REALISM IN MEDICINE.

Mr. President and Fellows
of The Massachusetts Medical Society:

When I received the compliment of an invitation to address you to-day I first thought that here was an opportunity to present some surgical subject which would have a general interest. Before I had settled on a theme, however, I remembered that this was the year 1900, and I felt that it would be plainly unfitting, at our last meeting in the nineteenth century, to ask you to confine your thoughts to any narrow field of research. For we are just finishing the hundred years in which medicine and medical study have done more for the world than had been accomplished by the disciples of Æsculapius in all previous time.

Wallace, in his recent book entitled "The Wonderful Century," draws a striking comparison between the achievements of human endeavor in the nineteenth century and in all preceding ages. He takes account of the discoveries which have been of sufficient weight to turn the current of thought or to profoundly modify the lives of men. In parallel columns he places these lists of notable

events; on one side those which preceded the year 1800, and on the other those which followed it. Certainly he is justified in calling this a wonderful century, for twenty-four important discoveries are credited to it, while he has found but fifteen discoveries of similar magnitude in all past time.

However we may differ with Wallace in some of his estimates, we must agree, I think, that this comparison is substantially a fair one, and must recognize that, measured by such tests as we can apply, the world and the conditions of life upon it have been more altered by man in the past century then in all time that had gone before.

In no realm of human thought has this recent advance been more rapid than in that of medicine, and in none other has it been of such wide and lasting benefit to humanity.

When we name surgical anesthesia, cellular physiology and pathology, antiseptic surgery and the germ theory of disease, we have an array of gifts for which the human race may well feel grateful to the medical men of the nineteenth century. Looking back through all past time, we find that in the seventeenth century Harvey discovered the circulation of the blood, and that in the eighteenth century Jenner introduced vaccination. Here the list of medical contributions of the first rank ends; four in the present, two in all past centuries. And of these two, vaccination, while working great good, did not admit of scientific explanation or understanding until the investigations arising out of the germ theory

opened our eyes to the significance of acquired immunity.

It would be manifestly impossible, in the time at our disposal, to review in any detail the progress of medical science in the three generations just past, and I do not mean to task your patience with an attempt at such a recital. But I think it may be well worth our while to take note of the discoveries which mark epochs in medical progress and which have occurred within the memory of many of those here present. A consideration of the direction of the research or study which led to them may help us to draw from them lessons, or deduce from them curves of thought, which will guide us along the best lines in the century that we are just entering.

A brief consideration of the history of medicine shows that it may, for purposes of study, be divided into two periods. Of these, the first is that long period from the birth of known time up to the beginning of this century, during which Idealism prevailed and theory succeeded theory only to be in its turn superseded by some newer invention of a more ingenious thinker. The second period is that of Realism, in which theories are not allowed to stand unless they can be shown to rest on demonstrable facts. It is not claimed that this, the inductive method, had not been used in medicine prior to the present century. Far from it, for the two already mentioned achievements of the past, namely, the discovery of the circulation of the blood and vaccination, were both obtained by men

following realistic methods, searching for facts and basing their theories on these facts only after they had been thoroughly tested.

It can be fairly asserted, however, that it is only within the past hundred years that inductive reasoning has become the prevailing influence in medicine, and that abstract ideas have come to be discredited. Now and then, even in the remotest times, men who were born observers attained some insight into the realities of things. Such men often solved the practical difficulties that were presented to them in the best manner and introduced rational methods of treatment which did much to keep medicine out of disrepute during that long period when error masqueraded in the cloak of philosophy. The questions that were intelligently handled in those early times were mostly anatomical or surgical and dealt with the visible or easily accessible parts of the body. The moment that obscure functions or the hidden causes of disease came under discussion, then the all-pervading idealism resumed its sway and the wildest speculation and theorizing prevailed.

Thus at the time when surgeons met the serious difficulties of an operation for stone in the bladder in a rational and enlightened manner, their medical brethren were treating pneumonia, typhoid fever and other diseases that taxed the endurance of their patients to the utmost, by bleeding and other methods of depletion, which still further reduced the strength so greatly needed.

It is true then of all time that medicine has owed its successes to its use of inductive methods. It has

reached lasting results only when it has rested its theories on accurately observed facts. We recognize the human senses as being on the whole, reliable observers, worthy of acceptance as witnesses to the facts.

No one would for a moment deny that our senses are fallible and often deceived; but they are the only witnesses we have, and we must make the best of them. They must not be easily trusted, and their observations must be constantly verified by independent investigations. This constant re-examination and verification or disproval of work done has been a marked feature of medical progress in this century.

