SCIENCE

VOL. 101 FRIDAY, MARCH 16, 1945 No. 2620

SCIENCE: A Weekly Journal, since 1900 the official organ of the American Association for the Advancement of Science. Published by the American Association for the Advancement of Science every Friday at Lancaster, Pennsylvania.

Editors: JOSEPHINE OWEN CATTELL and JAQUES CATTELL.

Policy Committee: MALCOLM H. SOULE, ROGER ADAMS and WALTER R. MILES.

Advertising Manager: THEO. J. CHRISTENSEN.

Communications relative to articles offered for publication should be addressed to Editors of Science, 34 Gramercy Park, New York 3, N. Y.

Communications relative to advertising should be addressed to THEO. CHRISTENSEN, Advertising Manager, Smithsonian Institution Building, Washington 25, D. C.

Communications relative to membership in the Association and to all matters of business of the Association should be addressed to the Permanent Secretary, A.A.A.S., Smithsonian Institution Building, Washington 25, D. C.

Annual subscription, $6.00 Single copies, 15 cents

THE ESSENTIAL NEED OF FUNDAMENTAL RESEARCH FOR SOCIAL PROGRESS[1]

By DR. ALAN GREGG

THE ROCKEFELLER FOUNDATION

IF there be some measure of truth in the observation that children seek the unknown but adults fear it, then research is a kind of fountain of eternal youth, for research, whose purpose is to meet the unknown, provides our minds with the perennial freshness and delighted curiosity of youth. In meeting here to-day to honor the National Research Council we are happy to celebrate an institution that has brought knowledge to youth and youth to knowledge. We seek to honor the National Research Council for its work, begun in 1916 and still continuing, in the furtherance of research work in the United States of America.

Yet praise is not what research needs: it needs better understanding. Unless the nature and value of research is more widely and more intelligently understood it will not flourish in our democracy. Research requires discrimination of a high order and tenaciously loyal support. Research does not employ magic: it calls for observation, experiment and reasoning. It is not hidden: few human activities are so accurately recorded or so freely communicated. It is not mystical: it rests upon experience and clear thinking. It is not the plaything of scholars: it is the laborious, costly, incessant, painstaking occupation, and preoccupation, of imaginative men and women who are humbly but actively dissatisfied with even the most that is yet known about men and things.

Unless we are prepared in the immediate future to initiate, pursue and support all kinds of research,

[1] Address delivered on the occasion of the presentation of the American Pharmaceutical Manufacturers Association award to the National Research Council, December 11, 1944 (Hotel Waldorf-Astoria, New York City).

and as never before, the New World will not remain on this side of the Atlantic or the Pacific. Any nation, any business, any university can ignore the importance of research but only at the inevitable price of losing its strength and foregoing its youth. Knowledge is power; and new knowledge is fresh power. How can we afford merely to wonder at the benefits research has already and certainly brought—and leave it at that?

My title is "The Essential Need of Fundamental Research for Social Progress." Such a title implies at least three questions worth answering: Is research essential for social progress? Is it fundamental or superficial research that is essential? What is the essential need of fundamental research?

Permit me a few comments on the first question: Is research essential for social progress? The question tempts me to a blunt remark: Is running essential when you are in a stampede? In other words, with research as a tool available to your competitors can you ignore its power? If you doubt the power of research look about you: Who here is dressed in homespun? Who here breakfasted exclusively on unprocessed foods raised and transported without benefit of meteorology, chemistry, physics and biology? Who got here on his own feet without the aid of airplane, train, subway, taxicab or elevator? Can you, or any one else, stop by fiat or pious resolve the advances of technology? Not without getting left so far behind as to make the words "social progress" a cackling mockery. I suspect that there have been societies and states in the history of the world in which life and human relationships were to the healthy participants as agreeable or more agreeable than life in these modern times is to us. But I am quite sure you wouldn't trade your life for theirs: you like to get well from a ruptured appendix, diphtheria or an acute mania or a rodent ulcer of the face—they couldn't and they didn't. In fact, it is precisely in the field of medical science that I would insist that progress is real. Do you seriously expect progress in the field of drug therapy to come from ignoring the kind of study which has given us our present amazing results in the use of insulin, liver extracts, vitamins, the sulfa compounds and penicillin?

"Social progress?" Let me tell you a story. One night in Berlin about 1929 I met Fritz Haber, whose fundamental researches on fixing nitrogen had enabled the Germans to fight the last war with synthetic explosives, independent of saltpeter from Chile. Despite this service to his Fatherland Haber was later rewarded by the Nazis with persecution and a broken heart. That evening he asked me if I found the research institutes of the Kaiser Wilhelm Gesellschaft at Berlin-Dahlem an ornament to German culture. I said "Yes." He replied: "Excuse me, it is not quite so! Ornament, no! Necessity, yes! We have enough solar energy in Germany to raise food enough to feed 38,000,000. From technological superiority alone can we export manufactures enough to buy the food for the other 20,000,000. From research only comes technological superiority. From brains depend twenty million people. It is not an ornament—it is a necessity."

