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REMARKS ON PROFESSIONS IN MEDICINE[1]

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THIS invitation of yours to speak here to-night I regard as no ordinary honor. Once before you offered me this same opportunity. Ten years ago seems so far behind us as to have occurred almost in another life time. Some of you must remember that through a long hour you were patient. And now you ask me again. You give me the chance of feeling a deep satisfaction in the belief that I was tried and was not found wanting. We both take a great risk. I take mine willingly. For there are things as to which I believe I shall feel the better for having shared my thoughts. Nor can I think of men and women with whom I prefer to share them better than with you. We have, as it were, through long personal friendships, established common points of view which, on such occasions as this, come to some sort of systematic expression.

But I can not begin without recalling that I was brought here originally by Jack Wyckoff, whom I have always cherished as one of the most gifted of my friends. His gifts were not the gifts of tinsel—he did not shine by any of the arts that compel the immediate and spontaneous admiration of other men. Quite otherwise. His virtues came to be impressed upon us by their sheer weight—massive things which, because they were exercised in right directions, came to be understood to be expressions of deep intelligence and actuated by profound human sympathy. Wyckoff understood, I think, that the profession of medicine is so inextricably embedded in the social forces of our, indeed of any, time that it is a distortion of the facts to think of its position as something isolated. To

[1] Read before the Alpha Omega Alpha (Honorary Fraternity), Delta Chapter of New York, January 24, 1940.

him the life of a physician was not circumscribed by the content of his immediate profession but transcended such narrowing confines. Had he been spared so he could develop the bases of his beliefs, I feel reasonably confident the remarks I am about to make would have expressed his own views. I have as you see, an abiding faith in the possibility of his indefinite growth.

I believe in two things—one, that socially and intellectually we are the inheritors of our past and bound by it and, second, that it is possible for farseeing and determined men powerfully to change our direction and to influence our future—the future of our kind. We must be mindful though that the sum total of human experience has been small. Small as it is, it has been won at the expense of incredible suffering and toil. We may, as human beings, represent little in a cosmic sense. But toil and suffering are not things we care, or should care, lightly to bestow on our descendants, unless we choose to be utterly cynical. Our other path is to become conscious, by meticulous exploration of our past, of what its meaning has been and to try to discern whether that experience points a desirable way hereafter.

We know that in our dark and not so very ancient history, white men in civilized communities became, chiefly as prisoners of war, literally slaves. That was a practise of man's inhumanity to man which, as far as expression of belief is concerned and the hope of amelioration, came to an end with the Christian revolution 2,000 years ago. Belief and expression, though, are one thing, and the practise of life another. The extent to which actual human bondage is still practised and the variety of forms which the dominance of man by other men still assumes, it would surprise us, I think, if we passed in review: the social forms in the Far East and in the somewhat Nearer; the industrial forms almost everywhere; the political forms which, due to doctrinal disguise, are operative in so many regions. Even of actual individual human slavery, the world is far from being free. Feeling for the sufferings of other human beings—compassion, the good-will which rejoices because other men have been given the opportunity to realize their highest potentialities, the best that is in them, that pervading sense of the worth and the dignity and the potential decency of men, that which makes us speak of the value of the individual man—these are the basis of the entire theory of our profession. It is because we have beliefs that we are a profession. For I take it that profession means belief—belief that a form of life can be devised as the result of which there is rendered to other men, service. And service may involve sacrifice—sacrifice, disinterested indeed to the point where life, even if not always cheerfully lost, is at least dedicated to achieving a greater measure of welfare for common men less favorably situated, or less favorably endowed. If you run through your minds the names of the professions, my meaning becomes clear—medicine, law, the military, theology, engineering. You wonder perhaps at the inclusion of certain ones because you notice that there have slipped in as professions, ways of life from which, in the general belief, sacrifice is or has been departing and the notion and the object of gain or of profit has entered.

But let me not take you too far afield. Let me continue to insist that at the basis of a profession is concern for the welfare of individual men—their worth, their dignity, their suffering, their opportunity. It is to that concern I wish to attach the word "compassion." As I think, the watershed of all human thought, of all human organization, of all human aspiration, is this divide. There can be only two ways —concern for individual men or the subordination of individual men to interests which transcend their personal welfare. How our world is divided in its views on this issue requires no emphasis on my part. But here, in conception, lies a parting of the ways of which we can not pretend to be oblivious. For the profession of medicine it is crucial.

