with seasons or years or markets. It is often necessary for the sake of clearness of presentation to deal with prices, but the general futility of doing so is demonstrated by the fact that even at the moment when this book was published prices differed widely from those reported in the chapters on the cost of food. This shows the need of thorough education in food values and we might almost say of training in arithmetic, which will enable one to see the money relations of food for oneself and to compare costs as prices change.

The important but often neglected subject of food prejudices is most happily treated in "Food for Children Eight to Twelve Years Old."

As Mrs. Rose points out, "only a few well-chosen dishes need be offered at any one meal, but a tendency to choose a single dish for a meal and refuse everything else should be discouraged. In adult life a well-balanced diet demands more kinds of food than in childhood, when such a variety of elements is supplied by milk alone, and it is a great advantage to have been so trained as to be able to take these in all sorts of forms. Most adults eat in groups and pronounced individual likes and dislikes have great economic and social, if not always physiological, disadvantages. Half the problems of the food provider arise, not from the difficulty of securing wholesome food to make a well-balanced ration, but from the necessity of remembering that . . . [individual tastes vary]. Youth is the time to cultivate respect for all natural foods as a means to physical and mental efficiency, and not merely as ticklers of the palate. . . . Most food aversions are acquired in early life when the sensibilities are keenest. An accident at the table with humiliating consequences, an unpleasant association of a food with illness, a comparison with something disagreeable, may cause repugnance lasting for years. Such aversions, once acquired, call for patience and tact and may never be completely overcome. . . . It is worth while to take thought as to how to keep children's attitude toward their food rational."

C. F. LANGWORTHY

RECENT PROGRESS IN PALEONTOLOGY

Invertebrates.—Owing to disturbed international conditions, the number of foreign contributions to the literature of paleontology is almost negligible. In this country the most important work on the invertebrate division of the science is contained in the two volumes on the Upper Cretaceous of Maryland, published by the geological survey of that state. It is illustrated by a handsome series of plates.

Dr. C. D. Walcott, in continuation of his studies of Cambrian geology and paleontology, has published the third of a series of papers that bears the title of "Cambrian Trilobites" (*Smithson. Misc. Coll.*, Pub. No. 2420). It is accompanied by 23 excellent plates. In the *Proceedings of the U. S. National Museum* Professor T. D. A. Cockerell has two papers on American and British fossil insects. In Bulletin 96 of the same institution Dr. R. S. Bassler and Ferdinand Canu have published a "Synopsis of American Early Tertiary Cheilostome Bryozoa." Dr. A. F. Foerste is author of an important memoir on the Upper Ordovician formations in Ontario and Quebec, published by the Canadian Geological Survey. Some new Silurian brachiopods from Maine are made known by H. S. Williams, and new Oligocene mollusks from Georgia are described by W. H. Dall, both papers contained in the *Proceedings of the U. S. National Museum.*

Fishes.—Some new anatomical features regarding the peculiar arthrodiran genus *Homosteus* are described by Dr. A. S. Woodward in the *Journal of the Torquay Natural History Society.* New investigations on British Paleozoic ganoids and lung-fishes have been conducted by Dr. D. M. S. Watson and Henry Day (*Mem. and Proc. Manchester Lit. and Phil. Soc.*, Vol. 60, pt. 1), and the latter author has also issued a note on the parasphenoid of a Palæoniscid (*Ann. Mag. Nat. Hist.*, Vol. 16, pp. 421–434).

The remarkable spirally coiled dental organs of *Helicoprion*, from the Permian of Russia, form the subject of two communications by A. Karpinsky, the original discoverer of these re-

mains. A new species, *H. clerci,* is described by him from the Artinsk beds. The reference of this genus to the Cestraciont group of sharks seems now fully warranted. Dr. A. S. Woodward (*Nature,* Vol. 98, pp. 163–164) has also discovered evidence which substantiates the view that the segmented structures known as *Edestus* form the symphysial series of the dentition belonging to *Campodus*- or *Orodus*-like sharks.

Italian science suffered an irreparable loss in the death last April of Professor Francesco Bassani, of Naples. A fine tribute to his memory, with a list of his numerous papers on fossil fishes and other subjects, has recently been published by his colleague Geremia D'Erasmo, and another by G. de Lorenzo.

Comparatively little has been added to our knowledge of fossil fishes from North America during the year. Dr. L. M. Lambe has described a few ganoids from the strata of Lower Triassic age near Banff, Alberta (*Trans. Roy. Soc. Canada,* Vol. 10), and others from the Coal Measures of Linton, Ohio, have been investigated by L. Hussakof (*Bull. Amer. Mus. Nat. Hist.,* Vol. 35). A report upon the collection of fossil fishes contained in the U. S. National Museum has recently been published by C. R. Eastman (*Proc. U. S. Nat. Mus.,* Vol. 52). It includes descriptions of a number of new species.

