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Professional Collaboration

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It is my purpose in this paper to examine some of the responsibilities and opportunities of the professions, particularly those of medical men and scientists in these days of great hazard and promise.

A fascinating future surely lies before us, provided that we can escape certain perils, and the most heartening potentialities lie in the field of medicine and in the sciences adjacent to it. The time is coming when the practice of medicine will rest securely upon a firm scientific foundation, upon a systematic understanding of the life-processes in all their complexity, and no longer upon the insecure and shifting basis which partially supports it today, with clear understanding in part, but with a great mass of uncoordinated, empirical data necessarily as the main reliance.

The full integration may not come in our lifetime; indeed, in the light of the enormous complexity of living organisms, its consummation may require more than the mere compilation of experimental facts and the orderly marshaling of them under working hypotheses, the method which has been successful in the far less arduous task of interpreting the mechanical aspects of the nature of the physical world. There may be required new methods of thought, novel ways of recording and transmitting the accumulated experience of the race, ways as yet unconceived of bringing to bear on complex problems the interrelated efforts of diverse minds. We may witness new devices as powerful, versatile, and rapid as digital computers in the realm of computation and analysis, but capable of interrelating and ordering masses of primary and inexact observations into meaningful arrays. There may be means for communicating the knowledge of a group which will render obsolete the cumbersome writing of papers and the chaotic task of storing and consulting them. Certainly we will see the day—perhaps we should have already—when the public lecture is fully obsolete.

The marks of progress are all about us. The biological sciences are moving forward on a broad front and at an accelerated pace. In the next decade the flood of accumulated basic knowledge may produce applications of startling moment, much as the accumulated fundamental knowledge in physics recently led to an understanding and manipulation of the atom, the transmutation of elements, and controllable atomic energy.

Genetics some 10 years ago turned from the higher organisms to more elementary ones, expecting to find there simplicity in the beginnings of genetic systems, and found instead an amazing early complexity. But, with the more plastic material, experimentation has proceeded at a breath-taking pace. Chromatography, the use of tracer elements, and michrochemical processes are sorting out many an old puzzle in biochemistry. The involved system by which bacteria synthesize the amino acids is falling into line, and some day we shall understand more of how these building blocks are assembled into proteins. The amazing skill of organic chemists produces for us not only duplicates of vitamins or hormones, but also derivatives and analogs of these, and we understand the first chapter of how an antibiotic may operate, or why a vitamin is essential as the building block for an enzyme. The chemistry of muscle action is not nearly as mysterious as it was; at least we know something of the source of energy and something of the process by which chemical bonding and shortening are interrelated. In photosynthesis it appears that we are, at last, on the verge of producing the essential chemical action *in vitro,* with chlorophyll and its associated protein isolated intact for our study.

We could readily extend the list of recent accomplishments. But there is vastly more to be done. We are, for instance, very far from understanding why one substance, with a molecular weight in the millions, may be beneficial, while another, differing only slightly, may interrupt essential life-processes. The world is still full of mystery, and it will be long before we understand much, even when we limit ourselves to the mere mechanism of life and do not approach that greatest mystery of all: that we, as conscious beings, are capable of pondering it all.

As we view how far we have come and glimpse the great vistas before us, we know that this is an exciting time in which to live and that stirring adventure beckons. There is accomplishment to be made that will render life more pleasant and we hope more fruitful, that will lift the burdens which man's shoulders have borne since he first dominated the earth and banish the pain and harassment that have always been his lot. For we now know that, given time and wisdom, the ills of man may be conquered, even those ills of his mind which have forever dragged him down. All this can be done if we escape our perils and continue on the bright path we have recently trod.

And what are these perils? First is the threat of war, appalling war that would be fast and terrible, in which H-bombs would destroy cities at a blow, in which hundreds of millions would be killed and maimed in an insane fury that would leave the whole world, belligerent and neutral alike, a devastated desert.

