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CLINICAL PHYSIOLOGY—AN OPPORTUNITY AND A DUTY

YANDELL HENDERSON, PH.D.
Professor of Physiology, Yale Medical School
NEW HAVEN, CONN.

The time has come for the formal recognition of clinical physiology as a distinct subject and a field of work of the first importance. More or less inchoate, more or less dimly recognized, it already exists. The function which I wish to assume toward it to-day is rather that of a priest at the christening than that of a midwife at the birth of this latest-born and most neglected of the family of the medical sciences. I wish to give it the distinction of a name.

In the progress of medicine during the past decade, no feature has been more striking than the rapidity with which the advances in theoretic knowledge made in the laboratories of pathology and bacteriology have been adapted to the uses of clinical medicine. Physiology, on the contrary, has to a large extent led a life of mere self-development—like a proud virgin, beautiful, cold and sterile. I know that I risk the vigorous dissent of other physiologists in making this criticism. But I believe that it is needed not only for the good of medicine but for the best interests of physiology itself.

Science uncontaminated by any contact with the practical business of the world has in recent years been extolled in many an eloquent period. Priceless in their practical results have been the investigations made by great thinkers with no practical end in view. Nevertheless, I hold that none of the sciences, certainly none of the medical sciences, can long remain wholly divorced from contact with practical aims and yet continue fertile.

The appeal of clinical physiology is both to physiologists and to clinicians. Physiologists now and in the next few years will find their richest and most fruitful problems in the field of clinical, rather than in that of purely abstract, physiology. In the golden age of physiology our great predecessors, Claude Bernard, Brown-Séquard, Marey, Ludwig, Fritsch and Hitzig, and many others worked at topics which were at that time essentially problems of clinical physiology. Where in the literature of their day will you find anything to compare in ineptitude with the ponderous discussion of the mathematics of a membrane manometer, on which some of their successors in Germany now spend their time? Had not Voit's life work on nutrition a broadly utilitarian object? Was not Bernard working at the problem of diabetes when he discovered glycogen? And at

animal heat with the problem of fever in mind, when he found the vasomotor nerves? We have dug enough ore from the depths for the present. Let us devote ourselves for a time to extracting some of the gold which it contains.

To clinicians in nearly all departments, physiology offers to-day a brilliant opportunity. The progress of medicine in overcoming the secrets of disease is like the siege of a walled city. The clinicians are the infantry. The laboratory workers are the sappers and miners, the heavy siege artillery and the aviation corps. It is useless to hurl infantry against an unbroken wall. When, however, a mine has been sprung or a bastion battered down, then is the time when good generalship will lead the infantry to the assault through the breach and over the fallen ramparts. The great breaches of the past few years, into which the infantry have stormed, have been those opened by pathology and bacteriology. Meanwhile physiology has not been idle. It has burrowed under and overthrown many of the strongest towers. What is needed now is the massed assault of the infantry. In simple words, there is in physiology to-day a great mass of knowledge and a wide range of methods readily adaptable to clinical uses and needs. If clinicians will acquaint themselves with this knowledge, and adopt, adapt and employ these methods, they will be able to march rapidly over obstacles now insurmountable.

Such a development of clinical physiology might well be the greatest event in the progress of medicine during the second decade of the twentieth century.

What the entire volume of clinical physiology should be in the future may most easily be shown by instancing such of its chapters as might be written even now. Such a chapter might be written about the clinical use of the sphygmomanometer, the significance of its measurements and the conceptions of circulatory functions which center in it. How valuable are these conceptions and measurements I need not emphasize before this audience! That which should be emphasized is the fact that physiologists began measuring blood-pressure in millimeters of mercury more than half a century ago; yet the clinical modification and utilization of the method is a matter of yesterday—perhaps I should rather say of to-day, or even to-morrow. Thus, by this example, it takes at least fifty years for a physiologic conception or method to find its way from the laboratory to the clinic. Many pathologic and bacteriologic methods complete the arduous journey in as many weeks.

It is only five years since I had the pleasure of attending a meeting of the British Medical Association at Toronto and of sitting in a great hall packed with clinicians, listening with open-mouthed interest to the wonderful news that the blood was under pressure in its vessels, that the pressure could easily be measured and

* Chairman's Address before the Section on Pathology and Physiology, at the Sixty-Second Annual Meeting of American Medical Association, held at Los Angeles, June, 1911.

that such measurements have a meaning. On this occasion a number of eminent authorities who had crossed the broad Atlantic, or traveled thousands of miles from the four quarters of Canada and the United States for this special purpose, thought it necessary to explain in words of one syllable how the heart pushes the blood through the arteries and how this pressure is measured by the raising of mercury in a tube of glass. Then arose one most eminent in authority who informed the audience in effect that using an instrument for such a purpose was all "bosh." For himself, he believed that the "tactus eruditus of the trained finger" told any competent physician or surgeon all that he needed to know!

