

## SCIENCE, EDUCATION, AND THE MUSEUM

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The nineteenth and twentieth centuries have been pre-eminently eras of scientific achievement, and especially in the last half century there has been seen the establishment of many laboratories whose avowed purpose is the gaining of new knowledge of the world around us. These laboratories are located not only in the great centers of population, but even in the farthest reaches to which civilization has advanced. Indeed, the extent to which scientific research is carried on by a people is by many taken as an index of the advancement of that people. Nevertheless, in spite of the fact that there has been produced many a great scientist and much scientific achievement, the public comprehension of what has been accomplished in these laboratories is usually inadequate and often faulty.

We are proud to hold up as the goal of the American people a very high state of general education. The founders of our nation wisely made provision for public education, and our standards as well as the average level have steadily risen since the first days of the republic. We have all accepted with no reservation the necessity for general education for all the people of the entire country. In the often quoted words of Mirabeau B. Lamar, second president of the Texas republic, "A cultivated mind is the guardian genius of democracy. It is the only dictator that free men acknowledge and the only security that free men desire." In carrying out this policy America, in common with other enlightened nations, provided at the expense of the state an education available to all through their formative years from earliest childhood on to maturity. In the systems of some nations it has not been held that all citizens of the state receive an education at public expense, but that is the legal ideal in the American state. Educational progress here has now long passed the stage when the little red school house constituted the sole cultural resource of the majority of communities, for in its place have appeared the consolidated school in rural communities, the public graded school and high school in every town, while at the top of the system are the junior colleges, senior colleges, and universities, offering educational and cultural opportunities to meet the requirements of any who seek them. In addition there are now well organized movements in many places which aim at adult education, and too, the women's organizations have had their share in raising the general level of culture.

So familiar are these matters that I wonder if many of us who live amid these surroundings and who accept as axiomatic the necessity of learning and culture fully realize the importance of popular understanding and appreciation of the scientific and academic achievements of this age. I think perhaps our appreciation of educational achievements is sometimes dulled by our closeness to it. I once heard a learned physician say that the importance of vaccination against smallpox is not as keenly realized now by the American people as formerly, but he said if we could go to a land like China where the practice is not general and see the terrible effects of this disease which we to a large extent have conquered and whose ravages we do not now dread we would fully appreciate what vaccination means

here. In a similar way we would perhaps better appreciate the influence of culture and learning on the lives of the people of a nation by visiting other peoples where the average level is much less high than with us. Last spring I had the opportunity to see at first hand a remarkable contrast in the lives of the higher and lower strata of society in Naples. Three months in Naples forced upon us the realization of the different lives which the highly cultivated upper classes of Italians lead from those which are the lot of the poorer strata of the Italian society. The high class of Italians are very high indeed in their cultural attainments and in the appreciation of the art objects which are all about them and in their evaluation of their historical monuments. The educated middle class, however, is much smaller than here, and among the lower classes there is a very high degree of illiteracy and a very general disposition to take things as they are with no attempt to change or improve them. They have in addition what seemed to be a complete failure to appreciate or care for those comforts of living or for the responsibilities of personal achievements which modern learning have brought about wherever education reaches a higher general level. Public education is available to the average Neapolitan for not more than five years and even for these years there is little compulsory education if the family does not desire to take advantage of what is offered. After seeing the shortcomings of Italy I have a much keener realization of the high function which general public education serves and a much better appreciation of the part this factor has played in the lives of the American people.

What has all this to do with the Oklahoma Academy of Science as an organization? Of course it has much to do with the institutions with which we are connected, but to some it would seem that the Academy was less concerned with the appreciation of scientific results than with their achievements. Yet the Oklahoma Academy of Science occupies a unique place in the realization of higher learning in this State. Here the representatives of all fields of scientific endeavor meet. In the Academy there is no cause or place for jealousy between institutions or between groups representing the different fields of thought. Here we meet to share our common results, to learn of things which have been done that are of importance to us, to get encouragement for our own individual activities, and to see visions of new and greater accomplishments for the future. I know that in the minds of some who still have the cartoonists' conception of the scientist that a meeting of 302 representatives of the various sciences who work in Oklahoma would call up more of amusement than of visions of welfare of the people of the State. Nevertheless, I would venture the belief that if we may look forward to the full participation of the members of the Academy in the program outlined in 1926 by the president of the University and president of the A. and M. College, a program of scientific cooperation and of governmental and social utilization of the Academy's services, and if when the program is accomplished and there comes with it an appreciation by politicians and those in governmental authority of the resources of knowledge that are gathered together in this organization and are available for public welfare we shall see a new day in Oklahoma affairs. Here is the common reservoir of learning in regard to natural and social science in Oklahoma, here is an organization in