Louis, the great clinician, who was active at the time when idealism was losing its hold and realism was coming to the front, said, "As often as I have formed an *a priori* idea and had afterward opportunity to prove the facts, I have invariably found that my idea was false." Here is the testimony of an honest man, striving after the truth and forced to recognize the fallibility of the human mind when acting without the constant control of the observant senses.

The present consistent and ever advancing progress of medicine toward a solid and enduring position among the arts and sciences of the world dates from the time when medical men came to Louis's way of thinking, and ceasing to be content with the so-called systems of medicine which had their origin in the minds of ingenious closet naturalists, sought to establish a foundation of fact for the superstructure of their thought.

It was then that they ceased to be animists, vitalists, Brunonians or animal magnetists, and began to be scientific investigators, searching after the truth with the best powers of observation that nature had put at their disposal.

They were no longer content with the pleasing and fleeting shows of the imagination, but when they found a fact which kept its integrity through all the tests that their ingenuity could apply, they duly prized it and put it by, to use when they could make it applicable. Such tested facts and the beliefs founded on them were kept under constant scrutiny, and if an improved method of investigation was discovered, the previously trusted facts were re-examined and rejected if found wanting.

The scientific spirit is one of skepticism, hard to convince and very annoying to the intuitive thinker. But the nineteenth century has shown us that this patient piling of fact upon fact builds up structures of an interest and beauty before which the wildest dream of the idealist pales, and with a quality of durability which is in strong contrast to the ever changing beliefs of the past.

The history of surgery affords, perhaps, as good an illustration as is possible of the triumph of the materialistic, the modern scientific method over the old idealism.

Who can tell us better the aspirations and hopes which seemed justified under the old régime than Ambroise Paré? No one better represents the high ideals of the surgical art in the past than he.

In 1575 he said: "God is my witness, and men are not ignorant of it, that I have labored more than forty years to throw light on the art of surgery and bring it to perfection. And in this labor I have striven so hard to attain my end, that the ancients have nought wherein to excel us, save the discovery of first principles: and posterity will not be able to surpass us (be it said without malice or offence), save by some additions such as are easily made to things already discovered."

To-day this prophecy sounds ludicrously short-sighted; yet it remained true for almost three centuries and forecast with considerable accuracy the course of surgery up to the time of the scientific upheaval which realism brought about. Could Paré come back to earth at this time, what joy he would take in the triumphs of modern surgery, for he loved his art truly and disinterestedly, and he would freely forgive the manner in which his prophecy has been belied. Not the least part of his pleasure would be in finding that with all the extraordinary advances that surgeons have made, they still hold fast to the ligatures that he gave them for the control of hemorrhage. Paré was the great realist of that day. He delighted in close observation and dared to follow what he saw.

To trace a little in detail, now, the paths along which the modern advances have been made, we find that at the beginning of the century the human senses, while recognized as credible witnesses and depended upon in a measure for the investigation of truth, were found to lack the acuteness neces-

sary for penetrating many of the secrets of Nature; and human ingenuity began to be turned to efforts to assist the preceptions and to widen their scope.

The power of the eye had for a long time been increased by the use of lenses, and the wish to aid its penetration into the depths of the body led to the invention of the ophthalmoscope, the laryngoscope, the cystoscope and other combinations of mirrors and lenses which brought the various cavities of the body within the reach of direct observation. Efforts in this direction will not pause until man ceases to be an inquisitive animal. Every year sees improvement in all such methods of investigation and a consequent widening of our knowledge of the hollow organs. Finally, at the end of the century, the remarkable discovery of Röntgen has enabled the vision to penetrate and discover the secrets hid in solid tissues.

In the meantime, the sense of hearing was not neglected. Something was known of percussion in the seventeenth century, and a rude auscultation of the borborygmi in the bowels had been practised before that; but the thorough and efficient use of these methods of diagnosis waited for Laennec, who, in the first half of this century, by his invention of the stethoscope, greatly aided the sense of hearing and opened the way for the modern practice of auscultation and percussion which has reached such perfection that the relative positions of deeply lying organs can be accurately made out and the lightest whisper in lung or artery is heard and understood.

Even the sense of touch has had its range of usefulness widened. For modern surgery affords so many opportunities for the correction of ideas gained through palpation, that the accuracy of deductions drawn from what it is possible to feel has been greatly increased, and a modern abdominal or pelvic examination is as great an advance on the less assured methods of a century ago, as are the modern means of locomotion over the old stage coach.