An indispensable reference work which brings together the titles of all publications on the subject of fishes, living and fossil, including their anatomy, physiology, embryology and systematic relationships, is the newly published Bibliography of Fishes, by Dr. Bashford Dean. The collection of the titles for the authors' volume of this work is the result of twenty-five years' unremitting labor. [C. R. E.]

Amphibians and Reptiles.—Dr. R. S. Moodie's important monograph[1] on the Coal Measures Amphibia of North America adequately summarizes and illustrates the numerous and highly varied types of the oldest well-known land-living vertebrates, which are first foreshadowed by a single footprint from the Upper Devonian of Pennsylvania. The amphibians of the Carboniferous age were mostly swamp-living forms embracing small newt-like and serpentiform types; there were also larger animals related to the Labyrinthodonts of succeeding ages.

The amphibians and reptiles of the "Red Beds" of Texas, New Mexico and elsewhere are very fully discussed in a monograph by Professor E. C. Case.[2] After describing the geography and environments of Permo-Carboniferous times the author gives an extended analysis of the fauna, in which he discusses the food supply and food habits, as well as the terrestrial and aquatic adaptations, of these animals. A majority of the forms were partly aquatic and more or less raptorial and carnivorous, but some fed upon insects, others upon mollusks, and others to some extent upon plants. The author discusses the conflict between the defensively and offensively armed types and shows that many of the amphibians and reptiles were so overspecialized that they became extinct at the end of this period. Two of the reptilian families and one type of amphibians developed excessively long spines on the back which the author believes to have been useless to these animals. He suggests that owing to the abundance of the food supply and to the perfection of the weapons of offense, the surplus vitality thus generated was used in the continued elaboration of certain structures, which were possibly useful in their inception, but finally became elements of weakness, and led to the extinction of the group. The monograph is accompanied by many restorations of these animals, by full faunal lists and by a welcome discussion of the classification.

Professor S. W. Williston also continues his investigations of American Permian vertebrates.[3] He gives first a full description of the skull of *Pantylus,* a cotylosaurian reptile which retains a very primitive skull-pattern, and secondly an invaluable and well-illustrated synopsis of the whole fauna of Permian amphibians and reptiles. These forms con-

[1] Carnegie Inst., Washington, 1916, Pub. No. 238.

[2] Carnegie Inst., Washington, 1915, Pub. No. 207.

[3] *Contr. Walker Museum,* Vol. 1, No. 9, pp. 165–236. Chicago, 1916.

tinue to yield many facts of great morphological interest. For example, the author holds that the almost universally accepted view of the origin of the sternum or breast-bone from the fusion of the distal and ventral ends of dorsal ribs in the mid-line is quite incorrect and that the conditions in the early vertebrates prove conclusively that the sternum has been derived rather through the fusion of the "ventral ribs," or gastralia, which were not cartilaginous, but dermal bones, arranged originally in many rows of small rhomboidal ossicles.

Morphological interest is also predominant in Mr. D. M. S. Watson's description[4] of the brain-case in *Eryops* and other Permian types which had an extremely low and primitive type of brain and inner ear. New Permian amphibians and reptiles of South Africa are described in a series of papers from the Transvaal Museum by Dr. Van Hoepen,[5] and from the South African Museum by Mr. S. H. Haughton.[6] The amphibians include most of the groups found also in the Permian of North America. *Myriodon* and *Rhinesuchus,* which are allied to the American *Eryops,* are represented by nearly complete skeletons.

Lieutenant R. Broom continues his description[7] of South African Triassic amphibian specimens in the British Museum. He also describes several new anomodont reptiles.

Two thecodont reptiles of South Africa are described, respectively, by Dr. Van Hoepen[8] and Mr. Haughton.[9] Of these *Sphenosuchus* is a primitive reptile remotely allied to the ancestors of the Phytosaurs, Dinosaurs and other reptiles with two temporal arches.

Several new Phytosaurs of the Trias of Texas and adjoining states are described by M. G. Mehl.[10] Of these long-snouted, gaval-like forms, *Machæroprosopus* and *Angistirhinus* are represented by very good skulls. The same author has discovered an ancestor of the South American caiman in the Oligocene of South Dakota.[11]

Among the sauropod dinosaurs, Dr. Holland[12] has briefly described a new species, *Apatosarus louisæ,* discovered in the great quarry near Jensen, Utah, from which the Carnegie Museum has recovered a very important series of dinosaur skeletons.

Mr. Barnum Brown continues his descriptions[13] of the varied dinosaur fauna of the Cretaceous of Alberta, describing several new types of duck-bill dinosaurs, one of which is ancestral to the crested dinosaur *Saurolophus.* The same author describes a remarkably well-preserved skeleton of another crested dinosaur which had a high skull crest resembling that of a cassowary. Some notes on the marine Triassic reptilian fauna of Spitzbergen are contributed by Carl Wiman in a paper recently published by the University of California.[14] [W. K. G.]

