

MEDICAL EDUCATION  
IN THE  
UNITED STATES AND CANADA

A REPORT TO  
THE CARNEGIE FOUNDATION  
FOR THE ADVANCEMENT OF TEACHING

BY  
ABRAHAM FLEXNER

WITH AN INTRODUCTION BY  
HENRY S. PRITCHETT  
PRESIDENT OF THE FOUNDATION

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We have no right, it is urged, to set up standards which will close the profession to "poor boys."

What are the merits of this contention? The medical profession is a social organ, created not for the purpose of gratifying the inclinations or preferences of certain individuals, but as a means of promoting health, physical vigor, happiness—and the economic independence and efficiency immediately connected with these factors. Whether most men support themselves or become charges on the community depends on their keeping well, or if ill, promptly getting well. Now, can anyone seriously contend that in the midst of abundant educational resources, a congenial or profitable career in medicine is to be made for an individual regardless of his capacity to satisfy the purpose for which the profession exists? It is right to sympathize with those who lack only opportunity; still better to assist them in surmounting obstacles; but not at the price of certain injury to the common weal. Commiseration for the hand-spinner was not suffered for one moment to defeat the general economic advantage procurable through machine-made cloth. Yet the hand-spinner had a sort of vested right: society had tacitly induced him to enter the trade; he had grown up in it on that assurance; and he was now good for nothing else. Your "poor boy"

<sup>1</sup> Wilgus, *Legal Education in the United States*, p. 29.

<sup>2</sup> There are 33,000 more in the preparatory departments of colleges and universities.

<sup>3</sup> We are indebted for these statistics to the United States Commissioner of Education.

has no right, natural, indefeasible, or acquired, to enter upon the practice of medicine unless it is best for society that he should.

As a matter of fact, the attainments required by our entire argument are not, as a rule, beyond the reach of the earnest poor boy. He need only take thought in good season, lay his plans, be prudent, and stick to his purpose. Without these qualities, medicine is no calling for him; with them, poverty will rarely block his way. Besides, if poverty is to be a factor in determining entrance standards, just where does poverty cease to excuse ignorance? Apparently the inexcusable degree of ignorance begins just where the ability to pay fees leaves off. For the schools that maintain "equivalents" for the sake of the "poor boy" are not cheap, and the student who can pay his expenses in them can also pay for something better, and pay his fees the student must; for it is precisely the proprietary and independent schools, avowedly solicitous for the "poor boy," that do the least for him by way of scholarship or other exemption.<sup>1</sup> They exact a complete settlement in cash or notes. Thus a four-year medical education in Baltimore, Philadelphia, or Chicago schools, on the "equivalent" basis, costs a boy in tuition fees and board about \$1420. The same student can go to Ann Arbor, get there two years of college work in the pre-medical sciences and modern languages, and four years in medicine, besides, for an expenditure of \$1465, covering the same items. Thus six years at Ann Arbor are not appreciably more expensive than four years in Baltimore, Philadelphia, or Chicago. Or, if a large city be preferred, he can get his two years in the admirable pre-medical laboratories of the University of Minnesota, at Minneapolis, followed by his four-year medical work there, for very little more. Low entrance requirements flourish, then, for the benefit of the poor school, not of the poor boy. Meanwhile, opportunities exist, in a measure during the school year, still more during vacation, to earn part, perhaps all, of the required sum.<sup>2</sup> Doubtless in the near future, the problem will be still further simplified in the interest of the better training by increased scholarship and other endowments, as in Germany. Meanwhile, it is dubious educational philanthropy to interrupt a poor boy's struggle upwards by inviting him into a medical school where there are excessively large chances of failure, escaping which he is at once exposed to a disadvantageous competition with men better trained by far.

So much from the standpoint of the individual. The proper method of calculating cost is, however, social. Society defrays the expense of training and maintaining the medical corps. In the long run which imposes the greater burden on the community,—

<sup>1</sup> Three scholarships, amounting to tuition fees for one year, are, however, annually awarded at the University of Maryland.

<sup>2</sup> It is stated that at the University of Chicago "the opportunities for taking work are more numerous than the number of students desiring to take advantage of them. . . . There is ample opportunity for the energetic student to earn his way, either in whole or in part, and opportunities usually outnumber those seeking them." *School Review*, January, 1910 (Notes and News). It must, of course, be remembered that only the vigorous and talented can afford to undertake the study of medicine under such conditions. The others are barred just as effectively from the low-grade as from the high-grade school. Students are found "working their way through" at the medical departments of Harvard, Michigan, Toronto, McGill, etc.

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the training of a needlessly vast body of inferior men, a large proportion of whom break down, or that of a smaller body of competent men who actually achieve their purpose? When to the direct waste here in question there is added the indirect loss due to incompetency, it is clear that the more expensive type is decidedly the cheaper. Aside from interest on investment, from loss by withdrawal of the student body from productive occupations, the cost of our present system of medical education is annually about \$3,000,000, as paid in tuition fees alone. The number of high-grade physicians really required could be educated for much less; the others would be profitably employed elsewhere; and society would be still further enriched by efficient medical service.

