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THE NATIONAL ACADEMY OF SCIENCES

ADDRESS OF THE PRESIDENT[1]

By Dr. W. W. CAMPBELL

DIRECTOR EMERITUS OF LICK OBSERVATORY AND PRESIDENT EMERITUS OF THE UNIVERSITY OF CALIFORNIA

NOT many times in a century does an existing condition receive wider recognition than has the present-day fact that up and down upon the earth, men, women and children are suffering in unaccustomed numbers; and we should realize that their sufferings are very far from being exclusively physical in character. In some degree, certainly, "the time is out of joint," and all who were "born to set it right," and who shall achieve high degrees of success in their endeavors, will be regarded as benefactors of the human race. Everybody who observes and thinks and draws inferences can mention a few methods or policies which, if adopted and applied, might help a bit. I myself wonder what would happen, for example, if the American styles in high custom-house tariffs, now become the fashion in so many nations, could be moderated to let the seven seas, covering three fourths of the earth's surface, be used again for international commerce; and so on through a long list of pertinent items which, by the way, seem to lie largely, perhaps entirely, within the domain of the economists and the social scientists. However, there are those who say publicly, but without inclination to be specific, that discoveries in the physical and biological sciences have been coming too rapidly for the good of the world. Such ideas are now two or three years old, but they are not "sleeping dogs," and there are still some things to be said in comment.

I assume that even the very small group of extremists who advocated the taking of a holiday in scientific research would not like to call off the scores of able and devoted investigators in medical science who

[1] Given at the dinner of the Academy in Cleveland, Ohio, on November 21.

are seeking the cause and preventive of cancer, the cause and preventive of infantile paralysis or the cause and preventive of the common cold, not to mention other scourges of mankind.

I wonder: does the holiday group think that Einstein's theory of relativity, with its profound influence upon the development of the physical sciences, has taken any laborer's job away from him?

"Man shall not live by bread alone." Has the building of great telescopes and expensive observatories and their use in studying the sun, the moon, the comets, the planets, the stars and the nebulae subtracted from any man's material welfare or from his joy of living?

Does any one in his senses want to halt or discourage the almost countless students of the atom, its structure and its ways?

Can we go out and find any upstanding young man who is ready to say that research in aerodynamics and other elements of the aviation problem, now so extensively and intensively conducted, should cease?

The tendency to place the blame for the ills of the world upon research in the sciences is due chiefly to a failure to comprehend the nature of scientific discovery. The critic is inclined to confuse discoveries in pure science with the applications of those discoveries to the affairs of the manufacturing and commercial world or to the winning of victories in war. The man in the street, and even the school teacher, the clergyman, the lawyer, and the intellectuals in all walks of life, frequently think of a scientific discovery as if it were an actual creation; as if it were something entirely new; something that did not exist up to that time. They think of new knowledge as new truth, and they are wrong; it is old truth. In general, the truth discovered through research is truth which has existed through the ages. The investigator has merely uncovered it and brought it to the attention of his colleagues and their fellow citizens. The mining prospector in the mountains who is so fortunate as to discover gold, that is, uncover gold, does not create that gold, does not even discover new gold, but he uncovers gold that is at least as old as the hills themselves; and such is precisely the case with the discovery of the truth about our surroundings.

The observations made by men of science in the last three centuries and the experiences of the human race have given us no valid reason to doubt the correctness of the thesis that every particle of "matter" in the universe—using the word matter in the older and popular sense—is endowed with the property and the necessity of obeying the fundamental laws of nature. Our universe of stars and other celestial objects, including our own star and our own earth and all its parts, has been evolving through long ages, up to its present state, under the guidance and compulsion and control of what, in my opinion, will eventually prove to be perfectly definite and relatively simple laws. We have no reason to suppose that these laws are ever capricious or undependable. In fact, the arbitrary and the capricious do not seem to exist in physical nature. Whether the arbitrary and the capricious exist in human nature is quite another matter; but that is a bridge we need not cross this evening!

The great planet upon which we live is responding to the forces, to the laws, which have controlled its evolution and will control its further evolution, save as to the occasional and puny efforts of man and other animals in opposition thereto. There is nothing of greater importance to the human race than that its universities and its other research institutions should determine the natures and the potencies of those forces and the ways of those laws so that the plans of man for doing the work of the world may be in harmony with them, and not in opposition to them; so that his modes of thought, his understanding of his environment, his reverence for the truth may be developed upon a firm basis. The more thoroughly we succeed in placing ourselves in harmony with our surroundings on the earth, in both the practical and the idealistic affairs of life, the better shall we succeed in marching with the evolutionary current that is always ready to serve us by joining forces with us.