This is not the only peril. The *Communist Manifesto,* which declares, "They openly declare that their ends can be

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attained only by the forcible overthrow of all existing social conditions," is still the charter of a powerful oligarchy that holds great nations in thrall. Political murder, enslavement, and conspiracy against neighbors did not end when Stalin was vilified. The advancing tide of Soviet domination, engulfing weak states by force or stealth, seems to have been momentarily halted, but it will again creep forward unless we are alert.

Nor is our democratic system safe without the eternal vigilance that is difficult to sustain in prosperous times. When all goes well, as it does today, citizens are prone to forget that a determined, informed public opinion is our only guarantee that the liberties won by our fathers will not be whittled away. We have the highest standard of living the world has ever seen. We have nearly full employment, many benefits that ameliorate the lot of the unfortunate, safeguards against the cruelties of nature, and some safeguards against the evil deeds of men. But can we hold on this high plateau, continue to provide liberally for those in distress, and, particularly, can we continue our insatiable national appetite for luxury, without forcing ourselves again into inflation?

Characteristics of a Profession

Whether we escape the perils and continue on the bright path to a happier life depends on whether we, as a people, think wisely and well. Not the acts of legislatures, not the pronouncements of courts, determine our future; these are transitory and can change. The great swelling voice of the mass opinion of the citizens of this republic, incoherent and discordant, erratic and superficial as it sometimes is, and rising to heights of sound judgment at rare intervals, maps out the road that all public servants ultimately follow.

This public opinion is not formed by the radio and the press or even by those who control these media. It is formed by that minute fraction of the population which thinks and speaks, by that small but powerful minority, disagreeing on every issue, arguing and ridiculing, which looks beyond the diversion of the moment and influences because it labors to understand. The members of the minority are in every station of life—in business, in labor organizations, and on the farm. They speak in every circle. The most significant group of those who think well is in the professions, for it is their prerogative, their duty, to think for their fellows within the limits of their diverse specialties, and they instinctively approach every question by attempting to understand it, for this is the way in which they gained admission to their privileged status. On the professions, then, rests much of the burden of guiding this country of ours on its strange but hopeful way.

What is a profession? What are the characteristics by which it is distinguished from other groupings or types of organization?

First and foremost, its members are the possessors and custodians of a special field of knowledge, acquired by long, assiduous study, and they are respected and accorded privileges because of that fact.

Second, it is a loose grouping of individuals rather than a pyramidal organization. In nature we find two types of organization, the integrated society, exemplified by the ant, and the associative society, illustrated by the flock of birds in migration. Both forms have been successful in evolution throughout the wide range over which organisms combine. Both forms are found among human institutions. The profession, most decidedly, belongs in the second category. This is not negatived by the fact that many professional men are members of other types of organization and, for example, derive their income in the form of salary rather than of fees, although the true status of some professions is threatened a bit by the trend in this direction. Whether a man can be an employee, and at the same time a truly professional man, depends on whether he can maintain his individuality and his relative independence, and many can. The true profession, however, is a voluntary binding together of independent members, deriving none of their sustenance from the association, utterly uncontrolled in their thoughts and actions as long as they remain within the law and within the code of the association itself.

Third, every profession has, to some degree, a symbolism and a ritual of its own. There is not so much of this in recent times, for many procedures which were once impressive are so no longer, because we have become more mature perhaps, or at least more skeptical.

Fourth, there is often, especially in the older professions, a means for maintaining standards and for disciplining those who violate a code, usually backed up by the civil law. Something of the sort is essential, for every profession is surrounded by charlatans, and, human nature being what it is, special privileges are bound to be abused. Of course these controls have been used at times to limit the professional privilege to the elect and hold down the numbers of those who enjoy the franchise, but this is certainly not a prominent feature today. On the other hand, the formalism and rigidity of control does seriously hinder the man who would enter the profession by an unconventional path, no matter how intelligent and devoted he may be, and it tends also toward an undesirable uniformity and standardization.