The argument is apt to shift at this point. If we refuse to be moved by the "poor boy," pity the small towns; for it is speciously argued that the well trained, college-bred student will scorn them. Not sympathy for the poor boy requires us now to sacrifice the small town to him, but sympathy for the small town requires us to sacrifice the poor boy to it. Two vital considerations are overlooked in this plea. In the first place, the small town needs the best and not the worst doctor procurable. For the country doctor has only himself to rely on: he cannot in every pinch hail specialist, expert, and nurse. On his own skill, knowledge, resourcefulness, the welfare of his patient altogether depends. The rural district is therefore entitled to the best trained physician that can be induced to go there. But, we are told, the well trained man will not go; he will not pay for a high-grade medical education and then content himself with a modest return on his investment. Now the six-year medical education (that based on two college years) and the four-year medical education (that based on the high school or equivalent) may, as we saw above, be made to cost the same sum. As far as cost is concerned, then, the better sort of four-year medical education must have precisely the same effect on distribution of doctors as the six-year training furnished by the state universities. If a Jefferson graduate is not deterred by the cost of his education from seeking a livelihood in the country, the Ann Arbor or Minnesota man will not be deterred, either. But a deeper question may be raised. What is the financial inducement that persuades men scientifically inclined to do what they really like?—for a man who does not like medicine has no business in it. How far does the investment point of view actually control? Complete and reliable data are at hand. The college professor has procured for himself an even more elaborate and expensive training than has here been advocated for the prospective physician. Did he require the assurance of large dividends on his investment? "The full professor in the one hundred institutions in the United States and Canada which are financially strongest receives on the average an annual compensation of approximately \$2500."<sup>1</sup> But the scholar does not usually advance beyond the assistant professorship: what figure has financial reward cut with him? "At the age of twenty-six or twenty-seven, after seven years of collegiate and graduate study, involving not only considerable outlay,

<sup>1</sup>"The Financial Status of the Professor in America and in Germany," *Carnegie Foundation for the Advancement of Teaching*, Bulletin II., p. vi.

but also the important item of the foregoing of earning during this period, he is the proud possessor of his Ph. D. and is ready to enter his profession. The next five years he spends as instructor. In his thirty-second year he reaches assistant professorship. He is now in his thirty-seventh year, having been an assistant professor for five years. His average salary for the ten years has been \$1325. . . . At thirty-seven he is married, has one child, and a salary of \$1800."<sup>1</sup> In Germany "the road to a professorship involves a period of training and of self-denial far longer and more exacting than that to which the American professor submits;"<sup>2</sup> in France "there are no pecuniary prizes whatever in their calling for even those who attain its highest posts."<sup>3</sup> What is even more to the point,—the posts of instructor and assistant in small colleges situated in out-of-the-way places can be readily filled at slender salaries with expensively trained men. Of course there are compensations. But the point is that a large financial inducement is not indispensable, provided a man is doing what he likes. In most sections the country doctor has better worldly prospects. The fact stands out that it is not income but taste that primarily attracts men into scholarly or professional life. That granted, the prospect of a modest income does not effectually deter; and not infrequently the charm of living away from large cities may even attract.

Our limited experience with physicians trained at a high level sustains this view. We have thus far produced relatively few college-bred physicians; large cities have bid high for them, without, however, bagging all. Johns Hopkins graduates in medicine, to take the highest quality the country has produced, are already scattered through thirty-two states and territories. As if to prove that money is not the sole deciding consideration, a dozen have gone as missionaries to the Orient and several into the army and navy. In this country there is a Johns Hopkins man practising at Clayton, Alabama, with 1000 inhabitants; at Fort Egbert, Alaska, with 458; at Gorham, Colorado, with 364; at Chattahoochee, Florida, with 460; at Fort Bayard, New Mexico, with 724; at Sonyea, New York, with 300; at Blue Ridge Summit, Pennsylvania, with 50; at Wells River, Vermont, with 660; at Fairfax, Virginia, with 200; at Fort Casey, Washington, with 300; at Kimball, West Virginia, with 2000; at Mazomanie, Wisconsin, with 900. They have scattered to the four winds, and inevitably.<sup>4</sup> No single influence controls: home, money, taste, opportunity, all figure. When we have produced as large a number of well trained doctors as Germany, they will be found in our villages, just as one finds them over there. Minnesota, closed after 1912 to all low-grade graduates, Kansas and North and South Dakota, agricultural states, Con-

<sup>1</sup> Statistics from twenty leading universities, discussed by Guido H. Marx in address, *The Problem of the Assistant Professor*, before Association of American Universities, January, 1910.

<sup>2</sup> *Carnegie Foundation*, Bulletin II., p. vii.

<sup>3</sup> Bodley: *France*, vol. i. p. 54.

<sup>4</sup> Western Reserve men (three years of college required for entrance) are to be found in Cochranton, Pennsylvania (population, 724); Solon Springs, Wisconsin (population, 400); Kinsman, Ohio (population, 824); Rawson, Ohio (population, 353).

necticut, Indiana, Colorado, look forward confidently to the high standard basis. Is there any reason founded in consideration for public welfare which holds back Illinois, New York, Pennsylvania, from similar action?

