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IN MEMORIAM—T. C. ELLIOTT

The death of T. C. Elliott, historian and former member of the Northwest Scientific Association, occurred at Walla Walla on May 3. Mr. Elliott was 81 years old. He was an authority on early Northwest history and had pub-

lished many papers in this field. Mr. Elliott was the recipient of an honorary degree from Amherst College and the Oregon State College. He will be missed by his many friends in the Pacific Northwest.

BIOLOGICAL RESEARCH IN THE COLLEGES

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I.

A previous communication* has called attention to the large and apparently increasing amount of sound biological research that is being done in the liberal arts colleges, teachers colleges and junior colleges throughout the United States and Canada. In the United States alone, biologists in over 200 of these colleges are producing research contributions of merit; from another 200 or more, reports have been received of research in progress, though no recent publications have been observed.

Much of this research is very fine indeed, particularly in the fields of protozoa, porifera, bryozoa, and the photoperiodic responses of animals. Excellent work has also come from

* American Scientist, Volume 30, No. 4.

these institutions in parasitology and helminthology, ecology—both plant and animal—genetics, cytology, systematic botany, entomology, histology, herpetology, ornithology, and mammalogy. There can be no doubt whatever that there is, in this country, an actual increase in the research activity of the colleges.

There is, however, much need for further development in this direction. There are at the present time about 1,000 colleges in the United States in which there seems to be no indication whatever that research in biology is being attempted.

II.

The hindrances to research activity and biological scholarship and instruction in the colleges are of several types. Chief among these is the exceptionally

heavy teaching load so often required of college teachers. Teaching loads in excess of twenty hours per week are by no means uncommon. Often the college teacher is obliged to deal with so wide a variety of subjects that research, if possible at all, can be done only under the tremendous handicap of excessive fatigue.

Teachers are frequently isolated, and thus deprived of the stimulus that derives from association with one's colleagues. Library facilities in the sciences are often primitive and inadequate, or for practical purposes nonexistent. The teachers of biology are often competently trained, and are not infrequently individuals who hold doctorates from strong American universities; quite frequently they are ambitious to carry on research, but are so poorly provided with laboratory appliances and library facilities that they are—or believe they are—unable to do so.

Lack of official encouragement of research, or more often, actual official disapproval, is another serious handicap.

It is pretty obvious that in many of these institutions, the biologists on the faculty are either dormant or discouraged; they are out of touch with the current development of the biological sciences, and not in effective communication with their biological colleagues. Library budgets are small, and few if any of the scientific journals are purchased. Teaching is often based on the textbook and laboratory manual, or on the textbook alone.

III.

My own interest in research in the colleges has been mainly prompted by the observation that, over a period of years, the research activities of many of the great universities have tended toward curtailment. Some recent studies have shown an actual decrease in the research productivity of the universities. From many sources we have had disturbing information, unfortunately too well confirmed, of reduc-

tions of budgets, and of teaching and research staffs in the great universities, and of inability to finance and continue research projects. Research in institutions of all kinds, especially including the large endowed universities and research institutions, undoubtedly faces lean years. We face the prospect of high taxation, reduced income from securities, lowered standards of living, and diversion to other purposes of resources that normally would have been devoted to research and higher education. If, in our own country, the sciences are to escape a prolonged eclipse, we will have to exert ourselves to the utmost to facilitate research wherever it can be carried on, and to preserve the research spirit.

IV.

For these and for many other reasons that will readily occur to the reader, encouragement of this trend toward research in the colleges is one of the most important of the issues before American biologists. If the premise is correct that research and higher education in the post-war years face exceedingly grave financial difficulties due to the tremendous national debt, and the economic policies, or necessities, that preclude the accumulation of the huge fortunes which have so largely sustained research and higher education in the past, then we must cherish every serious attempt to develop, throughout the nation, research programs that are locally founded and close to the people. Moreover, now that we have on our hands a war which amounts to a crisis in human progress, the nation needs a full utilization of its research and teaching facilities as it never did before. Our problems will not end with the signing of a peace treaty: far from it; I believe very firmly that a full utilization of the scientific talent in all the colleges and universities of the nation is one of the most important problems before us at the present time.

While it is true that the first responsibility of the administration and the faculty of a college is to provide for

its teaching program, there are serious objections to the theory that teaching and research are antithetic activities. Dr. Albert C. Casey, in an article in *Science* a few months ago, adduced a good deal of evidence that in the great medical schools research activity and competence of instruction are closely associated; the more research published from these, in the major research journals, the larger the proportion of their graduates passed state board examinations. In the colleges also, many instances could be cited in which outstanding teaching goes hand in hand with excellent research. It seems too that the institutions that encourage research by their faculties are better able to retain outstanding men. I think we can also suggest a reason for this. A large proportion of the men who go into biology, or chemistry, or physics, do so with the ambition of adding something to the stock of man's knowledge. Too often these men are later swamped with teaching and administrative duties and thus deprived of the satisfaction that comes from a research career. If, however, the institution is wise enough, or strong enough, to enable its scientific staff to make some progress toward realizing their research ambitions, then teaching in a small school becomes far more satisfactory than otherwise it would be.

