short duration of the phenomena. The hypothesis of a collision between a star and a nebula meets these two fundamental objections, and appears capable of accounting qualitatively for many or most of the phenomena, as was shown some years ago by Seeliger. But the spectroscopic data, and especially the dark-line spectrum on the rise, remain difficult to explain. A collision between a star and a relatively small dark body—recently postulated by W. H. Pickering—is also worthy of consideration, but presents difficulties of its own.

After what we now know and believe regarding the stores of energy which are locked up in the nuclei of atoms, the hypothesis of an explosive release of some such form of energy within a star can not be neglected. The chief difficulty about it seems to be that we might expect an even greater catastrophe than appears to occur—but this theory will probably prove to be increasingly flexible as our knowledge advances. At present, however, the collision theory appears to the speaker the most promising. The great frequency of novæ in the spiral nebulæ—where we might expect collision to occur, if anywhere in the universe—seems to be favorable to this view.

In concluding this hasty and imperfect survey of a wide field, two things stand out prominently—first, the importance of a study, which was once neglected and even rather despised, in the attack upon some of the most fundamental problems of astrophysics, and, second, the urgent need of extensive and active researches, observational, statistical and theoretical, to advance toward solutions of some of the many unsolved problems which still remain before us.

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CHARLES ROCHESTER EASTMAN[1]

ON this side of the Atlantic there have been few zoologists who have devoted their lives to the study of ancient fishes—which for the rest concerns not a few of the greatest problems of the vertebrates. Of investigators who have passed away we recall the distinguished names of Agassiz the elder, Cope, Newberry and Leidy, and to this goodly fellowship we must now add the name of Charles Rochester Eastman, whose services have contributed widely and intensively to a knowledge of fossil fishes. To this work he gave his time devotedly for a quarter of a century, publishing over a hundred papers, among them a number of monographs which rank among the most scholarly and accurate in their field.

Eastman graduated from Harvard in 1891, studied at Johns Hopkins, thereafter in the University of Munich, where he took his doctorate in 1894; he worked with Professor Karl von Zittel, whose laboratory then attracted a number of young American paleontologists. Here, as Eastman's interests already centered in fossil fishes, he was given the only material for research which the German university had at hand—a mass of detached teeth of a Chalk Measures shark—not attractive material, to say the least, but the young investigator attacked it with energy and soon gathered the data for a successful thesis. He was next given a post at Harvard, where in the Museum of Comparative Zoology, under the mantle of Louis Agassiz, he reviewed the collections of early fishes and found much material for publication. He now became interested in the Devonian fossils of the Agassiz collection, which he found shed light upon the rich finds from the Middle West, then being described by Dr. Newberry. Eastman's imagination was especially touched by the range and character of "placoderms" as the dominant group of Devonian times, and like many another worker, he set himself to solve the puzzles of their lines of evolution and of their kinship to modern fishes. Hence he sought actively for more extensive and better preserved material upon which to base his findings. The best collecting ground for these American forms was in Ohio, and throughout this region Eastman soon learned to know the fossil hunters and their collections. His studies upon these forms thereupon spread over wider fields, and became well-nigh encyclopædic; he brought the entire Devonian

[1] Born Cedar Rapids, Iowa, June 5, 1868, died Long Beach, N. Y., September 27, 1918.

fish fauna under his finger tips, literally: and if Eastman were sought for at this time, he would have been found at the top of the Agassiz Museum in the center of a labyrinth made up of tiers of great trays of fossils: and the visitor would come away with the impression that there was something almost uncanny in the skill with which Eastman could call up out of the mud-colored shales these primæval creatures, for their *membra disjuncta* would be made to fit in place so quickly, so faultlessly, and sometimes with so audible a click that one could almost picture the fish coming to life in its tray.

From the study of placoderms, Eastman's studies extended naturally to the contemporary lung-fishes and ganoids, and to our knowledge of these early forms he made numerous contributions. Now and again he would hark back to the group of sharks, trying ever to bring order into this primitive and difficult group. Port Jackson sharks, with their curiously modified dentition, which enabled them to crush the shells of shellfish, suggested new lines of evolutional changes, and his work on these forms from Illinois, Iowa, Missouri, Kansas and Nebraska showed new sequences and enabled him to fill out the gaps in their history. Certain of these early sharks became so similar to lung-fishes in their dentition, that, on this evidence alone, the two great groups of fishes might readily have been merged.

During the last decade of his work, Eastman's attention was drawn more closely to types of modern fishes. This was perhaps due to the fact that he had been able to bring to this country the famous collection of a Belgian paleontologist, de Bayet, and install it in the Carnegie Museum at Pittsburgh. Upon the fishes of this collection, especially those from northern Italy (Monte Bolca) he published a number of beautiful memoirs.

In matters relating to the phylogeny of fishes, Eastman was conservative. Thus, following Smith Woodward, he maintained that the group of placoderms which the latter defined as *Arthrodira* was definitely related to primitive lung-fishes: he had little sympathy with those who believed that they had solved the riddle of *Tremataspis* and *Bothriolepis* by associating with them arthropods. As a systematist, Eastman was thorough, and the forms which he described will rarely need revision.[2]

[2] Mrs. H. J. Volker has recently reviewed the papers of Dr. Eastman, and summarizes his systematic contributions as follows:

New families: (3)
Astraspidæ.
Peripristidæ.
Pholidophoridæ.

