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ADDRESSES.

THE ADDRESS OF THE PRESIDENT.*

Delivered at the Forty-ninth Annual Meeting of the American Medical Association, held at Denver, Colo., June 7-10, 1898.

BY GEORGE M. STERNBERG, M.D.

Fellow Members of the American Medical Association:

I desire at the outset of my presidential address to express to you my high appreciation of the honor conferred upon me and my thanks for the same. I esteem it a special honor to have been elected president of the American Medical Association at the semi-centennial meeting in Philadelphia. The large attendance, the hospitable reception accorded us by the citizens of Philadelphia, the admirable arrangements for our meetings, the high professional and scientific standard of the general addresses and of the papers read at the sectional meetings, all contributed to make this a memorable meeting, and it will be a matter of just pride in the future for those members who are able to say, "I was present at the semi-centennial meeting of the American Medical Association in Philadelphia in 1897." Possibly some of our younger members may have the privilege of attending the centennial meeting of the Association in 1947 and of giving testimony with reference to the success of the semi-centennial meeting and the status of scientific medicine at the close of the nineteenth century. If so, they will not fail to mention the fact that the founder of the Association, Dr. Nelson S. Davis, was present on this occasion and that the distinguished American surgeon, Nicholas Senn, was the presiding officer.

I congratulate you upon the favorable prospects for a pleasant and profitable meeting of the Association in this beautiful and hospitable city of Denver. I have had no doubts as to the success of the meeting over which I am called upon to preside since I heard the decision as to the place selected for our annual convocation. The invigorating air of this elevated region, the grand mountain scenery, and the inducements to activity offered by a State rich in mineral resources, all are conducive to physical and mental energy and to a broad-minded liberality, the results of which will no doubt be apparent in the arrangements made for the scientific work of the Association and for the entertainment of its members.

Our Association, as the representative body of American physicians, will no doubt continue to increase in membership and in influence. The day is perhaps not far distant when no reputable physician will be willing to confess that he does not belong to the American Medical Association and when no progressive physician can afford to do without our JOURNAL. And in order that every physician of good

professional standing may enjoy the privileges of membership I think it desirable that "Permanent Members" should be elected, upon application, without reference to their membership in "State, County or District Medical Societies" when they present satisfactory evidence that they are graduates in medicine of reputable standing in the profession and are willing to subscribe to the code of ethics of the American Medical Association. In other words, I would not exclude a reputable physician from membership because the State, County or District Medical Society to which he belongs declines to adopt our code of ethics. If he, individually, is willing to be governed by the regulations made by this representative body I see no good reason for rejecting his application for membership.

A liberal and progressive spirit will do much toward promoting the growth and influence of the Association. The medical profession in this country has suffered more from the ignorance of some of its members who hold diplomas from regular schools of medicine than from the attacks of those whom we call irregulars or quacks. Scientific medicine, being founded upon demonstrable truths, must in the end maintain itself and secure the confidence of the people. But when the results of scientific research are rejected through ignorance of the experimental data upon which they are founded, and the layman hears contradictory professional opinions about matters which the well informed knows to be definitely settled, he may be excused for not differentiating so sharply as we are disposed to do between regulars and irregulars. To maintain our standing in the estimation of the educated classes we must not rely upon our diplomas or upon our membership in medical societies, but must show ourselves superior in knowledge and in professional resources to the ignorant pretender or to the graduate of a medical school which is bound in its teachings by an untenable creed, adopted before the light of science had taught physicians to reject theories and the dicta of authorities in favor of truths demonstrated by modern methods of research. There are those who still speak of us as "old school physicians," ignorant apparently of the fact that scientific medicine is to a great extent of very recent origin, and that all of the great discoveries in relation to the etiology, prevention and specific treatment of infectious diseases, and nearly all the improved methods and instrumental appliances for clinical diagnosis and surgical treatment have had their origin within the ranks of the regular profession. While, therefore, we still have with us some "old school doctors," who have fallen behind the procession, the profession as a whole has been moving forward with incredible activity upon the substantial basis of scientific research, and if we are to be characterized by any distinctive name, the only one applicable would be "*the new school of scientific medicine.*"

* Owing to the arduous duties of his office Surgeon-General Sternberg was not present at the Denver meeting. His address was read by Dr. Col. Woodhull, United States Army.

