up-to-date and aggressive methods of rodent control will furnish an increased food supply for America and her Allies which will help to guarantee just that margin of advantage in the world struggle which will be necessary to victory.

Essential to action regarding any of the problems discussed in this paper, whether the domestication of and development of new resources from wild stocks, the protection or propagation of those which are beneficial, or the control or destruction of detrimental species, is an intimate and accurate knowledge of nature. And this knowledge can only come, in any comprehensive and authoritative way, through the collection of series of specimens, with the associated study, in field and laboratory, of the distribution, systematic relationships, habits, economic status and ecology of the animals concerned.

The present-day organization of American science delegates this task to the vertebrate zoologist in college or university, museum of natural history, or government laboratory.

It should ever be the obligation of the scientific man to labor for the public good. With a world to help feed, and a war to help win, it now becomes peculiarly the duty and privilege of the American scientific man to make increased practical application of technical information, in short, to furnish a large measure of cooperation and leadership in the struggle to make democracy efficient and so to secure the benefits of government by the people for the nations of to-day and the generations of the future.

WALTER P. TAYLOR
BIOLOGICAL SURVEY

## THE STATUS OF THE GRADUATE DEGREE IN MEDICINE[1]

THE University of Minnesota is offering graduate work in the various fields of medicine and surgery in three-year courses open to students who already possess the bachelor's degree, or its equivalent, the doctor's degree in medicine from a Class "A" medical school, and who have had at least one year's internship in a general hospital or a year's service in an approved laboratory of the medical sciences. On the satisfactory completion of such a three-year course, the student is eligible for the degree of Doctor of Science in internal medicine, in surgery, in pathology, or in whatsoever other branch of medicine he may have chosen his major subject.

The status of this new degree of Doctor of Science in a medical specialty has not yet been determined; hence the following analysis and discussion. Since the conditions laid down regarding admission, residence, language requirements, thesis and examinations are those which have long been applied by graduate schools of universities in the approval of candidates for the degrees of Doctor of Philosophy or Doctor of Science, it has been assumed by some that the new degree in medicine scholastically reaches only the level of these older degrees. This assumption would seem to be incorrect, first because of the longer time required to obtain the degree, and, second, because of the scientific ability exhibited by men with only the formal schooling represented by the doctorate in medicine or the baccalaureate in arts or sciences.

In the following diagram is shown the relationship in point of time required for the attainment of the M.D. degree in schools with the "Minnesota standard" and the attainment of the Ph.D. degree in universities in general, as well as the additional time required for the attainment of the new degree of Doctor of Science in a medical specialty.

It will be noted from the diagram that four students, *A*, *B*, *C* and *D*, who have had the necessary high-school or other preparatory training, enter the college of literature, science and the arts of the university at the same time and pursue regularly prescribed courses. At the end of two years in college, during which time he has taken a preponderance of prescribed physical, chemical and biological studies, *A* transfers to the medical school, and

[1] Presented before the Minnesota Academy of Medicine, St. Paul, Minnesota, October 11, 1916.

