

PRESIDENTIAL ADDRESS

A Plan for Accomplishing More Effective Research

ELI LILLY, Indianapolis

It takes a large amount of self-assurance for a person who has nothing more on his watch chain than a magnifying glass to attempt, in the words of a picturesque Hoosier idiom, "to teach his grandmother to suck eggs," and yet, certain experiences in the executive direction of some important pieces of research and the exigencies of the occasion possibly justify his taking some liberties.

In January of this year, an investigation on "Creative and Research Work in the Undergraduate College of Liberal Arts," conducted by DePauw University, revealed that in two-thirds of sixty-five of America's most important educational institutions conducting investigations of an advanced order, there were no central committees to consider and coördinate the work. In the remaining third, it is quite evident that in only a very few cases was the vital importance of proper coördination and coöperation recognized.

In the great majority of colleges, research is carried on by what might be called the "Departmental Pigeonhole System," that is, a single able professor with a few assistants and a small number of students bury themselves in the gloomy recesses of a single department, heedlessly avoiding the sparkling sunlight of collateral branches of knowledge and the cross-fertilization of ideas from the pollens borne on the fragrant breezes of the upper air. Rarely, if ever, can an investigation be properly confined to problems within the scope of a single department, and yet, in an overwhelming majority of cases we find pieces of research being planted amidst bleak surroundings where one or several life-giving elements vital to its full-flowering are sadly lacking.

The Departmental Pigeonhole System was at its highest peak in the days of the alchemists who worked in secret and kept their records in private codes, thus greatly delaying important chemical discoveries.

In China, a man who has a limited amount of knowledge is compared to a person sitting at the bottom of a well; the sky appears very small to him. In the ramification and specialization of modern sciences, we who specialize in one well find ourselves much in the position of the Chinese gentleman—our lines of vision do not diverge much from the mouth of our own particular well. It is necessary, therefore, that we join hands, pull ourselves to an elevated level, and see the horizon.

The logical way of starting an inquiry in any organization is to call together an enthusiastic group of men who know about the subject from as many viewpoints as possible. When this is done, scant respect can be paid to chilling academic departmental boundaries, but the brilliant results of such coöperation speak for themselves. Who would expect a surveyor to make a map if he were required never to move from one spot? It is just as reasonable to expect to explore thoroughly a complicated question from only one direction. Yet how great is the majority of research workers who have ignored this perfectly apparent truth. It has been a blind spot in our procedures.

Securing effective joint action between investigators in different departments calls for an excursion into the humanities. It cannot be accomplished by cracking together the heads of research men with the peremptory command, "Coöperate!" It requires long and careful preparation and presupposes that the head of the university is sympathetic to scientific inquiry and commands the respect and loyalty of his deans and that they have confidence and trust in one another, in short, that the *esprit de corps* of the institution is high. Unless you have this firm basis to build upon, time and effort will be wasted.

It is not as though coöperation were a brand new project with this Academy, for our Biological Survey may be mentioned as a successful instance of the value of working together. At the Indianapolis meeting of the American Association for the Advancement of Science last December, there was evident a heartening tendency for the various sections of the sciences to consult and advise with one another.

Dating by tree rings, to the very year of the building of a great number of the pueblos in the Southwest, is a most outstanding and brilliant example of the coöperation of astronomers, botanists, meteorologists, and archeologists.

The spirit of joint participation in well-planned research has been brilliantly developed in the great organization that we have the honor of visiting today. The morale of its staff has been of the highest order for years, so the proper elements for the development of coöperative work were present. Ten years ago the Purdue Research Foundation was formed and was fortunate enough to secure the services of a "catalyzer" who knew his humanities and under whose careful nurture the plant has grown to symmetrical and beautiful proportions.

At the beginning, a delicate touch was required, and the first activity was simply a survey which revealed that the faculty were conducting a surprising number of worthy projects, the existence of which had been hitherto generally unknown. Some of these pieces of work were more or less duplications, and there were frequent overlappings. Adroit and sympathetic suggestions with a sprinkling of spiritual and financial encouragement extending over a period of months was all that was needed to convince the staff that great good follows the liberal and generous exchange of ideas in research work. Since the professorial staff must be the inspiration of all original work, care was taken not to invade the chosen fields of professors who had long been conducting successful investigations. Their work was reënforced by additional funds and encouragement. The Purdue Research Foundation has grown to be one of the most successful centers of research in the country.

An objection might be raised as to the great difficulty to be encountered in the proper division of scientific credit and of financial return in coöperative work. We are apt to build up in our minds the horrid image of a flashing sword poised above the research baby in a desperate effort to discover its real parent. This is a bogey easily banished by mutual confidence and fair and impartial supervision. Under such conditions it has proved to be a trivial danger as compared with the great gain in power of accomplishment. The allocation of credit has long been solved by scientific men by the lists and order of their

names upon publications. Even in cases where temporary misunderstandings have been engendered, time, the great impartial umpire, has given the credit to whom it was due. The public cannot be fooled forever.

