but genial presence, his deep-toned but pleasant and cheery voice. He leaves a widow, three sons, and two daughters. His eldest son, who is in the Church, succeeds his father as Vicar of Stokesay; one is on the staff of the Geological Survey of India; and the other is a Civil Engineer in the Public Works Department of the Madras Presidency. J. H.

OTHNIEL CHARLES MARSH, LL.D. (YALE), PH.D. (HEIDELBERG).

BORN OCTOBER 29, 1831. DIED MARCH 18, 1899.

(WITH A PORTRAIT.)

SCIENCE of late has become so cosmopolitan in its interests that the loss of any one of its leading members is felt and mourned in distant lands as keenly as in the University in which he may have made his home.

A while since we had to regret the loss of Professor Dames of Berlin; yesterday we deplored that of Professor Nicholson of Aberdeen; to-day we mourn the loss of our dear American cousin, Professor O. C. Marsh of Yale. Such ties of sympathy and personal regard tend to knit more closely together our geological friends everywhere, and we join hands far and near in times of joy and sorrow.

O. C. Marsh was born at Lockport, New York, October 29, 1831, and graduated at Yale in 1860. Of his early years we have no details, but it may be inferred that it was due to the interest of his uncle, Mr. George Peabody, that after his schooldays had long ended he entered Yale College, where he graduated in 1860 at the age of 29. After travelling in Canada and Nova Scotia, where he discovered remains of a new Enaliosaurian (*Eosaurus Acadianus*) in the Coal-formation of Nova Scotia, he came to Europe and spent three years in the Universities of Berlin, Heidelberg, and Breslau, under Beyrich, Ehrenberg, Roemer, and other famous German Professors.

He visited London in 1864, and whilst diligently studying in the British Museum he became acquainted with the writer, and from that time a warm friendship was commenced, which lasted to the end. A letter arrived on the morning of the 20th March, addressed in Marsh's well-known handwriting, and also a telegram, the former full of life and pleasant hopes and promises, the latter the messenger of death: "Professor Marsh died yesterday, illness short, Beecher." Reverting again to 1864: we had just before (1862) secured the famous collection of Dr. Haberlein from the lithographic-stone quarries of Eichstatt, in Bavaria, which, among other treasures, contained the famous *Archæopteryx*. Marsh at that time devoted himself diligently to the investigation of the fossil Annelides, and discovered on one specimen the well-preserved jaws of *Helminthodes antiquus*, which he carefully worked out with his own hands and afterwards described and figured.

Returning to America in 1866, he joined Professor Sir William Thomson (now Lord Kelvin) when engaged in the delicate task of picking up and splicing the first Anglo-American cable in mid-Atlantic. The same year he was offered the Chair of Palæontology

at Yale University, the Professorship being instituted for him, and there he remained until the close of his career. Within two years after his appointment Marsh ceased to write miscellaneous papers, and devoted all his time, energies, and resources to the pursuit of Vertebrate Palæontology.

Aided by the liberality of his uncle, Mr. George Peabody, the founder of the Peabody Museum of the Yale University, Marsh commenced a series of expeditions for palæontological purposes to the Rocky Mountain region and the Far West. One of the earliest of these was in 1870, and lasted more than five months. It extended into Kansas, Nebraska, and Utah. The fossils obtained were chiefly from the "Loup River" Pliocene and the "Mauvaises Terres" or Miocene, both deposits having been accumulated beneath the waters of enormous fresh-water lakes, whose banks were tenanted by many of the peculiar Pachyderms of the Paris Basin. Many species of fossil horses (one of them allied to *Hipparion*), of Rhinoceroses, of *Titanotherium*, an *Elotherium*, camels, and carnivores were secured. These old lake-deposits of Miocene age abound in remains of crocodiles, serpents, turtles, and fishes. Numerous Mosasaurian remains also were obtained in Kansas. Another expedition followed in 1874 to the south of the Uintah Mountains, and was equally successful.

From the date of Professor Marsh's establishment at Yale University, a long succession of scientific papers appeared, mostly in Silliman's American Journal and in the GEOLOGICAL MAGAZINE.

Of his earlier papers may be mentioned the following:—On the discovery of a diminutive species of fossil horse (*Equus parvulus*); Reptilian remains from Brazil; Mosasauroid reptiles from New Jersey; a gigantic fossil serpent (*Dinophis grandis*) from New Jersey; fossil birds from the Cretaceous and Tertiary; a fossil Gavial from New Jersey; a gigantic species of Pterodactyle; new Tertiary mammals and birds; on *Hesperornis regalis*, a toothed bird; notes on *Tinoceras*; fossil quadrumana and carnivora from Wyoming; a new species of *Ichthyornis*; fossil mammals of the order Dinocerata; on the genus *Tinoceras*, etc.; on the structure of the Brontotheriidæ; new equine mammals; on the small size of the brain in Tertiary mammals; on the Tillodontia; on the genus *Coryphodon*; on the Pterosauria; on the Stegosauria, a new order of extinct Reptilia; on the Sauranodonta and principal characters of American Jurassic Dinosaurs; on Dinosaurian reptiles from the Jurassic formation; new Jurassic mammals.

Professor Marsh's first great work appeared in 1880 on the *Odontornithes*, a monograph on the extinct toothed birds of North America (4to, pp. xv + 201, with 34 plates and 40 woodcuts). Certainly, as a scientific publication, it surpasses any which have already appeared devoted to palæontology.

