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THE MODERN HOSPITAL AND MEDICAL PROGRESS[1]

To have the privilege of bringing to you the congratulations of my associates of the Rockefeller Institute on this, the one hundredth anniversary of the founding of the New Haven Hospital, is at once a great honor and a privilege.

This hospital began as a local organization to care for the sick and suffering poor of the community. We have learned how, from time to time, it has widened its field of activities and increased the breadth of its functions. In doing this it has emerged from its state of provincialism and has become truly cosmopolitan. It no longer ministers only to a small proportion of the inhabitants of a relatively small city, it no longer dispenses its beneficence only to those who enter its portals as patients, but it brings aid to the sick and suffering and protects the well in distant lands. Its influence reaches wherever scientific medicine is practiced. This widening of influence is due to a large extent to the inclusion of *education* and *research* into the formula of its functions. In assuming these new obligations this hospital has but reflected the great change which is everywhere taking place in the conception of the proper activities and duties of a hospital.

The idea of hospitals originating in man's feeling of sympathy and compassion for his fellows in distress, an emotion which very rarely is entirely lacking, even in the most rude and ignorant savage. This spirit of compassion led to the care of the sick and distressed when they are without home and friends. At first this could be done in the protector's household, but hospitality to such an extent, always difficult and burdensome, must have been almost impossible under primitive conditions. The Greeks organized institutions, *Xenodochia,* to which slaves could be sent when they were ill or were too feeble to work. The Arabs also organized institutions for caring for the ill, the most renowned one, built in Cairo in the thirteenth century, provided accommodations rivalling those of the hospitals of to-day. It was the coming of the Christian religion, however, with its deep content of the spirit of brotherly love, that stimulated the build-

[1] Address delivered at the New Haven Hospital, May 27, 1926, on the occasion of the celebration of the One Hundredth Anniversary of the Incorporation of the General Hospital Society of Connecticut.

ing of places in which the sick could be cared for. Especially the institution of the religious orders and the organization of the monasteries gave the greatest impetus to the development of hospitals.

The oldest existing hospital in London, St. Bartholomew's, recently celebrated its eight hundredth anniversary. It was founded by Rahere, a monk, who, having led a sinful life, made a journey to Rome, hoping by so arduous an undertaking to obtain forgiveness of his sins. While at Rome he fell ill and thought his last hour was drawing nigh. He then vowed a vow that, if he were allowed to return to his own country, he would build a hospital for the care of the poor. This was typical of the foundation of the hospitals of the middle ages. Their establishment was prompted by a spirit of pity or was undertaken as a penance for sin.

Although there were some exceptions, the relationship of these institutions to the development of medicine was not important. To all intents and purposes they were almshouses for the sick. There were no resident physicians. The remedial measures employed, when they were not harmful, were simple ones, magical words, nauseous mixtures, prayers, herbs, or the bark of trees. Norman Moore, in his history of St. Bartholomew's Hospital, has described one of the physicians in the following words:

> He employed a great variety of drugs, the reputation of which did not rest on experiment. He was not inattentive to the details of nursing. . . . He was equal to the physicians of our own time in his consideration for the feelings of his patients, in his desire to alleviate suffering and in his eagerness to master all the learning of his time. He was their inferior in method of observation as well as in every part of science.

At this time the most superficial aspects of disease were recognized. Men sickened and died, but knowledge concerning the nature of disease was almost entirely lacking; in what particular the sick differed from the well was not investigated. What the Greeks had learned of biology had been forgotten. As in all ages, even the present, man was more interested in the other manifestations of nature than in himself. Man knew the course of the stars in the firmament long before he had any idea of the vital activities of his own body. As he knew little about his body in health, he, of course, knew less about the conditions when unusual deviations in his physical state, that is, illness, occurred. I have recalled these facts to your mind only to emphasize the origin of the hospital idea, how interwoven it was with the idea of alms giving, how limited and provincial it was in its outlook, how unconcerned it was with the nature of disease. This conception of the hospital as providing chiefly, if not entirely, for the material and spiritual comfort of the poor when they are ill has persisted up to the present and has been difficult to dislodge from the minds of men.