There is a second strain in the life of medicine, often, perhaps usually, regarded as its dominant strain —the intellectual strain. Systems or methods or the content of education are the reflections, sometimes very pale, of contemporary knowledge. For many and complicated reasons, that knowledge is not always conveyed in its essence—it is misunderstood or it is misrepresented. A minimum, the part that is palatable, comes out unscathed. Sometimes the accumulations of the past seem to be regarded as of little account. That must be because teachers prefer, not always wisely, to devote themselves to values believed to possess greater validity because they possess greater currency to-day.

But ideas have long lives. One of our great contemporaries believes, indeed, that being once born they march down through the ages having histories of their own. It is an engaging view. The point is not so much that questions which nature suggests to us to ask remain unchanging in their formulation as that a way of looking at nature once suggested keeps being insistent, sometimes more, sometimes less, the intensity of the search for an answer varying with special and general circumstances. I remind you that the uses to which the heart and the blood and the blood vessels are put, engaged the attention of naturalists very early. They (the Naturalists) kept coming back century after century to an attempt at solution, always

thinking that an answer had been found, but never aware of the inaccuracy or the inadequacy of those answers. We think now that we have been making and are making great strides toward understanding. And we are. But let me remind you also that in a very real sense, we possess small likelihood of thinking of kinds of mechanisms except those which lie reasonably close to our hands. And yet, in connection with the circulation and its mechanics, the questions we can and do ask for which there is not even an approach to an answer are very startling. I am thinking, in the heart, of so essential a part of its mechanism as rhythm—rhythm itself being a phenomenon widely recognized as occurring in many aspects of nature, without in most situations our having the remotest notion as to how to proceed to find an answer to our inquiry concerning its origin or its nature.

I may be permitted to keep looking for illustrations for my thesis in the domain of the heart. Beside rhythm, of equal importance, is contraction. With the unfolding nowadays of precise knowledge on how a substance, expressed in its chemical formula, is translated into another one through direct action or through the intermediation of enzymes and of other substances, whether proteins or not, the way ahead seems long before, with any assurance, we can predict a time or a situation, about which one can say, this is the end of our journey. And in this same domain of contraction, though surprising increases in knowledge have occurred since Hill and Meyerhof studied in its simpler phases the glycogen-lactic acid cycle, the gap between that mechanism and the behavior of the protein, myosin, to name the chief constituent of muscle, is wholly untouched. And yet we are entitled to believe that, compared with what Aristotle knew or Galen, or Vesalius, or Fabricius, or Harvey, or Lavoisier, or even Tigerstedt or Starling, the difference appears to be that between poverty and wealth. There is an important sense though in which that difference can be exaggerated. Aside from the accumulation of actual information, what should concern us is the cerebral power, that power of mastery in the face of mystery which the mind of man knows how to exhibit in unravelling the intricacies of nature. It makes no difference to us whether what they accomplished, now seems simple. That will be what our descendants are like to think of us. The form in which criticism is practised in the East is relevant here. There it is the function of critics to put themselves in the place of creative artists or indeed of creative scientists. There is, I think, no fundamental difference between the two. That function is *Einfühling,* a quality which makes it possible to feel into the original creative situation. If we compass this act there is little doubt we shall appreciate that the intellectual capability exhibited then was of an order similar to any shown nowadays. Discoveries and the content of discoveries are new. But the flights of which the imagination is capable—are they higher now than then?

We are wont to think that the intellect, like the wind, bloweth where it listeth. Even if this were true I doubt whether I, or whether anyone, could trace under what influences and in what environments, men have come to think what they did in building the content of our culture. Of the two main schools of opinion, that the mind has been free roaming in search of its interests and that it has moved within frameworks dictated by the needs and temper of a time, there is still no final decision. Most of us believe that we are, even if we have not always been, free agents; that what we do to succeed is exactly adapted to what we should do. We take the general view that these are matters which have been thought out and can therefore be dismissed because they have passed successfully through the fiery furnace of experience.