But the primary characteristic of a profession has not yet been mentioned. Without it, no group, no matter how scholarly it may be, no association, no matter what the titles of its members, no assembly of striking individuals, no matter what may be the depth of their culture, is truly entitled to the proud name of profession. From the earliest times, this primary characteristic has been the hallmark of professional men when such men have lived up to their high ideals. The members of a profession minister to the people. The word connotes more than service. *To minister* implies no servility, no apology, no inferiority. On the contrary, members of a profession minister with dignity; they demand the respect due to their skill and devotion; they do not merely advise, they insist upon being heard; they do not submit their opinions for the judgment of the layman who is their client, no matter how powerful he may be; they insist that they have his confidence and that, in their special field, their opinion shall control, or that the client turn elsewhere. They recognize that he may need to join their findings with factors outside their special field in coming to decisions. They refrain, if they are wise, from any appearance of speaking with authority except in the area of their own competence. But within their proper scope, modest men though they may be, they advise and guide with pride, and with the insistence that the ancient art which they represent be received with the respect which is its due. And, when they minister to the weak and humble, they do so with kindness, bringing to the unfortunate, whether their ills are spiritual or physical, whether their misfortune results from the rigors of nature or the cruelty of man, that most heartening of support, a strong and able ally and friend on whom to lean. All this it means to minister. As long as members of our professions live up to their birthright, this will be the shibboleth that strengthens the bond among them.

There is a corollary characteristic. The true members of a profession detach themselves from the mad scramble after this world's goods. This does not mean, as it once so often did, that they abjure the fine things of life and retire into a monastery. In order to function with full effectiveness, a professional man needs a competence, that he may live in reasonable and proper manner, as befits his station and his mission. But when a man in the professions makes riches his primary goal, he ceases to belong to the profession in a true sense. The greatest exemplification of this corollary charac-

teristic lies among the humble members of religious groups—the devoted parish priest, the preacher whose flock, with their sorely troubled minds, is his primary concern, and to whom wealth, or even a proper income, has no meaning in the light of his devotion.

But this article is concerned principally with other professions, for religion stands by itself and should not be subjected to the analysis which applies elsewhere. And there are plenty of examples in other fields. The teacher, and there are many, who cannot be lured by any salary attraction to less satisfying fields from the joy he finds in aiding the development of young minds is all about us, and in fact we would be in a sorry plight without him. The lawyer who takes special satisfaction in protecting the indigent and the misunderstood, sometimes at the peril of his reputation, is known to all of us. The able and devoted country physician on his weary rounds needs no emphasis on his character.

Privileges

We speak of the privileges of the professions, and it is well to examine their basis and practice briefly. There are first the legal privileges, set up to protect the public against charlatans and salesmen of false service, and very necessary for the purpose: admission to the bar, the registration of engineers who deal directly with the public, and the license to practice. Systems, tests, and certification are essential whenever the choice of advisers is directly exercised by individuals, and we certainly, in this country, do not wish to replace this free choice by some form of bureaucratic assignment. In general, our procedures for public protection work well, even though they are occasionally viewed as a means for protecting the members of the profession themselves rather than the people they serve.

Let me, in all frankness, speak of this for a moment. Every profession, in order to function in a modern environment, is surrounded and supported by auxiliary groups, the technicians and semiprofessional groups who are the hewers of wood and drawers of water, but whose performance is nevertheless fully important to sound over-all results. These groups are not always treated with generosity and wisdom by the professions they serve. I might choose my examples from various fields—from the teaching profession where arbitrary linking of promotion and academic degrees is often carried to absurd extremes, from research laboratories where the skilled instrument maker who makes a result possible is given a curt nod rather than the recognition he has earned. Artificial barriers are foreign to our democratic philosophy, and they are gradually disappearing. Even in the military profession, an enlisted man occasionally becomes a general, and such examples, while rare, accomplish much in the improvement of morale throughout the organization.