There is, however, still another standpoint from which the question under discussion ought to be viewed. We have been endeavoring to combat the argument in favor of admittedly inferior schools dependent on fees on the ground that in the east, north, and west, these schools have already outlived their usefulness; that, even in the south, the need, greatly exaggerated, will gradually disappear. Let us, however, for the moment concede that the south, and perhaps other parts of the country, still require some medical schools operating on the high school basis, or a little less. Does it follow that the proprietary or independent unendowed medical school has thereby established its place? By no means. It is precisely the inferior medical student who requires the superior medical school. His responsibilities are going to be as heavy as those of his better trained fellow practitioner: to be equally trustworthy, his instruction must be better, not worse. The less he brings to the school, the more the school must do for him. The necessity of recruiting the medical school with high school boys is therefore the final argument in favor of fewer schools, with better equipment, conducted by skilful professional teachers.

The truth is that existing conditions are defended only by way of keeping unnecessary medical schools alive. The change to a higher standard could be fatal to many of them without in the least threatening social needs. Momentarily there would be a sharp shrinkage. But forethought would be thus effectively stimulated; trained men would be attracted into the field; readjustment would be complete long before any community felt the pinch.<sup>1</sup> Despite prevailing confusion—legal, popular, and educational—as to what good training in medicine demands, the enrolment in the five schools which have during the last four years required two or more years of college work is already 1186 students, and is increasing rapidly.<sup>2</sup> When the Johns Hopkins plans were under discussion in the middle seventies, Dr. John S. Billings, the adviser of the trustees in things medical, suggested that the graduating class be limited to twenty-five. "I think it will be many years before the number of twenty-five for the graduating class can be reached," he said.<sup>3</sup> The school opened in 1893; the first class, graduated in 1897, numbered 15; the third, graduated in 1899, numbered 32: so promptly did the country respond. Institutions that have switched from the high

<sup>1</sup> It has been calculated that in the supply of doctors the country is now "about thirty-five years in advance of the requirements"! Benedict: *Journal of American Medical Association*, vol. liii., no. 5, pp. 378, 379.

<sup>2</sup> In the sixteen schools on the two-year college basis there were (1908-9) 1650 students who had entered at that level. The total enrolment in these sixteen institutions was much greater, because the upper classes in several had entered on a lower basis. These figures are far from the total number of college men in medical schools. The pity is that they are scattered through institutions in which they lose the advantage which their education should give them.

<sup>3</sup> *Medical Education: Extracts from Lectures before the Johns Hopkins University, 1877-8*, p. 52 (Baltimore, 1878).

school to the college standard after due notice given<sup>1</sup> have thus far lost only one-half or less of their former enrolment. The only thing that falls in proportion is the income from fees; the percentage of graduates is reduced much less. At the University of Minnesota, there used to be an average first-year attendance of 80 on the high school basis; on the two-year college basis it is now 40; at Harvard on the former basis, 100 new matriculants; now, on a college basis, 79. Western Reserve, with 84 on the high school basis, advanced suddenly in 1901 to a three-year college requirement; the enrolment fell to 12, but by 1908 the loss was practically recovered. Most significant is the demonstration that the greatest loss is due to the transition from the high school or equivalent to the one-year college basis; the rise from one to two years of college has relatively little effect on enrolment. It would appear that the college requirement compels deliberation. Once decided, the student is not seriously hampered by the effort or the expense of an additional year.

It does not follow, however, that if schools generally rose to the college requirement, their losses would be only one-half and the recovery therefrom ultimately assured. For the schools that came off thus lightly were previously attended by a large proportion of high-grade men.<sup>2</sup> A much greater loss would undoubtedly take place in the lower-grade schools; many of them would be practically annihilated. For the tendency of elevated standards and ideals is to reduce the number of students to something like parity with the demand, and to concentrate this reduced student body in fewer institutions, adequately supported.

The basis which we have urged for medical education gives an undoubted advantage to the university medical departments. We shall see in subsequent chapters that other equally important factors are at work tending to restore medical education to the university status; but for the moment the difficulty of procuring anywhere else the necessary educational foundation is perhaps most cogent. A countermove, by way of avoiding this tendency, has recently emanated from certain Philadelphia schools,<sup>3</sup> in the form of a suggested five-year course, the first year to be devoted to the pre-medical sciences.

Several serious objections to this proposition may be urged: (1) a single year is insufficient for three laboratory sciences, and makes no provision for modern languages; the very best medical schools could with difficulty give one year's pre-medi-

<sup>1</sup> Cornell changed from the high school to the three-year college requirement with less than a year's notice. There was, of course, no chance to readjust matters; the next first-year class (1908) numbered 15; in 1909, this increased to 23.

<sup>2</sup> In these schools standards were elevated in advance of the operation of the formal declaration to that effect. For example, Columbia (College of Physicians and Surgeons, New York) goes to the two-year college basis 1910-11; but the entering class 1909-10 contained among its 86 matriculates 46 students with degrees, and 11 more who had had two years of college work.

