

character permits him to trifle with human life or health, or encourage the frailties of human nature, has no right in the ranks; therefore the qualifications of moral character expressed in the laws should be a matter of more important consideration than is frequently the case." And again: "The enforcement of laws of this character depends more upon the moral stamina of the dealer than the terror of the law."

There is no desire herein to discuss the value of alcoholics and malt beverages as medicinal agents but, unfortunately, the legalized traffic in them rests in the hands of physicians. In this comment attention is directed to the importance of keeping an undesirable class out of the drug business; a closer watchfulness over some of those engaging therein becomes a duty to the profession; the proposed regulations invite a condition by no means desired.

E. G. E.

COLLEGES OF PHARMACY AS PREMEDICAL SCHOOLS.*

BY HORATIO C. WOOD, JR., M.D.¹

Forty of the States in our Union demand as a prerequisite to the study of medicine one or more years of "college education," *i. e.*, a study of subjects beyond the high school standard. It is specified in many of these laws that this education must be acquired in a "college of arts and science." Although the wording of this section of the laws is sometimes ambiguous the manifest purpose of it is to exclude those schools where professional preparation has been the prime purpose. The University of Pennsylvania says: "Time spent in professional schools of law, dentistry, pharmacy, etc., will not be accepted as the equivalent of any part of the two years of college education."

I should like to have you consider with me for a little while this evening whether this discrimination against schools which teach pharmacy is a wise one.

REASONS FOR COLLEGE EDUCATION.

Before undertaking this investigation we should have a clear idea of why collegiate preparation is desirable for the study of medicine. As I see it there are three fundamental reasons.

First.—Weeding out the mentally incompetent. In an interesting article in the *Scientific Monthly* (January 1921) Professor Pillsbury, of the University of Michigan, points out that the modern educational system has a "very important function as a selecting agency, a means of separating the men of best intelligence from the deficient and mediocre. All are poured into the system at the bottom; the incapable are soon rejected or drop out after various grades and pass into the ranks of unskilled labor . . . the more intelligent who are to be clerical workers pass into the high school; the most intelligent enter the universities, whence they are selected for their professions." There can be no doubt that the amount of education a man can acquire is limited by his natural endowments. There are types of intellect, amply sufficient for the requirements of swinging a pick-axe or shoveling coal, to whom an asymmetric carbon atom would remain a mystery

* An address before the Philadelphia Branch of the American Pharmaceutical Association, November meeting.

¹ Professor of Materia Medica at the Philadelphia College of Pharmacy and Science.

even after forty years of study. It is manifest that a man with insufficient degree of intelligence to pursue a course at college can never reach high success in the practice of medicine.

Second.—Advantage of a certain degree of familiarity with what are called "cultural" subjects. A man may be able to cure malaria without ever having read Shakespeare, but he is certainly limited in his outlook on life and, I believe, in his usefulness to the community unless he has some acquaintance with English literature. It is highly improbable that he who has never read any of the standard masterpieces will ever develop a good literary style either in speaking or writing. When I say "good literary style" I mean the power of expressing himself so as to convey his meaning clearly and forcibly, not merely to charm the ear. If a man be ignorant of history he cannot properly interpret modern trends either in his profession or in the world in general and there is certainly a crying need in the medical profession to-day for men whose feet are held to the ground by a knowledge of the fads of the past. But I am not here to argue for the value of general culture as a professional asset; I can only say that, like the great majority of professional educators, I am firmly convinced of it.

Third.—The third, and probably most important, reason for the premedical course is to provide a knowledge of certain branches which are fundamental to the medical sciences.

COMPARATIVE ADVANTAGES OF SCHOOLS OF ARTS OR OF PHARMACY.

Let us consider the advantages of the present pharmacy course as a preliminary for the medical course under these three divisions.