As you all know, in the fifteenth and sixteenth centuries came the great revolution in man's mode of thinking. You are all familiar with this as it affected intellectual and artistic activities, as it influenced scientific development. Probably you have thought less about it in its relation to medicine. In the sixteenth century man came to see how he was made. He now saw the inner structure of his body clearly, with his own eyes, and not dimly, as before, through a haze of authority and tradition. This was important, but it was not nearly so important, even for medicine, as the fact that men in all affairs began to demand proofs. Concepts and theories alone no longer were satisfying. Every truth must be established by actual demonstration. Thus was ushered in the age of experiment, the full significance of which we are now only beginning to realize. At once the science of physics began to emerge and the science of chemistry to develop. Although the movement had relatively less influence on biology, nevertheless activity was now stimulated in ferreting out the secrets of life, in attempting to disclose the true nature of pathological processes and in endeavoring to devise means for delaying the progress of disease and overcoming its effects. Medicine began to be an objective and an experimental science. Physicians became scientists.

All this inevitably influenced the character of the hospitals. They became more closely linked with medicine. They began to have less the character of almshouses and to become institutions to which the sick were admitted in order that they might be relieved of the effects of disease. The hospitals also began to take part in the promulgation of the new knowledge concerning disease and its cure. They tended to become a part of the mechanism for instructing physicians. They added the function of education to their purely charitable aims. The idea that "a hospital is the laboratory where the results of Nature's experiments are to be studied and alleviated by the methods of science" began to be accepted. This step was taken only gradually, however. At first it was argued that the hospitals were institutions for the sick, not organizations for the instruction of physicians. It took centuries to overcome this prejudice and only recently the idea that the education of physicians is a legitimate function of the hospital has been generally accepted.

The education of physicians to-day is a far more complex matter than it was three centuries ago. The introduction of the experimental method into science

and the development of physics, chemistry and biology, were followed by an amalgamation of the content and principles of these sciences into medicine, so that medicine itself tended to become an exact science. As a result of this the course of instruction for the medical student has become so complex that, to the uninitiated, it seems bewildering. The student today must not only learn all the essential facts which have been developed in chemistry, physics and biology during the past centuries, but he must also learn how to apply this knowledge in his attempt to understand the phenomena occurring in the sick individual. It is no longer sufficient to name the disease from which the patient suffers and prescribe an appropriate remedy. The physician of to-day must attempt to analyze the disturbances accurately. He must be prepared to measure the alterations manifesting themselves from day to day, and his treatment must be established on a quantitative basis. Complicated instruments have been devised for the physician to use in making these measurements. Some years ago, Dr. Weir Mitchell wrote a most interesting paper on the early history of instrumental precision in medicine. He tells how three centuries before "the unerring regularity of the swinging of a suspended lamp in the cathedral of Pisa suggested to the young medical student, Galileo, the reverse idea of marking with his pendulum the rate and variation of the pulse." With such slowness, however, did the ideas of precision and accuracy make their way into medical practice, that it was only under the influence of the great Dublin school, in the first half of the last century, "that the familiar figure of the doctor, watch in hand, came to be commonplace." The procedure of counting the respirations came to be customary even later. Laennec, the inventor of the stethoscope, who only died in 1826, "never mentions, in seven hundred pages of his writings, any enumeration of breathing." The introduction of the clinical thermometer required even a longer time, although crude thermometers for measuring the heat of the body were constructed early in the seventeenth century. It was two centuries later before the thermometer came to be recognized as of value in the physician's armamentarium. I have heard that only one or two of the military surgeons of our Civil War employed a clinical thermometer. These men were probably looked upon as ultra-scientific and therefore impractical. In 1868, however, Wunderliche's classic work on clinical thermometry appeared and this finally convinced the medical world of the importance of the thermometer in medicine.