<sup>3</sup> These schools have no endowments; and the pre-medical sciences cannot be properly taught out of fees, as will become evident in chapter viii., "The Financial Aspects of Medical Education." Hence the work must be mainly make-believe. It would have to be given by already overburdened science teachers or, still worse, by practitioners. The Medico-Chirurgical College of Philadelphia offers these courses "in conjunction with classes in the sister department of pharmacy." This is absurd.

cal work,—they cannot possibly give two; as for anything more liberal, there is no chance at all. Hence the step would shortly prove an obstruction to further progress. (2) Unquestionably, the day is coming when the medical school proper will want a fifth or hospital year,—a culmination that will be indefinitely postponed if the year in question is prefixed to the course and assigned to preliminary training. (3) Finally, the arrangement protracts our present educational disorganization. It proposes that the medical school should do the work of the college, just as it is either doing—or doing without—the work of the high school. Now the strength of an educational system is wholly a question of the competent performance of differentiated function by each of its organic parts. Our tardily awakened educational conscience and intelligence find themselves confronted with several independent and detached educational agencies,—high schools, colleges, professional schools. Obviously, they are not indifferent to each other; they belong in a definite order and relation. We now know perfectly well what that order, what that relation, is. And the solidity of our educational and scientific progress depends on our success in making it prevail. To no inconsiderable extent, inefficiency has been due to irresponsibility resulting from just this lack of organized relationships; and the cure for evils due to lack of responsibility is not less responsibility, but more; not less differentiation, but more.

The reconstruction of our medical education on the basis of two years of required college work is not, however, going to end matters once and for all. It leaves untouched certain outlying problems that will all the more surely come into focus when the professional training of the physician is once securely established on a scientific basis. At that moment the social rôle of the physician will generally expand, and to support such expansion, he will crave a more liberal and disinterested educational experience. The question of age—not thus far important because hitherto our demands have been well within the limits of adolescence—will then require to be reckoned with. The college freshman averages nineteen years of age; two years of college work permit him to begin the study of medicine at twenty-one, to be graduated at twenty-five, to get a hospital year and begin practice at twenty-six or twenty-seven. No one familiar with the American college can lightly ask that this age be raised two years for everybody, for the sake of the additional results to be secured from non-professional college work. There is, however, little question that compression in the elementary school, closer articulation between and more effective instruction within secondary school and college, can effect economies that will give the youth of twenty-one the advantage of a complete college education. The basis of medical education will thus have been broadened without deferring the actual start. Meanwhile we are so far from endeavoring to force a single iron-clad standard on the entire country that our proposition explicitly recognizes at least three concurrent levels for the time being: (1) the state university entrance standard in the south, (2) the two-year college basis as legal minimum in the rest of the country, (3) the degree standard in a small number of institutions.



The practical problem remains. How is the existing situation to be handled? The higher standard is alike necessary and feasible. How long is it to be postponed because it threatens the existence of this school or of that? In general, our medical schools, like our colleges, are local institutions; their students come mainly from their own vicinity. The ratio of physicians to population in a given state is therefore a fair indication of the number of medical schools needed. Where physicians are superabundant, and high schools and colleges at least not lacking, the medical schools cannot effectively plead for mercy on the ground that elevated standards will be their death. New York has two schools on the two-year college basis or better; nine others rest on a lower basis. They would improve if they could "afford it."<sup>1</sup> But with one doctor for every 600 people in the state, with accessible high schools, with cheap—and in New York City, at least, free—colleges, it is absolutely immaterial to the public whether they can afford it or not. The public interest demands the change. We may therefore at once assume (what everybody grants) that the problem is insoluble on the basis of the survival of all or most of our present medical schools. To live, they must get students; they must get them far in excess of the number they will graduate; they must graduate them far in excess of the number of doctors needed. They will therefore require their clientele of ill prepared, discontented, drifting boys, accessible to successful solicitation on commercial lines. Inevitably, then, the way to better medical education lies through fewer medical schools; but legal enactments on the subject of medical education and practice will be required before the medical schools will either give up or relate themselves soundly to the educational resources of their respective states. No general legislation is at the moment feasible. The south, for instance, may well rest for a time, if every state will at once restrict examinations for license to candidates actually possessing the M.D. degree, and require after, say, January 1, 1911, that every such degree shall emanate from a medical school whose entrance standards are at least those of the state university. Such legislation would suppress the schools that now demoralize the situation; it would concentrate the better students in a few solvent institutions to which the next moves may safely be left. Elsewhere, every available agency should be employed to bring examining boards to reinterpret the word "equivalent" and to adopt efficient machinery for the enforcement of the intended standard. Equivalent means "equal in force, quality, and effect." The only authorities competent to pass on such values are trained experts. The entire matter would be in their hands if the state boards should in every state delegate the function of evaluating entrance credentials to a competently organized institution of learning. In many states, the state university

<sup>1</sup>The dean of a superfluous southern medical school writes: "Our faculty gets only what's left after all expenses are paid, and that averages \$400 per session of seven months. This we will cheerfully forego, and teach gratis, if only a class, or endowment, will pay cost of running the college. We will advance to the highest requirements just as soon as the conditions will admit, and are ready now to open next session under highest requirements if the wherewith to pay expenses is in sight." Observe that there is small consideration here for the "poor boy" or the "back country;" it is simply a question of college survival.

could very properly perform this duty; elsewhere, an equally satisfactory arrangement could be made with an endowed institution. Whatever the standard fixed, it would thus be intelligently enforced. The school catalogues would then announce that no student can be matriculated whose credentials are not filed within ten days of the opening of the session, and that no M. D. degree can be conferred until at least four years subsequent to complete satisfaction of the preliminary requirement. These credentials, sent at once to the secretary of the state board, would be by him turned over to the registrar of the state or other university, whose verdict would be final. A state that desired to enforce a four-year high school requirement could specify as satisfying its requirements:

(1) Certificate of admission to a state university requiring a four-year high school education;

(2) Certificate of admission to any institution that is a member of the Association of American Universities;

(3) Medical Student Certificate of the Regents of the University of the State of New York;

(4) Certificates issued by the College Entrance Examination Board for 14 units.