I suppose that no one, however eminent, would dare make such an assertion to-day. We do not now have to explain what arterial pressure is. But turn for a moment from the clinical aspects of the circulation to those of respiration. Here is a function of the first importance; a function subject to manifold alterations in health and disease; easy to observe, relatively easy to measure; a function about which physiologists have locked in their laboratories a considerable amount of information. Yet look through all the hundreds of well-appointed hospitals between Los Angeles and East-port in the state of Maine; look in all the elaborately equipped consulting rooms of all our eminent internists. Where will you find an instrument for anything more than the crudest observation and measurement of respiration? Nowhere, I believe! What do the clinicians of to-day—even the most learned—know of respiration? Next to nothing! And this little is mostly wrong.¹ If a patient pants for breath do not most of them order as many gallons of oxygen as his purse will allow to be blown off somewhere in the neighborhood? As well might they burn so many Chinese prayers printed on rice paper—except that it is profitable for the concern that supplies the oxygen. If, on the contrary, a patient's respiration is failing, oxygen may likewise be ordered; and a grim humor attaches to the fact that this oxygen, in order to comply with the requirements of the Pharmacopeia, has been carefully freed from every trace of carbon dioxide—the one substance which might act for a time to restore the respiratory center to its normal activity. Great is the medicine of to-day in its knowledge of man's parasites; great in its acquaintance with the appearance of his tissues after he is dead. But do we not lack an adequate comprehension of the functions of man himself, and a control of the working of the machine while, although somewhat damaged, it is still a "going concern?"

I am convinced that the now unutilized opportunities which modern physiology offers are so promising that any capable and well-trained physician or surgeon, if he will but take the trouble to acquaint himself with some one line of the subject—say respiration for example—and to work at it in connection with his practice, may make a notable contribution to practical medicine. What can be done in many lines may best be shown by instancing what has been done in a few. Consider the work of James Mackenzie, at first only a country doctor. With no better opportunities for work than a rural practice afforded he took the sphygmograph and applied it clinically. To-day his work on the application of

graphic methods to the clinical study of diseases of the circulation stands as one of the finest chapters of clinical physiology.

The electrocardiogram is affording a similar opportunity for advancement in the clinical physiology of the heart, an opportunity which fortunately a number of internists in this country have seen and utilized. The new work of Hirschfelder of the Johns Hopkins School on diseases of the heart and aorta is throughout essentially a treatise in clinical physiology.

On the side of surgery one of the most brilliant events of the past few years has been the development of methods allowing a ready access to the interior of the thorax. The work of Sauerbruch and Brauer, and of the other surgeons who have worked in this field, is a striking example of the profitableness of clinical physiology. So also is the work of Crile on surgical shock, and that of Cushing on the functions of the pituitary gland, normal and abnormal.

In a similar manner I might illustrate the sort of work which I believe that physiologists ought to do by examples of what some have done. Here may be mentioned the work of Erlanger on heart-block; of Cannon, not only on the normal movements of the stomach and intestines, but also on those after the performance of gastro-enterostomy, and of Meltzer in developing intratracheal insufflation from a method of mere laboratory interest into one which may prove of the greatest clinical utility.

All of these illustrations are drawn from the physical side of physiology. The physiologic chemists of to-day would easily afford ten times as many examples. In fact, the greater part of the flood of work which at present is almost swamping the journals of physiologic chemistry is essentially of this, to my mind, the right sort. It is directed to the solution, not of mere esoteric problems, but of topics of broad and pressing medical and human interest—diabetes, metabolism in disease as well as in health, and to those problems of nutrition which are of such tremendous import for the welfare of mankind.

It was a fortunate day for medicine when Emil Fischer turned his attention to the proteins. Almost at a stroke he lifted the pure and esoteric problems of biochemistry to a plane on which the great majority of chemical physiologists are incapable of working. Only a specially trained organic chemist can do this work. So our chemically-minded brethren, greatly to the profit of medicine and of their own scientific fortunes, have been forced to devote themselves to the cultivation of fields which will bear and are richly bearing fruit for to-day and to-morrow, rather than to that deeper ploughing and sowing from which the slow-growing harvest will indeed be of priceless value, but chiefly for generations yet unborn.

For the development of clinical physiology in America three conditions seem to be of special importance:

1. Internists and surgeons, and especially the professors of medicine and surgery in our medical schools, must be more interested, better trained and more widely read in physiology. It were better if they read less in the clinical and more in the scientific journals; better if they talked and practiced less, and investigated a great deal more.

2. Physiologists must assume the duty of teaching not only normal but also abnormal physiology. Both, in my opinion, should be taught in the second year of the medical course and as successive parts of one and the

1. So far as I am aware, the first paper ever written by an American clinician, based on a study of respiration in disease by precise physiologic methods, was presented as the oration in medicine at this meeting of the American Medical Association by Dr. C. F. Hoover

same subject. We cannot leave this for the pathologists to do. A man trained by autopsy and microscope is inevitably a morphologist. Just in proportion as he is fitted to deal with morphologic processes, he is unfitted to handle and expound functions of a physical nature—unless, of course, he happens to be an all-around genius.