Not that our science is complete, for we have still many things to learn and many problems which have thus far resisted all efforts at their solution; but we have learned how to attack these problems and no one any longer expects that they can be solved by the exercise of the reasoning powers and the facile use of the pen. The old saying has it that "the pen is mightier than the sword." This is no doubt true in politics, but in science the pen is a feeble instrument compared with the test-tube, the microscope, the chemical balance, etc. Nevertheless, I am about to advise well-informed physicians to make greater use of the pen, not for the elucidation of those problems which remain to be solved, but for the purpose of calling the attention of the non-medical portion of the community to the recent achievements of scientific medicine. It is a remarkable and lamentable fact that many persons belonging to the so-called educated classes are grossly ignorant as regards the present status of medical science. They not only speak of us as "old school doctors," but they entrust their lives and those of their children to pseudo-scientists who, taking advantage of popular interest in the great discoveries of the day, make extravagant claims as to the curative power of electricity, the X-ray, oxygen, ozone, or some wonderful microbe destroyer. Or, ignoring the exact knowledge which has been gained by experience and pains-taking researches with reference to the etiology of various diseases and the curative action of approved therapeutic agents, they accept the vagaries of the osteopath and the christian scientist as representing the latest development of scientific progress in medicine. The false assertions and claims of ignorant enthusiasts and conscienceless vampires, as a rule, pass unchallenged. Not only are they able to impose upon a gullible public through their published advertisements, but articles written by them or for them appear in the columns of reputable newspapers. The ever-present and irresponsible newspaper reporter espouses their cause through ignorance or for gain and their wonderful cures are related and copied from one paper to another without any competent critic raising his voice to show the fallacy of the claims. Again, positive denials of the value of the well-established achievements of scientific medicine are often made, unfortunately too often, by men who are authorized to attach the letters M. D. to their signatures. This leads to the frequent repetition of the old question as to "who shall decide when doctors disagree?" No matter how well a fact may be established by repeated experiment or by the common experience of the profession, some doctor may be found who, through ignorance or that obliquity of mental vision which characterizes the crank, will deny its truth. Thus, there are doctors who deny the value of vaccination, others who fail to recognize any value in results obtained by experiments on the lower animals, others who deny the etiologic rôle of well-known pathogenic bacteria, etc. As a result the anti-vaccination and anti-vivisection societies are able to fortify their position by quoting the opinions of medical men of more or less repute. But opinions are of no value when opposed to evidence, and it seems to me that those familiar with the evidence would do well to give to the public concise and comprehensible statements, suitable for publication in newspapers and popular magazines, setting forth the facts and the evidence upon which these facts are accepted by well-informed physicians.

But in doing so, great care should be taken not to make any assertions that are not based upon reliable data. A distinguished surgeon who has taken an active part in opposing the anti-vivisection bill introduced into the Senate of the United States through the influence of the Washington Humane Society, recently wrote me as follows:

I have been corresponding with Welch, Burrell, Bowditch and others in reference to the formation of a society for the distribution of literature and fostering the sentiment in favor of scientific research. I would be glad to have your own views in the matter. It has occurred to me that at the meeting of the various special societies and especially at the AMERICAN MEDICAL ASSOCIATION this spring it might be well to introduce resolutions indorsing the formation of such a society.

In reply to this letter I said:

With reference to your suggestion as to the formation of a society for the objects mentioned, I think the idea is a good one and shall be glad to aid you in carrying it out. I think we have given those who are opposed to scientific medicine too much rope in allowing them to publish all sorts of misleading statements without our taking the trouble to contradict them or to educate the people. If we had an association organized for the purpose of answering such false statements as have circulation in the newspapers much good might result. When this is left to individuals generally no action is taken, on account, perhaps, of the disinclination on the part of competent physicians to have their names attached to articles appearing in the newspapers lest they may be thought by their professional brethren to be seeking notoriety and be accused of unethical conduct. Certainly it seems to me that the profession has a duty to perform in this direction and I hope you will take some steps to bring about such an organization as you suggest.

In carrying out this plan care should be taken not to engage in controversy with individuals whose misleading statements we desire to correct, but rather to have a systematic plan for placing the truth before the public. For example, an article on the medical uses of electricity might show its limitations and call attention to the fact that it has no germicidal effect when currents are used which are not destructive of the living tissues. Reference might then be made to the unscientific nature of the evidence offered in favor of the curative action of electric belts, electric rings and the electropoise, which is described as "a little instrument which enables the system to take on oxygen freely from the atmosphere." I venture to quote from a paper entitled "Science and Pseudo-Science in Medicine," which I read before the Anthropological Society of Washington in 1896, in further illustration of the kind of missionary work in the education of the public which I think such an organization as has been proposed should undertake. Referring to the electropoise, I say:

The *modus operandi* of this wonderful instrument is more fully explained in the following published certificate (advertisement in *McClure's Magazine*):

One might conclude, from its name, that it was an electric battery. But it does not generate electricity and is in no sense a battery, belt, sole, or anything kindred to them. It consists of a small cylinder called a "polarizer," which is used in connection with the patient's body by means of a common electric cord. This polarizer causes oxygen from the atmosphere to be absorbed by the entire surface of the body with great rapidity, the strength of the absorption being regulated according to the ability of the patient to receive.

After a year's use we have this to say in its favor: 1. We have taken no medicine for the year. 2. All traces of la grippe and an old sunstroke trouble have disappeared and no symptoms of either remain. Once or twice, from severe overwork, we have found it necessary to hold up for a few days, but in no time for fifteen years have we been better than during the past year. Much of this we attribute to the use of the "Electropoise."

This notice of the "Electropoise" is without solicitation and entirely gratuitous. We do it for the good of the afflicted. We have no personal interest in it and are not paid for what

we say in its favor. Persons desiring further information can address the agent—Rev. Wm. McDonald in *Boston Christian Witness*.