It seems to me, as I view it from a distance, that the medical profession has much yet to learn before it is fully in step with the trend in this regard. Is the skilled technician who makes himself master of an intricate procedure, who is scholarly and wise, and who can, perhaps, manipulate tagged iodine for the thyroid better than the one who originally conceived the method, nevertheless, doomed to remain permanently in an inferior status, merely because his path to understanding was unconventional? Is the nurse of superior judgment and devotion accorded the full professional recognition that her caliber warrants? I know an accomplished archeologist, an eminent astronomer, and a number of outstanding engineers who never took a degree in course, but I do not know an eminent medical man who rose through a fully unconventional route. Ah, one says, but the system for protecting the public has to be far more effective in the medical field than elsewhere. I agree. But it does not have to be rigid and arbitrary in order to be effective; in fact, the two seldom go together.

I suppose we always need somewhat more positive limitations on designation of those who are entitled to prescribe or operate directly for fees. But I do wish that there were carefully guarded side entrances to the chosen circle as well as the well-marked front door. And, more to the point, I wish that the profession had more adroit ways of admitting to full acceptance, as special colleagues, those who excel in serving it well. I wish, also, that I could detect a trend toward passing on to auxiliary groups as much as possible of responsibility and of elevating activity, for the medical system is not one group but a number of interrelated ones, and its health is dependent on the morale throughout them.

The greatest privilege which a profession enjoys is not the prerogative conferred by law but the respect accorded its members by a grateful public, and, when a profession becomes intricately organized in the modern sense, it is essential that this unique privilege be shared throughout the groups involved in order to foster the pride and loyalty which alone can maintain the discipline and smooth interrelation needed for satisfactory performance. It is also essential, it seems to me, that there be no rigid caste system based on birth or youthful path of education, in which individual status is absolutely controlled until death, but a more fluid situation in which there are no barriers that cannot be surmounted by intelligence and hard work.

Responsibilities

What of the responsibilities of the professions, which accompany the privilege? We have already considered the primary responsibility, to serve well, to minister to the public with dignity and skill, in the fields which are their several domains. To this we have added another responsibility, secondary to the first, but of equal significance, the responsibility to lead their fellows in their consideration of public questions and in the intricacies of their daily lives. Upon the wisdom of those who thus lead, wherever they may be placed, whatever the competence which causes their associates to turn to them when puzzled, depends the safety of this country in a hazardous and promising world. There is a duty inherent upon those who can talk well to do so, and to make their thoughts known, to differ widely upon every question, with faith that an informed public opinion can resolve differences reasonably.

For the professional man, this often presents a quandary; it is sometimes difficult for him to speak without his hearers' being given the impression that he regards his eminence in one field as conferring upon him a special status in all fields. In fact we see, occasionally, the man of the physical sciences who speaks ex cathedra on politics or economics, and who thus debases the currency of those who would express honest opinions as laymen in problems where every citizen is entitled to participate and none is entitled to arbitrary judgment. But our complex modern affairs need more analysis by thoughtful men, and wide disagreement of opinion on public questions, outside of the professional field, is not inconsistent with the presentation of reassuring unanimity on well-accepted doctrine within it.

There is another responsibility of any profession, and this brings us back to my original theme. This is to enhance and extend the knowledge and understanding on which the professional practice of the profession is based. In the case of medicine, this means the profound task of understanding life, its origins, its chemical and physical processes, and its manifestations in man in his whole range of mental and physical ills and health.

The subject is too vast for any one individual or any one group; the skills and instrumentation from diverse fields are essential for progress. And all this calls for more and more effective collaboration between the medical profession and

the scientific profession, especially that part of the scientific profession whose subject matter is adjacent to medicine. I feel that such collaboration is today lacking or faulty in too many instances, and I am anxious to determine, if I can, the reasons for this situation.

