Encourage work by semi-research methods in the curriculum, putting some of this work as early as the Freshman or at least the Sophomore year, so that its tonic effect may be felt in later work. All college work may well be more by the research method than is now the case.

Present research to community by lectures and exhibits.

Urge value of administrative assistants to relieve faculty members of detailed committee work.

At Smith College attempt is made to put each teacher's classes at one end of the week, leaving study and research time freer from conflict with classroom duties.

FUNCTIONS OF INTERCOLLEGIATE EXECUTIVE COMMITTEE AND OFFICERS

Study problem of encouraging research in colleges and serve as a clearing-house for exchange of suggestions as to methods of promoting research:

(A) by publication of data and discussion,

(B) by correspondence,

(C) by promotion of regional and national conferences discussing promotion of research in the colleges and its relation to successful teaching. Research promotion should have a place on college association programs.

Serve as an agency to bring together in thought and action the colleges and the several organizations interested in the promotion of research in the colleges. Numerous learned societies and other organizations have committees on this subject.

Survey the colleges as to research status, teaching demands upon the time of the faculty members, etc. Perhaps publish results of such survey.

Study sources of aid for research, in and outside the colleges.

Assist individual colleges, or the colleges as a whole, to give and obtain aid for research.

Assist individuals to obtain help, financial and other, in their research.

Study the relation of college work in the past to the stimuli which led men into the life of research.

Develop recognition of the importance of research in the colleges—especially on the part of boards of trustees, administrative officers and those determining college policies.

Help secure for less experienced workers advice from leading scholars in choosing and directing research.

Aid in promoting cooperative research by bringing into contact advisers, workers and supporters in such work.

Aid in exchange of teachers between colleges, and between colleges and universities, also perhaps between industry and colleges there might be exchange of research men.

Assist in securing and arranging lecture courses, and more extended periods of resident work, by leading scholars, several colleges cooperating.

Aid in forming regional societies for cooperation and stimulus in scholarly interests. Neighboring institutions might form interinstitutional groups in different subjects of study for mutual stimulus.

Publish, at least annually, reports upon research in the colleges and its promotion.

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RESEARCH EXPERIENCES AND PROBLEMS IN A SMALL COLLEGE

THIS paper is prepared by request to present the conditions that have made and are making original work possible in a small college. It has been expected that statements should be definite and explicit and therefore I ask your indulgence when it seems to me necessary to refer to names and events connected with the history of a single college which is here represented.

Wesleyan University was established in 1831. Some think that a certain liberal outlook of its founders had bearing upon its later history. I will, however, pass over those considerations and mention at once an important period. We are familiar with the change in American universities leading to a greater recognition of scholarly work of which the founding of Johns Hopkins University in 1876 is often taken as a convenient landmark. By virtue of certain fortunate circumstances Wesleyan University was able to participate in this change. In 1873 the curriculum was revised, allowing more free election and bringing in new subjects for study. This necessitated an increase in the faculty student ratio. Previously it had been of the order of one teacher to eighteen students. After this it climbed rapidly to the neighborhood of one teacher to eleven students. In the accompanying chart (Fig. 1) a comparison is made between the number of students and faculty throughout the history of the college. (Line A is a graph of the number of students divided by 10 and line B shows the number of the faculty exclusive of the president and administrative officers.) Here may be noted the change in faculty student ratio occurring between 1873 and 1888. This revision of the curriculum giving broader interests and requiring a larger teaching force was the work of John Monroe Van Vleck and William North Rice. These two men also realized the value of research and by their counsel in the selection of new members of the faculty greatly aided in the introduction of this new element into the life of the college. In 1873 Wilbur O. Atwater became a member of the faculty. With the coming of Atwater, we find the first record of graduate work and the first beginnings of any continuous scientific investigation. His enthusiasm carried him outside of the college in search of financial support. This was received from private donors and later from the state, from the national government and from the