"We would suggest to the Rev. Wm. McDonald that he try the following simple experiment: Having connected the 'polarizer' with his leg by means of the 'common electric cord,' let him place one hand over his mouth and nose, thus shutting off oxygen of the atmosphere from the lungs, which have been provided by nature to furnish the necessary supply of this gas. Now let him note by a watch how long the supply of oxygen 'absorbed from the entire surface of the body' will answer as a substitute for nature's method of supplying this gas. We venture also to suggest to the Rev. Wm. McDonald that 'all traces of la grippe and of an old sunstroke trouble' might have disappeared during the year if he had not used the Electropoise. Assuming that this certificate is genuine, it answers very well to illustrate the fact that educated men who have not been trained in the methods of scientific investigation often arrive at conclusions entirely unjustified by the evidence before them and by the dangerous use of the *post hoc ergo propter hoc* method of argument."

The fact that a considerable proportion of those who are sick from various acute or chronic ailments recover after a time, independently of the use of medicinal agents or methods of treatment taken in connection with this tendency to ascribe recovery to the treatment employed, makes it an easy matter to obtain certificates of cure for any nostrum which an unprincipled money-seeker may see fit to offer to a credulous public. If 10 in a 1000 of those who have used the alleged remedy believe themselves to have been benefited, their certificates will answer all purposes of exploitation and the 990 will not be heard from by the general public.

As was to have been expected, the X-ray has already been made a source of revenue by more than one pseudo-scientist. The following account of the *modus operandi* of its supposed therapeutic action has recently been published in the newspapers:

After the Crookes tube is excited by the coil the magnetic lines of force are projected down in the same manner as they pass off from a magnet, and traversing the intervening space, pass through the body down to the floor and back to the coil and tube again, completing the circuit.

The X-ray is electrostatic in character and of a very high potential. With every discharge from the Crookes tube oxygen is liberated in the body, as well as the surrounding atmosphere, which, combining with nascent oxygen, forms ozone.

It is due to the electrolysis produced in the body that we are able to destroy the bacilli in contagious disease, ozone being the most powerful germicide known.

We remark, first, that we do not fully understand why "the magnetic lines of force" are reflected back by the floor, "completing the circuit." Inasmuch as the X-rays pass through wood, this mysterious action of the floor appears to call for some further explanation.

We will pass by the ingenious explanation of the formation of ozone, as a result of the action of the X ray, to call attention to the mistaken statement that ozone is "the most powerful germicide known."

The experiments of Fränkel show that the aerobic bacteria grow abundantly in the presence of pure oxygen, and some species even more so than in ordinary air.

It was formerly supposed that ozone would prove to be a most valuable agent for disinfecting purposes, but recent experiments show that it is not so active a germicide as was anticipated, and that from a practical point of view it has comparatively little value.

Lukaschewitsch found that one gram in the space of a cubic meter failed to kill anthrax spores in twenty-four hours. The cholera spirillum in a moist state was killed in this time by the same amount, but fifteen hours' exposure failed to destroy it.

Ozone for these experiments was developed by means of electricity.

Wysskowicz found that the presence of ozone in a culture medium restrained the development of the anthrax bacillus, the bacillus of typhoid fever, and others tested, but concludes that this is rather due to the oxidation of bases contained in the nutrient medium than to a direct action upon the pathogenic bacteria.

The conclusion reached by Nissen, from his own experiments and a careful consideration of those previously made by others, is that ozone is of no practical value as a germicide in therapeutics or disinfection.

Unfortunately lack of information relating to the definite results of scientific investigations is not confined to the non-medical members of the community. The statement above quoted to the effect that the X-ray, by electrolysis, produces ozone when passed through the body and that ozone is the most powerful germicide known, sounds very scientific, and having been made by one who has a legal right to attach the letters M. D. to his name, no doubt has been accepted as a reliable statement of fact by many educated people who have read the newspaper paragraph in which the statement occurs, which, having started in Chicago, was widely copied as an item of interest to the public in connection with the recent discovery of the remarkable properties of the X-ray.

Whenever any new discovery in medicine is announced some conservative physicians, and often men of reputation in the profession, are sure to commit themselves to a positive denial of the alleged fact. This occurred when the discovery of the tubercle bacillus was announced by Koch, it has occurred with reference to the treatment of diphtheria by antitoxin, and to the preventive treatment of hydrophobia by Pasteur's method. Yet these discoveries are based upon experimental evidence of the most unimpeachable character. To deny their reliability at the present day is simply to show ignorance of the nature of this evidence or a failure to appreciate its scientific value. Often the positive and premature statements of a physician relating to new discoveries in medicine are corrected, or at least regretted, at a later date; but sometimes the pride of opinion prevents a retraction in the face of the most conclusive evidence. The result is that such opinions, although they may have been given years ago, are always available to controvert the statements of those who maintain the value of vaccination, of experiments on the lower animals, of the diphtheria antitoxin, etc., and the non-medical public very often accept the opinions which coincide with their preconceived views, or arrive at the conclusion that there is nothing settled in our so-called medical science. It should be our aim to remedy this evil by elevating the standard of medical education, as we are doing in many parts of the country, by impressing upon the rising generation of physicians the importance of laboratory work not only as a means of instruction, but for the purpose of cultivating a scientific spirit of inquiry and just appreciation of the value of experimental evidence; and, finally, by instructing the public with reference to the present status of scientific medicine, the difference between fact and fancy, between the vagaries of the imagination and the demonstrable results of scientific investigation.