There are areas where good collaboration occurs, of course. In industry, in the pharmaceutical field in particular, I have the impression that medical men and scientists understand one another pretty well and work together reasonably effectively for common ends. Then too one can point to isolated cases where there is effective attack on problems by joint effort, because two individuals happen to speak the same language and supplement one another's skills smoothly. But there is not enough of it. I cannot think of many cases in which a physicist, for example, of top caliber and a medical man of equal status have jointly attained an important result that would have been inaccessible to either alone, and where the collaboration has been on a basis of full equality and understanding. And I believe this is because there are certain artificial barriers present which could readily be broken down.

Development of Collaboration during World War II

Let me examine a somewhat parallel situation. At the beginning of World War II there was almost complete lack of collaboration between scientists and military men. True, there were governmental laboratories where both types were present, but usually there was a gulf between them. True also, there were scientists and engineers in industry who worked closely with military men, but the relationship here was often that of purchasing agent and salesman rather than professional. There was generally a complete lack of understanding and an aura of myth and prejudice.

Military men thought of scientists as long-haired visionaries, with no comprehension of the tough practicalities of life in general and certainly not of war. They felt, and here they were right, that few scientists had the slightest conception of what is involved in military leadership, of the rugged indoctrination that enables a good officer to hold terrified men together, striving toward a common goal, in the face of disaster, horror, wounds, and sudden death. They felt, and here they were wrong, that scientists were generally prima donnas and softies who could not take it. Moreover, they felt sure that the art of war had matured, that technical change could come only gradually and in detail, and hence that scientists had nothing real to contribute, and moreover that they spoke a language which no normal human being could possibily comprehend or would wish to.

Of course, there were exceptions. There were Army and Navy officers who were excellent engineers and who had, as every really competent engineer must have, an understanding of the trends in the sciences on which engineering progress is based. But the main body of opinion was the other way. Early in the war a major general, whom I will be careful not to identify, but who headed a very important branch of the service, told me in no uncertain terms that research on weapons during a war was absurd, for no weapon developed during a war ever came into use before its termination. And an admiral asserted forcibly, and in writing for that matter, that the Navy had the submarine situation entirely under control and wished no suggestion from those who could not possibly comprehend its problems. Officers were generally polite, but courtesy usually connoted a feeling on their part that there was nothing to be gained by any less formal relationship.

And scientists, only too generally, thought of military men as dodos, who insisted on fighting every war with the weapons of the previous one, who resisted and resented innovations that would cause them to alter the ingrained habits and conceptions of a lifetime. Unfortunately, there was often something of truth in the concept. They regarded military men as caste conscious, with a tightly knit set of social conventions. They also felt that one could not collaborate with a military man, that all one could do would be to lay naked before him the fruit of his labors, for him to judge, without explanation and without appeal, from his unique position as the only professional man who understood war.

The relationship between medical men in uniform and out was, of course, markedly different. For many medical officers were professional medical men first and foremost, and many medical men in civilian life understood fully the problems of medicine in the services. But I have been considering the relationship on new weapons rather than on military medicine, and on this there was a yawning chasm and an almost complete lack of collaboration of any sort.

Yet, before the end of the conflict, the whole art of war had been completely transformed, because of the advent of spectacular new weapons: guided missiles, proximity fuses, radar, target-seeking torpedoes, recoilless guns, rockets, appallingly effective gases which fortunately did not come into use, and the A-bomb. Moreover, there had developed a genuine partnership between military men, on the one hand, and scientists and engineers, on the other. Mutual understanding and respect appeared. Close friendships developed. Many officers acquired a remarkable understanding of new technical developments. Many civilians became adept in the subtle aspects of the art of war. There was teamwork of the highest order, and out of it evolved a new concept of national conflict. The course of joint development has proceeded since the war, somewhat haltingly at times, but with continuing momentum, until it has now resulted in a situation which is entirely new in the world, and in which all great war is absurd and obsolete, an unmitigated disease which must be avoided by all means, for it would be fatal to civilization, rather than the last resort of diplomacy, to be indulged in when the risks appear justified.