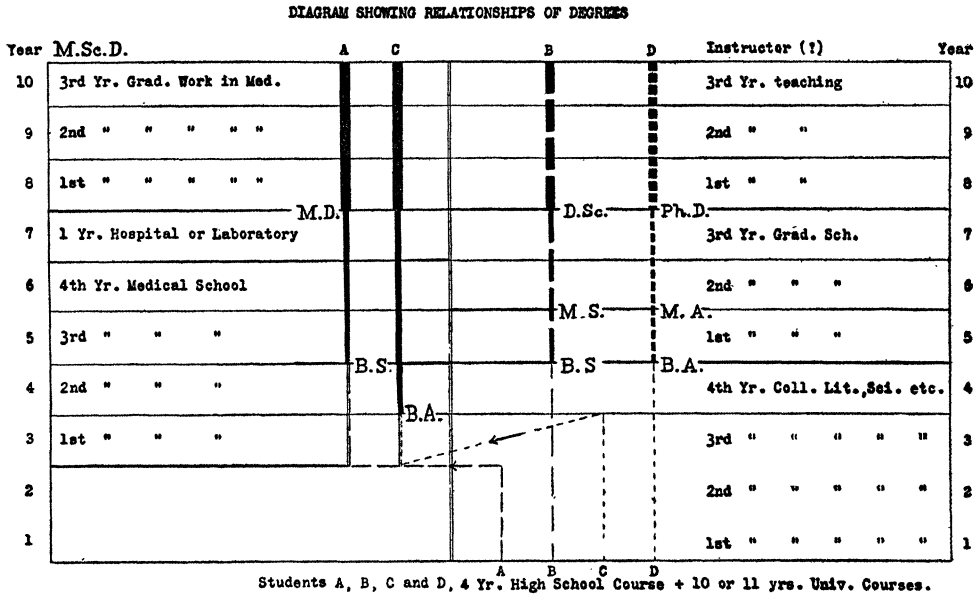


Diagram showing Relationships of Degrees
Students *A*, *B*, *C* and *D*, 4-year high-school course + 10 or 11 yrs. university courses.

takes therein two years more work, at the end of which time—a total period of four years—he receives his B.S. degree. *B*, taking a preponderance of prescribed physical, chemical and biological sciences, at the end of four years, all spent in the college, also receives his B.S. degree. *C*, entering the same college, but in addition to the required physical, chemical and biological sciences, adding thereto the special study of literature and the arts, at the end of three years in the college transfers to the medical school and in one year more, or after a total period of four years, receives his A.B. degree. *D*, entering the college and not indulging in a preponderance of the physical, chemical and biological sciences, but giving special attention to literature and the arts, receives his A.B. degree at the end of four years. Thus, each receives a bachelor's degree at the end of four years. If all four continue in the schools in which they were working at the time they received their bachelor's degree, *B* and *D* will receive their master's degrees at the end of another year and their doctorate degrees in science and philosophy, respectively, at the end of three years. Similarly *A* and *C*, after two and three more years respectively in the medical school and one year in an approved hospital or laboratory, will receive their doctor's degrees in medicine. Therefore at the end of seven years in the cases of *A*, *B* and *D*, and of eight years in the case of *C*, all four have attained the doctorate degree. It would appear that men starting on the new three-year graduate courses in medicine offered by the University of Minnesota in the clinics and laboratories in the Medical School in Minneapolis and in the Mayo Foundation in Rochester, already have spent as much time in making their approach to the study of medical specialties as that required for obtaining the Ph.D. or D.Sc. degree in good institutions.

It is improbable that the native ability, the preparatory school instruction, the habits of study or the skill of their university instructors, in the long run, is either better or worse in the group of doctors of medicine than in that of doctors of philosophy or science. Yet all will agree that, broadly speaking, there is a difference in the scientific attitude and habits of thought in the men of the three

groups. This difference is best explained by the fact that of the four students whose scholastic careers have been diagramed above, *B* and *D* have usually placed most intensive study on a very small field of science or art, while *A* and *C* have given less intensive study to a relatively much broader field. Incidentally also, *A* and *C* are apt to have come more closely in contact with living conditions, with science in the making as it were, than have *B* and *D*. The question is open to discussion whether *B* and *D* may not have concentrated too early and may not later suffer from lack of a broad knowledge of the science in the narrow field in which they have specialized and of other sciences related thereto. Some of the possibilities in this respect are pointed out by Stephen Leacock in one of his delightful "Essays and Literary Studies." Be this as it may, certainly *A* and *C* at least should be well able to see the broader relationship of narrow lines of scientific investigation. The question of present concern, however, is not the breadth of their culture—which unfortunately is usually all too narrow to enable them to get the most real enjoyment out of life—but rather the amount of their scientific ability, *i. e.*, their ability to utilize in new ways old scientific truths and to discover, as well as to utilize, new scientific truths.

The estimation of the relative scientific ability of members of the various groups is very difficult. Even if we could measure accurately each individual's scientific accomplishments we still might be in the dark concerning his native ability or the amount of his premedical and graduate study not represented by formal schooling. But in comparing large groups these factors may fairly be assumed to approximately cancel each other.