With the progress of scientific medicine, we have improved methods of teaching, and it is now generally recognized that reading medical books and listening to lectures is not a sufficient preparation for the practice of medicine, any more than the reading of

books on navigation would be for the responsible position of captain of an ocean steamer. It is for this reason that we insist upon the study of anatomy in the dissecting room, the teaching of methods of diagnosis and treatment at the bedside, and of chemistry, physiology and pathology in the laboratory. It is only within the past few years that our leading medical colleges have provided suitable facilities for practical laboratory work and even at the present day, as I understand, the laboratory courses are not compulsory in some institutions which provide for a four years' course of study as a requisite for receiving the degree of doctor of medicine. From my point of view these laboratory courses are a most essential part of the medical curriculum, not only because the student becomes familiar with the use of instruments and methods which will be of inestimable value to him in the practice of his profession, but especially because of the effect of the kind of training he there receives in enabling him to judge of the imperfections of our unaided senses and the small value of opinions in comparison with that of facts capable of demonstration; as also the relative importance of many things which to the superficial observer might appear to be insignificant and unworthy of attention. He learns not to accept the assertion of the professor in the lecture room or the dictum of any authority if this is in conflict with experimental evidence which he is able to verify for himself. On the other hand, he learns not to have an overweening confidence in his own judgment and powers of observation. He may fail to demonstrate the flagella on the typhoid bacillus, or the presence of the plasmodium in the blood of a malarial fever case, or of a trace of arsenic in the tissues of one who died with symptoms of arsenical poisoning. But having learned by repeated investigation that the failure was due to his want of expert skill in the use of the microscope or in the application of delicate methods of investigation, he learns that it is unscientific and injudicious to give a premature opinion in regard to any subject under investigation, and especially so when this opinion is based upon negative evidence. Failure to find the tubercle bacillus in a given specimen of sputum has little value unless the examination has been repeatedly made by an expert. It unfortunately too often happens that physicians, after a very perfunctory investigation, give a positive opinion based upon negative evidence. I have investigated, I have not found, consequently it does not exist. This is the attitude of the unscientific but self-satisfied man and it often leads to mistakes which are not only discreditable to the individual but damaging to the profession of medicine; for the mistakes of the doctors, as a rule, attract much more attention than their successes. The painstaking work and attention to details required of students engaged in chemical, physiological, bacteriological or histological studies, and the failure in their attempt to repeat an experiment or demonstration if through haste or carelessness they neglect any steps in the necessary technical processes, constitute an invaluable lesson. Indeed the scientific medicine of the present day can only be taught by such methods, and the scientific physician of the future must make his way to fame and fortune by traveling this somewhat difficult and time-consuming road.

I have spoken of the danger of arriving at hasty conclusions upon negative evidence, and wish now to call attention to the fact that physicians too often fail

to recognize the value of negative evidence as opposed to the deductions made from facts coming under their immediate observation. Thus, a case of paralysis following diphtheria may be ascribed to the administration of diphtheria antitoxin, but in view of the fact that paralysis often follows diphtheria when no antitoxin has been given, and of the negative evidence relating to the administration of the antitoxin in thousands of cases and in immunizing doses in other thousands of individuals, the deduction in a particular case that paralysis and the administration of antitoxin stand in the relation of cause and effect may well be doubted. Again, when a case of yellow fever occurs in one of our seaport cities, failure to trace the channel of infection has not infrequently led to the inference that the disease was of local origin. The fallacy here depends upon the assumption that the investigation has excluded all possible avenues for the importation of the infectious material from a foreign source, and a want of appreciation of the negative evidence which shows that yellow fever epidemics never have their origin at interior towns, and that they do not originate at towns on the sea-coast which have no foreign commerce. As well might we conclude, as perhaps some have done, that a case of smallpox is of *de novo* origin because the physician who sought to find the source of contagion was unable to do so. The negative evidence, relating to the non-occurrence of smallpox among persons not exposed directly or indirectly to contagion, is so conclusive that the profession accepts it as a fact that this disease does not originate independently of a previous case. It is a remarkable fact that some physicians still contend that the deaths which occur from hydrophobia in persons treated by Pasteur's method are due to the treatment and not to the bite of a rabid animal. If there is anything definitely settled in medical science we know that there is an infectious disease which we call hydrophobia, or rabies, which is transmitted from one animal to another and from animals to man by inoculation, through the bite of a rabid animal. Yet this well-established fact is denied by certain physicians. And ignoring the fact that more than ninety-nine out of one hundred of those who have been subjected to the Pasteur treatment have not developed hydrophobia although they had been bitten by animals proved in a considerable proportion of the cases to have been rabid the inference is drawn that the few deaths (less than 1 per cent.) from hydrophobia which have occurred during or after the treatment are due to this and not to the bite of the rabid animal which preceded the application for treatment.