First as a mode of selection of the mentally fit. The value of the present pharmacy course as a means of separating men into their intellectual or psychological groups seems to me at least equally high, if not higher, than that of the ordinary college curriculum. The subject of materia medica is as good a test of a man's memory power as that of history. Organic chemistry requires a degree of logical reasoning of as high a type as that in trigonometry or calculus. The man's powers of observation, as well as his control over finer muscle movements, are fully tested in the chemical and pharmaceutical laboratories. I might digress a moment to point out that motor control, *i. e.*, the power to guide accurately the finer movements of the hands, is regarded by psychologists as an important test of intellectual capacity and is an essential quality both to the student and practitioner of medicine. The success of the medical student in anatomy, physiology, pharmacology and chemistry is very largely conditioned on his ability to perform delicate manipulations.

The second advantage of a premedical college training is a widening of the mental horizon that comes only from knowing something of matters beyond the realm of our daily occupations. The relative value of various studies for this purpose is a matter of personal opinion, but I wish to point out that the differentiation of a purely cultural subject rests primarily upon the fact that it has no immediately apparent usefulness in assisting a man's professional activities. Whether a subject is a cultural one or an utilitarian one depends very largely upon what the student's future career is to be; for example, a knowledge of trigonometry is of no immediate advantage to a practicing physician but is essential to the engineer;

to the one it is a matter of general educational interest, to the other it means bread and butter. To the business man, Grecian history is purely an ornamental acquirement but to the artist it is almost a professional requisite.

While some of you may differ, the subjects which seem to me pre-eminently suitable as educational ornaments for the physician are rhetoric and history. I also believe that he should be well grounded in at least two foreign languages, one ancient and one modern, and that a knowledge of higher mathematics, as trigonometry and calculus, is valuable. I do not wish to infer that other subjects such as geology, psychology and botany may not be of value as educational embellishments but they are rather too closely related to the professional subjects to be considered as purely ornamental.

It is very manifest that the ordinary two-year course in pharmacy is so hopelessly deficient in these branches that it lies outside of all comparison with the academic institutions. There has recently been, however, a strongly manifest tendency on the part of colleges of pharmacy to enlarge the scope of their work, and a number of them have instituted courses covering four years of study and leading to a degree of Bachelor of Science in Pharmacy. In these institutions are being offered, although not in so abundant variety as in the academic colleges, courses covering the more essential topics of a liberal education such as English, French, German and mathematics.

The third reason for requiring a collegiate education is that there are certain branches fundamental to the medical sciences, which are no longer taught in medical schools, which are essential to understanding of the medical subjects. For example, it is manifestly impossible for a student to follow the course in physiological chemistry, which is usually given in the first year of medical curriculum, unless he has an acquaintance with general chemistry.

That this is the most important reason for premedical training is shown by the fact that a knowledge of the same fundamental branches is required, not only by the Council on Education of the American Medical Association, but practically all the medical schools in the country and also by the laws governing medical practice in a majority of the States in the Union.

Thirty-six of the United States require two years of college education as preliminary to the study of medicine, and four others require one year of college education. Of thirty-one States, of whose requirements I have record, twenty-seven specify that a portion of this preliminary education must be devoted to the subjects of physics, chemistry and biology and sixteen of them include also a modern language. In only four of these thirty-one States is there no restriction as to the subjects to be studied. The rules of the Council on Education of the American Medical Association require, in addition to a high school education, two years in an "approved college of arts and science" which must cover a minimum sixty semester hours and include a certain number of hours in specified subjects. These are shown in the table, Column 1. In addition to the obligatory subjects mentioned in this table the Council on Education "strongly urge" that a portion of the elective time be devoted to a foreign language, botany, zoölogy and psychology.

As an example of requirements which are distinctly in excess of the minimal outlined by the Council on Education we may take the entrance requirements of Johns Hopkins University. There are other schools in the country whose entrance

requirements are as high or even more strict than those of Johns Hopkins but I have chosen this school because, while it does not insist upon a collegiate degree, it requires an amount of preliminary education which cannot be finished in two years. The conditions for entrance into Johns Hopkins University Medical School are shown in Column 2 of the table.