But let us pause a moment. Let us pass by the Greek thinkers, though even in their schools there was sharp discussion of what, in the way of doctrine, should and should not be taught, and pause when we come to those first centuries of this era when other worldliness drove out all interest in the concerns of this world. Something, it now seems certain, remains of the old interests in the west of Europe, but, it seems, not much—legacies but not practise. And these legacies were best preserved in the outskirts of the Mediterranean, not at its center—in Arabia, in North Africa, in Spain. Not until there was need for codifying and teaching the Cannon Law did the semblance of systematic instruction return to Europe. The mind was not free to roam, not in the case of Copernicus, nor Galilei, nor Vesalius, though it roamed delightedly in the realms that were attempting to make order in the conceptual world—concerning God, destiny and salvation. Later, by not more than three centuries, with a new orientation, inquiry about the real world began again. But it took less than another 100 years from the publication of "De humani corporis fabrica" (1543) to that of "De motu cordis" (1628) before teaching had become so crystallized in the universities that academies were founded in Italy, England, France and Germany to struggle with the problem of how to get on with the advancement of natural knowledge. Evidences of such struggles are to be found in many places, dealing with many subjects.

Nor did medicine escape. It is necessary to recall that although there was systematic instruction in medical subjects, more especially anatomy and anatomy

perhaps alone, beginning with the closing centuries of the Middle Ages, studying diseases and observing therapeutic successes did not begin until the sixteenth century. In the University of Paris, teaching Harvey's discovery that the blood circulates, was out of the question. To escape from dictation by the vested interests, the more active enquirers founded and were aided in founding by the Government, the Collège de France and the Académie des Sciences. In England in the sixteenth century knowledge was so sedimented and crystallized in Gresham College, that a forward movement, though having its forward impulse and seat there, came to be more hospitably received at Oxford in the so-called "Invisible College," later to be competently protected under the charter of the Royal Society. But it was medical subjects rather than medicine or medical disciplines in the form of a curriculum leading to a degree and the right, in any modern sense, to practice that came into existence. At the end of the eighteenth century at Speyer, Johann Peter Frank, a layman, a Minister of State, faced problems having to do with the public health without benefit of medicine. But it was in the eighteenth century that what we now recognize as the semblance of a curriculum began to appear.

What I am trying to emphasize in this random recital is that old as is the enquiry concerning the behavior of the body, both in health and in disease, interest in learning the nature of its processes without older prejudices, coupled with an interest in anything like a systematic form of teaching, are the inventions of very recent years. You will, I think, look in vain for periods in which there existed belief in complete *freedom* of inquiry, even when there was an inquiry at all. It is a mistake to think that the tradition of free inquiry is ancient, or so well established, that it can be taken for granted as one of the secure possessions of our society.

The contention then is that the curriculum, as an expression of belief, is reasonably recent; that the curriculum once accepted, itself has tended to undergo a succession of crystallizations; that each one of these crystallizations has tended to become a rock-like deposit so that force was required on more than one occasion to blast a way clear to permit newer ideas again to flow. And my moral is that, in this background, it is of the utmost importance to be on guard against perceived and of course unperceived repetitions of these catastrophes. You will not need to be convinced that my account of the situation at somewhat older periods is reasonably fair. But you will not be content with the inference that we need to-day to be vigilant unless I offer examples for my statements. I am speaking, you remember, of the intellectual strain in medicine, its viscissitudes, its checkered fate. Perhaps the most striking example that occurs to me is in the domain of medical psychology. Thirty years ago, in any ordinary sense, such studies were not so much ignored as not even considered. The mind of man had a place in nature, but not in the medical curriculum—except it be what was roughly called insane. The mind anyway, as has recently been so plentifully emphasized, though it is an important instrument in our existence, found little favor in the attention of serious students because, so far as could be told, it dealt with what Descartes termed secondary and not primary qualities. Then came an era, under the leadership of Charcot and Breuer and Freud in which an attempt to be serious about behavior was attempted. Since Freud's death it has been possible for Burt to say in *Nature:*

> Freud was, indeed, one of the boldest and most original of thinkers. Nevertheless, the isolated items in his theories were by no means so novel as is popularly supposed. Both in Great Britain and in America a strong reaction against the intellectualistic psychologies of the nineteenth century had already set in. James and Stout had emphasized the need for a more dynamic psychology; McDougall had urged the importance of unconscious motives, particularly in the instinctive and emotional life; Janet had emphasized the importance of dissociation in mental disorder and disease; Havelock Ellis had attempted a scientific study both of dreams and sex. Freud's own great achievement was perhaps to incorporate what was most fruitful in these ideas in a single, striking, unifying system, and to collect a vast amount of empirical data from a wide variety of sources, all illustrating much the same fundamental mechanisms of the mind.

