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DEDICATORY ADDRESSES

BY

DAVID STARR JORDAN
DANIEL TREMBLY MACDOUGAL
GEORGE HOWARD PARKER
WILLIAM EMERSON RITTER

During the years 1915 and 1916, the working capacity of this Institution was increased by the construction of a wharf, a library-museum building, and several minor though important structures, the funds for which, $100,000, were given by Miss Ellen Browning Scripps.

These were dedicated on August 9, 1916, with the following program of exercises:

Invocation—Right Reverend Joseph H. Johnson, Bishop of Southern California.

Introduction—Benjamin Ide Wheeler, President of the University of California.

Addresses—A Plea for Old-Fashioned Natural History, David Starr Jordan, Chancellor Emeritus, Leland Stanford, Jr., University.

Biological Research Institutions: Organization, Men and Methods, D. T. MacDougal, Director of Botanical Research, Carnegie Institution of Washington.

The Sources of Nervous Activity, G. H. Parker, Professor of Zoology, Harvard University.

What the Scripps Institute is Trying to Do, Wm. E. Ritter, Scientific Director Scripps Institution.

Plea for Old-Fashioned Natural History

Dr. Jordan spoke in part as follows:

In this talk I shall have three purposes. The first is to express my appreciation of the kindly and intelligent interest in biological research shown by the founders of this Institution. Second, I would congratulate my old friend, Dr. Ritter, and his colleagues on their continuing and increasing opportunity to add to the sum of our knowledge of the life of the sea. Finally, with Dr. Ritter's permission and approval, I would say a word for old-fashioned Natural History, as a method of study and as a means of grace.

Biology in its various forms ranks among the inexact sciences. It is inexact because it leaves always more to learn. The more we know, the more remains to know. Exact science, strictly speaking, is not science at all. It is a form of logic. Pure mathematics, in so far as it is pure, not contaminated by observation or experiment, is a process of thinking. Its conclusions are all involved in its definitions or premises. It deals as readily with a world in four dimensions or two or possibly ten, as with the world we know, which is satisfied with three. It takes observation or experiment to show that this is a world of three dimensions, and that neither line nor surface can exist except as mental concepts framed for the purpose. In treating of either we must ignore for the moment breadth or thickness or both, although neither can ever be absent in any material object. A line without depth or width was never encountered in human experience and there was never an actual surface without some sort of backing, however thin the veneer.

By "old-fashioned" Natural History I mean the recognition or study of animals and plants as completed organisms, each greater than the sum of all the parts. It involves a knowledge of names and of some degree of classification. It leads up to the problem of the origin of species, the affinities of forms, the complex relations we call habits, the problems of geological and geographical distribution, the details of evolution and a balanced knowledge of things as they are, as actual though temporary stages in a universe of change. It is at once the beginning and the end of biological study. The beginning, because almost everyone who has left an impress in biological research has been drawn to these studies by contact with nature and by the love of first-hand knowledge,—the end, because all forms of biological experiment and observation lead finally towards the greater problems the aggregate of which we call Life. And its final end or purpose is interpretation, not of a narrow world of specialized experiment, a universe of chromosomes, unit characters, tropisms, synonymy, but of the whole great world of Life as it is, as it was, and through all its protean changes, must forever be. These are the questions which meet us first and which thereafter lead us on. What is it? What is it to me? And the fascinating problem, as to what it will do for mankind intellectually or morally, is the one which grips us finally. Observation comes first and then experiment and both lead from the gathering of facts to the contemplation of causes. Experiment is not necessarily nobler than observation because it comes later. Observation is the co-ordination of world experiments. All nature is one large category of relations of cause and effect on every side and covering every phase of life. Our experiments detach a fragment of nature to be viewed in intensive detail; we succeed in isolating two or three of her minor problems, asking her to solve these for us without interference from the rest. We are not sure in these minor sections of nature that we have included enough or that we have not taken too much to make the answers we receive intelligible or capable of rising to the rank of truths. An experiment is often the easiest line of attack, but it may also be the most deceptive.

Those sciences like physics and chemistry, often called exact, are the ones in which experiment can most completely segregate and simplify the phenomena of nature. Physical substance and chemical composition may run comparatively uniform. One mass behaves like another mass and like reagents yields like results. The sciences concerned with masses, forces and reactions may be relatively exact. They may freely use mathematics as an instrument of precision applied to tested and unvarying premises, by the elucidation of which we may deduce unvarying truth. But by mathematics alone we may not gather any of the crude material from which Truth can be crystallized. In biology facts are individual. No two objects are ever exactly alike, hence the relative futility of biometric versions of its problems. The effort may be roughly though not quite justly compared to an attempt to introduce binomial nomenclature and the concept of genus and species into Physics. The naturalist Rafinesque once described some twenty new species of thunder and lightning observed by him at the Falls of the Ohio, but his taxonomy can have no genetic basis and therefore no real kinship with classification of animals and plants.

Yet even Physics, Astronomy and Chemistry, however stable their basal concepts, can never be exact sciences. If they were we could learn nothing more about them. The most that can be claimed is that they are exact in spots, and moreover the unquestioned data no longer compel our first interest. But Zoology and Botany are not complete, even in spots. For though the great framework on which these groups are built up is becoming relatively stable, no part of it is finished. Science is human experience tested and set in order. The greater the accumulation of tested results, the more extended the outlook for further human contact with its further accretion of facts and relations.

