with radium of 300,000 activity. The exposure was one minute daily. While this case was incurable, the cancer grew smaller and less painful under the rays.

Dr. A. H. Smith reports having seen in a European clinic a rodent ulcer perfectly healed after five exposures, though this ulcer had been treated by the x-ray without benefit.

The place of this new element as a therapeutic agent has yet to be determined. At present the cost of it and its scarcity prevent it coming into general use. But if it can be found even in limited quantities, it will have this advantage of the x-ray: It will require no costly apparatus—merely a test tube. It will be free from expense of wear and tear. It can also be carried anywhere for use.

This is a newly discovered force. It will have powers for evil as well as good. Before long the charlatan will be exploiting its wonderful powers in the daily press at so much per line.

The investigations of this substance have only begun. Every week adds some new report to its wonders. It will not prove to be the panacea for all human ills—enough trial has been made to show this. It will have a specific limited field of action. First reports are sometimes flattering. Further trials must be made. But no new substance has been discovered during the history of the human race around which so much mystery clings as to this new element—radium. The principles of the conservation of energy, and the law of gravitation itself may need some changes in our statements of them, as a result of the properties found to reside in this particle of matter. It occupies almost the same place in physics that a biologic discovery would occupy in biology if it should apparently offer some serious objections to the generally accepted theory of the origin of species.

It is impossible to note in a subject like this, those to whom we are indebted for the work they have done; but acknowledgment is here made to Edgar L. Larkin, author of "Radiant Energy" for use made especially of his chapters on radiant energy and spectrum analysis; also to Prof. Oliver Lodge, Dr. S. G. Tracy, William J. Hammer on "Radium and Radioactive Substances," and John U. Lloyd.

THE CONFLICTING CLAIMS OF GENERAL EDUCATION AND PROFESSIONAL EDUCATION.*

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For the last fifty years there has been a tendency to increase the length of time devoted to professional training. This tendency has not been confined to medicine or law, or to the so-called learned professions as a group. It is equally conspicuous in the various lines of engineering and technology. It is manifest in those departments of school work which fit the boy for trade or for commerce. In every sphere of human activity modern scientific studies have made their influence felt. In every sphere, therefore, the practitioner who is familiar with the methods and processes of his science—be it physiology or mathematics, physics or economics—has an advantage over his competitor who knows only those rules of practice which can be picked up in the office or the shop.

But there are some respects in which this tendency has been more strongly felt in medicine than in any other calling, for a physician needs to be trained in more kinds of scientific study than almost any other man in the world. He must know something of physics and much of chemistry; he must know something of morphology and much of physiology. Each advance in any of these sciences increases the importance of the preliminary training which is essential to the successful practice of the arts of medicine and of surgery and the length of time which must be devoted thereto. If we add to the time thus consumed in the study of science the time which is involved in learning the practice of those arts—whether in the higher classes of the medical school or in the hospital experience which should follow—the period of technical training becomes so long that it is a burden to all men, and an almost insupportable burden to those who are poor. And if, in addition to this, we urge that the student of medicine should previously have completed a college course of the old type, we seem to postpone indefinitely his chance to become an independent practitioner and to have the comforts of a home and a family of his own.

Under such circumstances there arises an almost inevitable conflict between the claims of general education, as represented by the college, and the claims of technical education, as represented by the medical school, and in less degree also by schools of law, or theology or engineering. This conflict involves so many different issues and deals with matters of so much perplexity that I have felt some hesitation in offering an address on this subject which shall set forth the claims of the college. But from all that I have heard of this body, I believe that the very difficulties of the case will cause its members to welcome a presentation of a side of the argument different from that which is perhaps more habitually brought before their consideration.

As a first step in our analysis of the problem, let us try to get clearly before our minds exactly what we are talking about. What is the difference between general education and technical education? What is the distinction between the college and the professional school or group of professional schools? Most people would say that it was a difference in the nature of the studies

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pursued. Fifty years ago that would have been largely true. To-day it is not true. Fifty years ago the college taught a curriculum of classics and mathematics, with some metaphysics and a little very elementary science and history, which was supposed to give a foundation of general knowledge for all men; while the professional schools, whether of law or medicine or theology, were occupied with teaching the details of practice—to expound a text, to collect a note, or to write a prescription more or less suited to the occasion in hand. To-day things have changed at both ends. The professional schools no longer occupy themselves solely or chiefly with teaching the practice of their several arts, but lay at least equal stress on the training in the sciences which are at the foundation of those arts. The colleges no longer compel their men to go through a certain curriculum; but they offer a choice of courses suitable to the tastes and abilities of different individuals, from which each can choose that which best meets his wants. Within the limits of a college course the man who would be an engineer can gain an excellent knowledge of mechanics; he who would become a lawyer can learn the fundamental elements of legal theory; while he whose tastes lead him to the study of medicine can master not only the principles but the practice of chemistry, and can familiarize himself with anatomy and physiology and physics, and all those various sciences which form the foundation of successful medical study.