Nothing brings a more startling realization of the changes that have taken place in medical practice within the past few years than to read this paper of Mitchell's in the light of the present situation as regards quantitative methods in clinical examinations. What would be the opinion of the laymen of to-day if the physician failed to record the temperature of the body, and in case the disease is of any duration, to measure it frequently and to record the results in the form of a curve, so that the variations may be readily interpreted? What would be thought if he failed to determine accurately the pulse and respiration rates at equally frequent intervals, or if he neglected to count the number of corpuscles in a cubic millimeter of blood, or to measure the blood pressure in millimeters of mercury, a method so recent that it was introduced by one of my classmates? How shocked the physicians of any hamlet would be if one of their colleagues failed to determine the number of leucocytes per cubic millimeter of blood in the patient suspected to have appendicitis. All these methods of accuracy which I have mentioned are to-day among the most rudimentary and simple procedures in medicine. The modern physician must have accurate knowledge of the exact rate at which chemical changes are going on in the body, the so-called metabolic rate. He even must have records portraying electrical changes initiated by the heart at each beat. He demands accurate quantitative chemical analyses of the blood and the excreta. In addition to all these measurements, of which I have mentioned only a few, he must be skilled so that, by means of the stethoscope, he can hear and interpret the meaning of noises and musical sounds caused by the air passing in and out of the lungs, and those produced by the blood passing through the various chambers of the heart. He must be prepared to extend his vision to our innermost recesses by means of tubes and lights. He must even look through our solid tissues by means of X-rays. If we are infected with a bacterium, be it so small that it can only be seen with glasses of the highest magnification known, he must be prepared to determine its exact nature. And with all these instruments and procedures he must be familiar, not only as technical methods, if he is to use them successfully, but he must also know the scientific principles underlying their construction and use, otherwise they are but gewgaws to catch the unwary. Is it a wonder that medical education to-day requires the expenditure of long time and much money? So far as the instruction of the student in the basic sciences is concerned, so far as it is a matter of the study of the structure of the body, that is, anatomy, so far as it is a question of acquiring knowledge of biological phenomena, physiology or even of learning about the *methods* employed in the investigation of disease, the hospital is superfluous and unnecessary. Education and training in these things is the work of the university. But when the student has mastered all these he is not a

physician. He must study disease as it occurs in human beings. He must know how to apply in this study all the information that he has previously acquired, otherwise all his learning, all his skill in technique will profit him nothing when he comes actually to diagnose and treat, and, if possible, cure, our illnesses.

The details of instruction do not press hardly on the authorities in control of this hospital and on those of like situation. Here in the shadow of a great university and with the hospital virtually a component part of the university, the machinery of education is at hand, and the hospital authorities can easily obtain assistance in meeting their obligations. But the opportunities for wider service in the educational field are not confined to those hospitals so fortunately situated as is yours. The opportunity is open to every hospital in this country to share in the development of scientific medicine and thereby to multiply its services to the community which it serves.

In this country the medical student enters the medical school with some knowledge of physics, chemistry and biology. He then spends four years in a medical school and during this time he is expected to learn thoroughly the anatomy of the human body; he must also learn as much as possible about the functional activities of the body in health, he must learn about the nature of disease, the various causes, the structural and functional alterations that accompany, and result from disease. He must learn about the nature of the remedies that have been discovered and how they act. Then he must master the technique of studying disease, the methods employed in diagnosis, some of which I have mentioned. Now how much time is there left to become familiar with all the multitudinous manifestations of disease as it actually occurs? Fortunately, in schools, such as this, he may be able actually to work in the wards with the patients, but only for a few months, not long enough to make him a physician. Medicine should be as scientific as the state of science permits, but this does not mean that this discipline consists merely of a group of underlying principles which, once mastered, give the clue how to act in every emergency. Experience and training are essential for the physician. That the student does not and can not receive this training during the four years in the medical school is recognized both by the students and the faculty. That the students recognize it is shown by the fact that almost every graduate seeks to obtain a post as interne in some hospital. Here he remains for one or two years, or even longer. These years which he spends in the hospital as an interne should be the most profitable years in the education of the young physician. During these years he forms the habits which he follows during his entire professional career. During this period he either continues to be a student of disease and becomes a capable physician, or he is satisfied with what he has learned in the medical school, his intellectual growth stops and he becomes merely a routine practitioner and a man of business.

In not very remote times the young man on deciding to become a physician picked out the best doctor in the community to act as his preceptor and he placed himself under his direction. He went about with the older doctor, seeing his patients and learning from him the technique of practice. In addition he picked up many scraps of worldly wisdom and had transmitted to him the high ethical principles which for ages have been practised by the members of the medical profession. I have no doubt that there were good and bad preceptors, but the method, as a method, has much to be commended. Such a system now would be impossible, but the hospitals of to-day have the opportunity to replace in large measure the best of the preceptor system. By taking advantage of this opportunity every hospital in this country, even the smallest hospital in the most remote district, can share in the educational work which is able to extend so greatly the hospital's influence and effectiveness.

