# SCIENCE



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## MUSEUM METHODS.

### THE EXHIBITION OF FOSSIL VERTEBRATES.

THE exhibition of fossil vertebrates is a subject that may be treated from various points of view, but the purpose of the present paper is to deal with it from the standpoint of a vertebrate zoölogist, and to discuss the question what should be the relationship between the sections of a museum devoted to the exhibition of living and extinct animals. That there is, or should be, a very obvious connection between these two sections of a great museum is undeniable, although the relationship is generally ignored and, as Prof. Flower wrote in regard to the collections of the Royal College of Surgeons: "The specimens continued to be divided primarily, not according to their zoölogical or anatomical relations, but by a most inconvenient and artificial system, according as the animals from which they were derived lived before or after a particular period of the world's history."

While the *complete* divorce of recent and extinct animals is unfortunate, Prof. Flower's plan, on the other hand, goes to the opposite extreme, and while it may be applicable to such a collection as that of the Royal College of Surgeons, it does not seem applicable to the exhibition series of a large museum.

The question really at stake is, shall extinct animals be treated from a zoölogical or a geological standpoint; is it more important to exhibit the relationship of animals to one another as if they lived at the same time, or to show the forms of life which existed at a given geological epoch, and the various steps by which the existing order of things has been reached. No museum is large enough and rich enough to do both these things on an extensive scale, and the decision is practically unanimous that it is the province of paleontology to show the faunas of the past as it is that of zoölogy to show the fauna of the present. A purely zoölogical arrangement of all animals in a museum, recent and extinct, would probably fail of its own weight and extent. Prof. Flower himself recognizes the fact that there are difficulties in the way of a strictly zoölogical arrangement, for in the 'Guide to the British Museum of Natural History' he says: "Notwithstanding the objections which may be urged against this primary division of living things, it is one which prevails largely in museums, and which, owing to certain conveniences, as well as to the difficulty and expense of rearranging extensive collections and reorganizing the staff in charge of them, will probably be retained for some time to come."

Arranged geologically fossils tell the condition of life at any given stage, and show how fauna after fauna has arisen and passed away before that of the present was reached.

It might be thought that a collection could be arranged phylogenetically, but this is a physical impossibility, for, even were space available, specimens could not be so arrannged as to act as a genealogical tree and show at once their common ancestry, lines of descent and relations to one another. To do this is the province of a diagram or diagrams, and there is usually some wall space well fitted for this very purpose that is otherwise unavailable or could not be used to better advantage. Morever, the lines of descent of the majority of vertebrates are wholly or partly hypothetical, and this is a serious drawback to arranging a museum on a phylogenetic plan. Series to illustrate the line of descent of a group or species whose phylogeny is known are, however, invaluable and most instructive, and the museum which is fortunate enough to possess the necessary material cannot do bettet than to provide them. Just such a series is that illustrating the phylogeny of the horse, on exhibition at the American Museum of Natural History, in New York city.

The relations of extinct to existing animals are to be shown in two ways, or in two departments of a museum: firstly, in a synoptic, or index series; and secondly, in a general systematic system of skeletons. The synoptic series may be compared to a general introductory work on zoölogy, prepared with special reference to the needs of the public and those commencing the study of zoölogy. A systematic series is a detailed, descriptive catalogue, whose object is to furnish information for the advanced student. The idea of the synoptic series is yet in the earlier stages of development, and it seems not improbable that this will eventually come to occupy a large space in a biological museum. In the systematic osteological series the province of fossils is to round out the collection, to bridge over gaps between apparently unrelated forms and supply the missing steps which time has removed from the phylogenetic stairway. A most striking example of the need of intro-

ducing extinct forms in a collection is shown by the great gap now existing between birds and reptiles, a gap which the Dinosaurs and Archæopteryx will bridge over and by their presence make clear the affinities of these two great classes. Now a mere placing of fossils in their proper places will not do this, for the average fossil, crushed, mutilated, distorted, means very little to the average visitor. To do the thing properly we should have a complete and, preferably, a full-sized restoration of the extinct species, but this, the ideal method, is for many reasons far in the future; the *complete* structure of the majority of forms is unknown, while the cost of the knowledge and skill necessary for making such restorations puts a prohibitory tariff on their manufacture. Meanwhile the best that can be done is to supply their places with good figures,* but when this is done the drawings should be supplemented by specimens of casts of fossils to show the material on which the restorations are based and, which is almost as important, to give an idea of the size of the creature figured. Moreover, these specimens are needed as a guarantee to a somewhat suspicious public that the animals did actually exist. With the aid of these models, figures and specimens, supplemented by, or supplementary to, good labels, the relations of existing forms may be made plain and the exhibition series symmetrical.

A paleontological series then should be complementary to that of recent animals; the bulk of it should be by itself and arranged geologically, but, as fast as opportunity offers, the gaps between existing groups should be filled, so that, aided by the labels, the visitor may see that the relation between existing forms depends in many cases on species long ago blotted out of existence. Such a series should not be too large, for its object is to show clearly the principal modifications of vertebrate structure, and the display of too many forms tends only to confuse the visitor, or general student, for whom such a series is intended. It may, perhaps, be an open question as to just what 'too large' means. In my own case it means that I would not go beyond the representation of families, although where there is much diversity of form within a family more than one species may be introduced to advantage. And when all families, living and extinct, have been properly represented, the series will be of no mean proportions.

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* Just how to introduce these drawings in the exhibition series is a problem which I have incubated for two years or more without hatching a good solution.

This paper was written some time before the appearance of Sir Henry Howorth's article on Paleontological Museums in the February number of *Natural Science*, and his ideas as to the value of certain material lead me to add as a postscript some sentences striken out of the rough draft of my own article.

The questions arise as to whether it is worth while to exhibit many of the vertebrate fossils seen in museums and if they do not occupy space which might be used to better advantage. Much of the material shown, single teeth, fragments of bones, odd vertebræ and broken skulls, while, valuable enough to the paleontologist, are as caviare to the public. Even to the average student they are of little value unless he can handle them, and, while a certain amount of material is needed to impress upon the public the number and variety of the animals which have passed away, all beyond that simply tends to confuse rather than to instruct. And personally I am of the opinion that many of the objects ordinarily seen on exhibition might advantageously be relegated to the study series.

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