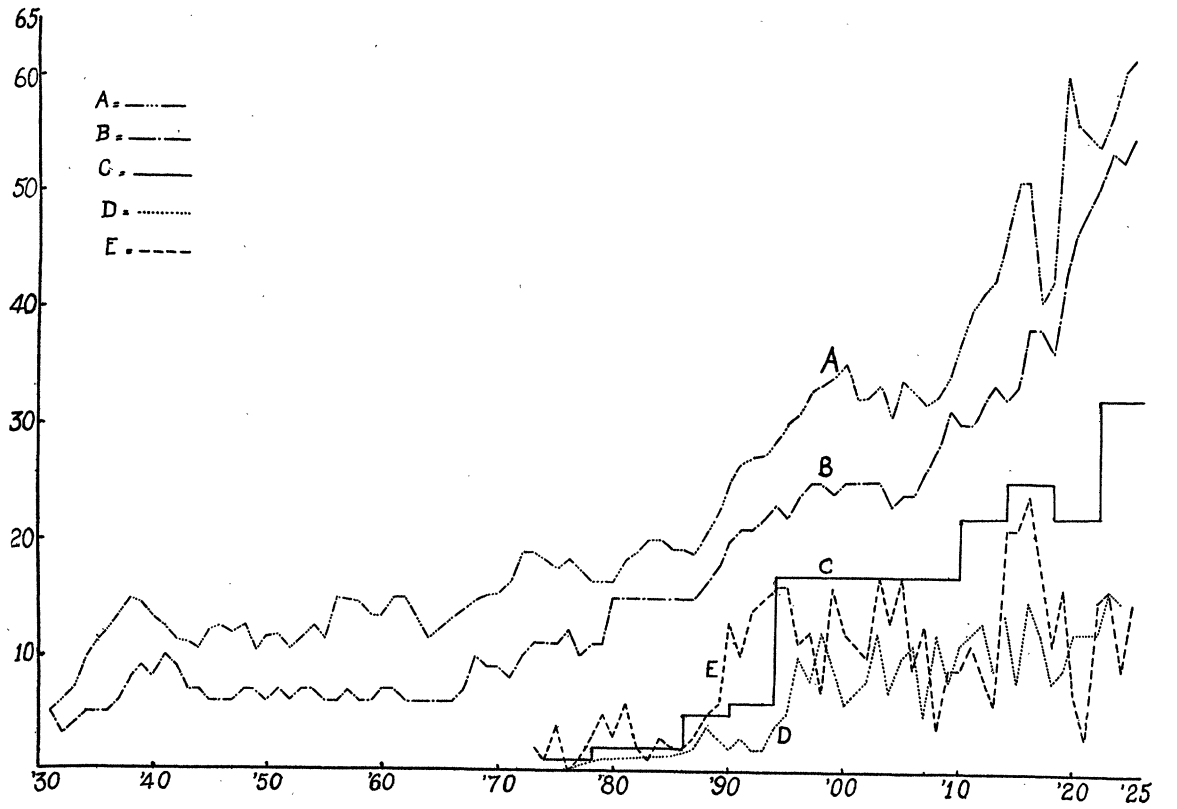

FIG. 1. Vertical distances indicate numbers of individuals; horizontal distances show calendar years from 1830 to 1926; line A shows the total number of students (graduate and undergraduate, *divided by ten;* thus when lines A and B approximate the ratio of one teacher to ten students is approached); line B, the number of members of the faculty not including the president and administrative officers doing no teaching; line C, the number of individuals in faculty publishing original results within four-year periods; line D, the number of individuals in faculty publishing original results during a given year; line E, the number of graduate students.

Carnegie Institution. For a college he was an extreme type. His chief interest lay in research. His example and precepts were one of the strongest influences in establishing in the minds of the faculty, trustees and alumni that research was a function of the college teacher.

In 1887 the college established an annual bulletin which has carried since its first year a record of all scholarly publications of the faculty (giving precise statements of title, journal and page, etc.). By means of this I have noted a remarkable rise in percentage of faculty participation in research beginning in 1894. The enthusiasm had spread to other members of the faculty and the increase in student enrollment during the eight preceding years had necessitated new appointments, and research ability had obviously been considered. This was also the period of the building and first operation of the Atwater-Rosa calorimeter and it brought upon the campus a corps of research assistants subsidized by the federal government.

The effects were clear. For example, during the period from 1902 to 1905, 75 per cent. of the faculty were making research contributions, and a survey of the last four years, 1922 to 1926, shows a similar percentage. There is some indication that certain conditions, which I will mention later, tend to retard the present rate of output, though apparently not reducing the numbers of faculty participating.

