ultimate reason of these matters; show me the sublime presence of the highest spiritual cause lurking, as it does lurk, in these suburbs and extremities of nature; let me see every trifle bristling with the polarity that ranges it instantly on an eternal law;—and the world lies no longer a dull miscellany and lumber room but has form and order.

The field of service to which this laboratory is dedicated is fertile; the outlook is vast; the future is full of promise, for never have the opportunities of applying chemistry to agriculture been greater. The reward, moreover, is certain, provided its devotees preserve the spirit and breadth of vision which actuated the founders of our science.

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PREPROFESSIONAL TRAINING AS REVEALED BY THE NEEDS OF THE PHYSICIAN[1]

THE need of premedical training, as a foundation for a medical education, is evident, and its importance is recognized. What is not so clear, however, and what is not so easily decided, is how broad and deep and firm a foundation is required for the medical superstructure. Just as any building must always be considered, as a whole, before the type of foundation can be determined, so, in the same way, the problem of medical education, in its entirety, must be thought of, the better to understand and appreciate the kind of premedical instruction necessary. It is, therefore, hoped that by calling your attention, on the one hand, to what the finished product of a medical school should be, and, on the other hand, to the deficient product that is produced, you will be helped to realize the urgent need there exists for certain modifications of the present-day premedical courses.

The ultimate aim of the science and art of medicine is (1) to preserve or restore health, (2) to prolong life or (3) to alleviate suffering. The most important object of medical education is to prepare young men and young women to carry out these aims, *i.e.*, to qualify them to practice medicine. Since there is such a misunderstanding as to what the practice of medicine implies, and since the premedical teacher should be familiar with what being a physician means, it might not be amiss, at this point, to define it. The practice of medicine implies (1) an ability to diagnose the patient's ailment, and (2) an ability to take care of the patient, *i.e.*, to treat him by any one or more of all the known and recognized preventive and remedial measures that the diagnosis might indicate and suggest. Ability to diagnose is, of course, dependent upon a thorough knowledge (1) of the fundamental sciences—normal and pathological physiology, chemistry and anatomy, and (2) of the exciting and predisposing causes of disease. Ability to treat implies first of all an ability to diagnose, because diagnosis indicates and suggests the kind of treatment necessary, and second it presupposes a knowledge of therapeutics which means the taking care of a patient by any one or more of the following measures: (1) preventive, (2) suggestive, (3) dietetic, (4) physical, (5) hydrotherapeutic, (6) medicinal, (7) mechanical, (8) operative, etc., etc. It further assumes a proper and sympathetic attitude towards the patient. In the building up of a medical education, therefore, therapeutics is the ultimate aim. All other subjects are important only in so far as they throw light on it. In other words, the young doctor, the product of the medical school, should be a humanized being, one qualified by education and training (1) to determine, by diagnosis, what measure or measures are indicated, and (2) to faithfully carry out such treatment, or, if he can not do so himself, he will arrange that another, qualified, shall do it for him.

One need not travel far nor search long for evidence that the product of the present-day medical school is being found wanting. While it is clear there is trouble, it is not easy to localize it and determine its cause. Undoubtedly, the public is to blame on the one hand, and, on the other hand, the schools are certainly at fault. Unlike the successful business corporation which is vitally interested in the turning out of its wares in the form of finished products, because that means satisfied consumers and continued success, the schools have been more or less indifferent to the needs of their graduates, their interest in these ceasing largely at commencement time. And so we find, among others, the graduate in medicine, handicapped by his training or lack of training, unable to do full justice to his patients and to himself.

Though irregular practitioners and patent medicine venders have always been with us, and probably always will be, it is a fact that they are thriving to-day as never before. The United States Bureau of Census, in its 1919 report, gives figures which indicate that the value of patent medicines and compounds increased from $83,771,154.00 in 1909 to $102,463,400.00 in 1914 and to $212,185,700.00 in 1919, a percentage increase in the ten-year period, 1909 to 1919, of approximately 250 per cent. B. C. Keller, in an article, "Laity's idea of physician," ap-

[1] Read before the Association of Urban Universities, November, 1923.

pearing in the 1923 July number of the *Illinois Medical Journal,* and quoted in the *Literary Digest* for September 22, 1923, shows that of 6,772 persons, from all walks of life, interviewed, 5,841 or 87 per cent. were against the regular physician as evidenced by their faith in and patronage of irregulars. This state of affairs is, indeed, all the more deplorable when we call to mind the fact that the public is able to enjoy more perfect health and thus to live a more complete life because of the profession of medicine's constant and self-sacrificing efforts in its attempt to prevent disease and preserve health. The gullibility of the public, therefore, must explain, in a measure at least, its attitude towards the profession.