But Freud was given no place in the University of Vienna either to study or to teach. His examination of the problems with which he dealt was not undertaken in any university in England; and in this country, although Hall was sufficiently concerned with this issue at Clark University to invite Freud to come there, there is still, so far as I know, no place in any university, except at Harvard University and there, not in the medical school but in the Department of Psychology, where these studies are welcome.[2]

I wish I were competent to search out and to set before you the reasons for this exclusion. If I venture to do so at all it is with the utmost trepidation and for no other reason than to find a gross example for a thesis I want in a moment to examine. It is not as if what I am about to say is invention of my own—in years past I have on many occasions taken part in and listened to conversations in which I learned

[2] I have recently been told that psychiatrists who have been psychoanalyzed are teaching in the University of Chicago. And the same statement may be warranted of other institutions. But that is not quite the same as having made an open provision for this form of teaching in medical schools.

that these were the views of many other men. To our great credit, be it said, it is well recognized that aberrant behaviors are among the commonest of the causes that send patients to physicians. That physicians are inadequately prepared to cope with such situations is recognized everywhere and the fact deeply deplored. But—to do anything to relieve this situation presents great difficulties. Our methods are not applicable to the analysis of these maladies. Is it unfair to point out that science is *only* a way of thinking about nature and that there was science before kymographs, manometers, galvanometers and Roentgen rays—perhaps even before weights and measures? These are the methods it is now respectable to employ. Until other appropriate ones become acceptable, it is not the part of respectability to meddle with them.

But if you regard this situation in medical psychology as exaggeration, let me recall that all advance with the aid of the intricate apparatus of laboratories was regarded as taboo by leaders of our profession no less recently than a single generation ago. Meetings and space in journals were devoted to disquisitions on the perils to which medicine was about to be exposed by men willing to devote all their time to current methods in the study of diseases. The echoes of that controversy are not yet dead, but times have materially changed, and quickly—it has now become respectable to attempt analytical methods. Let me recall further that our system was lacking in that there existed nothing essential except the professors, for whom the enterprise was on the whole chiefly a profit-making business. Obtaining a degree was a matter of having paid a fee. The course had no fixed length nor was it graded. Grading began in 1859 in the medical department of Northwestern University in Chicago—a three-year graded course. At Harvard College grading began in the early 1870's. And in a serious way it began at the Johns Hopkins in 1893 when the bachelor's degree was required for admission. There were no laboratories until 1878 when Dr. Delafield established one (The Laboratory of the Alumni Association at the College of Physicians and Surgeons) and until in the same year Dr. Welch opened a pathological laboratory, with private funds, I believe, at the Bellevue Hospital Medical College.

I want next to examine one aspect of the state of research in medicine and to draw lessons from the past to suggest that a forward advance is conceivably hindered by our current arrangements. It is not at all an infrequent experience in our hospital at the Rockefeller Institute that men come applying for posts at 27 to 29 years of age. The assumption when they come is naturally that what they desire is to devote their energies to the advancement of learning—to research. But there are among the applicants also men who, it turns out, intend rather to teach than to investigate and others still who wish to enter private or public practise. Recently among them was a very engaging and intelligent man who had decided that teaching was to be his career. He wanted instruction in the varieties of cardiac diseases. He wished to see intimately cases illustrating the senescent, the infectious, the toxic forms. After a period spent in observing one variety he wanted, much as internes do, to move on to another service—from mine, for example, to Doctor Swift's. I explained the situation; if you came for a year or two and had embarked on an investigation, presumably of significance—the chances were that when your time is up, you would still be far from having completed the written report of your experiences—to say nothing of attempting to savor one complicated subject after another. He understood, this lad, very well, when the situation was made clear. He was disappointed though because, when he entered practise as he intended to do, he would not have seen as correctly as he should have done cases of this or that named disease. He came from one of the better schools. That lad seemed to me to be laboring under a tragic misconception. He did not see that to the extent principles exist in groups of diseases, the essential thing in any discipline is to understand those principles, the general rules—that knowing all about individual so-called diseases was to attempt to assume a burden greater than was at all necessary and intellectually very uneconomical. But he went even further and wondered, indeed I think he doubted, whether there were value to him as a teacher in knowing something of the methods of research. I infer that I made my points in vain, for he decided against our plan of training.