In order to ascertain how nearly these conditions of preliminary education may be fulfilled in a college of pharmacy, I have summed up the amount of time devoted to the various subjects which are either requisite or highly desirable as a preliminary to medical study, in the first two years of three schools of pharmacy which offer a four years' course leading to the degree of Bachelor of Science in either pharmacy or chemistry. The curricula of these three schools, which are fairly typical, have been tabulated in the columns marked 1, 2 and 3 in the table.

TABLE I.

	A. M. A.	J. H. U.	1.	2.	3.
Physics	8	10	8	8	8
Chemistry	12	15	38	23	18
Biology	8	11	†10	0	0
Foreign language	*6-12	A	10	12	8
English	6	0	10	6	4
Pharmacy	0	0	10	8	11
Botany	*3-6	0	0	4	2
Pharmacognosy	0	0	0	4	9
Mathematics	*3-6	0	6	6	4
Others	26	B	8	0	2
Totals	60		100	71	66

* These subjects not compulsory, but "strongly urged."

† Includes botany.

A. "A reading knowledge of French and German" required.

B. Must have had Latin as far as four books of Caesar.

A. M. A. = Minimum requirements of the Council on Education of American Medical Association.

J. H. U. = Johns Hopkins University, entrance requirements.

It will be noted in the above table that the courses in all these schools meet or exceed the minimal requirements of the Council on Education except in the subject of biology, and in one school also in English. In school No. 1, which apparently meets all the requirements of the A. M. A., it is impossible to ascertain from the catalogue whether or not it meets the requirements in biology because no separation is made between the amount of time given to biology and to botany. While botany, strictly speaking, is a branch of biology, the Council on Education draws a line between general biology, botany and zoölogy; the rules state that the requirements in biology may be "satisfied by a course of eight semester hours in either general biology or zoölogy or by courses of four semester hours each in zoölogy and botany, but not by botany alone."

It is evident, therefore, that however we may feel upon the advisability of a student acquiring his premedical training in the schools of pharmacy, some modification of these courses is essential to conform with the legal requirements in most of them. It is probable, however, that these schools would have little difficulty in expanding their biological courses.

It seems to me evident that the course leading to Bachelor of Science in pharmacy is, at least from the legal standpoint, with perhaps some modifications, capable of being used in the training of medical as well as pharmaceutical students. The question, however, of the relative desirability of obtaining this introductory knowledge in a college of so-called liberal arts or in a college of pharmaceutical science is one that involves many more features than the mere amount of time devoted to specified subjects.

ASSERTED SUPERIORITY OF COLLEGES OF ARTS.

The most concise statement that I know of, as well as authoritative, on the advantages of collegiate training, is that of Dr. Colwell, secretary of the Council of Pharmacy and Chemistry of the American Medical Association.

In an address before the Annual Congress of Medical Education last year, Dr. Colwell (*J. A. M. A.*, March 13, 1920) sums up:

"The advantages in requiring that the premedical work be taken in approved colleges of arts and sciences are:

"1. The physics, chemistry and biology are taught without reference to their special bearing on medicine. It is not known to-day what particular facts obtained in the study of these sciences will be most useful in the medical research of to-morrow.

"2. The quality of the premedical work is assured since it is carried on in courses leading to the degree of Bachelor of Science in reputable colleges of arts and sciences. This provides also a satisfactory standard for measuring the value of irregular or so-called 'equivalent' courses.

"3. The student is free to make a final choice of his life-work until he is best qualified to do so. He enters the class leading to the science degree; he has a chance to compare notes with those studying for other callings, and may find that some other line of endeavor appeals to him more than medicine. If so, he can make the change without any loss of time, since his premedical courses are equally acceptable for admission to other departments. This freedom of choice is of great importance to the students, since from 10 to 30 percent change to some other calling before their two-year course is completed.

"4. Students now enter medical schools with the benefit of two years in the college atmosphere, the contact with students in other departments, the social life, and the athletics, which are bound to influence their entire lives.

"5. The arrangement is a safeguard against medical cults. It is seldom that a student who had studied genuine science in his courses in physics, chemistry and biology will be misled by the fallacious claims advanced by unscientific cults."