In exchange for such credentials, or for high school diplomas acceptable to the academic authorities acting for the state board, a medical student certificate would be issued; in default thereof, the student must by examination earn one of the aforesaid credentials, in its turn to be made the basis of his medical student certificate. In the southern states, the legal minimum would be necessarily below the four-year high school; in Minnesota, above it. But the same sort of machinery would work. The schools would have nothing to do with it except to keep systematically registered the name of the student and the number of his certificate; the state board or the university acting for it would keep everything else, open to inspection.

This is substantially what takes place in New York, where the State Education Department superintends the process. What is wanted in other states is an agency similarly qualified. For the present nothing can so well perform the office within a given state as its state university, or, in default thereof, the best of its endowed institutions. This suggestion is perfectly fair to all medical schools, for the credentials would pass through the hands of the state board to the reviewing authority without information as to the purpose of the applicant. The directions required would take up less space in the medical school catalogues than the complicated details they now contain. It should be further provided that the original credentials of every student be kept on file in the office of the state board or the reviewing university, and that they shall be open to inspection, without notice, by properly accredited representatives of medical and educational organizations. These simple measures would introduce intelligence and sincerity where subterfuge and disorder now prevail. The beneficial results to the high school and the medical school would be incalculable. Nor would the poor boy be subjected to the least hardship; for by exercising forethought,

he could accumulate genuine scholastic credits by examination or otherwise, *pari passim*, during the time he is accumulating the money for his medical education. So much actually accomplished, the rest will be easier. The reduced number of schools will not resist the forces making for a higher legal minimum. The state universities of the west will doubtless lead this movement; for once established on the two-year college basis, they will induce the states to protect their own sons and the public health against the lower-grade doctors made elsewhere. The University of Minnesota, having by statesmanlike action got rid of all other medical schools in the state, is thus backed up by the legislature and the state board. North Dakota and Indiana have taken the same stand. Michigan and Iowa will probably soon follow. "The adjustment is perhaps difficult, but not too difficult for American strength."<sup>1</sup>

<sup>1</sup>Adapted from Billroth: *Ueber das Lehren und Lernen der medicinischen Wissenschaft*, quoted by Lewis, *loc. cit.*

## CHAPTER IV

### THE COURSE OF STUDY: THE LABORATORY BRANCHES

#### (A) FIRST AND SECOND YEARS

THREE characteristic stages are to be discerned in the evolution of medical teaching.<sup>1</sup> The first and longest was the era of dogma. Its landmarks are Hippocrates (B.C. 460-377) and Galen (A.D. 130-200), whose writings were for centuries transmitted as an authoritative canon. Observation and experience had indeed figured considerably in their composition,<sup>2</sup> but increasingly remote disciples in accepting the tradition lost all interest in its source. The Galenic system took its place in the medieval university with Euclid and Aristotle,—a thing to be pondered, expounded and learned; facts had no chance if pitted against the word of the master. So completely was medicine dominated by scholasticism that surgery, employing such base tools as sight and touch, was held to be something less than a trade and accordingly excluded from intellectual company.

The second era is that of the empiric. It began with the introduction of anatomy in the sixteenth century, but did not reach its zenith until some two hundred years later. At its best it leaned upon experience, but its means of analyzing, classifying, and interpreting phenomena were painfully limited. Medical art was still under the sway of preconceived and preternatural principles of explanation; and rigorous therapeutic measures were not uncommonly deduced from purely metaphysical assumptions. The debility of yellow fever, for example, Rush explained by "the oppressed state of the system;" and on the basis of a gratuitous abstraction, resorted freely to purging and bleeding. His first four patients recovered; there is no telling how many lives were subsequently sacrificed to this conclusive demonstration. The fact is that the empiric lacked a technique with which to distinguish between apparently similar phenomena, to organize facts, and to check up observation; the art of differentiation through controlled experimentation was as yet in its infancy. Under vague labels like rheumatism, biliousness, malaria, or congestion, a hodgepodge of dissimilar and unrelated conditions were uncritically classed; the names meant nothing, but they answered as explanation, and even sanctioned severe and nauseous medication. Ignorant of causes, the shrewdest empiric thus continued to confound totally unlike conditions on the basis of superficial symptomatic resemblance; and with amazing assurance undertook to employ in all a therapeutic procedure of doubtful value in any. He combined the vehemence of the partisan with something of the credulity of

<sup>1</sup> Nothing would do more to orient the student intelligently than a knowledge of the history of medical science and teaching. It is a great pity that some effort is not made in the better medical schools to interest the student in the subject. A proper historical perspective would render impossible such opposition to improved medical teaching as is now based on conscientious but mistaken devotion to outgrown conditions.