Far too often the theory prevails that research and good teaching are incompatible activities; that the college, in selecting its faculty, must choose between having good teachers and having investigators, and cannot hope to find individuals who are good teachers and at the same time capable of adding to the stock of man's knowledge through research activity.

True enough, there have been stimulating teachers, who have never manifested much interest or ability in research; and there have been eminent research men who were failures as teachers; but men who possess both abilities have been so numerous as to discredit, totally, the easy assumption

that the two kinds of talent are incompatible.

The fact is, that instruction in the natural sciences becomes all the more vital and interesting if the teacher has interests that lead him beyond the facts that are, often very inadequately, presented in the textbook. In too many colleges, instruction in biology barely rises above the level of rote learning. Such instruction does the student a profound disservice if it encourages the illusion that he has mastered the science, when in fact he has merely read the book.

V.

The biologists of the nation, through their national scientific societies and state academies of science, have it within their power greatly to encourage and extend research activity in the colleges. The hindrances to such research are to a large extent remediable. A closer collaboration between the colleges and the large universities would do much to overcome the isolation which so often hampers the college teacher's research. Most of the large universities would welcome such integration. Broad problems such as those of *Drosophila* genetics could be pursued very profitably indeed by workers in the colleges that are situated conveniently to such centers as Columbia and the California Institute of Technology where breeding stocks and large and active research staffs are available for consultation. The possibilities of cooperation in research between the college faculties and medical staffs of hospitals, in physiological, pathological and bacteriological problems, deserves serious study. Many of the colleges are situated in reasonable proximity to industries that have pressing research problems before them. A survey of the possibilities of cooperation between college faculties and such neighboring industries might be highly productive. Federal organizations of national scope such as the Wildlife Service, and the Forest Service and the Soil Conservation Service are dealing with national

problems concerning which research will be in prosecution for possibly decades to come. Many of the colleges are situated in proximity to field stations of one or another of these federal agencies. The possibility of cooperation between their staffs and the biological faculties of the colleges might well be considered.

Lack of adequate library facilities, reported as one of the major hindrances of research, especially in the more isolated of the colleges, may be alleviated to some extent by inter-library loans. With modern facilities for the procurement of relatively inexpensive bibliographic services and the use of microfilm there is no good reason why any small college should not, from these and reprint collections, build up locally a working library fully adequate for a large amount of research activity. By concentrating library holdings in the fields that the college faculty elect for their research, and by consistent use of abstracting agencies and the acquisition of reprints it should be possible, under present-day conditions, for any really serious student to acquire all the research literature that he is likely to have to consult.

There is considerable evidence that research men on the college faculties are often at a disadvantage in procuring funds that are necessary to carry out even a limited research program. The state academies of science have in many states done a great deal to alleviate this situation. Several of the foundations are already active in supporting college research. The whole problem of the financing of such research deserves very serious study by some national scientific body; and the establishment of a national service agency which would advise and assist scholars in the presentation of their requests for grants would, I believe, be of great value.

A still more serious handicap in the conduct of college research lies in the

overcrowded teaching schedules that prevail in so many of the colleges. The accrediting agencies have already done much to alleviate this situation and will undoubtedly do more. The lack of support for research by college authorities, especially in the liberal arts colleges that are wedded to the "Great Tradition" of classical scholarship, is gradually being overcome as the college authorities become convinced that the best interests of the college lie in the direction of the encouragement of research and sound teaching in the natural sciences. Biologists have been, by and large, altogether too modest in presenting the claims of their science as an educational and cultural component of a well-rounded education. Far more could be done for the encouragement both of teaching and research in biology if some of the national scientific societies would direct their attention to the handicaps that affect their colleagues in the institutions that have not, so far, established a tradition of research. Biologists need to become more articulate. They need to assert the value of biology, and especially the value of biological research, upon every suitable occasion.

It is my conviction that the post-war years will see a tremendous stimulation of progress in all of the sciences and particularly in biology; and that the arts colleges, the junior colleges and teachers colleges will have their full share in this progress. The pursuit of science can no longer be interpreted as a function of the great endowed universities and the great research institutions. The development of an increased popular appreciation of research is well on the way. The amateur movement appears to be gathering strength. The goal of a broad national participation in scientific progress with competent, original work being done at every level from the great university to the small institution is becoming an attainable ideal.