Why was there this extraordinary transformation in the relations between two professional groups? Primarily because there was a war on, and men suppressed their prejudices and their preferences in the general national fervor and in the determination to serve well in a time of common peril. But the two groups, thus forcibly brought together, discovered that many of their prejudices and judgments were based on myth. And each group found, in the other, unsuspected qualities of character which they could wholeheartedly admire. The transformation occurred here, and in a parallel manner in Britain, because these were democracies, where gulfs of caste or pride were readily bridged. It did not occur in the Germany of Hitler or the Japan of military domination, for the highest type of partnership is impossible in the atmosphere of totalitarianism. And this is one very cogent reason why Germany and Japan lost the war.

Barrier to Collaboration

Now I am not going to present a detailed analogy between this relationship I have reviewed and the present relationship between medical men and scientists. Some of the aspects have their parallels, which you can readily recognize, and some most decidedly do not. But I do wish to point out one or two factors in the present situation to which we may direct attention, I believe to advantage, even although in so doing I may move close to the edge of that unforgivable social sin of criticizing one's host, for I do not believe we are going to make much progress in bringing the professions closer together unless we examine frankly some of the structural features of the barrier that separates them.

I dismiss at once the allegation that surgeons are too high-hatted to work

with, that traces of compensation remain from the days when they were joined with the barbers and shunned by gentlemen. Some of the same allegations are made regarding engineers, of whom I am one, for the engineer deals with costs, and the minds of true scientists are above such mundane matters. I dismiss these allegations as false at the outset so that they will not cloud our analysis. I know I am right regarding surgeons, for I have worked with many of them, and although I have found the same distribution of idiosyncracies that occurs in the general population, I have yet to find one wearing a tall hat.

Medical men, generally, feel that scientists do not understand the motivations, tensions, and inner emotions of a medical career, and they are generally right. Scientists have never walked the wards. There is a vast difference between deciding upon the contents of a syringe, upon which may hang the life of an accomplished and valuable patient, and deciding upon the contents of a test tube, upon which no more depends than the fate of a pet theory. There is a harrowing difference between looking at the position of a needle on a dial and looking into the eyes of a dying child. There is an essential distinction between the care of a patient and the treatment of a disease. Certainly few scientists have grasped the full import of these differences. But they can learn.

Medical men, generally, feel that scientists do not understand that the practice of medicine is, and must long remain, essentially an art, to which science can sometimes contribute, but which it can by no means at present supplant. They feel that scientists insist on proceeding logically point by point, pinning down one concept completely before proceeding to the next, working slowly toward a distant goal with little thought of applications on the way, whereas medicine must continuously do the best it can with what it has at hand, even though its processes are often admittedly unscientific and even crude. They feel that scientists do not appreciate this need for art, that they are contemptuous of all that does not conform to their own standards of rigor, and that they would therefore place obstacles in the road toward empirical but necessary advance.

To turn to the other side for a moment, scientists generally feel that, when a medical man and a layman are joined in an endeavor there will be no partnership in reality, but that the medical man will either dominate the combination or break it up. They feel that if the scientist tries to collaborate he will soon be reduced to the status of technician, and that, if results appear, they will inevitably become attributed to the member of the group who alone is privileged to deal directly with the essential ultimate subject matter, human life. They feel that the medical man is afraid to admit ignorance, even when justified, and that he tends to protect himself by overassertion.

Now let me assert at once that in regard to this preconception, and the others that I have just treated for that matter, there are many exceptions, many in each profession who understand and appreciate the opposite profession fully. But I am dealing in generalities, and, in this sense, there is unfortunately a real basis for the feeling which I find among scientists rather generally. And it is not, after all, too surprising to find this true. The medical man, if he is worth his salt, and by reason of his training and experience, is prone to assert himself. If he enters a home where there is a sudden critical illness, he must portray calm and confidence, however he may feel inwardly. If he enters upon a hazardous operation, he must insist that every move in the operating room be centered about and responsive to his personal needs and decisions.