New genera: (12)
Belemnacanthus.
Campyloprion.
Eobothus.
Eolabroides.
Gillidia.
Histionotophorus.
Palæophichthys.
Parafundulus.
Parathrissops.
Phlyctænacanthus.
Protitanichthys.
Tamiobatis.

New species: (115)
Acanthodes beecheri; marshi.
Ameiurus primævus.
Amiopsis (?) dartoni.
Anguilla branchiostegalis.
Asterolepis clarkei.
Asthenocormus retrodorsalis.
Belemnacanthus giganteus.
Blochius moorheadi.
Bothriolepis coloradensis.
Campyloprion annectans.
Caranx primævus.
Carcharias collata; incidens.
Cestracion zitteli.
Chanoides leptostea.
Cladodus aculeata; prototypus; urbs-ludovici.
Cœlacanthus exiguus; welleri.
Cœlogaster analis.
Conchodus variabilis.
Ctenacanthus acutus; decussatus; longinodosus; lucasi; solidus; venustus.
Dicrenodus texanus.
Dinichthys dolichocephalus; livonicus; pelmensis; pustulosus; trautscholdi.
Diplodus priscus; striatus.
Diplomystus goodi.
Dipterus calvini; costatus; digitatus; mordax; pectinatus; uddeni.
Elonichthys disjunctus; perpennatus.
Eomyrus formosissimus; interspinalis.
Erismacanthus barbatus; formosus.
Fissodus dentatus.
Galeocerdo triqueter.
Glyptaspis abbreviata.
Gyracanthus primævus.
Harpacanthus procumbens.
Helodus comptus; incisus.
Histionotus reclinis.

No one can recall Dr. Eastman without bringing to mind his keen appreciation of ancient literature. He read the classical texts fluently, and Aristotle and Pliny had to him the interest of modern authors. Perhaps he knew them and their kindred better than did any living paleontologist. For bibliographical work Eastman had ever a distinct leaning, for to know what others had done in a definite field was the only honest beginning of any research. It was this interest which led him to accept the invitation of the American Museum of Natural History to undertake the editorship of a bibliography of fishes which the museum was engaged in publishing, and it was under his supervision that the two first volumes of this work appeared—ever to lighten the labors of workers in this field.

BASHFORD DEAN

Homacanthus acinaciformis; delicatulus.
Homœolepis suborbiculata.
Janassa maxima; unguicula.
Lepidotus ovatus; walcotti.
Machœracanthus longœvus.
Macrosemius dorsalis.
Mene novæ-hispaniæ.
Myliobatis frangens.
Mylostoma newberryi.
Notagogus decoratus; minutus; ornatus.
Œonoscopus elongatus.
Onchus rectus.
Oracanthus triangularis.
Orodus intermedius.
Palæophichthys parvulus.
Parafundulus nevadensis.
Parathrissops furcatus.
Phlyctœnacanthus telleri.
Phœbodus dens-neptuni; knightianus.
Pholidophorus americanus.
Phyllodus hipparionyx.
Physonemus homus-piscatorius; pandatus.
Platinx intermedius.
Polyrhizodus grandis.
Priscacara dartoni.
Propterus conidens.
Protitanichthys fossatus.
Ptyctodus compressus; ferox; panderi; predator; punctatus.
Pygœus agassizii.
Rhadinichthys deani.
Rhynchodus major; pertenuis; rostratus.
Sagenodus cristatus; pertenuis.
Sauropsis curtus; depressus.
Squatina minor; occidentalis.
Stethacanthus erectus.
Streblodus angustus.
Synechodus clarkii.
Synthetodus calvini.
Tamiobatis vetustus.
Undina grandis.
Urosphen attenuata.

SCIENTIFIC EVENTS

THE FOREST SERVICE IN WAR TIMES

How the Forest Service met its war responsibilities is the main subject discussed by its chief, Henry S. Graves, in his annual report to Secretary Houston, just published. The war led, he asserts, to the temporary abandonment of many of the old lines of work, the curtailment of others, and the assumption of large new duties. Because of the close relation of the National Forests to the economic life of the country and to the production of necessities never before so urgently required, "their continued administration along lines which would prevent the breakdown of any essential industry was an obvious duty." At the same time the Forest Service was employing its technical knowledge and equipment for the furtherance of war preparations involving the use of forest products, in response to the many demands of the War and Navy Departments and the war industries.

There were furnished to the Army and Navy 446 men, while a considerable number left to serve in the War and Navy Departments in a civil capacity and to take part in industries directly concerned in producing materials for war uses. Still others were forced to leave the service because with the low standard of salaries, they were unable to meet the rising cost of living. All told, 1,179 persons had gone from the service prior to October 1. The situation of the Forest officers, clerks and others having fixed bases of salary is regarded by the forester as very critical, requiring the earnest consideration of Congress.

The receipts from the National Forests were slightly greater than in 1917, with a total of not quite $3,600,000. The grazing business produced an increase based on the land classification work, the area showed a slight net reduction, leaving the amount of government-owned land in the forests at the close of the year 155,927,568 acres.

Regarding the land classification the report says:

> After nine years of steady sifting to separate from the forests such lands as should not be retained permanently in public ownership, the task