It was fundamental research that Haber was talking about. Research comes from curiosity and fundamental research comes from curiosity about fundamentals. If we pose the question, "Is the kind of research which is essential to social progress *fundamental* research or *superficial* research?" the answer comes so promptly that I would apologize were it not for just one fact: fundamental research sometimes seems so far away from the immediate need that most laymen often distrust and in times of financial difficulties usually desert fundamental research. Indeed all the discoveries that have been described to you this afternoon began in logical curiosities regarding fundamentals and in their earlier stages were far removed from their eventual applications. They were not hastily improvised answers to impatient questions. They were discoveries of facts so deeply fundamental that as new facts they suggested still newer questions to which they were obviously the answer. In many a case the possible utility of a newly discovered fact becomes apparent *after* the discovery; indeed, the exquisite imagination of Fleming, who first suspected the existence of penicillin, lay just in realizing what his observation might be the answer to. Fundamental research answers questions we sometimes don't know enough to ask. Of course I do not wish to imply that fundamental research is not planned, deliberate, orderly and at times austere. It is all those things and withal it is free—free of the niggardly necessity to be bound to trivial needs or the petty tyrannies of the mind. The physics, chemistry, mathematics and psychology of to-day become the physiology and sociology of to-morrow and the therapy and social progress of the day after. We ought to know that. And yet I can not find a single department of pharmacology in the medical schools of North America adequately staffed and equipped in point of organic chemists, biophysicists, pharmacologists and clinicians.

This disturbing situation leads me to the last question I have raised—What is the *essential* need of fundamental research in the medical sciences? The answer is brains and character—research men well chosen, well trained and well supplied with freedom and facilities to work on fundamental questions. In so far as money serves the purpose of finding, training and cherishing exceedingly competent investigators it is

money invested, not money spent. Precisely because the National Research Council has sought through its fellowships to find and train investigators and teachers, and through its research programs sought to give research opportunities to competent workers we are here to-day to thank its members and offer the tribute of admiration and respect. The most essential need of fundamental research in medical sciences is men—men of attainment and men of promise still to be fulfilled. They can't live without salaries, they can't work without laboratories, they can't teach without pupils who want to join the ranks. Their curiosities are not to see how much they can take from society in money or prestige. They want to understand the fundamental facts of living tissues and living organisms and human relationships. They have their disappointments, their difficulties, their tragedies. They are human. Medical research is an abstraction—the realities are men who search and search again for causes and the relation between phenomena. Until we are prepared in this country to understand the motives, the needs, the rewards, in short the lives of research men we shall go our floundering, hit-or-miss, good-naturedly uncomprehending way, wasteful of these human resources, negligent of our opportunities and happily ignorant of our failures to meet the essential need of fundamental research—the finding, training and support of first-rate scientific brains. One- and two-year grants won't suffice. Medals and citations aren't enough. Time for long study and money for apparatus and helpers and the chance of steady employment—these are what first-rate men need and too rarely get from the society they could shower with the blessings of freedom from pain, relief from disability and the knowledge by which human life is not merely prolonged but rendered happy, freed from fear and ignorance. If you think I exaggerate reflect upon the contributions described this afternoon in the fields of anesthesia, bacteriology, nutrition, physiology and virus diseases.

Created during the first World War, the National Research Council under the auspices of the National Academy of Sciences continued in ensuing years the work of fostering and directing research work in this country. It will resume after this war its work in the service of science and of society. I could hope that in increasing measure the lay public will recognize how valuable are its potentialities, how ready and well qualified it is to administer funds for research work in peacetime and how useful could be its services to society.

Dr. Harrison, you represent the National Research Council not only by your own extraordinary gifts as an investigator, your long services as a counselor and teacher and the example of a splendid character, you also are the designated representative of the National Research Council to receive the tribute offered here to-day to the gifts, the services and the example of the scientists of America in behalf of the public health. I trust that this occasion will aid in a better understanding of the importance of fundamental research in the medical sciences and serve as a warm acknowledgement of the debt of society to the faith which has created and maintained the National Research Council.

THE STATUS AND PROBLEMS OF RESEARCH IN THE NATIVE LANGUAGES OF SOUTH AMERICA[1]

By Dr. J. ALDEN MASON
THE UNIVERSITY MUSEUM, THE UNIVERSITY OF PENNSYLVANIA

EVEN a relatively short sketch of the linguistic conditions of a large area should cover such points as: general features—phonetic, morphological and lexical—that characterize the languages, and the main points in which they differ from languages of other regions; brief digests of the grammar and phonetics of each independent family or at least of the more important ones; a classification of these families in groups according to phonetic and morphological type; a classification of the component languages of each family in their proper subdivisions as dialects, languages, groups and stocks, according to degree of linguistic relationship; and a reconstruction of linguistic history and migrations. As regards the aboriginal languages of South America it must be understood at the outset that, as comparatively little reliable data are available upon them, none of the above points can be treated with any approach to thoroughness, and on most of them little can be said at present.

South American Indian languages have no uniform or even usual characteristics that differentiate them from North American languages. The same may be said of American languages fundamentally, as opposed to Old World languages. Languages were formerly grouped into categories according to morphological

[1] Vice-presidential address of the incoming chairman of the Section on Anthropology, American Association for the Advancement of Science, Cleveland, September 15, 1944. This address was prepared as the introduction to the linguistic section of the Handbook of South American Indians to be published by the Bureau of American Ethnology of the Smithsonian Institution, and is here printed with the permission of that institution.