# RESEARCH AS A STATE POLICY

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The Oklahoma Academy of Science was founded in 1910. The first meeting was held at the University of Oklahoma at Norman and was followed by others at Edmond, Stillwater and Enid. In order to secure a representative attendance, it proved necessary to hold later meetings at Oklahoma City in connection with the annual meeting of the Oklahoma Education Association. Beginning four years ago, one of the sessions each year has has been held in Norman. Last year all sessions were held here but at the same time as the meeting of the Oklahoma Education Association.

This year we have held our meetings quite independently of any other organization or attraction and after today's experience it is apparent that the Academy can now stand on its own feet and will prosper by doing so. In fact it is the hope of many that the original custom may be resumed of meeting at different educational centers in the state.

This year the membership, as well as the program, has been divided into sections, each with its own vice-president. There now is a section for the biological sciences, one for the geological sciences and one for the physical sciences; and the social sciences, including sociology economics, government, education, philosophy, psychology and history, which have formerly found a place on a so-called general program, have a section of their own, which, under the able guidance of its vice-president, Dean Patterson, has at its inception become one of the strongest sections of the Academy.

Certain individuals and groups have played important parts in bringing about the vigorous growth which the Academy has enjoyed. When looking for contributing causes, we find them in the development of the various educational institutions of the state, the growing dependence of the oil and other industries upon research, the establishment of laboratories, and the study and utilization of the natural resources of the State—all these activities finding a natural expression in the Oklahoma Academy of Science. It is toward the further development of the research spirit in the state that I wish to direct your attention tonight.

You will find many definitions of research and countless attitudes in regard to it. To a Lowell, it means peering out into the starry universe with a telescope; to an Einstein, an investigation of the properties of space with the powerful instrument of mathematics; to a Michelson, the exact testing of the results of these theories with apparatus requiring a genius to design, construct and manipulate it. To Bohr, Thompson, Rutherford, and Milliken, research means an investigation of the structure and very nature of matter itself, the study of electrons and protons.

To the philosopher, research may mean keen intellectual penetration into metaphysical problems; to the expert in government, the collection and study of data relating to municipalities; to the economist, problems of transportation and marketing. To the industrial physicist and chemist it may mean solely the making of a better automobile tire; to the business expert, a study of the problem of "margin of profit in retail shoe stores".

We must not stretch our conception of the meaning of research to absurd lengths but there is probably more danger from narrow use of the term than from a broad interpretation and it is to be hoped that we scientists of Oklahoma, interested in different fields and different problems as we are, coming together in meetings such as these, will learn to know that the research spirit expresses itself in too many ways for us to permit its definition in any narrow form. Just as sectarianism has tended to obliterate the true spirit of Christianity, so insistance on this or that expression of the research spirit inevitably tends to antagonize those who should work together and to cause serious and even disastrous misunderstandings and misconceptions on the part of the public at large. The earlier Oklahoma or any other state feels that research includes all forms of scholarly endeavor, the better it will be for research in all its grades and branches.

Now I must admit that I am one of those who believe that there are differences of value in research activity and should hardly wish to see a Nobel prize awarded for research in retail salesmanship, yet I am just as strongly of the belief that we must recognize the research attitude and spirit no matter where we find it. As we associate together as persons interested in the same general field of endeavor, the pure scientist will be humanized and have his horizon expanded, and the expert in retail salesmanship may discover higher standards of intellectual achievement and possibly of ethics as well. Instead of antagonistic groups of

investigators, we need cooperative groups, doing work that is different but complementary. This is the basis upon which any true morale is created: a thousand people doing the same thing and thinking the same thought make a mob; a great manufacturing plant in which each man makes a certain part of a whole, is an organism. It is only as research men of the state work sympathetically in reciprocal relationship that we can have research as a "state policy". Many states have already accomplished this end to a greater or less extent.

The State of Wisconsin is fired with the research spirit. It was not very long ago that Wisconsin had a population of farmers starving to death on those stony, thin-soiled hills. The University, through its agricultural college, directed them into the dairy business, told them what kind of stock to buy, how to feed it, how to take care of their milk. It gave them the Babcock tester to measure its quality, taught them how to manufacture and market their dairy products, until today the farming industry of Wisconsin is one of the most prosperous in the country. But the state of Wisconsin did not stop with helping the farmer. It has, for instance, supported a strong Geological Survey, and it is well known that Wisconsin established the first legislative reference library to carry on research for members of the legislature and furnish the latest information on the problems of government.

