cine from the point of view of their rich, personal experience.

The fourth group, the volunteer assistants, should consist of younger men of ability of the practitioners' class. Officially they should work with and under the last-named group of teachers, but suitable men should be admitted for special purposes to the laboratories of the scientific staff. Under certain proper circumstances one or the other man of this group may be appointed to the staff of scientific assistants. The appointment of volunteer assistants should be for two years, and if after one reappointment they are not found deserving of advancement to the regular staff, they should not be reappointed.

As far as teaching is concerned, all parts should work as a unit, regulated chiefly by the head of the department.

The necessity for reappointment will serve, as stated above, as a valuable controlling factor; the power of appointment and reappointment should therefore be exercised with great care. I would suggest the following distribution of power. Heads of departments and full professors should be appointed, or reappointed, by the university; all other members of the staff should be appointed or advanced by the members of the medical faculty. In appointing and reappointing scientific assistants the head of the department should have at least three votes.

A head of a department who does not wish a reappointment, or is not reappointed, after ten years' service, shall have the right to be transferred to the practical department with the title professor—unless there are potent reasons against such a transfer. This, in conjunction with the privilege of having some private consultations at his own time during his occupancy of the headship, will compensate the head of a clinical department for the failure to obtain an appointment for life.

As to the relations of hospitals to the teaching department I can be briefer. There must be one hospital which is devoted exclusively to the teaching and study of clinical branches of medicine. While it may have laymen as trustees and a medical superintendent with the necessary clerical staff for the conduction of the business of the hospital, the actual management of its inside affairs should be exclusively in the hands of the medical faculty, and the inside affairs of each department should be exclusively or essentially in the hands of its head. This hospital should not have many private rooms for well-to-do patients, and, as stated above, they should not be used for private patients of the head of the department or any other member of the faculty. The income derived from the treatment of well-to-do patients in private rooms should go to the funds of the hospital.

There ought to be at least one other hospital at the disposal of the medical school which may have many private rooms. Here the practical staff of the school will teach at the bedside—in addition to their right to send patients to and teach at the school hospital—and here the consultants and practitioners belonging to the school may treat their private patients in the private rooms.

The students of medicine will have then a chance of learning predominantly modern scientific medicine at the one, and predominantly practical medicine with a mixture of art at the other, hospital. He will then be able to make his selection as to his future career, according to his natural inclinations and preceding impressions, whether it be scientific medicine with its elevating atmosphere, or active practise and all that goes with it.

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Rockefeller Institute for Medical Research

Research and Teaching in the University[1]

1. No verifiable evidence has been published which proves how research affects the quality of university and college instruction.

2. I believe that research work usually improves the teaching of the instructor, both in the subject in which the research is conducted

[1] Answers to twenty-one questions addressed to the writer by Messrs. William H. Allen and E. C. Branson, directors of a survey appointed to report on the work of the University of Wisconsin.

and in other subjects. It, however, depends on the man and the circumstances. Some men of character and ability may use their time most profitably in teaching. On the other hand, it may be the duty of some instructors to devote themselves mainly to research, even though they are therefore compelled to neglect somewhat their students. It is the duty of the university professor or instructor in equal measure to advance knowledge, to teach students and to serve the public. He should undertake what he can accomplish to best advantage.

3. Research affects methods of instruction directly in so far as it leads the instructor to think more independently and to gain command of his subject instead of depending on text-books. The principal arguments, however, for encouraging instructors to do research work are: (1) It is the business of the university to advance knowledge and to train men to advance knowledge; (2) Better men can be obtained if they are permitted to do research work, and (3) This gives an objective criterion of their ability.

4. Whether the teacher benefits most by research which he conducts alone, by research in which he is assisted by students, or by supervising the research of students, would depend on the circumstances of the case. An efficient professor would probably use the three methods. Perhaps on the whole the 'prentice method is the most desirable and the most economical in the production of scientific results.

5. The extent to which a student is helped by assisting the instructor depends on the kind of work he is set to do, the amount of freedom he is given and his understanding of the problem on which he is working.

6. The student who engages in research work uses the correct method of learning by mastering one subject and relating other knowledge to it; he gains in interest, in independence and in power of initiative, and he learns how to do research work.