Extraordinary as have been these advances in the investigation of living conditions under the earnest and constant pressure of clinical workers, it is when we turn to regard what has been accomplished by the post-mortem study of tissues healthy and diseased, that we approach that part of achievement in medicine which will make this century memorable.

Much had been done in the way of accurate observation of morbid conditions prior to the present century, but it was after the improved lenses of the modern microscope made possible the close study of the individual cells, that medicine made the forward stride which placed it in the ranks of exact science. Many men contributed to this result; for with the awakening of interest in the objective study of medicine, the laboratories, where such existed, were thronged with eager investigators, and if the time served, many of these might be mentioned with honor and reverence, for they advanced nearly abreast into the newly opened regions of cellular pathology.

It is impossible, however, to speak of this movement without mentioning the name of Rudolph Virchow, who will ever be remembered as the one who stepped forward from the ranks and led this advance. I well remember my first impression of Virchow when I went to Berlin in 1876 to study in his laboratory. He was not at first sight an imposing figure, and one would not have picked him from a crowd as the foremost medical thinker of the time. Any sense of disappointment on this score was, however, soon dispelled when he was seen at work. If I had brought no other impression from my foreign study I should have felt amply rewarded by the opportunity of seeing that trained intellect, backed by unrivalled powers of observation, leading the way through the most complicated pathological problems and making that way so clear that we wondered we had not seen it for ourselves. His eye seemed to penetrate to the centre of the organ he was examining, and we students used to say it was as good as a No. 7 Hartnack objective. One might well feel that to have been associated with him was a liberal education in medicine.

The habit of verifying, with the microscope, appearances dimly seen with the naked eye, and studying out the cellular changes involved, laid the foundations of modern pathology. At the same time, the optical instrument makers were constantly improving the lenses and methods of illumination in the microscope, so that it was possible from year to year to get a more and more

accurate idea of the cells and of the changes that occurred in them as the result of morbid processes. Embryology too, threw much needed light on the life history of the cell and upon the characteristics of different tissues.

This patient work of investigation required for its proper prosecution institutions devoted to the scientific study of medical problems, and it also required adequate means for the support of the investigators. Such institutions, and the necessary endowments, hardly existed in this country until the last quarter of this century, so that the earlier American students, who wished to be properly instructed in these higher methods of research, were forced to go abroad to seek the opportunity. Especially in Germany they found good laboratories and inspiring teachers, and they came back after their probation, inoculated with the skeptical, investigating Teuton habit. Even if they were soon plunged in the every day work of their profession and found but little time for the further prosecution of purely scientific work, still this habit of inquiry and of constant scrutiny of conditions passing under their eyes clung to them and was of the greatest service in their practice and in such study of their cases as they could make.

A man with his standard of work thus raised was no longer content with a name as the explanation of a set of symptoms, but felt driven to seek out and understand the morbid process which caused the observed phenomena and, if possible, to learn the cause of that morbid process. He had

thus ceased to be an empiric and had become a scientific practitioner of his art.

The arousing of this spirit throughout the medical world has been perhaps the best gift of this century to medicine. The establishment of the cellular histology and pathology marks one goal reached by this movement which is pressing on with a still accelerating speed.

We now come to speak of the second great contribution which this scientific spirit has made to the century. I refer to the germ theory of disease. The manner in which this discovery was made and in which the facts thus far established have been reached, is most encouraging, and awakens inspiring hope for the future. For it was not revealed by any flash of inspiration to a closet thinker, nor was it accidentally stumbled upon by an erratic investigator groping far ahead of his time. On the contrary, it came as the logical result of concerted human effort, stepping forward constantly from fact to fact. It was the most complete possible demonstration of the worth of this sort of study. There could be no more convincing proof of the value of laboratory work than this. When the cause of a disease is discovered by such investigation and its authenticity is shown by its power to reproduce the same disease, we at once feel that we have here solid ground from which to start for further researches.

It was this achievement, perhaps, more than any other, that informed the world that at last medicine was ceasing to be merely an art and was taking its place among the exact sciences.

We cannot speak of the germ theory without thinking of certain illustrious men. The names of Pasteur and of Lister will at once occur to you. We must not forget, however, that long before Pasteur's discovery of the influence of micro-organisms in producing fermentations, important work had been done by Vogel, Davaine, Schulze, Chevreuil, and many others. It remained for Pasteur to so illuminate the facts that thenceforward no one could doubt that the minute organisms associated with putrefaction and other fermentative changes were really the cause of those changes and not an accidental accompaniment or result of them.