<sup>2</sup> "The correct inductive method was borne in on the triumph of Hippocrates." Gomperz's *Greek Thinkers* (translated by Magnus, vol. i. p. 308).

a child, persuading too often by ardent insistence rather than by logical proof. His students were thus passive learners, even where the teaching was demonstrative. They studied anatomy by watching a teacher dissect; they studied therapeutics by taking the word of the lecturer or of the text-book for the efficacy of particular remedies in certain affections.

The third era is dominated by the knowledge that medicine is part and parcel of modern science. The human body belongs to the animal world. It is put together of tissues and organs, in their structure, origin, and development not essentially unlike what the biologist is otherwise familiar with; it grows, reproduces itself, decays, according to general laws. It is liable to attack by hostile physical and biological agencies; now struck with a weapon, again ravaged by parasites. The normal course of bodily activity is a matter of observation and experience; the best methods of combating interference must be learned in much the same way. Gratuitous speculation is at every stage foreign to the scientific attitude of mind.

We may then fairly describe modern medicine as characterized by a severely critical handling of experience. It is at once more skeptical and more assured than mere empiricism. For though it takes nothing on faith, the fact which it accepts does not fear the hottest fire. Scientific medicine is, however, as yet by no means all of one piece; uniform exactitude is still indefinitely remote; fortunately, scientific integrity does not depend on the perfect homogeneity of all its data and conclusions. Modern medicine deals, then, like empiricism, not only with certainties, but also with probabilities, surmises, theories: It differs from empiricism, however, in actually knowing at the moment the logical quality of the material which it handles. It knows, as empiricism never knows, where certainties stop and risks begin. Now it acts confidently, because it has facts; again cautiously, because it merely surmises; then tentatively, because it hardly more than hopes. The empiric and the scientist both theorize, but logically to very different ends. The theories of the empiric set up some unverifiable existence back of and independent of facts,—a vital essence, for example; the scientific theory is in the facts,—summing them up economically and suggesting practical measures by whose outcome it stands or falls. Scientific medicine, therefore, has its eyes open; it takes its risks consciously; it does not cure defects of knowledge by partisan heat; it is free of dogmatism and open-armed to demonstration from whatever quarter.

On the pedagogic side, modern medicine, like all scientific teaching, is characterized by activity. The student no longer merely watches, listens, memorizes; he *does*. His own activities in the laboratory and in the clinic are the main factors in his instruction and discipline. An education in medicine nowadays involves both learning and learning how; the student cannot effectively know, unless he knows how.

Two circumstances have mediated the transformation from empirical to scientific medicine: the development of physics, chemistry, and biology; the elaboration out of them of a method just as applicable to practice as to research. The essential de-

pendence of modern medicine on the physical and biological sciences, already adverted to,<sup>1</sup> will hereafter become increasingly obvious in the wealth of the curricula based upon them, and no less in the poverty of those constructed without them. But the practical importance of scientific method as such to the general practitioner is by no means so generally conceded. Its function in investigation is granted: there it is justified by its own fruits. But what has this to do with the education or the daily routine of the family doctor?

The question raised is fundamental; the answer decides the sort of medical education that we shall seek generally to provide. If, in a word, scientific method and interest are of slight or no importance to the ordinary practitioner of medicine,<sup>2</sup> we shall permanently establish two types of school,—the scientific type, in which enlightened and progressive men may be trained; the routine type, in which “family doctors” may be ground out wholesale. If, on the other hand, scientific method is just as valuable to the practitioner as to the investigator, it may indeed be expedient partly, or even in some instances altogether, to set aside gifted individuals as teachers or investigators and to guard the undergraduate student against original work prematurely undertaken. But this will not be construed to involve the abrupt and total segregation of medical education from medical research. Much of the educator's duty may consist in traversing a well known path; but if otherwise he is progressively busy, the well known path will never look exactly the same twice. The medical school will in that case be more than the undergraduate curriculum. Activities will be in progress that at every point run beyond the undergraduate's capacity and interest at the moment. But the undergraduate curriculum will not differ in spirit, method, or aspiration from the interests that transcend it.

The conservative in medical education makes much of what he conceives to be a fundamental opposition between medical practice and medical science; occasionally a despairing progressive accepts it. The family doctor represents the former type. One can ask of him—so the conservative thinks—only that he be more or less well grounded in things as they are when he gets his degree. The momentum with which he is propelled from the medical school must carry him to the end of his days,—on a gradually declining curve; but that cannot be helped. The other type—the scientific doctor—either himself “investigates,” or has a turn for picking up increases due to others. How profound is the opposition here depicted? Opposition of course there is between all things in respect to time and energy. The doctor who puts on his hat and goes out to see a sick baby cannot just then be making an autopsy on a guinea-pig dead of experimental dysentery. But does the opposition go any deeper? Is there any logical incompatibility between the science and the practice of medicine?

<sup>1</sup> Chapter ii. p. 24.

<sup>2</sup> This is the common contention of the routine schools that run on low admission requirements and employ practitioner teachers.