The division of financial returns resulting from royalties is handled in several ways by different universities. In a few, as in Harvard, nothing is patented and no royalties taken. This policy seems a wasteful one, for royalties create a fund for financing further inquiries. In some institutions, like the University of California, the attitude is to leave the University out of consideration altogether and to allow the professors to take out patents and handle the royalties as they see fit. In an increasingly growing number of research centers, however, the royalties are being used for further investigation. In the case of a university research organization, a very fair division would be: one-third of the royalty to be given the personnel involved, one-third to be plowed back into the general research fund, and one-third to be used for further work upon the project yielding the royalty.

While admitting the value of allied work in research in the applied sciences, a very natural mental reservation might occur as to its possibilities in original work in other fields. This doubt may be dispelled by a review of the usual departments found in leading universities and colleges. Take for instance philosophy, psychology, religion, political science, and political economy. Each one of these branches of knowledge should be used, individually and collectively, to triangulate upon the most vitally important questions of the day. Combined, they would be much stronger than if used alone—remember the old fable of the bundle of sticks.

Again the question might be raised as to what chance any of such studies have to gain financial encouragement, especially from business institutions. The answer is that the opportunity is here, or should be, for what is more important than the manifold personnel problems that face our civilization? Forward-looking businesses are employing psychologists and psychiatrists to develop the understanding of executives and to reëducate faulty reaction-mechanisms in individuals needing it. The one most important duty of the head of any organization is to develop and to stimulate the human material within it, for if the personnel is able and enthusiastic and of high morale, the work of the institution takes care of itself. Its success is assured. If its human material is not happy and enthusiastic and is ill-trained and dull, nothing on earth can save it. Do we dare say there is no chance for collaboration in research here?

That our spiritual development has a hundred-year lag behind our material progress is a trite statement. Several years ago Edward Filene, of Boston, warned business with the pregnant words, "Research or Bust." Are not the same words appropriate for those of our educators and religious guides whose efforts are so far behind the times? They need all the power they can borrow, beg, or steal to stem the tide of materialism engulfing the world and to teach all humanity that it is not what we have but what we are that is of real importance. We must be taught that the imponderables are vital—radiant personality, intense love of fine and beautiful things, honor, courtesy, etc. Our attention must be

taken from the gross, materialistic philosophy which occupies so many today to the exclusion of practically everything else. Greed in all quarters (and it is found in *all* quarters) should be attacked by the most powerfully allied groups of authorities that can be called to the colors. No chance for a coalition of talent here? Why, the very sky is the limit! Much important work along these lines is going on at the University of Iowa, but theirs is almost a voice crying in a dismal wilderness.

Let us mention a few other subjects selected almost at random, such as, law, sociology, history, languages, literature. There is not one of these fields which cannot be enriched by knowledge and insight gained from the others. Mathematics is the background and final arbiter in almost any field of knowledge. Not long ago I heard an outstanding scientist say that Dr. Irving Langmuir could prove mathematically what most highly trained men could just barely imagine!

The pioneer work of the Purdue Research Foundation has been followed very closely by Ohio State at Columbus. The Wisconsin University Departments of Medicine, Agriculture, and Chemistry have proved the great value of working together upon many of their problems. At the University of Iowa the spirit is growing, and we are wondering what relationship this spirit has to the notable development of a new school of American Art there. The Harvard Medical School is concentrating upon the problem of proper coördination in its pioneer work.

The next step in the "orchestration" of research will be the pooling of efforts by separate organizations. This will be more difficult than winning success in the various individual institutions. Let us hope that it will never be carried as far as by some individuals and universities in some foreign nations, where to every intent and purpose some center announces that its members are working in a certain field and all outsiders are warned not to trespass! In the coöperation of twelve of our agricultural schools in the cultivation of corn may be seen the dawn of this further coördination of experimental work. The Northeastern Agricultural Experiment Stations have appointed each director a referee for the guidance of investigation in one field. In astronomy, more perhaps than in any other field of knowledge, due to the relatively small number of important centers, the research work is organized, coördinated, and unified.

For more than a century, Indiana has been associated with men eminent in science. The founders of this Academy included a number of international fame in their respective fields. During the last fifty years, members of this organization have done much to enlarge the boundaries of knowledge, and there is enough high talent in this room today, if thoroughly coördinated, to cause Indiana to become a "center of white-hot spiritual energy." The free exchange of opinion, interaction of imagination, cross-fertilization of ideas, and the pooling of wisdom will cause the maximal utilization of human effort, the elimination of unnecessary duplication, and a great increase in results. Properly coöperative research work is synergistic and does not increase in success by arithmetical but by geometrical progression. Steps to secure its adoption by our educational bodies is the one greatest opportunity lying before us.