The schools, both medical and premedical, must, however, shoulder the biggest share of the responsibility. Answers to the question, "What do you consider was lacking, if anything, in your medical school course to fit you for your particular work?" asked of Harvard Medical School graduates, in a questionnaire sent to them about twelve years ago ("The profession of medicine," A. B. Emmons), brought out the fact that of all answering practically 50 per cent. agreed on the one point that a knowledge of therapeutics was their greatest lack. While this reflects conditions as they were some fifteen years ago, in spite of splendid advancements made, there still remains much to be done. That needed improvements are necessary to-day is evidenced by such articles as "Medical education as revealed by the war" (N. B. Foster, *J. A. M. A.*, 5/24/19), "The teaching of therapeutics" (Hare, *J. A. M. A.*, Feb., 1920), "The practitioner's view of the defects of medical education" (Blumer, Proceedings of Thirtieth Annual Meeting of Association of American Medical Colleges, March, 1920), etc., which call our attention to existing defects. However, it must be said to the credit of medical educators: (1) that they are aware of these defects, as reference to a series of papers on medical education in the 1919 *Edinburgh Medical Journal,* and a similar series of articles appearing in the Proceedings of the Association of American Medical Colleges, for the past several years, will show, and (2) that they have been and are considering ways and means of improving the medical course.

After duly charging the public on the one hand and the medical school on the other with the responsibilities that are theirs, there remains no small balance of blame that must be charged to the premedical training. When the Council on Education of the American Medical Association, in 1914, required one premedical year, and in 1918 two premedical years, consisting, in both instances, of prescribed courses in the sciences, with freedom in the choice of enough electives to make up the total required hours, for admission to its class A schools, it undoubtedly had for its object a better prepared medical student. Now, after these years of trial, in the light of the evidence presented, it is not at all surprising that it is becoming more and more questionable whether the added requirements are producing the desired results. The fact that two years ago five schools (Johns Hopkins, Cornell, Western Reserve, Leland Stanford Junior and the University of California) were requiring three years or more of premedical preparation for admission, and that now, in addition, five other schools (Yale, Rush, Dartmouth, Pennsylvania and Oregon) have joined them indicates that these ten schools believe the two-year requirement insufficient and inadequate.

The needs of the practitioner of medicine, as revealed by this study, suggest, among others, the following modifications of the present premedical curriculum, and these are respectfully offered for your consideration:

(1) As medicine is an art as well as a science, the cultural subjects and the humanities should be given greater consideration than they now receive. In the present two-year requirement 28 semester hours in the sciences and six semester hours in English are prescribed, but entire freedom is allowed in the choice of enough electives to make up the total number of hours, the emphasis being on the hours and not on the subject-matter. The implication is that the scientific instruction is the important phase of the premedical training and that nothing else matters. While this may be true, so far as immediate needs go, it is equally as true that such reasoning ignores the needs of the future. Both types of subject are certainly very essential and neither can replace the other. Whereas too much emphasis on the scientific side tends to make the student an unsympathetic and "cold-blooded proposition," the broadening influences of these other subjects make for a humanized being. What is needed is a balanced course—one built especially for the student by the combined efforts of premedical and medical educators. And in this connection we might ask—Is not a complete arts and science course, as a premedical requirement, worthy of most careful consideration?

(2) As the physician works with living patients, he must, of necessity, deal with the human mind. Therefore, psychology, now only a recommended subject, should be a required one.