Lister was deeply impressed by these discoveries. It had long been observed that subcutaneous injuries were quick to heal and followed a usually afebrile course, in marked contrast to the suppurations and fevers that accompanied the healing of open wounds. He was at once struck by the important bearing that Pasteur's discovery had upon this hitherto unexplained fact, and conceived the idea that the putrefaction produced in animal fluids by the action of organisms, might be responsible for the unfavorable course of healing in wounds exposed to the air. To test the correctness of this hypothesis he devised means of excluding organisms from wounds. The success of his efforts in this direction compelled the attention of surgeons and led by rapid steps through antiseptic to the aseptic surgery of the present day.

The discovery of this application of the germ theory threw the door wide open for the surgeon

to enter safely into the inner recesses of the body and to interest himself in the functions and disturbances of organs that had before been as sealed books to him.

The triumphs of the new surgery might well fill a discourse. It is with difficulty that I turn away from so fascinating a subject. To one whose surgical activity began with the introduction of antiseptic principles and who has grown up with the growth of modern surgery, it might well be forgiven if he dilated somewhat upon the triumphs of this golden age in which the power wielded by the surgeon has so wonderfully grown year by year. We are constantly urged forward by the encouragement, Be bold; Be bold, and but rarely are checked by the admonition, Be not too bold.

I cannot, however, allow myself the pleasure of such a digression, but must be content to point out that all this splendid achievement is one step in the onward progress of medical science, and that we owe it to the patient, plodding work of investigation that had gone before.

The interest of every laboratory, and indeed almost every microscope, was now turned to the scrutiny of fluids and tissues, for the purpose of discovering the individual organisms which caused each disturbance. One after another the bacilli, streptococci and staphylococci were ferreted out and classified, and with the aid of solid gelatine media they were presently obtained in pure cultures and their individual characteristics were made demonstrable.

It was now found that special organisms produced special diseases with such certainty that in cases of doubt the detection of the microbe involved in a morbid process at once settled the character of that process. Thus a malignant pustule could be at once distinguished from an ordinary furuncle or carbuncle and the appropriate treatment could be adopted early.

In the presence of such exact knowledge the nomenclature of disease improved, and instead of speaking of erysipelas, lymphangitis or cellulitis it now became usual to say a streptococcus infection of such and such an extent. We ceased to use the terms scrofula or consumption, but began to speak of tuberculosis of this or that organ, and to demand a demonstration of the correctness of our diagnosis by the recognition of the bacilli.

These well-known instances of our changed conceptions of familiar diseases are selected as illustrations of the fundamental alteration of our habits of thought wrought by these newly learned facts.

The next natural step in the investigation of the action of micro-organisms within the body was the study of the effects of these organisms on the tissues and of the provisions that nature made to resist their deleterious action and to limit their growth. Considerable progress has been made in this research.

It has been shown that the blood serum has a certain amount of destructive power and that the white blood cells are also active in the attack upon them. It has also been found, in the case of cer-

tain germs, that their growth in the body produces a future immunity of greater or less duration, and in the case of the Klebs-Lœffler bacillus this immunity has been traced to the blood serum, which acquires, under the influence of the organisms, a positively antidotal power.

The action of the antitoxic serum obtained from horses treated with the diphtheritic poison is so well known to you all that it would be both superfluous and tedious to dwell upon it here. It is, however, perhaps the high water mark reached by this modern investigation of disease. To learn the ultimate cause of a disease, and then, by a study of this cause, to obtain the knowledge which enables us to meet and vanquish the morbid elements after they they have obtained a foothold in the body, is certainly an achievement to be proud of.

It is natural that other organisms should have been studied with the object of discovering similar antitoxins. Efforts in this direction with the tetanus bacillus have yielded results that are decidedly hopeful, and the organisms of relapsing fever, cholera, the plague and tuberculosis have also yielded sera which seem to have some power in either checking or protecting against the parent disease. These are results most encouraging in view of the comparatively short time during which investigations in this direction have been under way. Much, however, remains to be done.

I now wish to turn aside for a moment to speak of an achievement which has been of incalculable benefit to medicine and mankind, but which lay

out of the line of the regular advance of scientific medicine and stands by itself as a gift made by empiricism. I allude to the discovery of surgical anæsthesia. No consistent, experimental study preceded and led gradually up to the final triumph. To be sure, an unconsciousness which, if not too deep, could be recovered from, had been produced by carbonic dioxide, and as early as the year 1800 it became known that nitrous oxide gas would produce a temporary unconsciousness to pain, but even this latter agent, which has since been shown to have some degree of efficiency, was at that time deemed so unsatisfactory that it attracted little attention.