In a state committed unreservedly to a research policy it is possible to attack fundamental problems which take years for their solution. One of the most important researches undertaken at the University of Wisconsin, during recent years, deals with the valuable properties which can be given to foods by exposing them to certain ultra-violet rays. Most of our food products are quite lacking in the growth giving quality found in cod liver oil, in which the principle exists in greater concentration than in any other known product. Through this research, cotton seed oil and olive oil can be made stronger in this principle than cod liver oil, and grains like wheat or oats can be given the same quality after a very limited exposure to the short wave-lengths of ultra-violet light. Children living under modern conditions are likely to be deficient in this part of their food. In fact, about eighty per-cent of children show indications of improper nourishment of this sort. Another investigation, pursued continuously for nearly fifteen years at Wisconsin, is now leading to remarkable results

in the use of compounds of arsenic and mecury in the treatment of paresis, or softening of the brain.

A striking example of a state which has caught the vision of progressive statehood and is setting the example for the rest of the South is North Carolina. In early days, Professor Holmes studied the resources of the state and rendered material assistance in the development of the textile industry. Since then the University has continued with studies of water power, transportation, availability of labor, and wage scales. Similar work has been done in South Carolina, where the University slogan is "Our Campus—The State". Today North and South Carolina are second only to Massachusetts in textile manufacture. In both states the weekly news letters, prepared by trained experts in the Extension Divisions, distribute authentic information regarding matters pertaining to state development and welfare. The North Carolina Department of Education, working in cooperation with the University, made an educational survey of the state about fifteen years ago. As a result of this survey they instituted a far reaching educational reform, located schools at advantageous points, built them with the aid of state money, and established bus lines in order to insure the attendance of all children of school age.

Through a study of the transportation problem of the state and the economic advantages of good roads, a mass of information was gathered which was presented to the people through extension lectures. As a result, North Carolina has today the best roads of any state in the South and a greater mileage, for its population, than any state in the Union with the possible exception of California.

In Iowa, the fact that thousands of dollars of the state's money are spent in research, need not be concealed from the legislature, so strongly do the people of the state believe in what is being accomplished. In the University Medical School, pioneer work is being done in corrective treatment of crippled children and many seemingly hopeless cripples are being conserved for a happier and more useful life. The plan of organization of this work involves the state at large and is being followed by many other states including our own.

Through the recent visits of Dr. Baldwin of the Iowa Child Welfare Station, Oklahomans are already familiar with the studies which are going on concerning the development of the normal child. Such research is of the highest type and its far

reaching effect in the production of a better race is hard to predict.

Of current interest is the work being done at Iowa under the leadership of Dean Seashore in establishing an examination at the close of the senior year in high school to determine the qualifications of students for college work. This involves an experiment running over a period of ten years, in which they take approximately two thousand students each year and make predictions of their success in college. Then they follow them through their college careers in order to determine the reliability of the predictions. It seems probable that the findings of this experiment will be so fundamental that they will lead to a national organization for the establishment of this service for the entire country.

The great work at the University of Illinois is too well known to require detailed description. Nearly two hundred investigations are being carried on by the Agricultural Experiment Station to make agriculture more profitable and conditions on the farm more livable. For example, much peaty swamp land has been changed into profitable farm land by the use of potassium fertilizers. Land so treated yields fifty bushels of corn to the acre where untreated land will not produce an ear.

Ten series of important engineering investigations are being carried on cooperatively by the Engineering Experiment Station and outside organizations which contribute funds, and thirty eight other engineering projects are under way. Two important radio contributions have recently been announced. One is a vacuum tube detector several times as sensitive as any on the market; the other is the perfection of a non-carrier wave system of broadcasting. So important are the results still being found in the famous warm-air furnace investigations that the national association of furnace manufacturers is continuing to supply money and equipment for the work. The University has further improved its Parr low-temperature process of coking Illinois coal, worth untold millions to the state. In addition to activities along practical lines, there is a large amount of fundamental research being carried on at Illinois.

In Kentucky a great deal has been done by the Agricultural Experiment Station which may be regarded as notable. For instance, the discovery of the bacteria which cause abortion in horses and cattle should prove far reaching in its effect upon the breeding industry. Considerable work has also been done on the root-rots which attack tobacco and corn, and extensive in-

vestigations have been conducted on securing resistant seed, on soil conditions, on utilization of limes and marls and in the conduct of the fruit industry. In the mining field, the University of Kentucky has carried on investigations on oil shales and road materials, while in Economics a careful study of taxation has been made.