7. The result of the instructor's research would usually be to increase his enthusiasm in teaching, which would doubtless apply more directly to the subject which he is investigating and to advanced classes, but it would tend to hold to a certain extent in all cases.

8. Both scholarship and research are important, but I regard the latter as the more important.

9. It is desirable for the student to choose some special subject for work and to connect his other interests with that subject.

10. It follows from this that in preparation for the master's degree or the doctor's degree it is best to require complete mastery of some subject, other knowledge being related to this, rather than to study the whole field of science as it might be represented in a text-book. I regard the preparation of a dissertation as usually desirable.

11. There is, in my opinion, no fundamental difference between adding to knowledge and applying knowledge in new ways. The distinction is between discovering or applying new methods and applying old methods in the old way. The professional school should be on the basis of the university, not of a trade school.

12. I regard knowledge as of value only in so far as it is useful. It may, however, be useful as religion or art is useful. All knowledge is likely to be of use, and the investigator is justified in carrying on investigations the usefulness of which can not be foreseen. I myself prefer investigations the immediate or remote usefulness of which is evident, though an element of danger enters when the utility may be a financial gain to the investigator. It would be desirable to pay the professor an adequate salary and let any money he earned by the application of science go to his department.

13. An instructor in chemistry is usually more usefully employed, even as regards his teaching ability, in conducting chemical investigations than in research as to how to teach chemistry. However, one of the advantages of research is that it leads the instructor to consider and adopt improved methods of teaching.

14. Scientific research is a different problem from helping students. As I understand it,

the object of the questions is to inquire whether the instructor is likely to help students more if he carries on research than if he does not, and my reply is in the affirmative, with the qualification that this is not based on definite knowledge and that much depends on conditions. There is probably a high correlation between ability to carry on research and ability to teach, and the productive scholar or scientific man is more likely to have a beneficial influence on the student than a professor who does nothing but teach and attend athletic events.

15. The stimulating effect of research is doubtless to a large extent due to professional recognition, and in return professional recognition stimulates research. The university should consequently promote the means of publication by professors and instructors, pay their expenses to attend scientific meetings, invite scholars and scientific men from other institutions to lecture and give courses, arrange for the exchange of instructors and the like.

16. It is more desirable for instructors in the department of education to study methods of instruction than for instructors in other departments to do so.

17. The more advanced a student is, the more desirable is it that his instructors should be engaged in research work. This would also be desirable even in elementary schools, but it is not at present feasible to obtain teachers competent to do research work or to pay them. Perhaps if salaries were more adequate all the way from the elementary school to the university, it might be possible to obtain men competent to do research work, to the great benefit of the students and of the world.

18. Under existing conditions the college or university which fails to provide for research work by its instructors is likely to have mediocre teaching. The better men tend to go to institutions where they will be encouraged to do research work and those who stay are apt to adopt the attitude of the schoolmaster rather than that of the professor. The university or college which does not regard the advancement of knowledge and public service as part of its functions has small claim to public support or private gifts, and is likely to deteriorate in all directions.

19. The amount of productive scholarship and research work conducted in America has increased many fold since the introduction of graduate work in the universities in the seventies, and at present three fourths of our productive scientific men are supported by our universities and colleges. The majority of our leading scientific men are connected with a few universities doing graduate work.

20. It is obvious that if the instructor devotes all his time to teaching, he can not do research work. The science in which America was most productive, prior to the introduction of the modern university, was astronomy, in which subject a large amount of undergraduate teaching was not required. Those men doing the most valuable work do not devote the larger part of their time to undergraduate or class teaching. A professor can teach by example as well as by lecturing.

21. I doubt whether most administrative work by instructors has a stimulating and broadening effect on their teaching. One of the chief dangers to the American university is that honor, influence and salary are given to administrative officers instead of to the productive scholars and men of science who are the university.

J. McKeen Cattell

SECTION OF ZOOLOGY OF THE AMERICAN ASSOCIATION

Section F—Zoology—of the American Association for the Advancement of Science will hold its annual meeting at Philadelphia, December 29, 30 and 31, in conjunction with the American Society of Zoologists and the American Society of Naturalists. All sessions will be held in the lecture room of the zoological department of the University of Pennsylvania. A joint symposium has been arranged for the afternoon of Thursday, December 31, with the following program:

E. G. Conklin—The cultural value of zoology.

C. B. Davenport—The value of scientific genealogy.