In the same geological horizon with the *Odontornithes*, Professor Marsh discovered and described *the first Pterodactyles*, or flying-lizards of America. These are of enormous size, having a spread of wings of nearly 25 feet, and were specially remarkable for having no teeth, hence resembling our modern birds.

The bird-like Fossil Footprints of the Triassic sandstones from the Connecticut Valley always interested Marsh, and he keenly and critically studied them; as, although no bones had been found near them, they had been regarded as undoubted footprints of birds, because it was supposed that birds alone could make such series of bipedal, three-toed tracks, and leave no impression of a tail. Marsh was able in later years to show that these bird-like tracks were most probably made by a small bipedal reptile named *Anchisaurus*, an early Triassic dinosaur.

In 1884 appeared the second of Marsh's great works, a Monograph on the extinct Dinocerata, a gigantic order of Ungulate mammals (Washington, 4to, pp. xviii and 237, with 56 plates and 200 woodcuts). These huge beasts, which nearly equalled the elephant in size, roamed in great numbers about the borders of the ancient Eocene lake-basin in Wyoming, where so many of them were afterwards entombed, The drainage of this lake by the Green River, its elevation from six to eight thousand feet, and subsequent erosion by the Colorado, has left exposed by slow denudation the great "*mauvaises terres*," or "bad lands," carved into peaks, cliffs, and columns of the most fantastic and varied shapes and colours, and has exposed the remains of the many extinct animals and the bones of the great Dinocerata for the attention of the explorer. More than 200 individuals of the Dinocerata have been brought together in Yale College Museum alone.

A *papier-maché* model, taken from the actual bones of the complete skeleton of *Tinoceras ingens*, has been presented by Professor Marsh to the Geological Department of the British Museum (Natural History), London, and serves as an interesting memorial of his work.

Professor Marsh's third Monograph is on the Dinosaurs of North America, and appeared in 1896 (imperial 8vo, pp. 110, with 84 plates). No fewer than fourteen papers, richly illustrated, had already appeared on this subject in the GEOLOGICAL MAGAZINE from 1882 to 1896, so that this Monograph could not be expected to add much to the knowledge already derived from the author's numerous separate memoirs. But all Marsh's work on the Dinosauria is here brought into one focus. Many fine plates were held back by him, as well as many details, for a future *édition de luxe*, which, alas! he never lived to produce, but which will doubtless be published at an early date by the University of Yale, provision having been made for that purpose by Professor Marsh in his will.

An excellent summary of Marsh's observations on Dinosaurs will be found in the GEOLOGICAL MAGAZINE, 1896 (pp. 388–400), with twelve admirable restorations of the leading forms. (See also GEOL. MAG., 1897, pp. 38–44.)

Marsh's toothed birds and toothless Pterodactyles may seem to be two of the most remarkable of his numerous discoveries; but his Monograph on the Dinocerata is in itself a grand and classical piece of work, sufficient alone to merit the highest distinction.

Yet if we turn to his long researches upon the Dinosauria, one would feel certainly disposed to give to these the first place of

importance in his lifework. Such wonderful forms of terrestrial reptiles as he has discovered, e.g., *Brontosaurus*, *Stegosaurus*, *Triceratops*, *Claosaurus*, *Anchisaurus*, *Ceratosaurus*, *Diplodocus*, and many others, either by their size or peculiar characters, have produced a more powerful impression on the public mind than almost any of the other discoveries of modern science.

From 1868 to 1890 scientific expeditions were organized to explore and collect fossils in the Rocky Mountain districts, resulting in the bringing to Yale of more than a thousand species of vertebrata; more than 400 of which have been described by Professor Marsh. He is said to have crossed the Rocky Mountains thirty times on these expeditions, and, although he may not have crossed the Atlantic quite so often, he was a very frequent visitor to England and the Continent, and his relations with men of science here were of the friendliest kind: witness the award to him of the first Bigsby Medal in 1877 by the Council of the Geological Society, who also elected him a Foreign Member in 1898.

Of the struggles for priority and other personal scientific squabbles which embittered some years of his life we need not now speak; over the silent grave we may only remember with gratitude the vast services to science which Marsh lived to perform.

By his will he leaves his entire estate to Yale University, with the exception of 10,000 dollars to the National Academy of Sciences, to promote original scientific research. Even his home and residence are left to the Yale University, to be used as a Botanic Garden and Laboratory. He is estimated to have expended 250,000 dollars on collecting the fossils which he gave to the Yale Museum a year ago. His estate will probably realize 100,000 dollars. (It should be also mentioned that during the thirty-three years in which Professor Marsh held the Chair of Palæontology in Yale, he received no salary for his services.)

A sum of 30,000 dollars is left to the Trustees of the Peabody Museum, to pay for the preparation and publishing of the results of his explorations. In this case we may *reverse* the *verdict* of Shakespeare and say,

"The *good* men do lives after them."

I cannot help quoting a few words from Marsh's last letter, dated Yale, March 10th, 1899:—"I did not intend to distribute many of these [casts] until after my monographs were published, but considering what confusion there seems to be in your country on the subject [of the Dinosauria], good casts of the characteristic American specimens might help on the missionary work of scientific instruction, and thus aid in bringing still nearer together our two countries."

It seems sad that he, who was with us at the August meeting of the International Zoological Congress at Cambridge, and the subsequent meeting of the British Association at Bristol, in September, reading and discussing papers there, should now have passed over to the great majority and that we should see his face no more.

H. W.