Birds.—A preliminary notice of a nearly complete skeleton of a gigantic fossil bird allied to *Diatryma* from the Lower Eocene is contributed by W. D. Matthew to the *American Museum Journal* for November of this year. It was a contemporary of the well-known four-toed horse *Eohippus* and comes from the same formation in Wyoming. It equalled the moas of New Zealand in bulk, but had a gigantic head with enormous compressed beak like the South American fossil bird *Phororhachos.* A further description of this remarkable creature, together with its probable relations to other extinct avian groups, was presented by Dr. Matthew and Mr. Granger before the December meeting of the Paleontological Society.

Dr. R. W. Shufeldt has reviewed our knowledge of the primitive Eocene genus *Gallinuloides,* and describes a new anserine form,

[4] *Bull. Amer. Mus. Nat. Hist.,* Vol. 35, pp. 611–636.

[5] *Ann. Transvaal Mus.,* Vol. 5, No. 2, pp. 125–149.

[6] *Ann. South African Mus.,* Vol. 12, p. 65.

[7] *Proc. Zool. Soc. London,* 1916, pp. 355–368.

[8] *Ann. Transvaal Mus.,* Vol. 5, No. 1, p. 83.

[9] *Ibid.,* p. 98.

[10] *Bull. Univ. Oklahoma,* Ser. 5, pp. 5 and 26; *Jour. Geol.,* Vol. 23, No. 2, Feb.-March.

[11] *Jour. Geol.,* Vol. 24, No. 1, Jan.-Feb., p. 47.

[12] *Ann. Carnegie Mus.,* Vol. 10, pp. 143–145.

[13] *Bull. Amer. Mus. Nat. Hist.,* Vol. 35, pp. 709–716. *Ibid.,* pp. 701–708.

[14] *Bull. Dept. Geol.,* Vol. 10, No. 5.

Palæochenöides, from the Miocene of South Carolina.[15] He also contributes an extensive account of fossil birds' eggs.[16] [C. R. E.]

Mammals.—Dr. W. K. Gregory[17] has continued his researches upon the evolution of the Primates. In a preliminary discussion of the theory of trituberculy, he shows that the tritubercular molar is the primitive type for Primates as for other Mammalia, and discusses the origin of this type of tooth. He then reviews critically what is known of fossil Anthropoidea and discusses their relationships to man and to the existing anthropoid apes. The shortening of the face and reduction of the front teeth in man he regards as an adaptation mainly to predaceous habits and a carnivorous diet replacing the primitive fruit-eating adaptation of his anthropoid ancestors. This is necessarily associated with the exclusive use of the hands and of weapons for attacking and dividing the prey, in contrast with the use of the teeth for those purposes among the Carnivora.

In his discussion of the phylogeny Dr. Gregory combats strongly the tendency of several recent authors to carry the divergence between the human and anthropoid stems far back into geologic time. He considers "that the Upper Miocene ancestors of the Hominidæ were at least very closely akin to the Upper Miocene common ancestors of the chimpanzee and gorilla, and that they were in fact heavy-jawed, stout-limbed, tailless and semi-erect anthropoid Catarrhinæ, with quadritubercular second and third upper molars and *Sivapithecus*-like lower molars." Nor does he regard the Neanderthal man as wholly excluded from the direct ancestry of the higher races. Dr. Gregory's paper is a notable contribution to the literature dealing with the ancestry of man.

Of high importance likewise is Stehlin's revision of the Eocene Primates of Europe,[18] now completed. The author gives an extended and well-illustrated description of the genera hitherto known, and adds a number of new forms, the most interesting of which are the Chiromyoidea, resembling the modern aye-aye (*Chiromys*) in the rodent-like front teeth, and in the author's opinion related to this group of lemurs. All of the Primates of the European Eocene are in the lemuroid stage of evolution, but their more exact affinities are regarded as very doubtful.

Dr. George F. Kunz's new book, "Ivory and the Elephant," includes a very full and interesting compilation of what is known concerning fossil proboscideans and the evolutionary history of the order, especially as to recent discoveries and opinions.

The discovery of Eocene Mammalia in Burma by Pilgrim and Cotter[19] is of great interest as affording the first direct evidence upon the early Tertiary Mammalia of Asia. The bulk of the fauna consists of primitive anthracotheres which may well be regarded as representing the ancestral group from which the ruminants are derived. This confirms the forecasts of Stehlin, Matthew and others as to the place of origin of the ruminants.