I find this experience important. The fact that it has become customary to carry on research in university clinics is evidence of the wide belief that this practise has advantage. And those advantages ought to be vividly appreciated. To make clear to anyone the nature of a current conception, especially on the part of teacher to student, it has seemed desirable that the story of the growth of that piece of knowledge should be told and retold in a lively fashion. The story so often suggests the origin, purpose and success of an adventure. Going actually through the mechanics of performing a research is as lively a way as any of becoming sensitive to the history of how knowledge grows. And a teacher I should think would be the more effective the more he knew such stories at first hand. But then this is all commonplace and well known. Every one does not become a good teacher, no matter how much he obeys the rules of the game. But anyone can become a better teacher if he knows

how knowledge has been acquired so that he can tell stories rather than present completed pictures. I had hoped that that lad would depart a wiser, even if a sadder man. But no; he was not persuaded.

Of course there is much to the making of teachers beside having acquaintance with the dynamics of research. Undoubtedly, aside from the immediate content in subject matter, how to teach has a technique. I can not be greatly in error in supposing that in preparation for teaching, the subjects which are included in the curriculum of a medical school, how to combine the various elements in each—content, technique and history—still requires thoughtful canvass. Otherwise I could not have had my recent experience.

To that other subject to which I referred briefly just now, I want also to direct attention. I am aware that I am about to tread on dangerous ground, that it is ground with which I am insufficiently familiar, that what I think, at least now, before you have set me right, is open to serious criticism. I am persuaded though that the subject is important and merits very careful study if the advancement of knowledge in the study of diseases is to be in a healthy situation. It is unnecessary to speak of preparation for investigations of problems in morphology or in physiology or in that aspect of morphology and physiology combined which is biological chemistry. These are subjects of wide and general interest which would be undertaken even if there were no diseases—subjects which healthy men would venture to study to enlarge their comprehension of this world. But the matter of studying diseases—that is where a perplexing difficulty compellingly presents itself. There are several ways of approaching its analysis—I shall attempt two. First, let me speak of the case of a determined student, man or woman, arrived at the age of 29, now confronted, perhaps not for the first time, with what next to do to become a responsible investigator. At the age of 29, he or she has done what the curriculum prescribed. There are in point of fact few persons who have the hardihood to ignore what is prescribed and I have recently learned again of the cases of men who were warned against making the attempt even of adopting bio-chemistry as a career except under the aegis of the medical curriculum and the medical school with the imprimatur of the degree of doctor of medicine. There is, of course, in this debate, a valuable argument in favor of knowing the background, as the curriculum presents it, of a discipline in which students design to carry on investigations. But need it be the whole, unmodified, time consuming and in part irrelevant curriculum? How much more hazardous would it be in point of fact for one intending to study diseases to proceed on an original course exactly and broadly calculated to fit him for his enterprise?

But it is desirable to turn aside to look at the medical curriculum. It is, is it not, a rigid structure, designed to acquaint students with what experienced persons regard as indispensable to those who engage in the practise of medicine. In part, the structure is responsive to a sort of historical blackmail exercised by Boards of Regents when they construct examinations for the license to practise. The Regents themselves are the victims of the historical process and system. And so history, the future, the Regents and the faculty combine to make the curriculum what it has become. So far as the fair, enticing, irrelevant world is concerned the curriculum is partly shafts and partly blinders. Do I exaggerate when I say it contains a great mass of necessary elements, no doubt, but from any single or many points of view, often ill assorted? Is it incorrect to believe that it contains subjects or parts of subjects which are taught because once they were regarded as relevant to current knowledge? The history of curriculums is the history of succeeding beliefs. We hold beliefs longer than we should and do not permit them to be dislodged when they *should* be, by novel discoveries and situations. We make our curriculums rigid so that revolutions are necessary to make room for new ideas. Conventions have such momentum that we teach them far beyond the time when they represent truth—to the exclusion of novelty. Novelty then grows up outside of schools and is later either forcibly admitted or becomes so potent as to exert disruptive force. I am not referring, as earlier, to the historical aspects of relevant subjects but to subjects which either need not be taught because they have no practical bearing or to subjects which, even if they have, receive a devotion in the time spent upon them out of all proportion to what is necessary, if there were introduced suitable latitude in the techniques of instruction. I am speaking of the mere saving of time. Of course I have been reminded that learning consists not only in becoming acquainted with subject matter but as much with the duration of familiarity with that subject, and that success is a function of the length of time we have the opportunity or the necessity of holding that subject matter in our consciousness. These are debatable matters. Indeed I am prepared to have you demonstrate to me that there is now in the curriculum nothing useless, that there is no misuse of time.