Unfortunately, at present, the interne is often regarded, and he regards himself as a fully trained physician. He fails to realize that he is still a fledgling and still requires vigorous training. Too often the hospital authorities and also, alas, the physicians of the hospital fail to realize their opportunities and obligations for directing him and for providing him with the means for obtaining the training which he needs. In my contact with young physicians, some of them from the best hospitals, I have been disturbed to learn how little they have received in the way of training, and how little they have developed intellectually, during their interne years. Only too often they have spent their days in routine occupations and have occupied their evenings in play or useless reading. They have not practised the scientific procedures about which they learned in the university. These have been performed in the hospitals by hired technicians. This is not the place to discuss the remedies for this state of affairs, but I may venture to offer certain suggestions.

The hospital authorities might, at least, provide a working library and, so far as possible, stimulate the internes to read good scientific and medical literature. It would be of very great advantage if each interne could be provided with a small laboratory which he can use as he pleases. Here he can acquire the habit of observing with his own eyes and making tests with his own hands, not in any routine way, but to satisfy his own curiosity. His laboratory

should be in miniature the laboratory which every scientific physician should have in connection with his examining room. Some internes will be interested in employing simple chemical methods, others will be more interested in employing the technique of bacteriology. All should have a microscope and should use it frequently.

The stimulation of an interest in the historical and literary aspects of medicine should not be neglected. It is important for the hospital to cultivate men as well as scientists. It would not involve great trouble or expense to place in the living quarters of the internes pictures of the great masters of the past and a few of the books of great physicians who have also roamed in the pleasant fields of arts and letters.

The hospital having provided the means for scientific culture, the stimulus to make use of them must come from the physicians who are responsible for the medical work of the hospital. In recent years practising physicians have at times complained that they are being deprived of the opportunity to teach. It is true that they have less opportunity now than formerly to share in the scientific education of medical students during the university period. But they have an extraordinary opportunity to influence the students during the interne years, during the period when they are studying the various manifestations of disease, during the period when they are learning how to practice medicine. The cultivation of the relationship of preceptor and pupil between the hospital physician and interne may go far in removing the danger that medicine may become too highly organized, or that the methods of the factory be applied in the treatment of disease. The physician's responsibility toward the interne should not end when he sees that the routine records are kept in a fairly orderly fashion. He may be counsellor, guide and friend, and through proper direction he may aid in making of the interne a student of disease, a scientific physician, a well-trained practitioner and a true gentleman.

The statement that "the true test of national medical progress is what the country physician is" contains more than a germ of truth, and the duty rests on the hospitals of the country and on the physicians of these hospitals to see that the country doctor, even though scientifically trained, is not a poor practitioner. The duties and the work of the hospital to-day are identical with those of the physician of yesterday, and the rôle of the preceptor of bygone days must be assumed by the modern hospital.

Time changes, but the ambitions, the methods and the work of the physician, as Osler described them, must not be altered:

> To wrest from nature the secrets which have perplexed philosophers in all ages, to track to their sources the cause of disease, to correlate the vast stores of knowledge, that they may be quickly available for the prevention and cure of disease—these are our ambitions. To carefully observe the phenomena of life in all its phases, normal and perverted, to make perfect the most difficult of all the arts, the art of observation, to call to aid the science of experimentation, to cultivate the reasoning faculty, so as to be able to know the true from the false —these are our methods. To prevent disease, to relieve suffering and to heal the sick—this is our work.

In addition to the function of teaching, the modern hospital has assumed another function, that of research, of endeavoring to contribute to knowledge concerning disease. In this also all hospitals can share, although the most important results are likely to come chiefly from hospitals like yours connected with medical schools, where organized research can be undertaken. Just as hospitals were loath to accept their opportunities in the field of education so have they hesitated to undertake and support the investigation of disease. In this they have again failed to realize the returns which may accrue to the hospital in the way of increased prestige and wider service. A hospital in which a new discovery is made at once becomes no longer a local institution. There occurs immediately an increase of its reputation and fame. There results an extension of the good it accomplishes. It now serves all mankind.