My object at present is simply to illustrate the value of negative evidence and not to present in detail the experimental evidence relating to the success of Pasteur's method of preventing the development of the disease in persons bitten by a rabid animal. But I may say, *en passant*, that this is one of the great and well established achievements of scientific medicine, which, however, is still doubted by many physicians not familiar with the evidence and positively denied by those who prepare and circulate sensational anti-vivisection literature. In supporting this view they ignore the evidence and publish the opinions of physicians, more or less distinguished, in opposition to the value of the method; which opinions were in some cases given years ago and before the method had been subjected to a sufficient test to demonstrate its practical value. The point I am trying to make

clear is that it is not only unscientific to give a positive opinion in advance of the evidence, or by one who is not entirely familiar with it, but that such snap judgments reflect discredit upon the profession. They are used by the enemies of scientific medicine to support their denial of any value resulting from animal experimentation, and greatly increase the difficulties of those whose task it is to convince legislative bodies that the progress made in scientific medicine during the past twenty-five years has been largely due to such experiments, and that restrictive legislation would to a great extent, arrest this progress.

Having referred to the injurious consequences of premature and unfounded opinions, especially when given by men of prominence in the profession, I desire to call attention to the best method of counteracting such mischief. This is undoubtedly by united action on the part of the more enlightened members of the profession in behalf of truth and progress. This assistance we have had in combating the antivivisection bill introduced into the United States Senate and vigorously pressed by the members of the Washington Humane Society, supported by their misguided friends in various parts of the country. The result has been eminently satisfactory, and shows that when exercised in a just cause the influence of the medical profession is a factor which will not be ignored even by the Senate of the United States.

Having made frequent reference to scientific medicine, it may be profitable to spend a little time in a consideration of the foundations, methods, resources and prospects of medical science as it exists today. We admit in advance that there is still much in medical teaching which is not science, but which is founded upon unproved theories and the traditions which have come down to us from a pre-scientific age. But medical teachers and writers show a constantly increasing appreciation of the methods of science and of the nature of the evidence demanded by it for the establishment of truth, and a corresponding want of respect for assertions and theories the truth of which has not been demonstrated.

In all departments of science our exact knowledge has been obtained by observation and experiment, and the advancement of science has largely depended upon improvements in methods of observation and experiment. Thus, the primitive astronomer observed the stars with the unaided eye, but the astronomy of the present day depends upon observations made with the telescope, measurements made with instruments of precision and mathematical processes, the results of which can be controlled and proved in various ways. So in medicine, the older physicians relying upon their unaided senses, made and recorded observations, some of which were exact and constitute part of the medical science of the present day, but many of which were inexact and unreliable, as were the inferences drawn from them. Until the compound microscope was invented and perfected we had no means of discerning the micro-organisms which have been proved to be the cause of many of the infectious diseases, or of recognizing the histological changes which result from various disease processes. By the invention and practical application of such aids to diagnosis as the stethoscope, the ophthalmoscope, the clinical thermometer, the laryngoscope, the vaginal and rectal speculum, the stomach tube, the urinary test case, the microscope and the

X-ray apparatus, we are able to recognize pathological conditions which to the unaided senses of our predecessors were beyond discovery, and which being known only by their effects led to vague speculations and vain theories as to the etiology of disease.

Evidently scientific medicine must be founded upon an exact knowledge of the structure (anatomy) and functions (physiology) of the human body in a healthy condition and of the changes in structure and function (pathology) which result from various disease processes; of the causes (etiology), natural history (clinical medicine) and regional distribution (medical geography) of the diseases which afflict mankind and the lower animals (comparative pathology); of the toxic action of various substances from the animal and vegetable kingdom (toxicology), and of the use of these and of other non-toxic substances, physical agents, etc., in the treatment of disease (therapeutics) and of the prevention of disease by disinfection, quarantine protective inoculations, etc. (prophylaxis).

Anatomy, as a fundamental branch of medical science, may be said to have had its birth when dissection of the human body was first practiced by the Greek physicians Herophilus and Erasistratus, about 300 years before the birth of Christ. Since that time constant additions to our knowledge have been made by the same method, and during the present century by the use of the compound microscope, of various staining methods, etc., which have revealed to us the minute anatomy of the tissues. The discovery that various tissues are made up of cells of diversified forms and functions, and that all of these have their origin from one primordial mother cell—the ovum, belongs to the present century and must be regarded as a fundamental fact in its relation to scientific medicine.

The study of structure naturally preceded that of function, and accordingly we find that physiology is of recent birth. Indeed, physiology had no scientific foundation before the discovery of oxygen by Priestly in 1774, and its progress since that time has gone hand in hand with that of chemistry. Some of its most notable achievements during the present century are: The discovery of the digestive ferments and their action, of the function of the red corpuscles of the blood as carriers of oxygen, of the glycogenic function of the liver, of the inhibitory influence of the pneumogastric nerve upon the heart. It is evident that in advance of these discoveries, which all belong to the present century, there was no scientific basis for medicine so far as physiology is concerned. But today the tripod upon which scientific medicine rests, viz., anatomy, chemistry and physiology, is a substantial structure made up of established facts. While scientific medicine could not exist independently of these fundamental branches, they simply constitute the basis upon which the superstructure has been reared, to a large extent during the last half of the present century. The histologic changes which occur as a result of various disease processes, were unknown and unknowable in advance of the invention of the compound microscope, and the same is true as regards the etiology of infectious diseases. While we owe much to the methods of research devised by Pasteur, Koch and other pioneers in this line of investigation, in the application of these methods the compound microscope is absolutely indispensable. And as medicine could not claim to be

scientific so long as we were ignorant as to the etiology of disease, and of the histologic changes resulting from disease processes, we must recognize the perfection of the compound microscope as the most important event of the century from our present point of view. The principle involved in the construction of the compound microscope was invented as long ago as the sixteenth century, but it is only within the present century, and principally during the last half of the century, that those improvements have been made which have made it available for etiologic and histologic studies. There is, however, a growing disposition to suspect that our microscopes, notwithstanding the great degree of perfection attained in their construction, are still inadequate to the task of revealing to us the specific infectious agents of certain diseases, because of their minute size.