In that event we are at an impasse. Students, not many perhaps but a few and very important ones, have in good faith passed through our schools and their interne periods—the periods of their major impressionability. They are 27 to 29 years old and when they come to us they must be told that the time is all but passed for them to become professional investigators. Of all of this I have seen tragic consequences. It is the more tragic when you reflect that

in other disciplines, in other natural sciences, in physics, and in chemistry and in subjects such as mathematics, great discoveries have been made before this age of 27 to 29. But even if late, why has it become at least doubtful whether a medical school is so constituted as to be a good training ground for learning how to carry on research in diseases? What the situation is in the study of diseases is, of course, familiar to you. I pass over that compartmentalization of diseases which has made it merely conventional to separate infectious diseases from those exhibiting predominantly chemical or physiological aspects. But these are essential differences when the time comes to apply the techniques of analysis. When that time comes it is also familiar to you that the comprehension that issues from analysis is obtained now, as no doubt it always was, not at the level of organization at which diseases, or indeed any phenomenon exists, but at a level more general and more simple, less organized, less special, than the obvious and apparent aspect which the whole integrated action presents. And nowadays whether a disease is metabolic or immunological or physiological so-called, essential investigation begins to take place at a level not at all obvious. How hormones actually operate, how muscle contracts, how the body defends itself against attack from infectious agents is to understand that mechanism in terms which do not in the least disclose themselves to the immediate attention either of patients or physicians. Naturally it would be absurd to say that an end has come to the opportunity for therapy on irrational grounds. One need not have so great confidence in the operation of the mind as to suppose that only through its mediation are far-reaching discoveries to come about. Contrariwise though, rational therapeutics can not be supposed to be dependent upon the comprehension of the superficial processes actually encountered. But to investigate at those levels of organization in disturbed or diseased organisms at which malfunction occurs seems to suggest on the part of investigators the possession of technical competence which can be acquired apparently only through long familiarity with the thinking and the techniques which are requisite in elucidating the mechanisms which are actually in operation. At 29 it is too late for most men on the threshold of economic responsibility, even if it were possible intellectually, to undertake essential reorientations in order to acquire the necessary equipment. I speak with feeling. Perhaps men will always be speaking with similar feeling in the sense that similar surprises lurk in store for all of us—we live on into unfamiliar eras. We are not spared like Cato, knowledge of the greater Rome. And in these days we live very fast. I am, if you please, not to be misunderstood; there are multitudes of collateral sources of interest and opportunities for the display of intellectual energies. Whatever other situations exist, this one, on which rational analysis depends, begins seriously to be removed from the opportunity of men arrived at 27. The inescapable consequence of this situation is that if problems now recognized as capable of solution are to be solved, salvation must result from the activities of men trained not as physicians are trained now. Other men, whether chemists or physicists or physiologists must be drawn into the service. Physicians who have first acquaintance with the phenomena and meaning of diseases must step aside from careers of this sort of adventure and limit themselves to the care of the sick. This is a noble and engrossing enough calling. But the serious and unfortunate question remains—must physicians insist upon such self-denying ordinances, when the opportunities for a different arrangement of study have not adequately been explored? In that case physicians have trained themselves so as to become incapable of investigating, at an appropriate level, the very subjects of their deepest concern. The result is deplorable only if one thinks it so. Many do. Indeed there are many physicians who think that the recognition and understanding of such special phenomena as diseases are not likely to be studied as successfully by others as by those whose especial concern and responsibility they are. A compromise has often been effected through association of physicians with other scientists. That may be the necessary conclusion of the matter. And yet—there are men of 27 who desire a different solution.