Turning then to the question in hand—namely, the relative scientific ability of men who have ended their schooling with the attainment of the M.D. degree as compared with those who have obtained the Ph.D. degree, we may, I think, start with the premise that medical science in America has at least kept abreast with any other science during the last quarter of a century. We might indeed be within the truth in saying that it has led in development, but for the purpose of the present essay, it is but necessary to assume that it has been equal to any other. The second premise, which we may lay down without question, is that the progress in medical sciences has been made by the men who are in the medical profession. It may further be postulated that in the United States most of the men who are responsible for the progress of medical science are members of the various medical societies whose membership is limited to those who have attained some distinction in some special field of medicine. It is presumable that there are instances of general practitioners who are not members of any society of the kind herein analyzed, and who yet have added materially not only to the practise, but also to the science of medicine. Such individuals, however, must be so few that their omission would have relatively little to do with

TABLE I

*Analysis of Scholastic Degrees of Members of Certain Clinical Medical Societies*

| Name of Society | Total Number Members Whose Degrees Were Found | Percentages. | | | |
|---|---|---|---|---|---|
| | | Total M.D. | M.D. Only | M.D. and A.B. or Equiv. | M.D. and Ph.D. |
| American Surgical Association | 169 | 100 | 55 | 43 | 2 |
| Association of American Physicians | 147 | 100 | 32 | 63 | 5 |
| American Orthopedic Association | 116 | 100 | 62 | 37 | 1 |
| American Association of Obstetricians and Gynecologists | 167 | 100 | 73 | 24 | 3 |
| American Pediatric Society | 66 | 100 | 30 | 67 | 3 |
| American Laryngological, Rhinological and Otological Society | 196 | 100 | 66 | 33 | 1 |
| Totals | 861 | 100 | 56 | 42 | 2 |

the figures or the question in hand. I have, therefore, taken the membership lists of the various medical specialists' societies in the United States of which the data were obtainable, and have analyzed the scholastic attainments of the members as a matter of comparison. Elimination of duplicate memberships has not been attempted since it would have been both difficult and unfair.

The results of the analysis of the scholastic degrees of certain clinical medical societies of limited membership are shown in Table I.

68 per cent. have the M.D. degree, 28 per cent. the M.D. only, 34 per cent. the M.D. with the bachelor's degree, 6 per cent. the M.D. and the Ph.D., 22 per cent. the Ph.D. without the M.D. and 10 per cent. neither the M.D. nor the Ph.D. The percentage of those having the M.D. without the Ph.D. (62) is nearly three times that of those having the Ph.D. without the M.D. (22). When to the number of these members is added the number of men having similar attainments who are members of the clinical medical societies, we find that

TABLE II

*Analysis of Scholastic Degrees of Members of Societies Covering the Fundamental Medical Sciences*

| Name of Society | Total Numbers Whose Degrees Were Found | Percentages | | | | | |
|---|---|---|---|---|---|---|---|
| | | Total M.D. | M.D. Only | M.D. and A.B. or Equiv. | M.D. and Ph.D. | Ph.D. | Other Degrees |
| American Association of Anatomists | 283 | 64 | 23 | 36 | 4 | 24 | 12 |
| American Physiological Society | 223 | 54 | 26 | 18 | 10 | 37 | 8 |
| American Society of Biological Chemistry | 153 | 41 | 13 | 16 | 12 | 50 | 9 |
| American Bacteriologists | 335 | 47 | 24 | 20 | 3 | 23 | 30 |
| American Association of Pathologists and Bacteriologists | 316 | 95 | 40 | 52 | 3 | 2 | 3 |
| American Society for Experimental Pathology | 40 | 100 | 30 | 60 | 10 | 0 | 0 |
| American Society for Pharmacology and Experimental Therapeutics | 74 | 87 | 49 | 26 | 12 | 13 | 0 |
| American Society of Experimental Biology and Medicine | 283 | 68 | 24 | 38 | 6 | 28 | 4 |
| American Psychopathological Association | 44 | 84 | 39 | 36 | 9 | 16 | 0 |
| American Association for Cancer Research | 89 | 94 | 40 | 49 | 4 | 3 | 2 |
| Total | 1,840 | 68 | 28 | 34 | 6 | 22 | 10 |
| Compare with Analysis of Certain Clinical Medical Societies (Table I.) | 861 | 100 | 56 | 42 | 2 | 0 | 0 |
| | | | | 73 | | | |
| "Who's Who in America" (1915 edition, selected names of those engaged in physical, chemical or biological sciences) | 3,446 | 48 | 20 | 26 | 2 | 23 | 29 |

Membership in these clinical medical societies presupposes the possession of the M.D. degree. It is interesting to note that, taken as a whole, 56 per cent. of the 861 members have the M.D. degree only, while 44 per cent. have the M.D. with some other earned degree. It is also interesting to note that only 2 per cent. of the 861 members have the Ph.D. degree in addition to the M.D. degree.