The main intellectual tool of the investigator is the working hypothesis, or theory, as it is more commonly called. The scientist is confronted by a definite situation; he observes it for the purpose of taking in all the facts. These suggest to him a line of action. He constructs a hypothesis, as we say. Upon this he acts, and the practical outcome of his procedure refutes, confirms, or modifies his theory. Between theory and fact his mind flies like a shuttle; and theory is helpful and important just to the degree in which it enables him to understand, relate, and control phenomena.

This is essentially the technique of research: wherein is it irrelevant to bedside practice? The physician, too, is confronted by a definite situation. He must needs seize its details, and only powers of observation trained in actual experimentation will enable him to do so. The patient's history, conditions, symptoms, form his data. Thereupon he, too, frames his working hypothesis, now called a diagnosis. It suggests a line of action. Is he right or wrong? Has he actually amassed all the significant facts? Does his working hypothesis properly put them together? The sick man's progress is nature's comment and criticism. The professional competency of the physician is in proportion to his ability to heed the response which nature thus makes to his ministrations. The progress of science and the scientific or intelligent practice of medicine employ, therefore, exactly the same technique. To use it, whether in investigation or in practice, the student must be trained to the positive exercise of his faculties; and if so trained, the medical school begins rather than completes his medical education. It cannot in any event transmit to him more than a fraction of the actual treasures of the science; but it can at least put him in the way of steadily increasing his holdings. A professional habit definitely formed upon scientific method will convert every detail of his practising experience into an additional factor in his effective education.

From the standpoint of the young student, the school is, of course, concerned chiefly with his acquisition of the proper knowledge, attitude, and technique. Once more, it matters not at that stage whether his destination is to be investigation or practice. In either case, as beginner, he learns chiefly what is old, known, understood. But the old, known, and understood are all alike new to him; and the teacher in presenting it to his apprehension seeks to evoke the attitude, and to carry him through the processes, of the thinker and not of the parrot.

The fact that disease is only in part accurately known does not invalidate the scientific method in practice. In the twilight region probabilities are substituted for certainties. There the physician may indeed only surmise, but, most important of all, he knows that he surmises. His procedure is tentative, observant, heedful, responsive. Meanwhile the logic of the process has not changed. The scientific physician still keeps his advantage over the empiric. He studies the actual situation with keener attention; he is freer of prejudiced prepossession; he is more conscious of liability to error. Whatever the patient may have to endure from a baffling disease, he is not further handicapped by reckless medication. In the end the scientist alone

draws the line accurately between the known, the partly known, and the unknown. The empiricist fares forth with an indiscriminate confidence which sharp lines do not disturb.

Investigation and practice are thus one in spirit, method, and object. What is apt to be regarded as a logical, is really but a practical, difficulty, due to the necessity for a division of labor. "The golden nuggets at or near the surface of things have been for the greater part discovered, it seems safe to say. We must dig deeper to find new ones of equal value, and we must often dig circuitously, with mere hints for guides."<sup>1</sup> If, then, we differentiate investigator and practitioner, it is because in the former case action is leisurely and indirect, in the latter case, immediate and anxious. The investigator swings around by a larger loop. But the mental qualities involved are the same. They employ the same method, the same sort of intelligence. And as they get their method and develop their intelligence in the first place at school, it follows that the modern medical school will be a productive as well as a transmitting agency. An exacting discipline cannot be imparted except in a keen atmosphere by men who are themselves "in training." Of course the business of the medical school is the making of doctors; nine-tenths of its graduates will, as Dr. Osler holds, never be anything else. But practitioners of modern medicine must be alert, systematic, thorough, critically open-minded; they will get no such training from perfunctory teachers. Educationally, then, research is required of the medical faculty because only research will keep the teachers in condition. A non-productive school, conceivably up to date to-day, would be out of date to-morrow; its dead atmosphere would soon breed a careless and unenlightened dogmatism.

Teachers of modern medicine, clinical as well as scientific, must, then, be men of active, progressive temper, with definite ideals, exacting habits in thought and work, and with still some margin for growth. No inconsiderable part of their energy and time is indeed absorbed in what is after all routine instruction; for their situation differs vastly from that of workers in non-teaching institutions devoted wholly to investigation. Their practical success depends, therefore, on their ability to carry into routine the rigor and the vigor of their research moments. A happy adjustment is in this matter by no means easy; nor has it been as yet invariably reached. Investigators, impressed with the practical importance of scientific method to the practising physician, tend perhaps to believe that it is to be acquired only in original research. A certain impatience therefore develops, and ill equipped student barks venture prematurely into uncharted seas. But the truth is that an instructor, devoting part of his day under adequate protection to investigation, can teach even the elements of his subject on rigorously scientific lines. On the other hand, it will never happen that every professor in either the medical school or the university faculty is a genuinely productive scientist. There is room for men of another type,—the

<sup>1</sup>C. A. Herter: "Imagination and Idealism in the Medical Sciences," *Columbia Univ. Quart.*, vol. xii., no. 11, p. 16.



non-productive, assimilative teacher of wide learning, continuous receptivity, critical sense, and responsive interest. Not infrequently these men, catholic in their sympathies, scholarly in spirit and method, prove the purveyors and distributors through whom new ideas are harmonized and made current. They preserve balance and make connections. The one person for whom there is no place in the medical school, the university, or the college, is precisely he who has hitherto generally usurped the medical field,—the scientifically dead practitioner, whose knowledge has long since come to a standstill and whose lectures, composed when he first took his chair, like pebbles rolling in a brook get smoother and smoother as the stream of time washes over them.