On each of these arguments I should like to say a few words.

First.—That the physics, chemistry and biology are taught without their special bearing on medicine.

While I confess I cannot see great weight in this argument, it would be true, at least in a degree, of a course in a college of pharmacy and science. If the biology in such an institution were taught with any bias at all it would be as introductory to botany, a subject which is not recognized in our modern medical curricula.

Second.—That the quality of the premedical work is assured since it is carried in the courses leading to the Bachelor of Science in reputable colleges of arts and sciences.

The crux of this argument, of course, lies in the B.S. degree. If a college of pharmacy is prepared to and does give a B.S. degree, after a standard four years' course, is it not just as "reputable" as an academic institution that does the same? Why should the fact that one institution teaches philosophy and Greek, and the other pharmacy and materia medica, beside the science courses, militate either for or against their respectability?

Third.—The student is free to make a final choice of his life-work until he is qualified to do so.

This means that when the student has entered the science course of a college he has not definitely committed himself to the study of medicine. If, however, at the end of one or two years of the college course which he has arranged as preparatory to the study of medicine, he decides he will become an engineer or an architect, he will have wasted a good deal of his time in studies that are of no direct value to him. But the chemistry and biology that he would learn in a college of pharmacy are just as useful to the lawyer as the chemistry and biology that he would learn in a college of art.

Fourth.—"The benefit of the college atmosphere, the contact of students in other departments, the social life and the athletics."

I confess that I am somewhat peeved whenever I come across this hoary tradition that association with your fellow man in a college hall has a different effect upon your character than association with the same man under any other circumstances. I believe the contact of the young man with his fellows is good for his development, but why that contact has to be sanctified by an ordained college of arts of science seems obscure.

As for the social life of a college, that is a thing which varies with the individual school, not with the class of institution. When we contrast, for example, conditions at a great university like Columbia—with its thousands of pupils, relatively few of whom are in residence at the college, contending with the distractions of a great city in whose midst it is situated—to those at a little college like Haverford—located in almost rural surroundings, with its two or three hundred pupils practically all of them living on the campus—it seems ridiculous to talk about the atmosphere of college life as a fixed entity. If we grant for the sake of argument that there is some advantage to a boy being thrown into such intimate contact with two or three hundred of his fellows that he comes to know most of them by their first name, evidently it is not to be obtained in a large metropolitan university; on the other hand, if we believe that there is some advantage in having a common interest with two or three thousand fellows of his age with most of whom he has not even a nodding acquaintance, obviously, he cannot reap that benefit at any one of the hundreds of small colleges scattered throughout the country.

The "atmosphere" of the college class room is only too often still that of school-boy days: "If I can fool the teacher (or in this case professor) into believing that I have done work that I have not done that proves how smart I am." It does not seem to enter the mind of the pupil that he is there for the purpose of acquiring knowledge which is going to enable him to earn his living and to take his place among the workers of the world.

In striking contrast to this, in a college of pharmacy and science the presence in the class of men who are engaged in direct preparation for their life-work helps

to awaken a realization in the whole student body that play-days are for children, and to engender an atmosphere conducive to serious study. This mental attitude, as well as the knowledge actually acquired, is a valuable asset to the student of medicine.

Fifth.—The arrangement is a safeguard against medical cults.

I can conceive of no atmosphere so hostile to the development of a medical cult as that of a college of pharmacy; I would not except from this statement even the halls of a medical school. Medical science is still based largely on theory; pharmacy is cold, indisputable facts and the man who has become accustomed to handling facts does not fall an easy prey to the weird speculations of the fad-dists.

There is one advantage that a college of arts has over one of pharmacy which appeals to me strongly; and that is the larger variety of secondary subjects offered to the student. Out of a required total of sixty semester hours the Council on Education insists on definite assignments for only thirty-four hours. In other words, nearly half of the student's course may be arranged to suit himself. If he be interested in history, or geology, or philosophy, he has a certain amount of time which can be devoted to these scholastic amusements. The pharmaceutical school, however, offers him but little in the way of diversion; pharmacy, mathematics and Latin is about the sum total.