The merchant, Johns Hopkins, of Baltimore, was a wise man. What more lasting monument could he have erected than that which he built when he established a hospital in which education and research were to be important functions. Suppose he should have left his money for the establishment of a hospital merely to care for the poor of Baltimore? Most of us would never have heard of Johns Hopkins. As it is, there is not an educated person in this country who does not know of this hospital and is not familiar with the donor's name. The poor of Baltimore have received far better care than would have been the case if education and research had been omitted and not only Baltimore, but the entire world, has been made much richer and better.

I, myself, happen to be connected with a hospital, the first function of which is research. This does not mean that patients entering the hospital and placing their lives in the custody of the physicians do not receive the very best care that it is possible to give or that everything possible is not done, or that anything is left undone, to restore them to health at the very earliest moment. Research in medicine is not antagonistic to the highest humanitarian motives or to the best medical treatment; quite the reverse. Contrary to certain apprehensions, expressed at the time of the opening of the hospital, the number of patients has never been limited because people were afraid to come, fearing that they would be experimented upon. Pa-

tients request admission to such a hospital because they recognize that if the desire to learn activates the physicians, all that is possible will be learned, and increased knowledge gives increased power to help.

While most of us agree that research in medicine is important, we probably do not all agree concerning the part which the hospital should play, or is able to play, in this endeavor. It is true that in research concerning disease much can be learned, and in the past has been learned, through experimental studies carried out in laboratories not immediately connected with the hospital. It seems obvious, however, that no study of any disease can be complete without the direct observation and investigation of patients suffering from this disease. It is in these patients only that the phenomena that it is desired to study can be seen. Moreover, the superficial aspects of these phenomena, at least, can only be investigated by those who are trained in clinical medicine. Much has, and still can be, learned by employing clinical methods alone and the importance of such studies is not to be undervalued. But it would seem unwise to restrict the clinician to the employment of these simple methods. To limit any serious investigator to the most simple aspects of his problem would only result in destroying his interest and extinguishing his enthusiasm. It is felt, therefore, that the hospital should offer opportunities to students of clinical medicine to carry on investigations of disease, even though these investigations may require the employment of the most complicated laboratory equipment and the application of the most fundamental methods of the basic sciences.

The physician coming in daily contact with the sick has a constant appeal made to him to search for facts which may result in methods of relief. It is not intimated that the laboratory worker does not also feel this humanitarian impulse, but the physician, having the results of disease constantly before him, is more likely to keep his mind on the real purpose of the investigation and therefore is not likely to wander far away from the main problem. On the other hand, there are many workers who should experience no restraint of any kind in their investigations. They are the men from whom probably the most can be expected in unravelling the riddles of disease, and it will be a sad day for science and for progress when these men are not given full liberty. These men, however, should work in the laboratory. While the methods employed by the workers in the hospital and those in the laboratory may frequently be identical and their fields of work may frequently overlap, this is not to be deplored or to be avoided. The problems are large enough, the ends sought are important enough, to justify an attack by many men with different points of view and different kinds of training. There is no great danger that investigations by physicians in the hospitals will become too involved, too fundamental. It is fortunate for medicine if physicians can be found who are sufficiently well trained and have sufficient intellectual equipment to enable them to attack the problems of disease with the most complicated methods of the exact sciences.

In the past physicians caring for the sick have played an important part in the progress of science, not only in biology but also in physics and chemistry, even in astronomy. Copernicus was a physician; Gilbert, one of the most important figures in the history of electricity, was physician to Queen Elizabeth; Paracelsus, the father of chemistry, was a doctor; Robert Mayer, who demonstrated the principle of conservation of energy, was a country doctor. The list might be extended indefinitely. Indeed, in the development of pure science, up to very recent years, physicians played a leading part and they constituted a considerable proportion of the membership of the learned scientific societies. The results of their own labors, however, ultimately excluded them from participation in scientific pursuits. As medicine became more technical and intricate, the demands on the time of the practitioners became greater and greater, so that finally physicians found time only to apply the results of the labors of their former colleagues and were compelled to commit the advancement in science, including medicine, largely into the hands of their laboratory confrères.

Fortunately, in very recent years there has been an attempt to remedy this situation. It has become obvious that the services of the clinician, with his knowledge of disease as it occurs in man, should also be employed in organized and intensive research concerning its nature. In order to permit this, however, it is necessary that these physicians have protection and relief from an excess of routine duties, and above all that they be relieved of the exactions of private practice. Certain hospitals, like this one, have not delayed in providing these conditions and the results are already justifying this program.