An analysis of the scholastic degrees of the societies covering the fundamental medical sciences is shown in Table II. In these, the possession of the M.D. degree is not obligatory for membership. Of the total 1,840 members 73 per cent. of the total 2,701 have the M.D. degree, or the M.D. with the A.B. degree or its equivalent. Thus, it would seem that 73 per cent. of the men who have been responsible for the progress of American medicine started with only the scholastic equipment, at least so far as is indicated by their degrees, of the men now entering upon the study of specialties in medicine, while only 15 per cent. have the Ph.D. or B.Sc. degree.

Probably one third of the 2,701 members of the medical societies here studied are duplicates. In order to get a larger list and at the same time cover a broader field I have made

for comparison a similar analysis of the earned degrees of 3,446 persons engaged in any of the physical, chemical or biological sciences (including medicine), whose names appear in the 1915 edition of "Who's Who in America." The inclusion of a name in this publication indicates that its holder has attained a certain amount of public eminence though not necessarily of a kind indicated by his degree. An analysis of the degrees of these 3,446 persons shows that 48 per cent. have the M.D. degree, 20 per cent. have the M.D. only, 26 per cent. have the M.D. plus the A.B. or its equivalent, 2 per cent. have the M.D. plus the Ph.D., 23 per cent. have the Ph.D. without the M.D. and 29 per cent. have degrees other than M.D. or Ph.D. It therefore appears that in the field of physical, chemical and biological sciences the sort of eminence indicated by registry in "Who's Who" has been attained by twice as many with the degree of M.D. as with the degree of Ph.D.

An analysis of similarly selected names in "American Men of Science" was begun but abandoned since it was found that the latest (1910) edition does not include the names of many of the younger men who are largely responsible for the present progress of American medicine.

Until the later years of the last century the teaching of medicine in America, except in a very few schools, was a travesty on pedagogy. During the present century it has probably improved more than the teaching of any other science. To-day the man who obtains the M.D. degree from an institution with the equivalent of the "Minnesota standard," *i. e.*, including a final year's hospital or laboratory work, probably has quite as much scientific ability as the man who obtains the Ph.D. or D.Sc. degree from the same institution. This seems to be proved by the time he must study, by the character of the subject-matter of his studies, and by the probability of his accomplishing something in science in after life. If this be true and the M.D., Ph.D. and D.Sc. degrees from high-grade institutions represent an equivalent training, it must then appear that the three years of graduate training in a special branch of medicine now offered by the University of Minnesota should result in scientific ability just three years "to the good" of that represented by any one of the three doctorate degrees.

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## SCIENTIFIC EVENTS

### THE RESEARCH CORPORATION

THE Research Corporation was incorporated in the State of New York in 1912 on the initiative of Dr. F. G. Cottrell, who gave to it his patents concerning the process known as the "electrical precipitation of suspended particles." The objects of the corporation are:

First: To build up a business organization which, so far as possible, should be a model of efficient administration, for the purpose of demonstrating the commercial value of the precipitation processes included in the original gift and of such other inventions as the corporation might acquire by gift or otherwise, and of making such inventions a source of profit.

Second: From the profits so earned to accumulate an endowment fund to be used for the intensive study of scientific and industrial needs, and to provide the means, through the testing of new discoveries and through study, investigation and experimentation, of supplying such needs.

During the year 1916 the pioneer period in the application and development of the electrical precipitation processes may be said to have been completed. The corporation, which began with a cash capital of ten thousand dollars, is now spending that amount every month and has in its service a staff of forty-five engineers and others engaged in field and office work. The assets of the corporation as reported by the auditors on February 16, 1917, in cash and securities, were $217,862.72. A laboratory has been established and experts have been employed to study the workings of the precipitation processes, and, if possible, to develop improvements and meet new problems. Careful consideration has also been given to other patents and processes which have been offered to the corporation, and