And this is the aspect of medical characteristics which the layman usually sees. He does not see the small conference between medical men on a tough case, where there is full discussion and give and take, where the opinion of the most junior member is treated with respect if he can support it ably, where there is no organization, and no one is boss, even although one man alone may be called upon to resolve the discussion and render the final decision. Still, and to be fully frank, I believe there is a bit of real basis for the feeling that, where a medical man is joined with other professions, he instinctively tends to take over.

The essence of collaboration is the suppression of all instinct toward the establishment of a pecking order—in fact the enjoyment of any social grouping whatever depends intimately on the complete absence thereof. In relations between professional men there is no such crude and elemental concept involved. But, since its presence or absence is so determining in our judgment of human relations, even the remote suggestion that a sublimed form may be present destroys the effectiveness of collaboration, for collaboration means the substitution of a group objective, voluntarily accepted, for the individual objectives of the members.

Breaking the Barrier

I could go on and try to examine a few more structural members in the barrier. But what do we do about it?

In the first place, let us record that there are individual members of every profession who will never collaborate with anyone under any circumstances. Let them depart in peace; their day is nearly done. The time is over when a Leonardo da Vinci could comprehend all of known art and science. We are also past the day when men of genius could retire to a cubicle, exclude all, and emerge with an intellectual feat of scientific reasoning before which all would bow in humble admiration. Even in the remotest corners of extreme specialization, where isolated contributions springing full grown from a master mind are still possible, the most notable advances are made under conditions where mind works on mind and where credit for primary initiation is sometimes hard to assign. The man of genius still is the most important element in the whole array, and upon his excellence most of progress depends, but if he does not know how to collaborate or is too selfish or timid to do so, we can safely forget him.

We cannot order collaboration. This is not a dictatorship. Moreover, while shotgun marriages sometimes turn out surprisingly well, shotgun collaboration is a contradiction in terms. And no amount of artificial organization, no joint institutes, or combined reviewing committees, or joint directors, will come within the squirting range of a syringe of getting at the heart of the matter.

I have only one prescription, and I cannot write even this one in Latin. The professions fail to understand one another sufficiently; let us attempt to bring them together. We do not have the impulse of war to force men into contact, and hence it will take long to produce a detectable improvement in relations by this means. Yet I see no other path.

Now I do not mean more joint professional meetings; not that! If they occur I would expect them to widen the gulf more completely. Nor do I have in mind lectures by a member of one profession for the edification of another. I am skeptical of the value of all lectures. I would hope that we might approach, much more nearly than any such artifices as those, the core of the dilemma. And that resides in the misconceptions which each profession has in regard to the other.

If I were speaking to a group of physicists, I would have a suggestion to make. I believe it would help a bit if medical men, those who do not already understand it, were given an exemplification of scientific research in action and at its best. I am far from advocating in this connection more popularization of science, or more interpretation of science in one field for those in neighboring fields, although such steps have merit. I wonder if one could reconstruct the meeting in 1939 at which the news of a cru-

cial experiment and the ideas of Frisch and Meitner were communicated to a group of physicists, and from which meeting emerged the concept of atomic fission, to be confirmed by experiment in three laboratories within 48 hours.

I fear it would be difficult to recapture the genuine atmosphere, the give and take between earnest men, the tentative hypothesis which collapsed on a sentence, the subtle grasping of relationships which were hardly expressed, the symbolism which crammed into a yard of blackboard the concentrated essence of a generation of mathematics, the mounting tension as revolutionary concepts became clearly formulated and accepted. Something of the sort might be done, and I believe there is many a medical man who, if he participated thoroughly in such an affair, even on a much less ambitious plane, would learn something worth while about how the scientific mind really operates, and what is the method of scientific collaboration at its best.

I suggest, also, that it would help to join a scientist occasionally in serious, responsible discussion of a case, typical or otherwise, of kidney malfunction, or metabolic disorder, or whatever, along with the physician in charge and the staff members. At times the fresh approach, unhampered by tradition and in spite of ignorance, will come up with a clarifying comment under such circumstances. And, in the process, the scientist will grasp more fully the central importance of art in what you do, and the contributive nature of science. He will appreciate the fundamental difference between the analysis of a disease and the forced explicit treatment of a specific case.

