

devoted to a discussion of phyllotaxy. The arrangement of leaves in spiral lines is first considered and then the various published views upon this topic are discussed with some fullness. Schumann passes in review Braun's work in establishing the study of phyllotaxy upon a scientific basis, Hofmeister's effort to explain the spiral arrangement by the fact that new organs are formed in the largest gaps left between organs already formed, Schwendener's success in demonstrating the mechanical basis for phyllotaxy, and Sachs's theory that the spiral lines, e. g. in the Screw-Pine, are produced by torsion during the growth of the axis. He, himself, points out that the arrangement of leaves in straight or spiral ranks is intimately connected with the symmetrical or asymmetrical development of the sheathing bases of the leaf, which make their appearance upon the growing point of the plant before the leaves do. This relation holds true in all Monocotyledons and most Dicotyledons. In the second half, the special morphology of the genus *Adoxa* and of the Cohort *Fluviales* is discussed in support of this view.

W. A. S.

III. MISCELLANEOUS SCIENTIFIC INTELLIGENCE.

1. *Bulletin from the Laboratories of the State University of Iowa.* Vol. II, No. 2.—This number of the Iowa Bulletin opens with a long paper on the Myxomycetes of Eastern Iowa by T. H. McBride, with ten beautiful plates from drawings by Miss Mary P. McBride. It also contains four important paleontological papers by S. S. Calvin; a paper by B. Shimek on the identity of *Pyrgula scalariformis* with *P. Mississippiensis*, and its occurrence, with other species, in the loess of the Mississippi, but known only in the fossil state; and Notes on Karyokinesis, by L. B. Elliott. Prof. Calvin reports on fossils from the Lower Magnesian limestone of Northeastern Iowa, showing their relations to those of the Calciferous of New York.

2. *Astronomical Journal Prizes.*—Two prizes of two hundred dollars each, in a gold medal or in money, are offered in the *Astronomical Journal*, No. 284, to be awarded to resident citizens of the United States. Details of the conditions are given in the *Astr. Journal*.

The first will be given for the best series of determinations of the positions of comets during the year ending March 31st, 1894:—the second for the best discussion of the path of a periodic comet, the investigation to be made within the two years next preceding Sept. 1, 1894.

3. *Ostwald's Klassiker der Exakten Wissenschaften.*—A notice of this valuable series was given in the January number of this Journal; the three following volumes have just been issued:

No. 38. Photochemische Untersuchungen von R. Bunsen and H. E. Roscoe, (1855-59). Zweite Hälfte.

No. 39. Die in der Atmosphäre vorhandenen organisirten Körperchen: Prüfung der Lehre von der Urzeugung von L. Pasteur (1862).

No. 40. Zwei Abhandlungen über die Wärme von A. L. Lavoisier und P. S. DeLaplace (1780 u. 1784).

APPENDIX

ART. XXII.—*Restoration of Anchisaurus*; by
O. C. MARSH. (With Plate VI.)

1893

Amos

3rd SW

45

THE Triassic Dinosaurs now known from the Connecticut river sandstone have been investigated by the writer, and some of the results have already been placed on record in this Journal.* Remains of five individuals have been discovered, sufficiently well preserved to indicate the main characters of the animals to which they pertained. These were all carnivorous forms of moderate size, and the known remains are from essentially the same geological horizon. Many larger forms, probably herbivorous, are indicated by footprints, but no characteristic portions of the skeleton have yet been found.

The genus *Anchisaurus*, one of the oldest known members of the *Theropoda*, is so well represented by parts of four skeletons, two nearly complete, from these deposits, that a restoration of one species can now be made with considerable certainty. This has been attempted, and the result is given, one-twelfth natural size, in the accompanying plate. The animal when alive was about six feet in length.

The skeleton chosen for this restoration is the type specimen of *Anchisaurus colurus*, already described by the writer. This skeleton when discovered was entire, and apparently in the position in which the animal died. Portions of the neck and the tail vertebræ were unfortunately lost before the importance of the specimen was realized, but the skull and nearly all the rest of the skeleton were saved. From these the matrix in great part has been removed, so that the more important characters can be made out with certainty. The parts missing are fortunately preserved in a smaller specimen of an allied species (*Anchisaurus solus*) found at the same locality, and these have been used to complete the outline of the restoration. Portions of two other specimens, nearly allied, and from the same horizon, were also available, and furnished some suggestions of value.

The restoration as shown on Plate VI. indicates that *Anchisaurus colurus* was one of the most slender and delicate dinosaurs yet discovered, being only surpassed in this respect by some of the smaller bird-like forms of the Jurassic. The

* This Journal, vol. xxxvii, p. 331, April, 1889; vol. xlii, p. 267, September, 1891; and vol. xliii, p. 543, June, 1892.

position chosen is one that must have been habitually assumed by the animal during life, but the comparatively large fore limbs suggest the possibility of motion on all four feet. The compressed terminal digits of the fore feet, however, must have been covered by very sharp claws, which were used mainly for prehension, and not for locomotion.

The small head and bird-like neck are especially noticeable. The ribs of the neck and trunk are very slender. The tail apparently differed from that of any other dinosaur hitherto described, as it was evidently quite slender and flexible. The short neural spines and the diminutive chevrons directed backward indicate a tail not compressed, but nearly round, and one usually carried free from the ground.

The present restoration will tend to clear up one point long in doubt. The so-called "bird-tracks" of the Connecticut river sandstone have been a fruitful subject of discussion for half a century or more. That some of these were not made by birds has already been clearly demonstrated by finding with them the impressions of fore feet, similar to those made by reptiles. Although no osseous remains were found with them, others have been regarded as 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.

It is now evident, however, that a dinosaurian reptile like *Anchisaurus* and its near allies must have made footprints very similar to, if not identical with, the "bird tracks" of this horizon. On a firm but moist beach, only three-toed impressions would have been left by the hind feet, and the tail could have been kept free from the ground. On a soft, muddy shore, the claw of the first digit of the hind foot would have left its mark, and perhaps the tail also would have touched the ground. Such additional impressions the writer has observed in various series of typical "bird tracks" in the Connecticut sandstone, and all of them were probably made by dinosaurian reptiles. No tracks of true birds are known in this horizon.

The genus *Ammosaurus*, represented by remains of larger size from the same strata, was a typical carnivorous dinosaur, and apparently a near ally of *Anchisaurus*. So far as at present known, the footprints of the two reptiles would be very similar, differing mainly in size.

The only other reptile known from the Connecticut sandstone by any part of the skeleton is a large *Belodon* from a lower horizon. This crocodilian may be called *Belodon validus*, and will be described by the writer later.

New Haven, Conn., Jan. 21, 1893.

