and figures of almost all (270) are given. It is expected that the work will be completed in three volumes. An extended notice may be expected on the completion.

THEO. GILL

SCIENTIFIC JOURNALS AND ARTICLES

The Journal of Experimental Zoology, Vol. VI., No. 3 (June, 1909) contains the following articles: "Studies on the Physiology of Reproduction in the Domestic Fowl—I., Regulation in the Morphogenetic Activity of the Oviduct," by Raymond Pearl. This paper describes a case in which a regulatory change in the shape of eggs successively laid by the same hen occurred, the change in shape following a logarithmic law. "The Physiology of Nematocysts," by O. C. Glaser and C. M. Sparrow. Experiments made on living nematocyst-bearing tissues as well as on artificially isolated nettling organs show that a rise in internal pressure brings about the discharge of the stinging thread; that osmotic pressure is responsible for the explosions of nematocysts in Eolids; that this may explain the similar processes among Cœlenterates; and finally that the nettling threads, contrary opinions notwithstanding, are capable of penetrating the tissues of other animals. "Observations on the Life History of *Tillina magna,*" by L. H. Gregory. A study of the morphology, physiology and methods of reproduction of the organisms, and its reactions to stimulations during different periods in the life history, with especial reference to the questions of artificial rejuvenescence and the inter-relations of nucleus and cytoplasm. "Studies of Tissue Growth—II., Functional Activity, Form Regulation, Level of the Cut and Degree of Injury as Factors in Determining the Rate of Regeneration—The Reaction of Regenerating Tissue on the Old Body," by Charles R. Stockard. The rate of regeneration in the medusa, *Cassiopea,* is independent of functional activity; form regulation inhibits growth; and the level of the cut determines the rate of regeneration in many species. The degree of injury does not exert the same influence over the rate of regeneration in all species; the new tissue has an excessive capacity for the absorption of nutriment even to the detriment of the old body.

SPECIAL ARTICLES

ON THE RESTORATION OF SKELETONS OF FOSSIL VERTEBRATES

IN a paper published last October[1] the writer, in referring to the mounted carnivorous dinosaur in the American Museum of Natural History supposed to be *Allosaurus* or *Creosaurus,* compared its hands with those of Marsh's restoration of *Allosaurus.* Inasmuch as the hands of the New York specimen are wholly artificial and those of Marsh's figure mostly or wholly so, it will be seen that the comparison was of something less than no value at all. A serious error on the part of the writer must therefore be confessed. How it came to be committed will probably be of interest to nobody.

Although the quite complete hind leg of *Allosaurus* on which Marsh based his restoration[2] is in the U. S. National Museum, the materials belonging to the fore leg, restored by Marsh on the plate cited, are not in that museum and I therefore do not know just what parts were in Marsh's possession. From his language we have the right to suppose that he had at least the scapula, the coracoid, the humerus and some claws.[3] These parts, then, ought to be available in making comparisons with corresponding parts of related dinosaurs. Further differences between *Allosaurus* and *Creosaurus* are said by Marsh[4] to be found in the elongated sacral vertebræ of the latter genus and the transverse processes, which are placed higher up on the centra than in *Allosaurus.*

It appears to the writer that some animadversions may justly be made on the methods of preparing restorations of fossil animals, both as shown in the scientific journals and as displayed in our museums. It seems incontestable that the public has a right to know on what materials all reconstructions, as well as

[1] *Proc. U. S. Nat. Museum,* XXXV., pp. 351–66.

[2] "Dinosaurs of North America," Pl. XII., fig. 2.

[3] *Amer. Jour. Sci.,* XXVII., 1884, p. 334, Pl. XII., fig. 1.

[4] *Amer. Jour. Sci.,* XVII., 1879, p. 91.

all conclusions, have been based. If the reconstruction of a skeleton or a part thereof is a graphic one those parts which are uncertain or missing ought to be indicated by the style of the drawing. As an example to be disapproved let us take Professor Marsh's restoration of *Camptosaurus dispar*. In his "Dinosaurs of North America," Plate LVI., the skeleton is represented as complete, except the front extremity of the hip bone and the tip of the lower jaw, the predentary. Nevertheless, according to Mr. C. W. Gilmore, who has recently studied all the materials,[5] it is found that the skull was missing (except perhaps the lower jaw), nearly all of the dorsal vertebræ, all of the tail, a part of the scapula, a part of the coracoid and all of the ribs. The skull shown in the restoration is evidently that of *C. medius*,[6] and this in its turn was, according to Gilmore, restored partly from probably another species, *C. amplus*. The restoration of the reptile would have been far more valuable had the doubtful and missing parts been so represented.

As regards the restoration of the skeletons of fossil animals for exhibition a few words may be said. Where the actual bones enter into the preparation their value may be impaired either through their being put into inaccessible positions or being partly covered with plaster. Sometimes a skeleton or a part may be mounted in a slab of plaster so as to show one side, naturally the best one. The investigator worthy the name will burn to see that hidden side. Hence, means should be sought for concealing as little as possible of the precious bones.