At this time, when the world was unprepared for such good fortune, the knowledge of the anæsthetic properties of sulphuric ether was given to Thomas G. Morton, a Boston dentist, who was without scientific training, but who was possessed of the idea that surgical anæsthesia was possible, and who in his effort to compass it, was ready to take any hint that came to his ears as to an agent by which it might be obtained. His good luck led him to hear that sulphuric ether, when inhaled, produced a temporary unconsciousness. Knowing no more than this, ignorant of the possible dangers of the drug, he risked his reputation and future peace of mind by trying it. Had ether possessed dangerous qualities and caused the death of the first patient, or had that patient been so unfortunate as to die from asphyxia, a mishap that might well have happened with the then in-

complete knowledge of proper methods of etherization, Morton would probably have gone to gaol and later to a dishonored grave. He took those risks and Fortune smiled on the brave, albeit reckless, man. His was the venture and his is the honor.

Surgical anæsthesia was thus discovered, as it were, by accident. It came as a revelation rather than as a result of consecutive steps leading to that goal.

It is interesting to notice, too, that it was revealed at the very time when experimentation upon animals was beginning to be necessary to medical research. It seems to have been pre-arranged that when man's development reached the point of needing to study the phenomena of life upon the living, then his intelligence should compass the relief of pain.

This discovery, as I have said, lay to one side of the line along which scientific medicine was advancing, but it has been of incalculable aid to that advance. How greatly the triumphs of aseptic surgery would have been curtailed if surgical anæsthesia had not been attained. And in experimental medicine it has done far more to alleviate the pain of necessary operations. Without it, many of the most important investigations would have been impossible, for the delicate dissections and manipulations necessary in physiological research could not have been made on animals conscious and struggling.

I have presented to you this brief and incomplete sketch of the great movement of medicine under the guidance of Realism, to show how it has steadily proceeded along a path without a break, or rather the progress has been more like that of an army penetrating an enemy's country, where different columns, mutually supporting each other, advance along parallel lines, meeting success, now here, now there.

Cellular pathology put us in a position to appreciate and understand the action of germs, and the work in bacteriology opened ways in which the student of the cell could make still further conquests.

I have not tried to do more than point out the grand strategy of the forward movement and the important places that have been taken. Many of the lesser achievements in this advance have however been essential to the success of the greater.

Physiology, physiological chemistry, pathology, bacteriology, embryology, anatomy, clinical medicine and surgery, have all, within their own fields of action, kept abreast of the general movement. Men trained in Science, skilled investigators, have occupied the firing line, constantly pushing forward, and as fast as they have gained new territory the practitioners of medicine have moved in like settlers and made it their own.

After this hasty review of the general course of medicine in this century, it should be of especial interest to us to study the part which America has played in promoting and in keeping step with the advances that have been made.

At the beginning of the century the main idea that an American student had in entering upon the study of medicine was to learn what he could of the care and treatment of the sick, with so much understanding of anatomy, physiology and pathology as could be made of service in his pratical work. The teaching in the scientific branches of medicine was, as I have said, very meagre in this country, so that a young man, wishing to be thoroughly abreast of the times, was forced to seek instruction in the laboratories of Europe. The result of this was that a well-trained American physician had usually passed two years abroad acquainting himself with the methods of the best teachers of the world.

The lack of opportunity at home, forcing men to travel, had its partial recompense. For the young American, travelling from teacher to teacher, going for each part of his education to the place where that was best taught, learned to look at things in a broader way than would have been the case had he found all that he required in one school.

This increased breadth of view was at once reflected in the medical practice of the men so trained, and long before American physicians began to take their proper place as scientific investigators they developed in their ranks some of the best practitioners in the world.

Many men came back from their foreign travel filled with a desire for research; but the absence of facilities and the need for self support stunted their

aspirations in such directions. It was not until the last quarter of the century that the use of labaratories became so manifest that they began to spring up and to receive adequate support in this country. I cannot, even in so condensed a review of this movement, forbear to speak of the pioneer work done at the Johns Hopkins Hospital under the inspiring lead of our guest, Prof. William H. Welch. The wise provisions of that foundation gave the Johns Hopkins Medical Faculty the almost unique opportunity of putting their school on the right line from the start. And thanks to the wisdom and energy of Professor Welch and his co-workers, the scientific investigation of disease at once took its proper place in that institution. Since that time the constant help that laboratory investigation gives to the clinical study of disease has appealed so strongly to the practical American mind that pathological laboratories have sprung up in every direction and are still constantly on the increase. These have been of the greatest value in raising the scientific quality of the work in many of our communities. Such laboratories have given men inclined to research opportunity for pursuing their studies, and have also enabled many clinical workers to acquire a knowledge and facility in scientific methods. This training has been of great service in their practice. They have gained a clearer understanding of morbid processes and have come to have a personal acquaintance with the germs against which they are constantly waging war. When a man thus

trained speaks of a bacillus he has in his mind a distinct picture of its appearance and its characteristics. He knows where to look for it and what effects to expect. If it is a pneumococcus he watches the serous membranes and early detects its migration to them. His horizon has become wider and his vision more acute.

