

## APPENDIX.

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### ART. XXI.—*On the United Metatarsal Bones of Ceratosaurus*; by Professor O. C. MARSH.

IN the April number of this Journal (vol. xxvii, p. 331), the writer described a remarkable new Dinosaur, the type of the genus *Ceratosaurus*, and of the family *Ceratosauridae*. The skull, vertebræ, and pelvis were described and figured, but at that time little was known about the feet. More recently portions of these have been recovered from the same individual, and they prove to be as remarkable as the other parts of the skeleton already made known.

The most interesting feature in the extremities of this Dinosaur is seen in the metatarsal bones, which are completely ankylosed, as were the bones of the pelvis. There are only three metatarsal elements in each foot, the first and fifth having apparently disappeared entirely. The three metatarsals remaining, which are the second, third, and fourth, are proportionally shorter and more robust than in the other known members of the order *Theropoda*, and, being firmly united to each other, they furnish the basis for a very strong hind foot.

In figure 1, these coössified metatarsals of *Ceratosaurus* are represented, and for comparison the corresponding bone of a penguin is given in figure 2.

In comparing these two figures, it will be seen that the three metatarsal elements of the Dinosaur are quite as closely united as those of the bird. To the anatomist familiar with the tarso-metatarsal bones of existing birds, the specimen represented in figure 1 will appear even more like this part in the typical birds than the one shown in figure 2.

The position of the foramen, as seen in figure 1, *f*, is especially characteristic of recent birds, and, as a whole, the hind foot of this Jurassic Dinosaur was evidently similar to that of a typical bird.

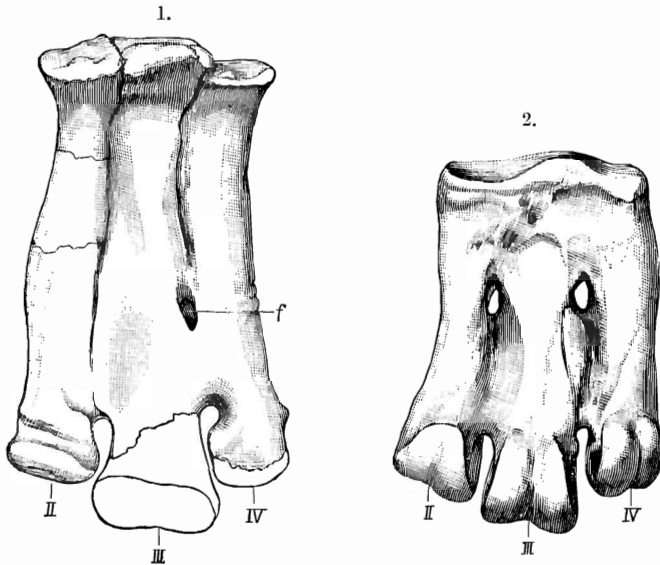


Figure 1.—United metatarsal bones of *Ceratosaurus nasicornis*, Marsh; left foot, front view. One-fourth natural size.

Figure 2.—United metatarsal bones of great Penguin (*Aptenodytes Pennantii*, G. R. Gr.): left foot, front view. Natural size.

All known adult birds, living and extinct, with possibly the single exception of *Archaeopteryx*, have the tarsal bones firmly united, while all the *Dinosauria*, except *Ceratosaurus*, have these bones separate. The exception in each case brings the two classes near together at this point, and their close affinity has now been clearly demonstrated.

Yale College, New Haven, July 23d, 1884.