In mounts where original materials are used in connection with artificial substances the latter ought to be plainly distinguished from the former. It was a complaint of some of Marsh's assistants[7] that one would have to go over some mounts with a moist sponge in order to distinguish plaster from bone. The practise now in the museums may not be quite so bad, but Barbour's test has sometimes, at least, been made ineffective by the application of a coat of shellac. Too often the texture and the color of the bone is imitated very closely. Then the device of a thin red line between the bone and the plaster and that of a small red cross on whole restored bones are employed. These, however, are hardly visible at a distance and are not understood readily by the visitor; and they do not appear in photographs and reproductions of them. The writer believes that there ought to be a decided difference between the color of the bone and that of the plaster. It may be that the appearance of a great mammal or reptile thus mounted will be somewhat variegated, but equally variegated is probably also our knowledge; and beauty ought not to be secured at the expense of truth.

It frequently seems that the restoration of missing parts represents lost labor. In the United States National Museum is a large part of the skeleton of the extinct bird *Hesperornis* which was mounted by Mr. F. A. Lucas. For sufficient reasons the missing sternum was restored in plaster. The few cervical vertebræ preserved are shown in their place on a rod of metal. Nothing would have been gained by restoring the missing cervicals and the missing skull; especially since a drawing in the exhibition case shows the visitor the form of the whole bird. The example is to be commended.

The visiting public ought to be shown the reasons for each restoration that has been adopted; and this because of its educational value. If the hind leg of a great dinosaur is missing it may be restored from the other, but differently colored, and then labeled as missing in the specimen and reproduced from the one present. If both legs are wanting and are restored from the limbs of another individual or from those of a related species, this fact should be stated and the attention drawn to those real limbs, in case they are in the museum. The interest of the visitor will thus be excited, he will make the problem of the expert his own problem, and will pass judgment on the work done.

The plain indication of the restored parts of

[5] *Proc. U. S. Nat. Mus.*, XXXVI., 1909, p. 270.
[6] Marsh, *op. cit.*, Pl. LVIII.
[7] *Amer. Naturalist*, XXIV., p. 388.

fossil animals is likewise a matter of common honesty. Emperors, grand dukes and millionaires may found museums, and they secure recognition for their munificence; but right at hand are the masses of the people who, in the end, foot the bills, and they have also their rights. The declaration that all men are born free and equal was not a more important one and one perhaps not so wholly true as is a principle said to have been uttered by one of our senators during the debate on the pure food law: The buyer has a right to know what he is getting for his money. The principle applies in all walks of life, however much it may fret those who would secure wealth, position and honors disproportionate to their deserts. Applying it to museum administration, we may say that the visitor has a right to know whether he is gazing at real bone or at plaster, and the reasons therefor. Moreover, it is futile and mischievous to attempt to hide the nature of the restoring materials. It is sooner or later detected and suspicion is thrown on the whole exhibit.

It is the practise sometimes to build up a fossil skeleton out of the bones of various individuals. This can not be condemned in all cases, but usually it is dangerous. It may be permitted to make a skeleton of the extinct auk from as many individuals as there are bones. In the case of less well-known animals, represented probably by fewer bones there is likely to result a mixture of species and even of genera. And no hybrids are so fertile as these, inasmuch as they reproduce themselves throughout the world by means of the printing press. And these hybrids are monsters besides, having legs belonging perhaps to two or three distinct animals, the head to another and so on. Of these can we not say with Horace, who was describing[8] an object made up of members gathered here and there,

Spectatum admissi risum teneatis, amici?

And we may inquire if it advances science to send out over the world figures of an animal whose body belongs probably to one family and its head to another?

Rather than mingle the bones of several individuals belonging possibly to various species, it would be better to restore in plaster the various parts, except those of the principal individual, possibly of this also. Labels on the parts of the restored skeleton ought to direct the viewer to the bones, shown near by, on which the restorations have been based. As intimated, if visitors in the museums are not interested in plaster restorations and models it is probably because they believe that these things are products of the unchastened scientific imagination. There appears to be no other good reason why a plaster Megatherium should not be relatively as interesting as a plaster Venus of Milo. In these wholly artificial restorations the unknown parts should be as conscientiously indicated to the eye as in other cases.

And these plaster casts of the great animals that sojourned on the earth in bygone ages present another advantage that seems to be of the highest importance for the advancement of science. For now and anon some one among us, a paleontologist inchoate as yet but confident, the beneficiary of a favorable environment, bestriding his light-legged, straight-legged gypsiferous steed, perhaps *Brontodiplodococamarosaurus,* may gallop safely and merrily up the rugged slopes of the Mount of Fame.

OLIVER P. HAY

[8] "Epis. ad Pisones," I., 5.

SOCIETIES AND ACADEMIES

THE ACADEMY OF SCIENCE OF ST. LOUIS

THE Academy met at the Academy Building, 3817 Olive Street, Monday evening, April 19, 1909.

Dr. Robert J. Terry, of the Washington University Medical School, read a paper on "An Observation on the Development of the Vomer." The observations made on the development of the vomer in *Caluromys philaucler* affects the question of the homology of the mammalian vomer. Is the single vomer of mammals comparable with the single parasphenoid or the paired vomers of lower forms? Except in man the vomer of mammals has been found to arise from a single center. Lately, however, the bone in question has been seen to be accompanied by a parasphenoid ossification. It seems also to be the case in *Caluromys* that the origin of the base is paired.