In Colorado, as in North Carolina, the Extension Division functions as a vehicle by means of which the various departments of the University may be available to the people of the state. To expedite this function of rendering service to the whole commonwealth, the work of the Extension Division is administered through bureaus which operate in closest connection with the various schools and colleges of the University.

The Colorado Medical School is consciously entering upon an era of larger service to the state. It serves as a place to which the ordinary practicioner may go to learn the results of the latest researches in medicine, many of them carried on by the professors of the school. Through the efforts of the staff of the Psychopathic Hospital, persons in danger of becoming insane have been restored to a normal state of mind and returned as useful workers in society. The eyesight of several children, being educated in the School for the Blind, has been completely or partially restored and the lives of these children made happier and more useful. The Medical School specializes in cases which are beyond the capabilities of the regular practicing physician, when research is necessary to find the cause of the trouble and to assist in its cure.

In the neighboring states of Texas, Kansas, and Nebraska the state educational institutions and other agencies have played important parts in state development. Of this, the work in Nebraska is typical. There, much valuable research, extending over a period of many years, has been carried on in agriculture. Among the important problems are: the causes of tuberculosis in swine, the various diseases affecting potatoes, blister canker on apple trees,the regional adaptation of corn, and many others The Conservation and Survey Division, which includes the Soil Survey, Geological Survey and Industrial Survey, working under the statutes of the state, is in charge of the research and survey work relating to resources and their development. Soil surveys of more than fifty counties have been made and land classification for all. This means that data are available on all the land in Nebraska and practically every farm can be described. Road ma-

terials are being investigated and studies made of ground and surface waters. In cooperation with the department of Public Health, assistance is rendered in the location and correction of water supplies for farms, towns and railroads. The water power problem has been investigated in detail. The department of Town and Institutional Planning uses all available data in making institutions more efficient and towns better places in which to live.

The College of Business Administration of the University of Nebraska, through its Committee on Business Research, has within the last few years been making careful studies of various problems and publishing them in a series of bulletins which have a state wide distribution. It is not hard for one to imagine the enthusiasm which the thousands of small busines men of Nebraska will feel for the University, and especially for its research program, after profiting from pamphlets on "Control of Retail Credit", "Operating Expense of Retail Grocery Stores", "Labor Turnover in Department Stores", "Trade Practices and Stock Turnover" and "What to Read on Business".

In this review of a few typical examples of some of the outstanding things which are being done in other states it is apparent that the educational institutions play an important part in research for the benefit of the state. In many cases, as in Nebraska, the research work centers largely in the University, which includes the agricultural college. In other states it is found distributed among different state schools, the Geological Survey, the Department of Health, and other agencies.

In our own state of Oklahoma there exists an unequaled opportunity for service of the kind which we see exemplified, in one way or another, in the cases which have been mentioned. Already, important contributions, with which you are familiar, have been made by the University, the Agricultural and Mechanical College and other educational institutions. The Bureau of Municipal Research, located at the University, is rendering valuable assistance to a number of municipalities in aiding them in the solution of their problems and pointing the way to further development. The Agricultural Experiment Station at Stillwater has served the state in many ways, the research work of Dr. Lewis and Dr. Sanborn being perhaps the best known.

The State Geological Survey has kept steadily at work (except when interrupted by the Walton administration) in collecting

data regarding the resources and conditions of the state, such data being of the greatest importance in state and national development. At Bartlesville is one of the most important stations of the United States Bureau of Mines, located there in 1918 in cooperation with the state. This station has a staff of forty one persons and is the best equipped public institution for petroleum research in the world.

Oklahoma is, of course, unique in the extent to which a knowledge of Geology is applied in the location and production of oil. The larger companies not only employ expert geologists but also maintain research departments. Most of the research has been along the lines of geology and chemistry, but as is usual when scientific methods become more exact, the need of physics is apparent and the Marland Refining Company has recently established a research department of trained physicists and chemists under the direction of Dr. Haseman, a former member of the faculty of the University.

Thus it is apparent that research work is already well under way in Oklahoma in a number of diverse fields, and the ground work fully laid for a state program of research. In fact it is fortunate that research is not too intimately identified with the educational institutions but exists in independent state bureaus and industrial concerns. I wish that there were time to go, in some detail, into the possibilities of research in this state as it concerns the various existing agencies and others whose organization is eminently desirable.