Thus there can be a closer approach by each group to the mental processes of the other. But I would go further than this, even though some feel that I may be naive in my approach to a very subtle problem. Men do not learn to understand one another merely by sharing intellectual experiences. They must meet on an emotional level if the foundation is to be built for collaboration on a high plane.

Scientists do not understand the true life of a medical man. With notable exceptions, this is certainly true. Yet all good scientists learn with facility, or else are simply scientists emeriti. Give them a taste of the medical life in its starkest rigor. I remember keenly one of my boyhood experiences, when I accompanied a country doctor through a poverty-stricken hospital. I remember also a conversation with a great friend and an eminent banker, whose maid had been injured by an automobile, and who had just seen the midnight scene in an emergency room for the first time, and whose admiration for the young internes was a joy to witness. I remember also being conducted through a ward, suitably attired so as not to embarrass the patients, with a young surgeon, and watching the devotion in the eyes of a humble woman for whom he had built a new face.

Pick a few outstanding and human scientists and give them such experience, and they will grasp a part of the world of man's experience which they have never known. I do not mean witnessing an operation, where the interest is mainly technical. I mean an introduction to that inner sanctum, where the true heart of medicine throbs strongly, that sanctum which is securely guarded against the cynicism of selfish men, and against the ribald comments of those to whom nothing is sacred. Indoctrinate well and test, communicate the password, and guide. From true scientists the response, while silent, will be all that you hope.

Now, what about this queer notion on the part of scientists, that medical men tend to try to dominate any small group brought together for collaboration. Here I do not know enough about the medical profession to prescribe, although I know quite a lot about some medical men. The ones I have become well acquainted with are entirely free of the fault. Perhaps there is no basis for the rumor. So I will have to leave the treatment of this ill, if indeed the symptoms are real and have not been misinterpreted, to medical men. It may call for properly proportioned psychiatric treatment; I am sure it is no case for surgery. It may be that it merely needs to be given a name and relegated to the category of rare diseases for which there is no cure but which are not of great social moment. Medical men will know. I merely mention that I have heard the allegation.

There are other ways, worth-while no doubt, in which the professions may be brought to a better understanding of one another. It is not necessary that they be brought to a full understanding of one another's subject matter; that would be impossible. For, if they grasp one another's mores and traditions, methods of thought, deep convictions, and motivations, there will be no further need to stimulate collaboration of the highest sort. It will occur automatically. And from it will result a surge forward on that complex task of understanding life, where the skill of all professional groups will be strained to the utmost, a new accomplishment which will place a firmer foundation under the keystone of that honorable profession to which medical men belong, ministry to the people. May that ministry always be conducted with pride and dignity. And may the gratitude of humble men always remain the primary compensation and reward.

Chemical Aspects of Enzyme Inhibition

Irwin W. Sizer

The subject of enzyme inhibition has come to the forefront in recent years because it offers the chemist the opportunity to study the nature of the active site and the mechanism of enzyme action. To the physiologist, it affords a technique for studying the functioning and coupling of enzyme systems within living cells and tissues. In its application to insecticides, herbicides, antimicrobial agents, and drugs, the concept of enzyme inhibition has not only proved fruitful but has provided a rationale for future developments in these areas. Although this article deals primarily with the chemical aspects of inhibition, major applications to medicine are discussed in which the biological effects of chemical compounds can be interpreted in terms of inhibition of particular enzyme systems.

Ever since the discovery of enzymes, it has been known that they are highly labile molecules which can be readily poisoned by a variety of agents. Modern developments date from 1928, when Quastel and Wooldridge (*1*) demonstrated the inhibition of succinic dehydrogenase by malonate and its reversal by excess succinate. The phenomenon of competitive inhibition was almost for-

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