What I have been saying earlier is that it may be possible, by taking thought, finally to add a cubit to our intellectual stature. We may be able to guide men who wish to find themselves in different positions at 27, into different channels—either in our schools or through flexible arrangements elsewhere in the universities. If suitable arrangements can be made within the schools, a signal advantage would be gained through the simultaneous presence under protection of men of similar ultimate interests, of varieties of students actuated by similar motives, devoted to similar ends and separated only by the different approaches to those ends. Ten years ago I entered a plea in this company for mutual understanding among all of us devoted to the service of different aspects of our lives in medicine. I am reverting to that subject. What I have observed in the interval is that the old Adam still struts among us, that all the differences in temperament have not been bridged. Men still fall into strata. They still practise their snobberies. It is a little soon to expect the heaven, we hope, all of us, to establish on our earth. But now when we begin to understand better what the elements of our problem

are, I ask seriously whether this situation should not be taken into review. Whether we can not find ways in which within the schools, means can not be found for educating men, within a faculty of the medical sciences, to undertake the variety of services which lie open to us. Men of 21 are perhaps not too young to declare, provided the facts have been placed before them, wherein their dominant interests lie. Life is too hard and competition too keen, much longer to permit ourselves the luxury of *not* knowing. You will say, the trouble lies farther back, in school and college—and I agree. We begin, all of us, to recognize the fact that the physical frontier has disappeared only to find that instead of being far away and out of reach, it has moved close to our very doors. There are new frontiers; we must choose, young and early, which one we are to cross and within which one we are to find home. We know anyway—most of us. We can be aided by discerning advisers. The various careers in medicine can then be harmoniously developed. Diseases can be competently studied. Their analysis need not be delayed or made complicated by requiring the collaboration, no matter how eager and willing, on the part of men of different outlooks and trainings and interests.

Whether the problem I present can be solved in the way I suggest makes little difference. I am more interested in raising doubt lest we be betrayed by our sense of security—doubt lest we conclude that what has once been adopted is eternally established. The history of intellectual organization, as this has been illustrated in the behavior of universities, I have suggested, does not necessarily encourage us to conclude that there is nothing left to suspect or to learn.

There is no other profession which requires of its members so great a range of responsibilities—the whole gamut of human concerns from irrational to rational. Response to suffering is the *fons et origo* of our motivation. The history of man has made us aware at least of this, exemplified in St. Francis, that sensitiveness to suffering is bred in our beings. We could not escape the motive of compassion if we would. But to be effective, we must, in this very necessity, collectively put hard heads at the service of soft hearts. There lies the difficulty of our complex professional existence. Somehow we must harmonize our dual nature. That may, hereafter, turn out to be more difficult than ever it has been. But the success of our test will be measured in the degree to which we recognize our double obligation and embrace our double opportunities.

SCIENTIFIC EVENTS

THE PRINTING PRESS OF LEONARDO DA VINCI

THERE was an informal private opening of an exhibition of the scientific achievements of Leonardo da Vinci at the New York Museum of Science and Industry on Wednesday, July 24.

Correspondents have called attention to a quotation in the issue of SCIENCE for May 24 in regard to the printing press of Leonardo, stating that it antedated the press of Gutenberg. This is obviously impossible, as Gutenberg died in 1468 and Leonardo was born in 1452. In regard to the press of Leonardo, SCIENCE has received from a correspondent the following details:

To ascribe a definite date and a definite locality to Leonardo's printing press would be quite impossible because of the lack of authoritative records. Suffice it to say that the machine was put into actual operation somewhere in Italy towards the end of the fifteenth century.

Leonardo's exhaustive mechanical studies and applications proved very helpful in enabling him to produce a machine much more practical than that of Gutenberg's, in that it could be operated by one man in a comparatively simple manner.

Movable type was cast of lead and placed in a shallow basin on a very heavy wooden car equipped with rollers. Once the type was in position the actual printing was a very simple matter, requiring but the turning of a solid wooden cylinder threaded at both ends, which turning caused several simultaneous things to happen. A large cogged wheel on the top of a very massive wooden frame engaged with cogs on the upper end of a long pipe, which rotated rapidly, causing the rope connected to the car to wind on a roller, thereby pulling the car into position under a heavy wooden block, which, lowered because of the turning, provided the pressure needed for the impression.

Turning the cylinder in the opposite direction raised the weight and let the car roll down a slightly inclined plane for the printer to place another sheet of paper over the type.

Because of Leonardo's studies on the effect of friction this machine is as frictionless as possible, and with a system of weights so arranged as to be perfectly balanced, the operation of this press is almost effortless.

To those who appreciate the beauty of simplicity and compactness in a mechanical contraption the beauty of this press is inescapable and the amazing versatility of the inventor startling in its scope.

A working model of this press is included in the present exhibition of the works of Leonardo. On this same model a short description of its invention and operation was printed during a similar exposition last year in Milan, Italy.