Mr. H. E. Anthony's discovery of numerous well-preserved fossil mammals in a cave in Porto Rico[20] is of remarkable interest. The fauna thus far found consists of a small ground-sloth related to one of the smaller Cuban genera, two or more new genera of rodents rather distantly related to the South American hystricomorphs, and an insectivore of a wholly new family, very remotely related to the continental forms, and lizards not yet studied. This evidence when carefully weighed will have an important bearing on the geographic relations of Porto Rico to other West Indian islands and to the mainland. As far as appears at present, it indicates a prolonged isolation and the ultimate derivation of the fauna rather from Central America by way

[15] *Geol. Mag.*, Vol. 3, August, pp. 343–347.

[16] *The Emu,* Vol. 16, pp. 80–91.

[17] *Bull. Amer. Mus. Nat. Hist.*, Vol. 35, pp. 239–355.

[18] *Abh. Schweiz. Palæont. Gesell.*, 1916, Vol. 41, pp. 1299–1552, 2 pls. and 82 text figs.

[19] *Records Geol. Surv. India,* Vol. 47, pp. 42–77, 6 pls.

[20] *Annals N. Y. Acad. Sci.,* Vol. 27, pp. 193–203, 7 pls. See also Allen, J. A., *ibid.*, pp. 17–22, 4 pls. Later descriptions covering more extensive material in press at time of writing.

of Cuba than from South America by way of the Lesser Antilles; certainly not from North America. But it seems doubtful whether any former continental connection is indicated, the mammalian fauna, like that of Cuba, etc., being limited to a few groups which can be accounted for in other ways.

Mr. E. L. Troxell[21] describes the skeleton of a Pliocene horse which is in many respects intermediate between the three-toed horses of the Miocene and the true *Equus* of the Pleistocene. It is referred to the genus *Pliohippus*, but is much more complete and more truly intermediate in character than the type species described many years ago by Marsh. A second and more complete skeleton has recently been discovered in western Nebraska; both are in the American Museum in New York. [W. D. M.]

C. R. EASTMAN,
W. K. GREGORY,
W. D. MATTHEW

SPECIAL ARTICLES

THE REFLECTION OF γ-RAYS BY CRYSTALS[1]

RUTHERFORD and Andrade[2] have shown that when γ-rays fall on the faces of crystals at certain angles regular reflection takes place as in the experiments of Bragg[3] with X-rays. This should show itself by an increase of absorption of the γ-rays, and in the experiments to be described evidence has been obtained of this character.

A fine pencil of γ-rays passed through a vessel containing a crystalline substance into an ionization chamber where the ionization was measured. The crystalline structure of the absorber was then destroyed either by powdering, melting or by dissolving in water, and any change in the ionization current was measured by a balance method. The change in the ionization gives a measure of the radiation which is reflected from the crystals at such an angle with the direction of the beam as not to enter the ionization chamber. The experimental arrangement is shown in Fig. 1.

The small thin glass crystallizing dish *D*, containing the crystals under investigation was placed over a hole in the lead block *L* so as to rest either directly on the lead block or on an adjustable iron-gauze shelf above it. The γ-rays from the source *S* passed through the crystals and hole, which was 1.2 cm. in diameter, and through a very thin sheet of aluminum foil into the ionization chamber *A*. The balance chamber *B* also received γ-rays from the source through a thick adjustable lead slit *R*. Electrodes passing into *A* and *B* through earthed guard rings were connected to a Wilson-Kaye electroscope *E*. The chambers *A* and *B* were hollow brass cylinders 15 cm. long and 8 cm. in diameter. They were insulated and connected to −200 volts and +200 volts, respectively. By means of the key *K* the gold leaf could be earthed or joined to a divided megohm in series with a storage battery for the purpose of measuring the sensibility of the leaf. The leads to the electroscope from the chambers *A* and *B* were completely shielded by brass tubing and lead foil earth connected, so that electrostatic effects were eliminated. The balance chamber *B* was surrounded by a lead sheet 3 mm. thick to prevent any soft scattered radiation from entering it, and all connections to the electroscope were shielded as much as possible from direct radiation by thick blocks of lead. The lead block *L* was 7.5 cm. thick, and for the position of the source used in most of the experiments about twenty-five times as much ionization was produced by the rays passing through the hole as through the rest of the block.

Owing to their short wave-lengths the angles of reflection for γ-rays are probably small. It is, therefore, necessary to use a small cone of

[21] *Amer. Jour. Sci.*, Vol. 42, pp. 335–348, 7 text figs.

[1] This article was written in April, 1914, and describes some experiments performed in Professor Sir Ernest Rutherford's laboratory at the University of Manchester. At that time Rutherford and Andrade were working on the same problem by the more direct method. While the results recorded in this paper have apparently little quantitative value, the general method of attack may be of sufficient interest to justify their publication.

[2] Rutherford and Andrade, *Phil. Mag.*, May, 1914, p. 854.

[3] Bragg, *Phil. Mag.*, May, 1914, p. 881.