On the chart line C shows the number of the faculty participating in research within four-year intervals and line D indicates the number of individuals publishing their results each year. In neither case are the actual number of papers indicated which would be greater in the case of the publication of more than one paper each year. I deemed it of more importance to find the percentage of faculty participation rather than the amount of work accomplished.

There were certain minor aids to research. In 1891 on recommendation of E. B. Rosa a college machine shop was established, which has been maintained ever since. The expert machinists in college employ have made many scientific instruments of utmost precision. These included the Atwater calorimeter, Bradley

liquid air machines, the Rosa curve tracer, apparatus for psychological investigations designed by Raymond Dodge, micro-dissection apparatus, etc. This machine shop has been an inestimable aid to all fields of research employing mechanical devices, and in certain notable cases apparatus has been made for other institutions: liquid air apparatus for Harvard University, a self-recording magnetic declinograph for the Department of Terrestrial Magnetism of the Carnegie Institution, and quartz piezo-electric frequency standards for the U. S. Bureau of Standards. Also during the war various pieces of apparatus were perfected for different branches of the service.

Other phases of scientific work were the conduct of the State Geological Survey for many years by Professor William North Rice and the establishment of the State Bacteriological Laboratory, under Dr. H. W. Conn, which was housed by the college from 1905 to 1917. There have also been notable contributions in science from the departments of mathematics, physics, psychology and astronomy. In as much as this is a scientific audience, I will but merely mention that original work was in progress in other departments as classics, philosophy, English literature and history (Woodrow Wilson completed his book on "The State" while at Wesleyan).

The publicity given creative work by its annual record in the college bulletin has undoubtedly had its place as a spur to work, though sometimes criticized as breeding undue haste and superficial performance. Ability in research became one of the criteria for appointment and promotion, although in some cases wisely or necessarily waived.

If I may summarize the factors of the past we may say that the college took its place in the wave of scholarly advance of the American universities on account of the presence of at least two men who were alive to the values of the new phase and because of the advent of a most enthusiastic research worker. His energy and success gave the necessary stimulus which was a most important factor leading to a constant increase in numbers of men with capacity for original work.

This brings me to a survey of present conditions and problems. The present enrollment shows 621 students, including seventeen graduate students, a faculty of fifty-seven, including administrative officers, thus showing a faculty student ratio of about one to eleven. If from this list are eliminated members of administration doing no teaching, and the department of physical education which now includes athletic coaches, it has been found in a survey just completed that from the remaining fifty, thirty-five, or 70 per cent., have at least a definite research program. Seventeen, or 34 per cent., actually published last year work of research value. A consideration has been given to the correlation between age and productivity. There has been found no indication that older men after becoming established are neglecting research. They still by example are leaders in this work. Indeed, there is real reason to fear that younger men are not given sufficient opportunities for research.

Various aids are given to facilitate original work; as, for example, an endowment for research in chemistry and in biology; also the appointment of a full-time research associate in astronomy. There has been an increase in stenographic aid (though still quite limited). There is now an annual appropriation to pay in part expenses to attend scientific meetings. A research committee has recently been established.

There is some evidence that while many are taking part, the percentage of individuals publishing papers annually has decreased, or, in other words, that the work is appearing more slowly. Whether this means that there is not so great a tendency to rush into print as formerly or whether there is a greater difficulty in carrying out work at present, I do not know. There are, however, certain factors which just at present are imposing a heavy teaching burden. This is a period of transition in educational methods and there is much experimentation in most universities and colleges. At the elementary end there is the desire to establish orientation courses and in the later years special attention is given to the "gifted students." I believe these new methods in the end will give us a better educational system, but there is a tendency to superimpose the new things without removing the antiquated elements and thus to increase at least temporarily the teaching load. The difficulty may be met by increasing the faculty student ratio, but this is expensive.

A comparison of departments having a notably heavy student load per instructor with those having the lightest loads shows clearly that research is easier in these latter cases. These represent a student faculty ratio, which, if extended to the college as a whole, would be of the order of one member of the faculty to eight students. Clearly another factor—the personal equation—is also very important, as there are certain exceptions to this generalization.