(3) If ever there was need for the break between the premedical and medical subjects, that need certainly does not exist to-day. It is bad, pedagogically, to say the least. As the laws of physics, chemistry and biology must be applied in diagnosing diseases and treating patients, it is highly important, in the

teaching of these subjects, that the instructors understand the relations between their own subject and what follows. This appreciation will be lacking until there is a greater working together of premedical and medical teachers. For, isn't it as important that the instructor in physics, say, should cooperate with the instructor in physiology as it is for the latter to work with the clinical teacher? Therefore, a greater cooperation between the various teachers concerned with the training of a medical student is urged, in the hope that a better correlation of subjects and a more efficient course will follow.

In conclusion, may we anticipate that to your efforts will be due no small amount of credit for making of the future medical graduate a more finished product.

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UNIVERSITY OF BUFFALO

SCIENTIFIC EVENTS

THE NATIONAL SCIENTIFIC SOCIETIES MEETING IN WASHINGTON DURING CONVOCATION WEEK, DECEMBER 29, 1924, TO JANUARY 3, 1925

THERE have been printed in SCIENCE articles concerning the approaching meeting of the American Association for the Advancement of Science and the national scientific societies associated with it. A list of the sections of the association and of the societies with the principal officers, including the addresses of the secretaries, is as follows:

President

J. MCKEEN CATTELL, Garrison-on-Hudson, N. Y.

Retiring President

CHARLES D. WALCOTT, Smithsonian Institution, Washington, D. C.

Vice-presidents and Retiring Vice-presidents for the Sections

Section A (Mathematics)

Vice-president, J. C. FIELDS, University of Toronto, Toronto, Canada.

Retiring Vice-president, HARRIS HANCOCK, University of Cincinnati, Cincinnati, Ohio.

Section B (Physics)

Vice-president, K. T. COMPTON, Princeton University, Princeton, N. J.

Retiring Vice-president, W. F. G. SWANN, University of Chicago, Chicago, Ill.

Section C (Chemistry)

Vice-president, F. G. COTTRELL, Fixed Nitrogen Research Laboratory, American University, Washington, D. C.

Retiring Vice-president, E. W. WASHBURN, National Research Council, Washington, D. C.

Section D (Astronomy)

Vice-president, JOHN A. MILLER, Swarthmore College, Swarthmore, Pa.

Retiring Vice-president, HEBER D. CURTIS, Alleghany Observatory, Pittsburgh, Pa.

Section E (Geology and Geography)

Vice-president, W. C. MENDENHALL, U. S. Geological Survey, Washington, D. C.

Retiring Vice-president, N. M. FENNEMAN, University of Cincinnati, Cincinnati, Ohio.

Section F (Zoological Sciences)

Vice-president, EDWIN LINTON, 1104 Milledge Road, Augusta, Ga.

Retiring Vice-president, E. L. RICE, Ohio Wesleyan University, Delaware, Ohio.

Section G (Botanical Sciences)

Vice-president, G. R. LYMAN, West Virginia University, Morgantown, W. Va.

Retiring Vice-president, C. J. CHAMBERLAIN, University of Chicago, Chicago, Ill.

Section H (Anthropology)

Vice-president, E. A. HOOTON, Peabody Museum, Cambridge, Mass.

Retiring Vice-president, E. A. HOOTON, Peabody Museum, Cambridge, Mass.

Section I (Psychology)

Vice-president, R. S. WOODWORTH, Columbia University, New York, N. Y.

Retiring Vice-president, G. STANLEY HALL, *deceased.*

Section K (Social and Economic Sciences)

Vice-president, THOMAS S. BAKER, Carnegie Institute of Technology, Pittsburgh, Pa.

Retiring Vice-president, JOHN F. CROWELL, 171 Liberty St., Bloomfield, N. J.

Section L (Historical and Physiological Sciences, History of Science)

Vice-president, LOUIS C. KARPINSKI, University of Michigan, Ann Arbor, Mich.

Retiring Vice-president, FLORIAN CAJORI, University of California, Berkeley, Calif.

Section M (Engineering)

Vice-president, A. E. KENNELLY, Harvard University, Cambridge, Mass.

Retiring Vice-president, JOHN T. FAIG, Ohio Mechanics Institute, Cincinnati, Ohio.

Section N (Medical Sciences)

Vice-president, WILLIAM A. MACCALLUM, Johns Hopkins University, Baltimore, Md.

Retiring Vice-president, RICHARD P. STRONG, Harvard University Medical School, Boston, Mass.