With the appearance of laboratories the need of endowments for pathological and other scientific work has been brought home to our people. Practical business men see that the researches in the higher branches of medicine bear tangible and most valuable results; that by them the health of the community is improved and protected. They are thus encouraged to invest in a movement which has such evident good effects in the present and that holds forth still brighter promises for the future. Considerable sums of money have been drawn into these enterprises and have already done much good. They have, however, been but as a drop in the bucket which we wish to see filled. This work, by its interest, attracts the best minds and the world should discharge its proper obligation to them and should see that they are adequately cared for.

The administration of laboratories and the prosecution of complicated investigations is expensive.

At present I see no direction in which charity to the human race can better expend itself, with full assurance of lasting good, than in assisting the prosecution of such studies whose benefits are shared by all peoples and go down to remotest posterity.

The perfecting of a system under which the scientific investigation of disease may flourish should be the constant aim of all American physicians. The profession of this Commonwealth have already taken steps in this direction, of which mention may be here appropriate.

A quarter of a century ago we had at the Harvard Medical School, a chemical laboratory, a physiological laboratory, a dissecting room and a small pathological laboratory. Students had fairly good opportunities for the study of chemistry and anatomy, but they had no regular laboratory instruction in either physiology or pathology. Both of these important branches were taught by lectures to large classes in which each individual had but little personal contact with the professor, or with the phenomena described. The pathological instruction up to that time and till a considerably later period, was given by men who depended on clinical practice for their support and gave what time they could spare from this to their own scientific studies and to the instruction of the students.

It would take too long to describe in any detail the gradual changes by which this condition of things grew and expanded into that which exists to-day; but a statement of the present provisions for research and teaching in the Harvard School will give an idea of the rapidity with which this movement has advanced.

The physiological laboratory, with a professor, an associate professor and a greatly increased

corps of teachers, is now thrown open to the students who receive personal instruction in small classes. There is a laboratory for embryology, and histology, where the development and the finer anatomy of the tissues is taught to small classes, by the professor, the assistant professor and other assistants.

There is a good-sized pathological laboratory under the direction of a professor who gives his whole time to study and teaching, and he has in addition to this the control of the clinical laboratory at the City Hospital, which is under the supervision of the assistant professor.

The clinical laboratory at the Massachusetts Hospital is also available for teaching purposes, and being under the direction of one of the instructors in pathology, makes very substantial contribution to the opportunities that the students have in this branch.

Surgical pathology has a special demonstrator, and the Curator of the anatomical museum, having control of the surgical material obtained at the Massachusetts Hospital, is able to give special instruction in it. In the new buildings now nearing completion, he will have a large room devoted to his department and will have ample accommodation for small classes in this specialty. The surgical department, too, have taken steps towards the establishment of a special laboratory in the Medical School for surgical pathology.

Even this list does not complete the recital of what the Harvard Medical School is doing for

pathology, for at the Bussey Building in West Roxbury the professor of comparative pathology has his laboratory and is constantly at work on the pathological questions suggested by the diseases of animals, and has done much in tracing out their connections with human diseases. The limitations of the laboratory space at his disposal prevents his accommodating students, but his own original researches are making constant valuable contributions to our knowledge of microbic diseases.

In addition to these laboratories and teachers devoted to the study of pathology, the Medical School has also a large and well-equipped laboratory devoted to bacteriology, and a professor with a corps of assistants devoted to the study of the life history of micro-organisms. Besides the instruction and research work done there, great assistance is rendered to private practititioners by the systematic examination of material submitted. Thus this department acts in a measure as a clinical laboratory for the profession outside of the hospitals.

A considerable enlargement of the chemical laboratory and its staff, the establishment of a laboratory for physiological chemistry under able direction, a laboratory of pharmacy and a laboratory of hygiene, with an assistant professor who, besides his research and teaching, gives aid to practitioners by examinations made for them, complete this rehearsal of the present provisions and opportunities for scientific training.