What, then, is the difference between a college and a group of professional schools? What, then, determines whether we should advise the student to obtain these acquirements in the one institution or in the other?

The difference, I take it, is not in the studies themselves, but in the surroundings under which they are pursued. The distinction is not in the things taught, but in the ethical atmosphere in which they are learned. The college student pursues his investigations amid a set of associations which bring him into contact with non-professional life on as many sides as possible. The student in the professional school, on the other hand, is in an atmosphere which reduces these outside influences to a minimum and encourages him to narrow his efforts on the work immediately in hand. The college course gives a man breadth of sympathy; but with all except the best men, this breadth is accompanied by a sacrifice of intensity of application. The professional course secures the intensity, but with a corresponding danger of sacrifice of breadth. Which of these alternatives shall we choose? Which of these ends shall we pursue to the comparative disregard of the other?

The tendency of late years has been to choose the second alternative—to regard intensity of application as the vitally important thing to be secured, and to look with distrust, if not with absolute dislike, on scientific requirements which have been obtained in the broader but less exacting atmosphere of collegiate study. Indeed, this attitude has in some instances gone beyond mere distrust or dislike. A man who has acquired his chemistry or his anatomy outside of the medical school is liable to a summary rejection of his claim that this knowledge has in any wise advanced him toward the practice of his profession. Speaking broadly, a student's class rating in our medical schools depends not on his amount of knowledge, but on the time that he has spent in some medical school in acquiring that knowledge—the duration of the period during which he has breathed the professional atmosphere. We do not go

so far as the legal profession does in England, where admission to the bar is based on the number of dinners that a man has eaten at a certain place; but the difference is one of degree rather than of kind.

Now it is easy to see the reasons which have led to the adoption of this general policy. We want to have our professional men trained in habits of intense application. This will save their time, will make their work more efficient, and will fit them for the practice of their profession more speedily than would be possible in any other way. What I wish to point out is that this gain is attended with certain serious dangers of loss to the student himself, to the cause of scientific progress, and to the influence of the medical profession as a whole; and that any consideration of the subject which looks only at the gain and fails to notice the loss is an imperfect and somewhat dangerous one.

The first of these dangers is that of commercialism. To this danger the student who does all his scientific study in an exclusively professional atmosphere is often very seriously exposed. A professional school is filled with men who are anxious to make a living, and who look on their scientific study as a means of enabling them to make a living better than they could without it. In fact, the special intensity of their effort in the early years of professional study is largely due to this commercial motive. There are some men to whom this will do no particular harm. There are others to whom it does very great harm indeed. With such men science, instead of being regarded in her proper light, as an agent of service to society, becomes a mere handmaiden of business. A man who looks at medicine in this way will probably make more money than if he looked at it in any other way; but I am sure that the members of this audience would regard this monetary standard as a very ignoble measure of the aims of the medical profession, and would deprecate any change in the system of education which would give increased prominence to this element of success in the mind of the young man of twenty who is beginning his scientific studies and forming his scientific ideals.

The evil effect of such a perversion of standards does not stop short with the individual student. It is bound to show itself in the methods of the profession as a whole. It will result in an undue exaltation of those elements of study and practice which form the basis for triumphs of technical skill. It is, perhaps, presumptuous for a layman to form a judgment on matters like this; and yet I can not forbear saying that the temper of many of the students and of some of the instructors in our medical schools is to-day rather unfavorable to the study of physiology. Anatomy, which is in many ways an exact science already highly developed, they pursue to the utmost, and make it a basis of successful surgery. Certain parts of pathology, in like manner, are made a basis of successful medical practice; but general physiology, by comparison, at least, is neglected. In such schools—and there are many of them—the students are led to use the results of the past to cure the individuals who are afflicted with certain definite diseases; but they are not in corresponding degree led to make scientific progress in those fields which to-day are difficult and doubtful, and give no assurance of commercial return to the investigator, but whose very doubt and difficulty make investigation more necessary and give greatest possibility of service to future generations.

And, apart from its direct effect on the physician himself, this separation of the scientific studies of the

medical profession from those of other men has, I think, an indirect effect adverse to the political and moral influence of that profession in the community as a whole. It tends in some degree to make the physicians a guild or trades union, apart from the rest of society. The old-fashioned country practitioner, who had learned nearly all his medicine from contact with his fellow-men, was extremely defective in his scientific training; but he was a power in the community, and knew how to influence the conduct and life of that community. His successor to-day knows more of science, but he does not always know as well how to make that scientific knowledge a stimulus to those about him.