In a late number of the *Centralblatt f. Bacteriologie* Löffler and Frosch have published their official report of investigations, made for the German government, relating to the etiology of foot and mouth disease of cattle, the results of which are very interesting in this connection. As in smallpox, rabies, scarlet fever, typhus fever, and certain other infectious diseases, the efforts heretofore made to demonstrate the specific etiologic agent in foot and mouth disease have been unsuccessful. The carefully conducted investigations of Löffler and Frosch also failed to demonstrate the presence of any specific micro-organism in the lymph drawn with proper precautions from the vesicles about the mouth or udder of infected cows. Cultures in various media inoculated with this lymph remained sterile and no micro-organisms could be demonstrated, by the use of the microscope, in stained preparations. Nevertheless, experiments showed that this lymph was infectious material and that calves inoculated with a very small amount of it invariably developed the disease in two or three days. Very much to the surprise of the investigators named, they found that lymph which had been filtered through a porcelain cylinder, which was proved by experiment to arrest the passage of bacteria, retained its full infecting power. That the result was due to the multiplication of the infectious agent in the body of the infected animal, and not merely to the introduction of a very toxic non-living substance present in the lymph, was shown by the small dose required to produce the disease (1-10 to 1-40 c.c. of filtered lymph), and also by the fact that the disease could be transmitted to other animals by inoculating them with like amounts of lymph taken from the vesicles which developed in the calves inoculated with filtered lymph. The authors conclude their report as follows:

It seems difficult to escape the conclusion that the action of filtered lymph does not depend upon a soluble constituent, but upon an agent capable of self-multiplication. This must be so small that it can pass through a filter which retains the smallest known bacteria. The smallest hitherto known bacterium is the influenza bacillus of Pfeiffer. This has a length of 0.5 to 1 μ . If the supposed micro-organism of foot and mouth disease were only $\frac{1}{10}$ or even $\frac{1}{2}$ the size of this, which is not at all impossible, it would, according to the reckoning of Professor Abbe of Jena, be too small to be recognized by our microscopes, even when provided with the best immersion objectives.

In the department of etiology the most brilliant and far-reaching discoveries of the century are the discovery of the anthrax bacillus (1850) and demonstration of its etiologic relation to the disease with which it is associated, by Davaine, Pasteur, Koch and others (1863-1875); the discovery of the tubercle bacillus

by Koch (1882) and the discovery of the malarial parasite by Laveran (1879). These discoveries, so essential to the progress of scientific medicine, would evidently have been impossible without the aid of the compound microscope. But just here I wish to insist upon another point, which is, that for the untrained eye the microscope is little better than a toy and it may even be regarded as a dangerous instrument because of the inevitable mistakes which the novice will make if he undertakes to decide questions of diagnosis by the use of high power oil-immersion objectives without having had the necessary training for such delicate work. In blood examinations, especially, considerable experience is necessary in order to give value to the evidence afforded by a microscopic investigation. It is a very easy thing for the non-expert to overlook the malarial parasite, and still easier to mistake vacuoles in the corpuscles, deformed red corpuscles, etc., for parasitic elements. But the scientific physician will make himself an expert and I trust the time is not far distant when the microscope will be considered by the practicing physician as essential for daily use as is the stethoscope, or even the clinical thermometer.

For the illiterate and even for many of the so-called educated class the whole of medicine consists in the cure of disease by medicines, or by some agency, natural or supernatural, and a failure to cure is evidence that medicine is not a science. We readily admit that the cure of disease is one of the principal objects which medical science has in view, and that from a scientific standpoint therapeutics is very much behind some of the other branches of medicine. This is shown by the diversity of remedies prescribed for certain diseases, and the failure of any one of these remedies to effect a cure in many cases. But on the other hand, therapeutics has made great advances during recent years and by the application of scientific methods of research, the exact value of alleged remedies and of various methods of treatment is now determined with far greater precision than formerly.

A few years ago the intelligent and honest physician did not claim to have any considerable number of specific remedies at his command; but his scientific knowledge relating to the cause, symptoms and pathology of disease enabled him to conduct many cases to a successful termination, which without his assistance would have proved fatal. By the use of instruments of precision and scientific methods of investigation he was able to make an early diagnosis, and to give advice which might stay the progress of a disease, which in its more advanced stages it would have been beyond his skill to arrest.