The student is throughout to be kept on his mettle. He does not have to be a passive learner, just because it is too early for him to be an original explorer. He can actively master and securely fix scientific technique and method in the process of acquiring the already known. From time to time a novel turn may indeed give zest to routine; but the undergraduate student of medicine will for the most part acquire the methods, standards, and habits of science by working over territory which has been traversed before, in an atmosphere freshened by the search for truth.

For purposes of convenience, the medical curriculum may be divided into two parts, according as the work is carried on mainly in laboratories or mainly in the hospital; but the distinction is only superficial, for the hospital is itself in the fullest sense a laboratory. In general, the four-year curriculum falls into two fairly equal sections: the first two years are devoted mainly<sup>1</sup> to laboratory sciences,—anatomy, physiology, pharmacology, pathology; the last two to clinical work in medicine, surgery, and obstetrics. The former are concerned with the study of normal and abnormal phenomena as such; the latter are busy with their practical treatment as manifested in disease. How far the earlier years should be at all conscious of the latter is a mooted question. Anatomy and physiology are ultimately biological sciences. Do the professional purposes of the medical school modify the strict biological point of view? Should the teaching of anatomy and physiology be affected by the fact that these subjects are parts of a medical curriculum? Or ought they be presented exactly as they would be presented to students of biology not intending to be physicians? A layman hesitates to offer an opinion where the doctors disagree, but the purely pedagogical standpoint may assist a determination of the issue. Perhaps a certain misconception of what is actually at stake is in a measure responsible for the issue. Scientific rigor and thoroughness are not in question. Whatever the point of view—whether purely biological or medical—scientific method is equally feasible and essential; a verdict favorable to recognition of the explicitly medical standpoint would not derogate from scientific rigor. There is no doubt that the sciences in question can be properly cultivated only in the university in their entirety

<sup>1</sup>An introductory course in physical diagnosis is given in the second year; occasionally clinical work is begun in its latter half.

and in close association with contiguous, contributory, or overlapping sciences. No one of them is sharply demarcated; at any moment a lucky stroke may transfer a problem from pathology to chemistry or biology. There are indeed no problems in pathology which are not simultaneously problems of chemistry and biology as well. So far the rigorously and disinterestedly scientific viewpoint is valid. These considerations, however, still omit one highly important fact: medical education is a technical or professional discipline; it calls for the possession of certain portions of many sciences arranged and organized with a distinct practical purpose in view. That is what makes it a "profession." Its point of view is not that of any one of the sciences as such. It is difficult to see how separate acquisitions in several fields can be organically combined, can be brought to play upon each other, in the realization of a controlling purpose, unless this purpose is consciously present in the selection and manipulation of the material. Pathology, for example, is a study of abnormal structure and function; the pathologist as such works intensively within a circumscribed field. For the time being, it pays him to ignore bearings and complications outside his immediate territory. Undoubtedly, the progressive pathologist will always be at work upon certain problems, thus temporarily, but only temporarily, isolated. But in the undergraduate class-room he is from time to time under necessity of escaping these limitations: there he is engaged in presenting things in their relations. The autopsy, the clinical history, will be utilized in presenting to the student, even if incidentally, the total picture of disease. Similarly, the anatomist can score many a point for the physiologist without actually forestalling him. He views the body not as a mosaic to be broken up, but as a machine to be taken to pieces, the more perfectly to comprehend how it works. The pharmacologist is in a similar relation to the clinician. The principles of bacteriology lose nothing in scientific exactitude because, taught as a part of the medical curriculum, they are enforced with illustrations from the bacterial diseases of man rather than from those of animals and plants; and histology is not the less histology because tissues from the human body are preferably employed.<sup>1</sup> In

<sup>1</sup>The following quotations from "An Outline of the Course in Normal Histology," by L. F. Barker and C. R. Bardeen (*Johns Hopkins Hospital Bulletin*, vol. vii., nos. 62, 63, p. 100, etc.), forcibly illustrate the above contention.

"In deciding as to the plan to be adopted we have been much influenced, too, by the fact that our students are students of medicine. Thus it will be noticed that in the selection of tissues, those from the human body make up a large part of the material used; and when animal tissues are employed, special care has been taken to point out how they differ from the human. Moreover, in deciding what to exclude from the course thought was given to the bearing of the specimens on the practical work in medicine which was to follow, and stress was laid upon those portions of human histology which previous experience has taught us are of the most importance in the appreciation and interpretation of the pathological alterations in disease. In the present status of pathological histology a knowledge of certain details is of much greater value than that of others; and for the student entering medicine, a judicious selection of what shall be given and what shall be left out should be made by some one who has had a more or less wide training in pathological histology.

"Further bearing in mind the life-work for which the student is preparing himself, we have not always chosen the method which would show the finest structural details of the tissues. While the most delicate methods have been introduced in places, we have endeavored to familiarize the students with a large number of different modes of preparation. The student who has been brought up entirely on 'gilt-edged' histological methods will find himself sadly at a loss in battling with the 'rough and ready' world in which the pathologist has to live." (Somewhat abridged.)