While, in all candor, we must acknowledge this is a real deficit, I feel that there are certain superiorities of a school of pharmacy and science which offset it.

Of the three fundamental subjects whose necessity is recognized by everyone, there can be no question that the most essential is chemistry. It must be remembered to-day that in most medical schools there is absolutely no instruction in the subject of general chemistry; it is as much taken for granted that the student knows this subject as it is that he knows how to add and multiply (to be sure, I have met medical students, not a few, who were unable to work simple problems in percentage, but they are laboring under a great disadvantage). A fair knowledge of general chemistry is an absolutely necessary antecedent to physiological chemistry, and the better the student is grounded in chemistry the easier it will be for him to gain a clear apprehension of pharmacology, physiology and many other branches.

I do not think that anyone can seriously question the greater thoroughness of the chemical instruction given at a college of pharmacy and science compared to that of a college of arts and science. In the first place, if we compare, as typical, the number of hours on the curriculum of college No. 1 we will note that there are three times the requirements of the Council on Education. Moreover, I am persuaded that the quality of the teaching is superior and this I say without derogation to the academic institutions. It is only reasonable to expect that a subject which occupies nearly one-third of the time of the students, and is taught by one-sixth of the faculty, of an institution should be more highly developed than at an institution where it forms a mere accidental or unimportant part of a great number of courses. Go out among the druggists and the doctors of the United States and see who has the better knowledge of chemistry! It is not merely because the druggist uses his chemistry, for I doubt if the pharmacist has much more need for chemistry in his daily occupation than the physician, but it is because the

training in chemistry given in schools of pharmacy is more than equivalent to the entrance requirements for the medical school *plus* the chemistry he learns after he enters the medical school.

In physics and in biology, the other two fundamental subjects, it is not unreasonable to suppose that the training will be at least equal, if not superior, in the school of pharmacy to that in the academic institution for the reason that both of these subjects are more or less fundamental to the subsequent course in pharmacy.

We see, therefore, that the college of pharmacy is superior to the college of arts in the instruction in the required premedical subjects and I wish to go further than this and to show that the college of pharmacy offers certain advantages even in the elective studies. It is notorious that the weakest part of the medical curriculum is in *materia medica*. Time after time medical writers have stated that the reason that the manufacturers of proprietary mixtures flourish like the green bay tree is because the physicians of this country realize their inability to write a prescription properly. There is no better way to learn how to mix drugs, and how not to mix them, than to see the actual results of various combinations. In other words, while I would not assert that a practical acquaintance with pharmacy is necessary for the writing of prescriptions, I do believe it is of valuable assistance. That most teachers of pharmacology agree with this view is shown by the number of medical schools which include a course on pharmaceutical manipulations as part of their regular studies. But the time given to this course in a medical curriculum is totally inadequate to teach anything but the merest smattering of general principles. Even if we grant that the instruction in pharmacy in the typical B.S. course of the schools of pharmacy and science is more than is actually needed by the physician, it would require much argument to make me believe that a knowledge of geology or calculus is more valuable to a doctor than a knowledge of pharmacy.

We should perhaps bear in mind in this discussion the student who is willing to spend four years in order that he may have a college degree, and givesome thought to the senior years of a college of pharmacy and science. In some of the institutions of this nature there is considerable variety in the subjects that are offered in senior years. The student may fit himself, for example, for an immediate position in industrial chemistry, or for the practice of pharmacy in one of its numerous branches. If at the end of his sophomore year he is still intent upon the study of medicine, he has offered to him a variety of subjects such as *materia medica*, bacteriology, pharmaceutical chemistry, etc., which will be of direct assistance in his future medical career, that are not obtainable in the ordinary college of arts and science.

In conclusion I may sum up my views in the statement that while the courses leading to Bachelor of Science in Pharmacy are comparatively new and not yet developed to their highest efficiency, the day is not far distant when medical colleges and legislators will no longer be justified in their discrimination in favor of the college of arts and science as against the college of pharmacy and science.