Recently several additions have been made to the list of specific therapeutic agents, and there is good reason to believe that further discoveries in this direction will be made as a result of investigations now being conducted in pathologic laboratories in various parts of the world. Among the most important recent discoveries in this department of scientific medicine, I may mention the use of thyroid extract for the cure of myxedema, and the antitoxin of diphtheria. The discovery of the diphtheria antitoxin promises to be as important for therapeutics as the discovery of the anthrax bacillus was for etiology, and will no doubt henceforth be regarded as one of the most notable achievements of the century. It resulted directly from laboratory experiments relating to the production of immunity. The demonstration of Pasteur that ani-

mals could be rendered immune against anthrax and other infectious diseases by one or more inoculations, with an attenuated culture of the pathogenic bacillus to which they were due, at once led to an attempt to explain this immunity, and to numerous experimental investigations having this object in view. The result of these investigations was the discovery that the blood of animals rendered immune by such inoculations contains specific antitoxins which may be utilized for the production of immunity in other susceptible animals, and also in certain cases, for the cure of an infectious disease. While the practical results have been most notable in the case of diphtheria, some success has been attained in the specific treatment of tetanus, streptococcus infection, pneumonia, and even in tuberculosis. These results give encouragement to the hope that future investigations may develop methods of obtaining these antitoxic substances in such form and amount as will enable us to successfully use them in the treatment of those infectious diseases for which we have not heretofore had a specific remedy.

A recent discovery of considerable importance from several points of view is the so-called Widal-reaction. This depends upon the fact already demonstrated for several pathogenic bacteria, that during the progress and within certain limits, after the termination of a specific infectious disease due to micro-organism of this class, a substance is formed in the blood which has a specific action upon the particular bacterium which is concerned in the etiology of the disease. The reaction consists in the agglutination of the bacterial cells in groups or masses, and in the arrest of motion in motile bacteria in recent cultures. The diagnostic value of this reaction in typhoid fever is well established, but the reaction is not always obtained during the first days of an attack, when it would be most useful. However, the scientific value of the test is undoubted and it will be of great assistance in determining the true character of atypical cases of the disease, which have heretofore so often been called by some other name. The importance of this reaction for the differentiation of pathogenic bacteria, which can not readily be distinguished by their morphology and cultural characteristics is apparent. Therapeutics has profited greatly, not only by the scientific researches of chemists and bacteriologists, but also by those of the physiologists and physiologic chemists. Investigations relating to the internal secretions of ductless glands have shown the essential rôle which some of these glands play in the animal economy and also the fact that pathologic changes resulting from their impaired functional activity may be relieved by the administration of extracts from corresponding glands taken from the lower animals.

The curative action of thyroid extract in myxedema is well established, and some success appears to have been attained in the treatment of Addison's disease by an extract from the suprarenal bodies. The active substance in the thyroid has been called iodothylin. According to Professor Chittenden, this substance is "a non-proteid cleavage product of a more complex body, naturally present in the gland and characterized by containing both iodine and phosphorus." He considers it pretty thoroughly established that iodothylin "possesses all the peculiarities associated with thyroid therapy."

Abel and Crawford have succeeded in obtaining the active alkaloidal substance from the suprarenal bodies

in the form of a sulphate. This in very small quantities causes a remarkable rise in blood pressure when injected into animals, and applied locally it promptly causes a constriction of the vessels of an inflamed eye.

Let us turn, for a moment, from therapeutics to prophylaxis. Here the progress of medical science has been even more prolific in practical results. Where thousands have been saved by the timely administration of suitable medicines, or by the skilfully performed operation of the surgeon, tens of thousands have been saved by preventive medicine. And preventive medicine is today established upon a strictly scientific foundation. If our practice was *pari passu* with our knowledge, infectious diseases should be almost unknown in civilized countries, and those degenerative changes of vital organs which result from excesses of various kinds would cease to play a leading part in our mortuary statistics. But while our knowledge is still incomplete in some directions, and while individuals and communities constantly fail to act in accordance with the well-established laws of health and the scientific data which furnish the basis of preventive medicine, the saving of life directly traceable to this knowledge is enormous.

Smallpox no longer claims its victims in any considerable numbers except in communities where vaccination is neglected; cholera has been excluded from our country during the last two widespread epidemics in Europe and its ravages have been greatly restricted in all civilized countries into which it has been introduced; the deadly plague of the seventeenth and eighteenth centuries is no longer known in Europe, and the prevalence of typhus (so-called "spotted" or "ship fever") has been greatly limited. Typhoid fever, tuberculosis and diphtheria are still with us and claim numerous victims, but we know the specific cause of each of these diseases; we know where to find the bacteria which cause them and the channels by which they gain access to the human body, and we know how to destroy them by the use of disinfecting agents.

The mortality from tuberculosis is constantly diminishing in our large cities, and the complete destruction of the infectious sputa of those suffering from pulmonary tuberculosis would no doubt go a long way toward the extermination of this fatal disease.

For a long time vaccination as a means of preventing smallpox stood as a solitary example of prophylaxis by inoculation with an attenuated virus. But Pasteur and others following in his footsteps have shown us that protective inoculations may be successfully practiced in several of the infectious diseases of the lower animals. Haffkine's cholera inoculations appear to have been attended with considerable success, and recent experiments in inoculating susceptible persons with cultures of the typhoid bacillus give some encouragement to the belief that they may be rendered immune against typhoid fever by this method. That children may be rendered immune against diphtheria by comparatively small doses of the antitoxin is well established. The value of Pasteur's method of inoculation for the prevention of hydrophobia in persons bitten by rabid animals is now generally recognized by well-informed physicians.