which may share upon equal terms all who in this state are scientifically interested and all who are concerned with whatever that has to do with the scientific aspects of this State's development. In our government are many departments whose business involves application of scientific facts and in the industries here are employed many whose activities are primarily scientific, although directed along the applied lines. Let it be the purpose of the Academy to enlist the interest of all these and indeed to become a clearing house for all matters of science which touch the welfare of this large community.

If the level of general education is the foundation upon which governmental and social well-being rest, then any means for establishing a better understanding of scientific results on the part of people as a whole is of importance to society as a whole. One of the agencies which has operated to promote general understanding of scientific attainments is the museum. I wish to deal particularly with the public museums as educational force and to show the degree to which modern museums, particularly of natural history, have developed. It is not possible to discuss at any length the various agencies which exist for the purpose of bringing the new knowledge to those who should profit most generally from it. I would here attempt nothing more than to point out the place which one means only of public education the museum has in the State and to emphasize the usefulness of it in accomplishing a greater popular understanding and appreciation of the progress of modern science.

"Study nature, not books," said Agassiz, meaning not to study books less but to study nature more. And Cicero in 56 B. C. wrote as follows: "Wherefore, if it is your wont to admire my wisdom—and would that it were worthy of your good opinion and of my own surname of Sapiens—it really consists in the fact that I follow Nature, the best of guides, as I would a god and am loyal to her commands. . . . To rebel against Nature—is not that to fight like the giants with the gods?" The study of nature has occupied the mind of man through all the course of his development from his most primitive groping for understanding up to the highest stages of his most modern learning. Not only his culture but his physical well being has demanded that he consider nature and her doings. Not only his curiosity but his conscious attempt to look after his own welfare has demanded that he give thought to her and as knowledge has accumulated with it has come the realization that the preservation of objects of nature as well as the published result of their study is necessary for a complete understanding of the environment in which we live. Books, though written by the best scientific minds, become out of date. Interpretations change and with them our sense of values. But the facts of nature may be preserved and recorded for generations as yet unthought of with a faithfulness that is unchanging. Of the making of books about nature, and of their perusal, too, there is indeed no end, but for the understanding of nature they give at best an imperfect and perhaps a faulty idea unless accompanied by the objects of nature.

The value of the modern museum is based much more upon the appreciation of the place of nature and its facts and laws in the upbuilding of society as such than upon the mere interest and desire of man to conserve that which he is interested in, although the collectors' interests are thought

by many to be the main spring which is actuating the formation of great museums. Certainly the modern museum of natural history is by no means a mere collection of preserved and stuffed specimens. It is much more than the "dead circus" of the small boy who came home shouting gleefully to his mother what he had just seen. In only one of the great museums of Europe where I visited and in none of the modern American institutions of which I know was the impression given of dead animals arranged in row after row as might be the case in a "dead circus." I was sorry to see in the zoological museum of the Jardin du Plantes just such a collection as is suggested by the idea of a "dead circus." The numbers of specimens in this museum were inconceivably large and every group of animals was represented in bewildering array. A student of variation for whom large numbers of specimens of a particular kind are necessary would be very much at home in this museum, but I do not think that the student who seeks to find living nature would come from this museum with a sense of satisfying accomplishment. Rather the modern museum seeks to show an organism as if it were alive, attempts to reveal animals and plants in relation to each other and to take one into the very place where the creatures in question live.