It is true that many discoveries made in the domain of the sciences represented by members of the National Academy could be used to the injury, or at least to the disadvantage, of human society. A knowledge of bacteriology, of the ways of the bacilli of this or that infectious disease, has been of priceless value to the peoples of the world; and the possibility, or the threat, that such knowledge will be used in time of war to kill the men, women and children of an enemy nation is not sufficient reason why further advances in bacteriology should be discouraged.

That the *too-rapid* introduction of labor-saving machinery and of the electric control of machinery from central switchboards, say in the middle and later 'twenties, when the industries (all except farming) were booming, had a serious bearing upon labor unemployment, can not be denied; but is that a good and sufficient reason why the further study of electricity or of any of the forces or phenomena of nature should be discontinued? Many devotees of the pure sciences, including several members of the National Academy, have ably maintained the thesis that advances of knowledge in the fields of the various sciences have been accompanied by the development

of new industries giving employment to great numbers of men, perhaps more men than have been simultaneously displaced by new labor-saving devices in the older industries. However, the time may come when governments will endeavor to regulate, not the discovery of knowledge in the domain of the sciences, nor the speed of discovery, but the applications of new or old knowledge, in the form of mechanical inventions or new methods, to the work of the world, in order that labor would have time to adjust itself to conditions which governments may think are changing too rapidly. Quite likely the governments of the nations will attempt, by international agreements, to prevent the killing of enemy peoples by microbes, by poisonous gases, by giant bombs dropped out of the blue sky. Some of the agreements or treaties on the subject might prove to be "mere scraps of paper." Even so, we could wisely recall that the present-day use of automobiles by kidnappers and other inhumans does not even suggest to any of us that no more automobiles be made. Realizing that all such problems of attempted control by government would have to deal with human beings and human nature, one is impelled to hope that the guidance of the economists and the social scientists would be found ready and equal to the extremely difficult occasion, in case of call.

I have confidence that all thoughtful persons, including the young men and the young women who, spiritually at least, are the most tragic sufferers from the ill economic winds which have been blowing throughout the world, will join us in saying that the Golden Age of mankind is in the future and not in the past.

PRESENTATION OF THE MARY CLARK THOMPSON MEDAL[1]

By Dr. DAVID WHITE

SENIOR GEOLOGIST OF THE U. S. GEOLOGICAL SURVEY

FULFILLING the unanimous recommendation of the committee, you are to-night bestowing the accolade of tribute to distinguished service in geology and paleontology on a member of the academy whose first collegiate experience was that of professor and whose first scholastic investiture was that of master of arts, in honor, at Yale University.

In common with many boys in Cincinnati, Schuchert began at an early age (12) to collect the abundant Ordovician invertebrate fossils which public improvements had made accessible in many new quarries and exposures; but his matriculation in paleontology as a profession was delayed until he was 17, when he became a paid assistant to E. O. Ulrich, then curator of geology at the Cincinnati Society of Natural History, and now also a Mary Clark Thompson medalist of the academy. Four years afterward he was called, together with his collections, to assist James Hall at Albany, who was preparing an "Introduction to the Study of the Genera of Paleozoic Brachiopoda." Next he worked at the Peabody Museum with Beecher, who was studying the ontogeny of the same great class, in which Schuchert had long been deeply interested.

In 1893 Schuchert went to the Geological Survey and the National Museum in Washington as assistant and understudy to Walcott on the invertebrates of the older Paleozoic. There he took part in Walcott's great monograph on the Cambrian Brachiopoda, besides sharing in the excitement of working out the Cambrian Medusae.

Where could a student have found more satisfying courses in Paleozoic paleontology than under Ulrich, Hall and Clark, Beecher and Walcott?

While in Washington Schuchert completed his "Catalogue of Brachiopod Genera and Species"[1] and inaugurated the present admirable plan of cataloguing, arranging and exhibiting the invertebrate fossils, of which he was curator, in the National Museum. This work is a model followed by many other institutions.

To Schuchert the ancient world is a ceaselessly shifting landscape, alive with constantly changing and evolving animals and plants. Accordingly, the appeal of paleogeography to his vivid paleontological realism was as natural as it was fortunate. Paleogeography treats of the succession of geographies of geologic times. It gives orientation to geological history and sets a background to the history of life. It is a most fascinating and stimulating task, which, nevertheless, few geologists have the courage to undertake and still fewer to print their products—which is probably well.

Starting with shore lines definitely determined at a number of points—with feet on the ground, so to speak—the paleogeographer proceeds to trace his coasts, mountain regions and principal basins and streams through points less well located, and on to points less probable, and, finally, through points

[1] At the dinner of the Academy in Cleveland.

[1] U. S. Geol. Surv., Bull. 87, 1897.