We can, perhaps, understand the real nature of the change better if we look outside of the medical profession and see how a similar change has taken place in the aims of the lawyer in the progress of the law and in the influence of the legal profession in the community. The lawyers of to-day are far better trained in the theory of their profession than was the case a century or a half century ago. They make fewer mistakes. They know more accurately how to adapt means to ends. But there has been an increased narrowing of the standards of success, which gives us more men with large incomes, but fewer Lincolns and Websters and Calhouns. There is an increased ability to take advantage of technical details in advising a client to avoid a lawsuit, but a diminished readiness to adapt the law to new conditions, commercial and social, in the way that the English judges of 1700 or the American judges of 1800 were ready to adapt it. There is, in short, a separation of interests between the legal profession and the community in which the lawyer lives, which stands in the way of the rendering of that public service which the profession should be competent to perform.

Is there any remedy for all this? I believe that there is, and that it lies in the direction of encouraging men to do the preliminary work of preparation for their several callings while they are yet in the broader atmosphere of the college, rather than in the narrower atmosphere of the professional schools. Some sacrifice of intensity of application this doubtless will involve; but I believe that any loss from this cause will be more than compensated by the increased gain in sympathy and enjoyment, in the spirit of progress and in the power of using such professional work for the benefit of a man's fellows, which will accrue from this change. I would not abate one jot of the strictness of our requirement of scientific knowledge as a preliminary in professional study; but I would welcome that knowledge, no matter where it was acquired. I would hold that if a man really had the necessary training in chemistry or anatomy, he would make a better physician instead of a worse one if he had obtained it outside of the limits of the professional school. Instead of discouraging men from beginning their scientific studies before they enter a professional school—which is the net result of our present somewhat exclusive policy—I would stimulate such study in the colleges, giving fair recognition to its results. I would encourage a man to begin his scientific specialization at as early a period as possible and to defer his ethical specialization until as late a period as possible. The sooner a man's brain begins to turn to his lifework the better; but the later a man's horizon tends to be narrowed to the sphere of his lifework the better also.

I believe, therefore, that the true policy is not a shortening of the college course and an attempt to make

it a time of intellectual eclecticism, if not of intellectual dissipation; but an inclusion within that college course of all the scientific studies which it can be made to contain, and the fullest recognition by our various professions and professional schools of the results of such study when obtained in the college atmosphere. I believe that in this way we can best solve the problem of training men for the duties of their several professions, without untraining them for the wider duties of scientific progress and of American citizenship. I believe that in this age, more than in all others, we need to emphasize the importance of those conditions in education which make for catholicity of sympathy, for wide acquaintance with all kinds of men, and for broad range of vision, both present and future. I plead not for any lowering of professional standards or for any lessening of intensity of requirements; but for the recognition of the great fact that our engineers and our lawyers, our ministers and our physicians, must be men first and technologists afterwards—and that any true system of professional education should find a place for helping men to broaden their mental and moral horizon, even while they are learning to concentrate their vision on those special lines of human activity with whose investigation they are charged.

The Cultivation of Medicinal Plants.—The *American Journal of Pharmacy* for December contains an article by Dr. Kraemer, the editor, on "The Conservation and Cultivation of Medicinal Plants," in which he predicts an early extermination of the principal medicinal plants of this country unless measures are taken to protect and to cultivate them. Certain well-known plants, as *spigelia*, *serpentaria* and *senega*, are already becoming scarce, whereas in Linne's time they were found in abundance in Maryland and other Atlantic states. It is well known that some plants have been improved by cultivation, and it is reasonably to be supposed that all can be when the peculiar requirements of each have been ascertained. Kraemer urges a study of these plants in their natural surroundings that they may be successfully cultivated and conserved. Many of the medicinal plants now in use are being cultivated in this country. It is stated that 40,000,000 pounds of peppermint are produced annually near Kalamazoo, Mich. Castor beans, from which castor oil is obtained, are raised in the west and middle states. Valerian is produced in Vermont. *Digitalis purpurea*, *Atropa belladonna*, *Sanguinaria canadensis*, *Cimicifuga racemosa* and many equally valuable plants have been raised experimentally in this country and, in Kraemer's opinion, could be grown successfully with the proper cultivation. A number of native medicinal plants which still grow here in abundance are named. The more common ones mentioned are couch grass (*Agropyrum repens*), marshmallow (*Althaea officinalis*), stramonium leaf and seed (*Datura stramonium*), grindelia (*Grindelia robusta*), hydrastis (*Hydrastis canadensis*), mandrake (*Podophyllum peltatum*), and American hellebore (*Veratrum viride*). Kraemer urges the further cultivation of certain plants which have been introduced into this country and grown here to some extent, such as senna (*Cassia acutifolia*), colocynth (*Citrellus colocynthis*), gentian (*Gentiana lutea*), poppy (*Papavera somniferum*), etc. He believes that three-fourths of all medicinal plants are grown either wild or in cultivation in this country, and that fully one-half of the remaining fourth could be successfully raised here. Americans must realize the necessity of protecting their forests and plants, and must consider their care and preservation a duty both to themselves and to future generations.