An expedition sent out by the American Museum of Natural History of New York to gather material for the Gila monster group of that Museum illustrates the faithfulness with which it is sought to reveal the conditions of nature. The most recent tendency in building an exhibit in a museum is to make use of what are known as habitat groups, that is, to represent the organism as it is in its own native surroundings. The habitat group is the highest expression of museum activities so far as they are concerned with the exhibition as distinguished from the scientific study of organisms. For the Gila monster group, eighteen Gila monsters, four species of cactus involving eight large specimens, a considerable mass of gravel, dirt, and sand, and even larger rocks were collected and sent in from the field. In addition to this, sufficient plant material was collected and preserved in a special solution which retained the natural colors to form with the gravel and other materials the necessary background. In addition to these actual objects, lumiere plates were made for a further record of the actual field conditions. Stomach contents were studied to discover upon which organisms the Gilas feed and then the actual food specimens were collected and sent back alive. The building of the exhibit actually constituted a reconstruction of the animals' own home with them in it. It is obvious that the expense of such a group is no small matter.

For many groups the impressiveness often depends as much upon the artificial foliage and other accessories which go into it as upon the specimens which it is designed chiefly to show. The great amount of labor and the costliness of such a group will perhaps be better appreciated from a brief description of the method by which leaves are made of wax to represent the natural foliage. A leaf is first placed upon a bed of clay and cast in plaster. When one side has been cast the clay is removed and a cast made of the opposite side to fit into the first one. From these molds the wax leaves are all prepared. Of course the molds have to be treated properly with hardening solution of borax or other material and coated with

paraffin or linseed oil so that the wax leaves do not stick to the mold. The actual process of making the wax leaf as described by Coleman is as follows: "When the leaves are to be cast from a squeeze mold, the mold must be soaked in hot water and used while warm and moist. Heat keeps the wax from chilling till it fills the mold and moisture prevents it from adhering to the plaster. A film of cotton is laid upon one side of the mold—better the concave side if either one is so. A piece of cotton-covered hard iron wire is laid along the line of the midrib, with its end projecting to form a stem, and if the leaf be a thick one more cotton is laid on top. Melted wax, tinted green with oil colors, is then poured upon the cotton and the upper part of the mold squeezed down upon it. The whole is plunged into cold water, opened, and the cast removed." For larger leaves it is necessary to make a framework of twisted wires covered with gauze. After the cast is taken from the mold it must be trimmed, the imperfections removed, and finally it must be shaped with the fingers. The leaves are then assembled upon the stems in the proper manner for the plant in question and a final touch of color is applied with an air brush. Of course a mold may be used on very many leaves, but when it is realized that perhaps 10,000 are necessary for a single group, the laboriousness of the process will be better appreciated. The making of wax flowers is sometimes less complicated than the making of leaves since in a great many cases dies may be used for the purpose of cutting out the petals from the wax.

No museum of the present day is content to exhibit mere stuffed animals mounted as if they were statues, although the degree to which it is possible to construct habitat groups depends upon the resources of the institution. All modern museums, however, attempt to have something of the habitat shown for as many animals as possible. When we see the amount of labor and study which has gone into the making of the exhibit, it follows that a museum of the present day offers unusual opportunities for education. Few children can see a polar bear or a walrus in his native surroundings, and yet a habitat group such as is shown in the "Pacific Walrus Group" or the "Polar Bear Group" of the Colorado Museum of Natural History at Denver does not leave an imaginative child lacking in the understanding of the lives of these creatures.

We were particularly impressed with the use made of the great museums of Europe in formal teaching. Wherever we went, with the single exception of the Paris museum previously referred to, we saw many visitors and always groups of pupils from the lower grades on up accompanied by teachers who acted as guides. Parties are brought to those museums from the surrounding town and cities, and it would seem that a few who go through the school systems of the land lack the opportunity for understanding at first hand a great deal of nature and of developing that love and appreciation of the objects of nature which it is the real function of the museum to teach. In the older European civilizations museums have grown up through the years until now no considerable area in the more populous countries is without a museum in fairly easy reach, and conscious efforts are made on the part of educational authorities to bring its facilities to as many students as possible. In America the great museums are few and yet nowhere in the world is a more serious attempt made to cooperate with school authorities than in the American Museum of Natural History of

New York. For this purpose great sums of money are appropriated each year and examination exhibits, lantern slides, and lectures are made available to the tributary districts as well as the facilities of the museum extended for direct teaching purposes. And all of this in addition to the regular program of research and scientific publication which it is the museum's larger function to carry out.

May the time not be far distant when the children and young people of our own region may share in these opportunities which are available to those of our older states and of the more advanced nations of Europe.