I would like to mention one more point before proceeding to a final thesis. It has been abundantly proven that members of the faculty are capable of more creative work of high quality if given the opportunity. For example, when aided from the outside by provision of research assistants, or by more time, as when in technical war service or on leave of absence, there have been notable accomplishments. Had the number of papers been indicated on the chart, certain crests would be noted (beginning with Atwater's work) when individuals or departments re-

ceived some extra aid and the output was increased. I, therefore, wish to insist that the ability exists. It awaits only the opportunity. At present, and undoubtedly formerly in individual cases, research is at a standstill for lack of time. But time costs money.

There has always existed one serious question in regard to the place of research in the colleges. They have prided themselves in doing better teaching than the larger units. In the past this idea has been based in part on statements by university men in regard to the percentage of students who have been led into graduate work from the university and from the small college. These statements appear to favor the latter. The small college fears that if research is greatly emphasized, teaching will be neglected—teachers will lose contact with students and the intellectual stimulus will be lost.

I feel, however, that common ground is in sight. For example, the present educational "urge" to stimulate the "gifted student" by special problem methods or by participation in research is a method in which only creative minds can be the effective teachers.

It is my opinion that for some of our smaller endowed colleges there exists an exceptional opportunity to experiment in intensive educational methods, provided that they will curtail further increase in student enrollment while their resources grow. The problem of salary scale is also involved. In my opinion the best criterion is that it should be such that a reasonable number of the best students will be attracted into the profession. This is not at present the case, although there are indications of improvement since the post-war depression period. One can not be blind to the fact that such an intensive program involves a serious financial problem. Funds are needed. Research time is expensive. This program, however, will yield more time for research without diminishing the amount of attention which the individual student receives from the faculty. There will be a more carefully selected group of students introduced into an atmosphere more charged with intellectual life. If, on the other hand, these colleges grow as in number of students their resources grow, the opportunity may be lost, never to return.

H. B. GOODRICH

WESLEYAN UNIVERSITY

Dr. George D. Olds, president of Amherst College, spoke of Amherst's past and present support of members of her faculty in research, endorsed the present movement for encouragement of college men in research and pledged Amherst's hearty cooperation.

Professor C. E. Seashore, dean of graduate studies in the University of Iowa, said that research is in the air in America to-day. He contrasted talent and creative ability in research, emphasizing the comparative rarity of creative ability. A man who has research in him will do research in spite of too heavy a teaching burden. The trend toward emphasis upon research is so strong in the whole life of the country that it will aid emphasis upon research in colleges, especially emphasis upon the research method in teaching.

Dr. Vernon Kellogg, permanent secretary of the National Research Council, said:

> I have been impressed by the fact that so many of the students in professional schools and graduate departments of the universities have come from the colleges rather than from the undergraduate departments of universities. I asked the dean of one of the greatest graduate schools in regard to this and he said, "We get 90 per cent. from the colleges." This means that the students already have had the spirit of research cultivated in them in college.
>
> I want to suggest that we pass a resolution at this meeting, as follows:
>
> *Resolved:* That we recommend to the council of the American Association for the Advancement of Science that they invite the National Research Council, the American Council on Education, the Social Science Research Council, and the American Council of Learned Societies each to name a representative to meet a representative of the association, the five representatives to consider and enter upon definite plans for encouraging and promoting research in American colleges.

Dr. Kellogg's motion was passed at the meeting and later was approved by the council and was adopted by the association.

The members of this committee are: Vernon Kellogg, for the National Research Council; C. R. Mann, for the American Council on Education; Edward C. Armstrong, for the American Council of Learned Societies; Knight Dunlap, for the Social Science Research Council (interim appointment), and Maynard M. Metcalf, for the American Association for the Advancement of Science.

WILLIAM HEALEY DALL

THE death of Dr. Dall on March 27, 1927, removes one of the last pillars from the fast disappearing class of systematic naturalists—a class whose roll of honor in America is adorned by the names of Audubon, Agassiz, Allen, Baird, Cassin, Cope, Coues, Dana, Gill, Hyatt, Kennicott, Leidy, Newberry, Packard, Richardson (Sir John) and Verrill. And it may be said with truth that in his chosen field no one of these labored more faithfully, or contributed more substantially to the advance of knowledge.