3. Finally, I hold that in the future students who are being trained to be physiologists, whether in the field of physical and nervous or of chemical physiology, ought to have the M.D. degree. In our better medical schools the improvement of the curriculum in the last few years has been so marked that even the clinical courses have, to a great extent, lost that deadening influence on the students' ability to think scientifically which they formerly exerted. Furthermore, the elasticity introduced into the curriculum by the elective system, as practiced at Harvard and at Johns Hopkins, affords opportunities for the student who plans to be a physiologist to take little of what he will not need and to devote himself largely to his special interests.

I do not regard the Ph.D. degree alone as insuring a sufficiently broad training for a physiologist, either in the chemical or physical line. It is true that many American physiologists are merely doctors of philosophy. I am such myself. But I know, by the sad experience of years wasted in filling in the gaps in an utterly insufficient technical training, how great a handicap this is. Any doctors of philosophy who profess a different view I am compelled to regard as like the fox in the fable who lost his tail. If they, like this cunning animal, claim that a condition of taillessness is an advantage, I would like to warn all the young physiologic foxes to beware. Grow a good bushy tail in the form of an M.D. after your name, and let no tailless old fox beguile you out of growing it.

400 Prospect Street.

SPINAL FRACTURES

OPINIONS BASED ON OBSERVATIONS OF SIXTEEN OPERATIONS *

A. F. JONAS, M.D.
OMAHA

There are no graver injuries than fracture of the bony structures of the spinal column. No class of fracture presents more difficult problems for solution. In none is there greater uncertainty as to diagnosis, management and ultimate outcome.

Surgeons who have had a considerable experience with spinal fracture have not become wildly enthusiastic as regards treatment and prognosis. If a surgeon has operated frequently, he has learned that a fracture dislocation usually causes a partial or complete division of the cord, and that complete recovery is extremely rare. He may count a considerable number of operative recoveries and some patients who have regained a partial functional activity, but complete restoration of function is uncommon.

However, when we carefully review our cases and consider the extensive destruction of the cord in a large percentage of instances and the long periods of delay that are only too common before active interference is resorted to, and again when we recall the unusual handling of many cases of spinal fracture, while being transported home or to the hospital, often increasing the

bony displacement and cord compression and augmenting the laceration of meninges and spinal vessels, it is not strange that our results are no better.

I desire to record briefly my personal experiences with injuries to the spinal column. During a period of thirty years there have come under my observation forty-two cases of spinal injury that involved the bony structures of the spinal column, as shown by spinal deformity and complete motor and sensory paralysis of all the structures below the seat of fracture. In this number are included all that I have examined as my own cases and those that I have seen in consultation with other practitioners. Of this number only sixteen have come to operation. In the light of our modern conceptions of the surgical treatment of compression fractures, too many of these have been allowed to be unoperated on. And yet those of us who have witnessed much of accident surgery and particularly of spinal fractures, and have learned to know of the severe crushing of the cord and its membranes in a large percentage of cases, understand too well the hopelessness of the greater number of them. Not only are surgeons not enthusiastic about spinal operations, but the laity is loath to give its consent, owing to the well-known uncertain prognosis. You and I have been compelled to admit that the final outcome is uncertain when we advise a laminectomy as the only chance. We cannot even give an approximate estimate as to the prospects. We have no means of knowing how extensive is the traumatism to the cord and its envelopes. We are fairly certain, in a given case of deforming fracture with paralysis, that the cord is certainly damaged and still we cannot ascertain, with certainty, if it is compressed or lacerated or completely divided. It may be fair to assume that the cord is completely divided where there is a pronounced angular deformity and complete motor and sensory paralysis, and yet moderate cord injury has been found with extreme posterior angular deformity. We may say that the spinal deformity does not always indicate the extent of the cord injury. Consequently we have to deal with an uncertainty. I have met with cases in which there was no spinal deformity and yet there existed complete paraplegia and a laminectomy demonstrated actual cord destruction. And again I have examined one case of marked posterior lumbar deformity causing complete paraplegia immediately after the accident with entire relief of paralysis after traction had been made on head and pelvis and a partial restoration of the deformity by digital pressure. The patient was able to walk about in spite of marked angular deformity. Between these two extremes we have every variety of clinical picture presenting a great array of traumatisms that are often at variance with the physical findings. The traumatisms may amount to a simple transient concussion or may consist of a complete division of the cord. Unfortunately the vast majority of fracture dislocations have produced partial or complete cord division. In my operative work complete division occurred in the greater number of cases and in none of them, with the exception of an occasional temporary improvement, did I see a patient completely recover. We were convinced that recovery of these cases was absolutely impossible. Practical experience and experimental research seemed to indicate that the spinal cord never regenerated until the publication of Hart and Stewart's case¹ of severed cord in the dorsal region operated on by them in 1901. We had been taught by Ludwig, Wiesman, Ballance and others that

* Read in the Section on Surgery of the American Medical Association, at the Sixty-Second Annual Session, held at Los Angeles, June, 1911.

1. Tr. Am. Surg. Assn., 1902, xx.