ing in Baltimore with Councilman, Flexner, Barker, MacCallum, now my successor, Whipple and Winternitz.

To you, young men in this audience, to whose scientific papers I have listened with such delight and instruction, an *apologia pro mea vita*—my antiquity is revealed by my Latin pronunciation—would contain a far more useful message for me to deliver than to figure as an example, but on this score here and now I can only plead changed times and conditions no longer calling upon an investigator for activities which may once have seemed desirable.

I should, however, like to claim the privilege of years and of experience in addressing to the younger investigators a few words of advice and of precept, not conspicuously exemplified in my own career, which, though they may be trite, are not, I conceive, needless of emphasis under present conditions.

Allow nothing to divert you from your professional and scientific work. While maintaining a spirit of cooperation, resist the call to give general addresses, especially at a distance from home, to serve on committees, to assume time-consuming administrative duties and to show visitors around laboratories, clinics and buildings. The active scientific investigator should be at least as inaccessible to the intrusion of casual visitors as the financier or the railway president. Interruption beyond two or three years of investigative work is likely to be fatal to its successful resumption. If you have found your problem it should absorb you, and its successful pursuit should make you the happiest of mortals in the consciousness of adding something to the body of ordered knowledge. Strive for and be content with a scientific reputation based upon the judgment of the best workers in your own field, usually a relatively small group. Such reputations are enduring and often unrelated to merely local or even general professional reputations.

Investigators are usually, although not always, the most stimulating teachers, but it should be more widely realized that students in our American medical schools suffer from over-teaching. It is quite as important that educational and scientific institutions should learn how promising investigators may be and often are spoiled, and to protect them as their most precious asset, as it is to provide facilities for research. I firmly believe that the productive years of scientific discovery may be greatly prolonged by recognition and remedy of conditions which at present too often and unnecessarily shorten them.

I have, I fear unpardonably, encroached too long by these remarks upon this morning's program of scientific papers. Permit me to close by renewed expression of my grateful appreciation of the signal honor of enrollment among the Kober medallists.

THE PRODUCTIVE CAPACITY OF A UNIVERSITY[1]

RICHMOND COLLEGE is a name long familiar to me, for its baseball teams often visited our campus at Chapel Hill when I was connected with the University of North Carolina. Its buildings were familiar through annual visits to Richmond for our football game with Virginia—visits begun always in high hopes of victory and ending all too frequently with a dolorous return after defeat.

Knowing the Richmond College of former years, I was immediately struck with the name University of Richmond on the invitation to take part in these exercises. Securing copies of the catalogue and pamphlet announcements, I rejoiced over the views of the beautiful buildings, constructed and in contemplation; the extension of its teaching of women at Westhampton College; the Schools of Law and of Business Administration; the summer school, and other evident lines of activity.

Having noted the new title "University of Richmond" I naturally looked for an account of its graduate school. This was found to be very limited. May I congratulate the authorities of the university on making no false pretenses in this matter, and in not undertaking work of a more advanced character until the foundation work of the undergraduate departments is thoroughly developed, and adequate facilities have been provided in which the best type of graduate work can be undertaken.

I feel confident, however, that not only the faculty and the board of trustees, but also all those who have supported and will support this institution, agree that if this university is to measure up to the full realization of its name, all hands should be joined in bringing about the development of a graduate department which will equal in the sterling character of its training the work now given by the collegiate schools.

On this occasion I should naturally prefer giving an account of the remarkable achievements in recent years in the field of chemistry, but your problem, as I see it, is a much broader one than chemistry alone. It is fitting, therefore, that we dwell for a short while on the thought of the productive capacity of a university in the full significance of that term. An institution must send forth men and women trained in the methods and imbued with the spirit of research; through the publication of the results of such research it must make its contribution to truth and to the ever-widening bounds of human knowledge.

I note that you contemplate raising an additional fund for endowment. It may be helpful to remind

[1] Address delivered at the dedication of the new chemistry laboratory of the University of Richmond, Virginia, April 11, 1927.

ourselves at this time that when he was entrusted with the wise expenditure of a bequest for the foundation of a university, President Gilman, in his plans for Johns Hopkins University, thought only incidentally of buildings, his main care was to secure outstanding men who through their work with advanced students would create a true university in its highest sense. His success marked a new era in our conception of university training.

The presence of an active graduate school has its stimulating effect upon that undergraduate training which you are now trying to perfect. It removes effectually any disposition in the undergraduate mind to consider thought or knowledge as static. Where research is in progress, undergraduate courses lose all semblance of routine and take on a new significance as foundation work for the higher training which is necessary if one's future is not in all probability to have definitely fixed limitations.

In the graduate school there is training in searching the literature of any subject, in formulating problems with precision, in the careful gathering of facts, in making fair deductions through accurate reasoning and in publishing results in understandable form. Such work and its publications constitute the second productive capacity of a university. Moreover it is an obligation, for the university must through productive scholarship contribute its addition to that great fund of knowledge which makes for human progress.

Men and women trained in this atmosphere, no matter what the thesis subject may have been, possess an equipment which will enable them to undertake any problem with reasonable hope of its solution. There is a tremendous demand to-day for those so trained. We have landed full head-on into the age of research in America.

Eight years ago when the men in the Chemical Warfare Service had been demobilized and many of them were seeking in vain for positions, I wrote an editorial urging those who had not received a Ph.D. degree to return to their universities, no matter at what sacrifice, and complete their graduate training, for the country would need them. Many leaders in chemistry at that time criticized the editorial on the ground that if the plea were heeded, there would be a surplus of such trained men. Time, however, has told a different story. Last year at the meeting of the American Chemical Society in Philadelphia I made inquiry of the heads of the chemistry departments of many of our universities, and the answer was the same in every case. They told me that they had turned out more Ph.D. men that year than ever before, nevertheless, it would have been easily possible to place double the number of men had they been available. Both universities and industries are seeking doctors of philosophy.