Time permits only a consideration of the terms in which research must be interpreted to the citizens of the state. As already stated, no narrow conception of research will suffice. To enlist the support of business men, politicians, editors, ministers, lawyers, doctors and the man on the street, it must have a spiritual appeal. All true research is a spiritual matter, spiritual in conception, spiritual in the attitude of the worker, spiritual in its results.

I have known even scientists to value the work of Faraday in terms of the monetary significance of motors, generators, telephones and telegraphs. The test of the worth of Faraday's work is whether it is good for humanity. Research cannot be measured in dollars, but if the use of electric power, electric household appliances, electric lights and telephones has released the human spirit, it is justified.

Unfortunately many of the applications of research have been

materialistic. As a result of research and invention we have the modern factory system with its concentration of laboring populations in great centers and all the attendant evils. But out of these same factories has come the automobile and through its use the factory worker is now able to go back and forth to his little home in the outskirts of the city and enjoy the advantages of both town and country.

The World War, directly involving practically every nation on the globe and causing a loss of life of over ten million troops, was manifestly made more destructive and far reaching by the prostitution of the results of scientific research. But now we see that through the study of the social, economic and legal bases of war there is a strong possibility of permanent peace. When research leads civilization into trouble what is needed is more research.

Men like James Harvey Robinson and Albert Wiggam show us that progress in the application of social and political science has lagged so far behind progress in the physical sciences that society is incapable of protecting itself against itself. If our present civilization is to be perpetuated it must see that no fields of research which will contribute to the safety and betterment of the human race shall be neglected It is comprehensive programs that touch the imagination of the citizens of a state

To be sure, not every individual can rise to this point of view and if it becomes necessary to justify research on the basis of dollars and cents, it can be shown to return a thousand fold; but the way in which the average man will rise to an idealistic appeal is astonishing. Witness the development of an ethical attitude in Rotary, Kiwanis, and Lions clubs. The Chamber of Commerce of today is far different from what it was twenty years ago Or, to take an example nearer to our thesis, when visited by members of the legislature of California, the staff of the Scripps Institution frankly stated that most of their research would have no money value to the state, but explained that all increase of knowledge of nature is useful to the people of a commonwealth either for their enlightenment, or pleasure, or material gain. To their surprise, the institution received two and a half times its former appropriation and the State Board of Control stated publicly that California is committed to research as a definite and perpetual charge upon the state.

Students of history know how whole nations have responded to an ideal. The same phenomenon appears in the development

of American municipalities. When one visits the magnificent Field Museum and the Art Institute of Chicago, and learns of the comprehensive plans for beautifying the city, one is witnessing the tangible results of the vision of a few choice spirits in literature and art, like Hamlin Garland and Lorado Taft, who in the early days determined to make Chicago a center of culture as well as of commerce and industry. Twenty years ago, in the city of Cleveland, Tom Johnson gathered about him a group of young men and women and inspired them with social and political ideals. Today, when one visits Cleveland, one recognizes immediately that it is the home of a distinctive municipal spirit, and when one finds, in other cities, idealistic municipal plans on foot, one is likely to find there some member of Tom Johnson's group.

But we do not have to go beyond the borders of our own state to find examples of the principle involved. When I cross the bridge at Tulsa and see those towering buildings, I feel a thrill just as great as when I first saw the sky scrapers of New York rise from the mists of early morning. A quarter of a century ago Tulsa was a shack town with a few hundred inhabitants. But among them, were a few men with a vision. It was not in the grasping spirit with which some municipalities seek a new industry, but with the inspiration of empire builders, that the Tulsans reached deep into their pockets and financed that famous Booster trip which toured the East and started the movement which has made Tulsa the oil capital of the world.

Research is a normal expression of life. The biological organism behaves instinctively until it encounters a situation which it cannot handle. Then, if it has the capacity, it manifests intelligence in adapting means to accomplish the new ends which it has before it. Research is this same principle in human beings. They muddle through until they encounter difficulties and then they begin to use their brains to overcome them. Or they conceive some end which their immediate resources do not enable them to achieve. Then, again, they use their brains.

In the words of Dr. Merriman of the Carnegie Institution, "the research spirit represents a reaching out to understand and use all that lies about us. Its expression is as natural to a thinking mind as hunger is to stomachs . . . . It is identified with the growth tendency inherent in biological organisms, which may carry us on and on without limit, as our powers and range increase from age to age. Constructive work is inseparably a part of the living of the intellectual life."