Certainly the contrast between the conditions of twenty-five years ago and those of to-day indicates that our medical teachers are fully awake to and mindful of the demands of modern science. Indeed, despite all the recent improvements that I have imperfectly recounted, the College is at this moment considering a plan for the very great enlargement of the Medical School accommodations. They are driven to this by the need for still more laboratorial space to meet the requirements of modern medical education.

I have selected the Harvard Medical School to serve as an illustration of the recent advances in American methods of study, because it is the institution with which we are most familiar. Similar changes have been going on in greater or less degree in all our centres of medical study, and as a result of this awakening of interest in scientific investigation and teaching, we have already reached the point where it is no longer necessary for American practitioners to go abroad to complete their training in the higher branches of medicine. Ample opportunities now exist in this country for the attainment of an education wholly up to the modern requirements of practice.

It is still wise, for a man who can spare the time, to travel and learn what he can of other points of view and methods of work. I am inclined to think that the time is near, if not already here, when our foreign *confrères* might learn something by coming to this country.

An acquaintance with the literature of a subject

does not widen a man's field of view in the way that an acquaintance with the makers of that literature does.

To return from this digression and to continue our consideration of home matters, we find that this movement towards scientific and accurate methods is not confined to the teachers of medicine. If the time served, it would be a congenial task to say a few words of deserved praise of our Boards of Health.

The executives of State and city have been fortunate in selecting competent, sagacious men to guide the public in matters of sanitation. We are not surprised, therefore, to find that they have been fully alive to the forward movement in medicine, and have established laboratories for the study of sanitary questions. Here are made the many tests necessary in the selection of cases for isolation. Antitoxin is here carefully prepared for distribution, and all possible aid is given to practitioners in the application of laboratory methods to the study of their cases.

We are thus entering the twentieth century with an enthusiasm and a promise for the future which are well justified by what has already been accomplished.

We have many unfinished tasks on our hands. Important principles have been established in the nineteenth century, the detail of which remains to be worked out.

There are many infectious diseases and others believed to be parasitic in origin, of which the microbic causes remain to be discovered.

Our knowledge of the action of microbes in the body and of their effects upon the tissues is in its infancy.

What we know of the action of the tissues in protecting themselves from the micro-organisms and their products is as nothing to what remains to be known.

Efficient antitoxic sera are as yet few, but the list is slowly growing.

These are all questions which bear directly on the successful treatment of disease. We wish, however, to aim higher than this and to learn how to prevent disease.

Our experience with small-pox and diphtheria show that for some diseases, at least, the body may be made resistant by producing alterations in its fluids or tissues. Lister has shown us, too, how other diseases may be prevented by intercepting the microbes and preventing their entrance into the body. This is comparatively easy in surgery, where we have full control of the conditions; can we not protect the body from other infections? Our methods of disinfection of dwellings and public places are constantly improving, but they are still lamentably inadequate. Our boards of health have accomplished something by the isolation of cases of infectious disease and by the extensive use of disinfectants to cleanse the habitations of the sick. The street cars are adorned with signs warning against expectoration, in the hope of thus limiting the spread of tuberculosis, the germs of which are contained so abundantly in the sputa of those afflicted.

May we not hope that further knowledge of the life history of micro-organisms and a more widely spread habit of seeking them out, may make their destruction more generally attempted and more thorough?

If every public hall and school room could be safely and quickly disinfected during the night hours while it is empty, is there any doubt that the public health would be greatly benefited thereby? Sanitary engineering may make this possible, in which case every enlightened community will make it obligatory. Unfortunately there is a force constantly contending against the efforts of our sanitarians, and this is the very steady increase in the numbers and consequent crowding of our populations. For germs flourish in a crowd.

It is to be hoped that the efficiency of our methods of sanitation will be so greatly added to in the near future as to enable us to meet and overcome these increasing difficulties.

There is another nut that the nineteenth century leaves to the twentieth century to crack, if it can. It is the question of the cause and nature of malignant growths. With all the knowledge of them that we have gained through cellular pathology and embryology, we are still left much in the dark with regard to their causation. Bearing considerable resemblance, as some of them do, to processes that are known to have a microbic cause, it is natural that attempts should be made to convict them of a parasitic origin. Without going into the arguments or a minute consideration of the

evidence advanced, I think that I shall be in accord with the best present opinion if I bring in a verdict of not proven.

Diseases of this sort, especially the carcinomata, are apparently on the increase. So prevalent are they and so much to be dreaded that, were it possible to choose in advance the next great medical achievement, the world's vote would probably be for the discovery of a cure for cancer.