The complicated investigation now carried on in the hospitals can rarely be made by one man working alone. They usually require the cooperation of a number of men and they require the use of many complicated methods of the exact sciences, and of many sensitive instruments, which, in comparison with the instruments of precision mentioned by Mitchell, are as the delicate tools of the watchmaker to the broad axe and saw of the woodsman. In a recent book, two famous experiments have been contrasted, the first one being devised by Galileo at the outset of his career, and the other by Michelson, with the aid of his famous interferometer, carried out in 1891 and

repeated in 1905. Galileo dropped heavy balls from the top of the leaning tower of Pisa and demonstrated that objects of different weights, if released simultaneously, reach the earth together. So far as experimental skill and delicacy of apparatus were concerned this experiment could have been made at any time within the preceding five thousand years. Michelson's experiment could not have been made a day sooner than it was. This experiment concerned the determination of the earth's motion through the ether and has an important bearing on the theory of relativity. It required the general advance in technology and was conditioned upon the state of scientific knowledge then existing.

Now, in the study of disease, a stage almost corresponding to that of Michelson's experiment has been reached. Edward Jenner, somewhat over a century ago, through the simple observation that dairy maids, after infection with the cowpox, failed to contract smallpox when later they were exposed to that disease, deduced the theory that inoculation with virus from infected cows would protect inoculated persons from contracting the more severe human disease. This great discovery was not dependent in any way upon the state of the basic sciences. It might have been made by the Greeks if the conditions had been propitious. Discoveries like this will always be made. Simple experiments, like that of Galileo, may even now yield information of the first rank, even in physics. In the discovery of new facts about disease, however, the path to be trod at the present time is usually more intricate and is as dependent upon the basic sciences as was the famous experiment of Michelson.

Let us consider for a moment an investigation which is now under way in your hospital and elsewhere. This investigation has to do with the disease in children known as rickets. Something over two centuries have passed since the classic account of this disease was given by Glisson (1650). In the succeeding years much was learned about this disease through simple observation—the conditions under which it appeared, its frequency in different places, and so forth. Then came a period during which the finer microscopic changes in the bones and other structures of the body were detected and described. But when all this was accomplished the real nature of the condition was almost as obscure as it had been two centuries before. It now becomes necessary to investigate this problem with all the aids which modern chemistry and modern physics can supply, if the real secrets of the disease are to be revealed. It is true that chance observations have accelerated progress just as they so frequently do in all scientific investigations. No chemical studies were needed to learn that codliver oil is of value in the treatment of this disease, or that exposure to sunlight is in some way important in its prevention. But it is hardly possible that chance observations will give the answer as to why these measures have an effect and still less tell us what the essential nature of the process, which we designate as rickets, really is. In any case, modern man is not content to wait for chance observations to give him information. To-day we explore. We do not wait for the wrecked mariner to return home to tell us of unknown lands.

The complete solution of the problem of rickets requires that information be obtained concerning the physical state of calcium in the blood and the conditions under which it is deposited in the bones; inasmuch as the main feature of the disease, the bending of the bones, is the result of a failure of calcium deposition. A few years ago we might have thought that the problem could be solved by simple chemical estimation of the inorganic calcium in the blood and tissues, but we now know that such information alone adds but little. It is necessary to know not only the actual amount of calcium present but also the physical state in which it exists. This requires the methods of physical chemistry. Fortunately, this science, due largely to the genius of one of your greatest men, Willard Gibbs, has developed so far that it is not impossible that the physical conditions existing in the blood, that most complicated of all fluids, will soon be made simple and understandable. Then it seems that light, which, as we know, in some mysterious way touches the chlorophyl in the plants so that the leaves burst forth and the plant grows, is also concerned in the deposit of calcium in the bones. To investigate this requires making use of the methods and content of one of the most complex branches of physics. To one standing afar off the difficulties seem too great to be overcome. It would seem absurd to attempt to solve such riddles. Yet, the methods are available; the men are ready, and indeed are at work in a half dozen clinics and laboratories. It would not be surprising if any day we should be told what the nature of rickets really is.