What we call law in nature is merely as Darwin asserted "the ascertained sequence of events". Every relation of cause to effect involves some sort of law and every slightest fact in natural history has some history of causation behind it. The flowers of the scarlet Ixia before us have a peculiarly bent corolla,—all the Amaryllis family have it more or less. Behind this fact lies a cause if only we could find it. A curious fatality there is in plant as in animal life. The Amaryillis corolla would not be bent if, under all conditions of its past history, it could have been anything else. There is philosophy behind the old explanation of why a crab runs sideways. Such is the meanness of the crab that it would run some other way, backwards or forwards, if it possibly could! Yet every crab varies the method a bit, each in his own way. All the rest of us animals and "our brother organisms, the plants", are like the crab in this regard. We run our race in our own way, but with the limitation that we would run in some other way if we possibly could.

A word as to tolerance in science may not be out of place. Many new lines of observation and especially of experiment have opened in the last twenty-five years. Many more will open in the quarter century to come. These involve additions to knowledge, not a sweeping away of the old, nor a relegation to the dustheap of the methods of Humboldt, Carl Ritter, Cuvier, Linnaeus, Agassiz or Baird. We stand on their shoulders, dwarfs on the shoulders of the giants. They strove to glance at the whole majestic Cosmos. Such a vision is as glorious now as in the days before the miscroscope and microtome had ranged the infinitely small along with the infinitely great. No one of us can compass the whole, but every man may look beyond his bit of the field out over the broader vision of the whole, each meanwhile devoting himself to that part which he can work best and enjoy most heartily. We should not ask which is most "popular", most repaying, most up-to-date. It is discouraging to see the young biologists, in Dr. Coulter's words, "all paddling in the same pool", however alluring that pool may be.

Some thirty years ago I was at Johns Hopkins University, when the collections of a Maryland Natural History Society were turned over to that institution. Two or three advanced students were picking out the fishes. The bowfin, the gar pike and some small sharks were regarded as treasures. These species bore some relation to problems in the morphology of the higher vertebrates. Every specimen that did not make some such appeal was thrown away, regardless of the other problems it might help to answer, and regardless of the fact that even the bony fishes, humble as they are, have a morphology, an embryology and an evolution of their own. The pool we paddled in in those days was morphology. Then came embryology, the second of the "ancestral documents" of Haeckel, the third being paleontology. But the results of embryology were unexpectedly indecisive. In other words, its problems, like others, are very complex. Next came the movements towards histology, a field which proved amazingly rich. In our day similar wealth is found in genetics, and in physiology, while in ecology as a modern subject we come back close to the old-fashioned natural history with which we started. I should not in the slightest degree depreciate any of these lines of research. Each of them has helped to illuminate our whole intellectual field. Each is clearing and strengthening our conception of evolution, though sometimes they interfere with the simplicity of our formulæ.

With all this we have not destroyed the old charm of the study of nature in detail, nor have we reduced the need of it. Through our ignorance of species and of the methods of taxonomy some of us have made systematic study unfashionable. In the contemplation of organisms in the closet or the garden, we sometimes overlook the fact that species exist out of doors, each one as a different kind of living being. It should be no disgrace to know an animal or plant by its scientific name. It has no other name, and if we know it, we must speak of it. The confusion into which systematic biology has been sometimes thrown comes mainly from those who do not understand that accuracy is as important in this field as in any other. An exact nomenclature is as important in systematic science as sharp knives in anatomy. Those who wish to know animals without getting the names right should be commended to the popular text books "How to Know the Birds, the Insects, the Plants" without knowing anything about them. In no field can accurate knowledge come from casual survey.

Exact determination of genera and species lies at the bottom of all real study of geographical distribution and of geological succession as well. There is all the difference in science between the actual truth and "something equally good", which is said to obtain in Pharmacy. In an address before the Association for the Advancement of Science some years ago on "The Making of a Darwin" I tried to show that three elements were vital. First and greatest the raw material, the germ plasm—the stuff of heredity, which determined the original Darwin. To build up a Darwin these potentialities must first exist. Next they must be aroused by contact with Nature, her facts and her problems, the facts which fascinate leading to the finally obsessing problems, to "fanaticism for veracity," to borrow one of Huxley's finest phrases. Lastly, contact with inspired and inspiring teachers, those by whom from generation to generation the "Higher Heredity" of naturalists has been vivified and kept alive. Darwin tells us that at Cambridge he "walked with Henslow", eager teacher and learned botanist, even as we of the passing generation once "walked with Agassiz" and as you of the present generation have walked with Agassiz's pupils—with Brooks and Wilder and Morse and William James, with Verrill and Minot, with Packard, Hyatt, Hartt and Snow, and the rest whose torches were kindled at the flame of the same great teacher.

And here I may well close with a sentence I once heard from Agassiz, one of the last words ever spoken to those who were his disciples,—"This is the charm of the study of Nature herself; she brings us back to absolute truth every time we wander."