It will then perhaps be interesting for you to know that provisions have been recently made in this community looking to systematic research into the cancer question, and I am sure you will be glad to hear what steps are being already taken in this direction. Last year a sum of money was put at the disposal of Harvard College for the investigation of this question. The donor, Mrs. Caroline Brewer Croft, left by will $100,000 for this purpose, and after deducting the exceedingly liberal legacy tax which England exacts, a still considerable sum is left for the furtherance of the wishes of the testatrix. The income of this fund, with some substantial additional gifts obtained by the Professor of Surgery for the same object, are now available for these researches. The investigations under the direction of a committee appointed by the corporation of the college have been put in charge of the department of surgery and the instructor in surgical pathology has been selected to devote himself to a study of the pathological side of the subject. The coöperation of the laboratories of the Boston City Hospital and of

the Massachusetts General Hospital has been obtained and workers in these laboratories have been selected to devote their time to this object. All of these men are in close touch with each other and will have the control of a large amount of material.

At first it is proposed to examine the present theories of cancer production. The question of the relation of germs or parasites to these growths will receive minute and exhaustive attention. Incidental to this examination, the inoculability and infectiousness of malignant growths will be studied.

Besides this study of the pathological side of the subject, attention will be given to the general question of whether the impression that malignant growths are on the increase is well founded. Statistics are already being collected with a view to getting information upon this point, as well as ascertaining the conditions of life which favor the development of these neoplasms and it is hoped that by a long, persistent effort in this direction, light may be thrown on the etiological side of the question.

Something may also be hoped from a patient investigation of remedial agents. In syphilis and in some skin affections we have new growths of tissue which are caused to disappear by the constitutional use of drugs. The effect of arsenic in so-called sarcoma of the skin and the fact that this same drug has, in some cases, effected or seemed to effect the disappearance of a sarcoma which

had invaded the lymph glands, offers some encouragement in this direction.

Such is the beginning of this enterprise. The funds are barely sufficient for a good start, but for so good an object it is to be hoped that others will be forthcoming. In the neighboring state of New York a liberal appropriation has been made by the legislature for similar researches. So much earnest effort cannot be without avail, and it is satisfactory to us all to feel that America is lending her hand to the investigation of this burning question. Whatever comes of it we may be sure the labor will not be wasted.

Most of us here are practitioners of medicine, men so occupied in the care of the sick that but little strength or time is left for the pursuit of purely scientific studies. Are we then of no avail in this forward movement? I do not think so; and I wish to close this rather rambling discourse by pointing out a few of the ways in which the busy profession at large may substantially assist their brethren who are devoting themselves to research.

The mere moral support of feeling that the profession are backing them up and are appreciative of their labors and quick to profit by them, is of great importance to the investigators.

The intelligence of the audience has a stimulating effect upon the teacher, and if we take an active interest in this work and keep ourselves informed of the steps gained, we shall lend the encouragement of our interest to the men work-

ing in the laboratories. We shall, at the same time, fit ourselves to judge properly new ideas and shall be stimulated to observe accurately and record phenomena which pass under our eyes. It must act as an incentive to the men who are working out the higher problems of medicine to feel that any hint they are able to obtain will be at once made of practical value, or will at least be fairly tested and its value determined.

A profession thus made up of men who are in the habit of applying all known scientific methods to the study of their cases and who demand that every patient shall have the advantage of as minute an investigation as is possible, will keep the scientists supplied with material for their studies, and by bringing them in contact with patients will make them in a measure sharers in the emoluments of practice.

This last consideration is no small matter : For in this country, where government does not support its investigators, they must be provided for in other ways. The medical colleges supply places and salaries to a certain number, but there are many men of scientific bent who are unable to follow their inclinations because they must be sure of adequate support for themselves and families. If an enlightened profession demands the services of such men, we may be sure the supply will equal the demand. The army of investigators will not lack recruits. Many a good man will be enabled to spend his life in congenial research instead of seeking his livelihood in the routine of practice, for which perhaps he is ill fitted.

Do not understand me to disparage the practice of healing the sick or to imply that any other pursuit is higher. I only wish to point out that a man, loving the laboratory, may, if driven into general practice, prove to be a square peg in a round hole.

Lastly, it is important that the profession at large, who come in close contact with the people, should keep the community informed of the importance and magnitude of scientific work. In this way only can the proper interest be aroused and necessary endowment and support be obtained.

These are a few of the many duties devolving upon us as we enter the twentieth century. We are in the middle of the stream of medical progress and the current shows no sign of slowing. Let us do our utmost to ensure that it flows on with increasing tide and that there are no back eddies or slack water on the American side.