There are many such problems waiting for solution to-day and their solution will bring relief to thousands of sufferers and happiness to thousands of households. We are apt to boast of the enormous progress that has been made in medicine during recent years. These discoveries have produced an effect on mortality statistics and on the average length of life that is most gratifying. But if we contemplate the history of physics and chemistry during the past three hundred years and consider how biology has delayed in making use of the methods that have been so fruitful in the other sciences, one wonders whether, after all, medicine to-day may not be in about the same

stage of its development that applied physics was in the middle of the last century when, although the principles underlying the telegraph and telephone had been developed, the real wonders of our age, such as radium and the wireless transmission of the voice and sound, had not even been imagined. With the present rapid application of the recent great discoveries of physics and chemistry to the solution of problems of disease and other biological phenomena, it is not impossible that the next decades will witness discoveries relating to the prevention and cure of disease which will far transcend the discoveries of the past half century.

Is it not stimulating to us who are interested in hospitals as instruments for the furtherance of human welfare that these institutions are now permitted to share in the great advances that are being made and that are likely to be made in the future? Until recent years, while the hospitals were appreciative of the contributions which their physicians made to medical progress, yet, as organized institutions, the hospitals themselves played little part in these advances; but now they stand beside the universities and the scientific institutes in educating physicians and in advancing medical science.

Funds and resources must of course be available to exercise properly these functions of education and research. But is it not likely that, when the public fully understands that hospitals, such as this, are engaged not merely in caring for a limited number of the sick poor, but are contributing to the relief of suffering the world over by making better doctors and by increasing knowledge concerning disease, funds for this work will pour into the hospital coffers in greatly increased amounts? "If the public wants good doctors it must help to make them."

I realize that it is like "carrying coals to Newcastle" to reiterate these things which you have already considered for yourselves and about which you have made such wise and far-reaching decisions. The results obtained here in the way of new discoveries and in the improvement of medical education, in the increased service of the hospital to the community, in the ever increasing reputation of your institution must make you very proud and very ambitious for even greater things. The New Haven Hospital has always stood in the front ranks. Its past is an honorable and glorious one. At times its luster may have been dimmed owing to its proximity to a famous university, but in recent years in the great universities the world over the medical faculty has acquired increasing importance. In medical education in this country, the hospital is playing, and will play, an important rôle.

But just as the success of the university is dependent upon the men who comprise its faculty, so the accomplishments of the hospital depend upon the abiilty and energy of the physicians working within its walls. The organization and the equipment may offer opportunities, but the success of the hospital will really depend upon the character of the men who are attracted to join in its activities and upon the breadth of the spirit of service that pervades its atmosphere.

May this hospital in the future, as in the past, have the services of the greatest men in the medical profession. May they be guided by the same broad humanitarian spirit as have their predecessors and may the next centennial bring as marked cause for satisfaction to your descendants as this first centennial has brought to you. "Prosperity to the New Haven Hospital and health and ease to its poor patients."

RUFUS COLE
HOSPITAL OF THE ROCKEFELLER INSTITUTE

THE SUBSIDENCE NEAR SHARON SPRINGS, KANSAS

ON the morning of March 9, 1926, a certain rancher, living about five miles east of the little town of Sharon Springs on the plains of western Kansas, chanced to see across the fields a dun-colored cloud of smoke. Hasty investigation revealed a newly formed, great yawning hole at the edge of the gently rounded bluff that here looks down on the dry sandy flat of Smoky Hill River. The cloud was dust. Excited word was broadcast by the press that the bottom was dropping out of Smoky Hill River, that a volcanic explosion of some sort was in full blast, or maybe a great gas blowout was in process of blowing.

According to reliable report the opening was at first something over fifty feet in diameter and appeared to be some hundreds of feet deep. Two streams of water from the underflow of Smoky Hill River were cascading into the depths, sounding distantly on rocks below.

On March 11, when Professor G. S. Lambert, of the Kansas University Department of Geology, went to Sharon Springs, the depression was a much enlarged irregular ellipse about 125 feet wide and 250 feet long, the longer axis at right angles to the low river bluff which here trends from south to north. Water filled the lower part of the hole, small springs on the river side adding constantly to the water in the pool. The precipitous cliffs on the upland side of the depression were seen to be formed by dark bluish drab stratified rock and on the side toward the river flat of sandy alluvium. At least two thirds of the large hole occupied a part of the former river bluff, the smaller part projecting into the lower ground of the river plain. Evidence pointed clearly to a subsidence caused by solution of rock material under ground, but