Williston on the Permian reptiles of America should have been entirely ignored. Some of the many, and much worn, illustrations of the Dinosauria might easily have been replaced by excellent illustrations from one or the other of these writers.

The paleontology of fishes is very fully covered by Pompeckj, illustrations and discussions of typical forms of the various groups being chosen. The reconstruction of the Devonian *Paleospondylus* by Sollas, based on serial sections, is given. The restorations and drawings by Patten and Traquair of the early Devonian Placodermi are well shown in many illustrations, as well as such recent figures as Hay's *Edestus crenulatus,* which is one of several early elasmobranchs figured. Many well-known restorations and figures of fish anatomy from the writings of Dean, Dollo and Woodward complete the work.

The general discussion of the recent mammals by W. Kukenthal is followed by a sixty-four page article by O. Abel on the paleontology of the mammals. This latter section is illustrated by 122 figures, which are well chosen, as we would expect from such an eminent student as Abel.

The article on "Zelle und Zellteilung" covering one hundred and seventy pages, richly illustrated with 225 figures, is one of the more extensive biological articles. It is divided into three sections: (1) Zelle und Zellteilung, Botanisch; (2) Zoologisch; and (3) Zellphysiologie. The botanical section is written by E. Kuster, the zoological section by L. Bruel and the physiology by M. Verworn, each section being followed by numerous references to the important literature.

The anatomy and physiology of the sensory organs, covering sixty-five pages, with eighty-one figures and many bibliographic references, deals with special sense organs throughout the whole range of animal life. The discussion and illustration of this immense subject is necessarily brief and specialists will be disappointed to see their favorite subjects but slightly touched or neglected; however, for a work of this character the article will prove helpful.

The work, taken as a whole, contains many interesting contributions to paleontology and zoology. The articles discussed above may be taken as typical of the other articles in the work. A general index of three hundred and sixty pages closes the work. The individual articles show that a high ideal was adopted, which has been well sustained throughout. The volumes are well printed, the illustrations are clear, and in every way the work lives up to the good reputation so long enjoyed by the press of Gustav Fischer.

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October 30, 1915

Proceedings of the National Academy of Sciences

The eleventh number of volume 1 of the *Proceedings of the National Academy of Sciences* contains the following articles:

1. *Experiments on the Development of the Limbs in Amphibia:* Ross G. Harrison, Osborn Zoological Laboratory, Yale University.

   At the time of appearance of the tail bud the anterior limb of *Amblystoma* is already determined in the mesoderm cells of that region of the body wall which lies close to the pronephros and ventral to the third, fourth and fifth myotomes. The prospective significance of this group of cells, as a whole, thus is defined some time before differentiation becomes visible.

2. *A Mechanism of Protection against Bacterial Infection:* Carroll G. Bull, Rockefeller Institute for Medical Research, New York.

   Bacteria circulating in the blood are quickly removed when they are agglutinated or clumped, and the clumps deposited within the organs are taken up by phagocytes and digested. They appear not to be destroyed by solution or lysis through the operation of serum constituents of the blood.

3. *On the Life-History of Giardia:* Charles Atwood Kofoid and Elizabeth B. Christiansen, Zoological Laboratory, University of California.

Giardia muris and *Giardia microti* produce a readily recognizable enteritis in mice, and both binary and multiple fission take place in the free non-encysted stage—there is no *Octomitus* stage. The morphological characters separate six species. The parasite in mice appears to be distinct from that in man.

4. *The Inorganic Constituents of Alcyonaria:* F. W. CLARKE and W. C. WHEELER, United States Geological Survey, Washington.

The stony corals have been repeatedly analyzed, and with generally concordant results. Thirty analyses here made have confirmed the older data. The object of the investigation is to determine what each group of organisms contributes to the formation of marine limestones. The highest proportions of calcium phosphate are commonly associated with high values for magnesia.

5. *An Experimental Analysis of the Origin and Relationship of Blood Corpuscles and the Lining Cells of Vessels:* CHARLES R. STOCKARD, Department of Anatomy, Cornell University Medical School.

Vascular endothelium, erythrocytes and leucocytes, although all arise from mesenchyme, are really polyphyletic in origin; that is, each has a different mesenchymal anlage.

EDWIN BIDWELL WILSON

SPECIAL ARTICLES

INTERFERENCES WITH TWO GRATINGS

IF two identical grating are placed with the ruled faces and rulings in parallel and the horizontal and transverse axes of their spectra (of the same side and order) in coincidence, white light passed through them from the collimator of a spectrometer shows intense, nearly equidistant, vertical interference fringes in the telescope. The path difference is subject to the equation $e(1 - \cos\theta)$, where e is the distance apart of the ruled faces and θ the angle of diffraction. These fringes therefore belong to the coarse set which I described elsewhere. Though not exceptionally sensitive to displacements of either grating, they are available throughout a relatively large interval; *i. e.*, e may be increased from coincidence to over 2 cm. As two stretched films suffice, these strong fringes admit of many practical applications.

A more interesting class of fringes may be observed, when the light used in the same instrument is homogeneous. There are three types of these fringes of constant wave-length. The first of these is obtained with the same adjustment for coincident longitudinal and transverse spectrum axes, but needs a wide slit. Obliquity of the incident rays here replaces the above color difference. The second class appears with a fine slit, coincidence of longitudinal axes, but in the absence of coincidence of transverse axes (in which adjustment the fringes would be of infinite size). They are thus evoked by a difference in the angle of incidence at the two gratings, respectively. Frequently they are seen to best advantage with the naked eye or a lens. They increase in size as the eye is withdrawn from the grating; or if seen in the telescope, if the ocular is either pulled out or pushed in from the position for the principal focus where D lines only are seen. For any given position of the eye they do not vary in size while either grating is displaced from coincident position, to the position of vague evanescence, 4 or 5 millimeters beyond. Both this and the following fringe patterns rotate rapidly with the slight rotation of either grating in its own plane.

The third class is obtained in the absence of a collimator and is due to the varying obliquity of diffuse homogeneous light. The longitudinal spectrum axes must coincide, but the transverse axes need not. They are very strong, best seen with the naked eye or lens, but admit of relatively little displacement of either grating, as they vanish with increasing smallness. They usually lie in a definite focal plane, which recedes to infinity as the gratings are more and more separated.

Finally it is interesting to note that phenomena of a somewhat similar kind may be obtained with reversed spectra.

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