The time at my disposal is entirely inadequate for the purpose of setting forth the present status of scientific medicine, but I trust that enough has been said to justify the claim that we are not "old school doctors," and to show that medicine has not been

behind other branches of science in taking advantage of improved methods of research and in establishing itself upon the sound basis of facts, demonstrated by experiment and observation with instruments of precision.

What has been said will also show that there is no room for creeds and pathies in medicine, any more than in astronomy, geology or botany. Every man is entitled to his own opinion upon any unsettled problem, but if he entertains an opinion in conflict with ascertained facts he simply shows his ignorance. There is no restriction placed upon any physician who graduates from our regular schools as to the mode of treatment he should pursue in any given case. If he sees fit to prescribe a bread pill or a hundredth trituration of *carbo vegetabilis* there is no professional rule of ethics to prevent him from doing so. But if his patient dies from diphtheria because of his failure to administer a proper remedy, or if he recklessly infects a wound with dirty fingers or instruments, or transfers pathogenic streptococci from a case of phlegmonous erysipelas to the interior of the uterus of a puerperal woman, it would appear that the courts should have something to say as to his fitness to practice medicine. There is, however, nothing in the code of ethics which will prevent him from associating with reputable practitioners. But no matter where or when he obtained his medical degree, he can scarcely be said to belong to the modern school of scientific medicine. We must not fail to recognize, however, that the progress of knowledge has been so rapid that it is impossible for the busy practitioner to keep pace with it, and that even the requirement now generally adopted by our leading medical schools, for a four years' course of study, is inadequate for the attainment of such a degree of professional knowledge and practical skill in diagnosis and therapeutics as is desirable for one who intends to practice scientific medicine.

UNIFORMITY THE KEY TO RECIPROCITY.

Presidential Address to the National Confederation of State Medical Examining and Licensing Boards, eighth annual meeting, held at Denver, Colorado, June 6, 1898.

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The members of this Confederation are entitled to receive the thanks of the communities which they represent upon the substantial progress that is making all over the Union toward a more perfect system of medical education. It is believed that these improvements have been due in a large measure to the influence exercised by State medical examining boards. It has been my privilege on previous occasions when addressing this body to refer to the relationship between the medical schools and the State examining boards, and I hope I may be pardoned for again calling special attention to this subject, which I regard of much importance.

Before entering into its extended discussion, however, let me remark that it is a significant fact that no medical journal or magazine of influence anywhere in the United States has uttered a word of antagonism to the system of separate examination by the State, a practice which is fast becoming prevalent in all the States and Territories. If a few of doubtful standing have endeavored to create dissension, or have expressed opposition to the method, they have found no listeners, or at least they have not been able to impress

their readers with their sincerity or the justice of their wail.

Society papers, too, have been devoid of adverse criticism except, perhaps, in a few unimportant instances. There was a time when considerable criticism was directed toward the character of the examinations, especially at the questions propounded; but as the conditions have been more and more appreciated we observe less complaint of this kind. It has been stated that only teachers in the schools could adequately examine for the State. However much this might appear good in theory, in practice its fallacy has been demonstrated. Only theorists now venture to affirm or reaffirm this now exploded sophism.

No one will, I believe, asseverate that the state examinations are perfect, for there is still much room for improvement; but the work may well be left in the hands of the examiners, who may be intrusted with it with every confidence that they will address themselves to its faithful and honest prosecution.

The colleges have now agreed by a considerable majority that four years is the proper time to set apart to medical training. Not a few are of the opinion that nine months in each year should be devoted to college work. Perhaps all will soon come to this conclusion. The two important questions remaining to be next settled are: 1, uniformity in preliminaries, and 2, equalization of State examination. The first concerns the colleges, the last the examiners must attempt to solve.

By far the most important of the two is the one relating to preliminary qualifications requisite to entitle a neophyte to enter upon the study of medicine. If all medical colleges could agree upon a uniform minimum it would not be long before other moot questions would be settled, even to the interstate indorsement of licenses.

The difficulties in the way are chiefly of degree; for none question, so far as I know, the necessity of some literacy before accepting matriculates. In the East the tendency is toward higher preliminaries than in the West and South. Our Southern friends contend that good doctors can be made with less education than would satisfy our Eastern ideals; that in the mountainous regions not so much of letters as of sense is demanded; that highly educated men will not settle in those districts, hence the people will suffer for want of medical service; and that for these and other reasons not only must they be permitted to accept students with a low grade of educational attainments, but that also they must be allowed to graduate them in medicine after shorter terms of collegiate training. This on its face seems reasonable and is convincing to many; at least it appears to satisfy the consciences of many college professors. It is not an argument, however, that would hold for a moment if all the colleges were endowed. It is difficult to overcome it so long as incomes depend upon numbers in attendance. It has, however, been the experience of schools that have adopted high preliminaries, that the more intelligent students are attracted to their amphitheatres; that a more satisfactory quality of instruction can be imparted; that less time is required in primitive work and that broader training is the result.

It is a mistake to suppose that students will flock to low grade schools. They almost invariably search for the best and will not be satisfied with less. It is