The factors which have brought about this wide expansion of research activities are numerous, but there are certain outstanding influences to which I would like to call attention. Because of acute shortages during the war period, the story of coal-tar and the thousands of products made from it gripped the imagination of the public. All through this story there stood out preeminently the great rôle research had played in this remarkable development in a foreign land. To build up that industry in this country, research was again emphasized, and the results were remarkable. It was a true romance of modern industry.

For many years there had been fine research departments in some of our most important corporations, such as the General Electric Company and the Eastman Kodak Company. Unfortunately, however, the real story did not get across until suddenly the country awoke to the fact that wood (methyl) alcohol, which for many years had been made here by destructive distillation of wood, was threatened by the importation of large quantities of synthetic methyl alcohol (methanol). The daily press handled the story extensively, and again the great value of research in industry was advertised. Just then, at the psychological moment, a series of articles entitled "What Price Progress?" appeared in the New York *Commercial,* written by Hugh Farrell, its financial editor. These articles were printed in pamphlet form by the Chemical Foundation and given wide distribution. This was no technical treatise, but a vivid portrayal of how industries which had followed the lead of research had prospered and how oblivion had waited for those who did not make use of this great agency of modern progress. Finally the many investors throughout the nation opened their eyes, and the spirit of research was in the atmosphere.

Along the same line, but going deeper to the roots of the matter, was a front page story, appearing one day in the newspapers all over the land, bearing an appeal from Secretary Hoover and a committee of nationally known men, urging voluntary contributions for a fund of two million dollars anually over a period of ten years, for the support of research in pure science in American universities. This appeal was made to business men as a wise investment, on the ground that progress in applied science is conditioned by and dependent upon progress in pure science. In that statement Secretary Hoover, head of the great business department of our government, did not hesitate to state: "The laws discovered by pure science are the basis of applied science and all industrial development."

In similar vein, the Secretary of Agriculture, Mr. Jardine, has, within the last fortnight, stated in his public address at New Haven that, "men were not laying enough emphasis on pure science in proportion to our emphasis on the application of science and were not stimulating and training an adequate personnel in scientific research." Secretary Jardine further stated "the agriculture of the future will be successful in proportion to the extent to which it is shaped and guided by the basic facts revealed by scientific research, especially research in the fields of natural science, economics, engineering and business administration."

Research is truly the word to-day, not as a momentary fad, but as a permanent addition to our national equipment. Within the last week, two striking announcements emphasized in what important ways this new tool is being utilized. The morning papers of April 7 carried the announcement of a new policy by the largest of all our corporations, which is taking definite steps toward the creation of a great department of scientific research; the papers of Friday morning carried an appeal for a fund of $2,000,000 to be used for the benefit of the lepers in the Philippines, not for grounds and buildings where segregated they may pass away the remainder of their lives, but for research and equipment which will go to the root of the matter and drive out this dread scourge from among men.

The South is profiting to-day at every turn by the research which is adding so constantly to science and to the efficiency of industry. As a Southerner I have rejoiced over the news of the great industrial developments in the South and the many evidences of increase of wealth. Then I asked myself this question, "What contribution, in turn, is the South making to research in both pure and applied science?" To answer this question fairly, I have used methods of research and have gone over carefully the *Journal of the American Chemical Society* and *Industrial and Engineering Chemistry,* the publications of our national organization of chemists, and listed by states the origin of all the research articles published in these two journals last year. From this study (Table I) it was found that from the thirteen states south of the Potomac River, namely: Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, Arkansas, Tennessee and Kentucky, there have appeared among the four hundred and twenty-seven contributions to pure science in the *Journal of the American Chemical Society* only twenty-two articles from these states, just 5.2 per cent. Of the two hundred and eighty-four reports of scientific work in *Industrial and Engineering Chemistry,* only twelve were from these states, just four per cent. I regret to record that from the states of West Virginia, South Carolina, Georgia, Alabama, Mississippi and Louisiana not a single contribution was made. I regret to recall that among the three hundred and forty-eight contributions from university laboratories printed in the *Journal of the American Chemical Society* in 1926, there is not a single communication from a university in any of the following Southern states: West Virginia, South Carolina, Georgia, Alabama, Mississippi and Louisiana. Of the many contributions to applied science in *Industrial and Engineering Chemistry,* there is not a single paper from a university in the following states: West Virginia, Virginia, South Carolina, Georgia, Florida, Alabama, Louisiana, Texas, Arkansas and Kentucky.

TABLE I

Total Contributions of Results of Scientific Work, in A. C. S. Journals, 1926

	From U. S.	From 13 Southern States	Per cent.
J. A. C. S.	427	22	5.2
I. & E. Chemistry	284	12	4.0
Total	711	34	4.8

Contributions from Universities in U. S.

	From U. S.	From 13 Southern States	Per cent.
J. A. C. S.	348	22	6.3
I. & E. Chemistry	103	5	4.8
Total	451	27	6.1

I shall make no effort to assign the blame for this deplorable state of affairs, whether it be shortsightedness of legislatures or penuriousness of men of wealth in the South, the lack of understanding by the executives of our Southern institutions, or the deep rut of routine into which professors have without adequate remonstrance allowed themselves to be thrown.

One thing is certain, it is time for an awakening and for a wholehearted union of forces and of effort in order that this great section of our country should meet its full obligations and take its proper place in the progress of America.

May the University of Richmond, situated in this great city of the new South, soon find itself in position to contribute its full quota to the research output of the nation and to offer to the men and women who come within its walls a future of unbounded possibilities.

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