with the results and methods of the pioneer work in *ballon sonde* meteorology, carried out by Professor Rotch in the United States with the financial cooperation of the Louisiana Purchase Exposition, and, later, of the Smithsonian Institution. Most men of science in this country probably already have a general idea of the importance of this investigation, and those who are able to keep up with meteorological literature know how widely this work has been discussed, and with what a warm welcome the results have been received abroad. If we mistake not, SCIENCE has contained several notices of this work. Mr. S. P. Fergusson contributes the first portion of the volume, on the "Apparatus and Methods," in which a brief account is given of the historical development of this kind of investigation. (It may be recalled that on March 21, 1893, MM. Hermite and Bésancon first employed a special instrument, recording time, pressure and temperature, which was sent up with a *ballon-sonde* in Europe.) "The Method of Reducing the Data" is discussed by Mr. H. H. Clayton. Then come a series of tables in which the records are given *in extenso*. "A Discussion of the Temperature and Wind," also by Mr. Clayton, follows. Particular interest attaches to the vertical temperature gradients, a subject which has been much discussed of late years, and which has important theoretical bearings. It appears that for all seasons the rate of decrease of temperature with increase of altitude above 2 km. increases up to about 8 km., then diminishes, and that there is an inversion in the gradient above 13–14 km., the well-known "isothermal stratum," whose existence was first established in Europe. Mr. Clayton contributes an interesting fact to the discussion concerning the cause of this isothermal layer. He suspects that a diminution in the northerly currents is characteristic of the region above 10 km., and that this may in part explain the phenomenon. The most frequent gradients in the lower air (0–1 km.) are the adiabatic gradients of dry air (0.9°–1.1° C.) and of saturated air (0.5°–0.6° C.). Inversions of temperature also show a maximum frequency in the lower stratum. Between 1,000 and 7,000 meters the prevailing gradients are the adiabatic gradients of saturated air. The adiabatic gradients for dry air diminish rapidly from the ground up to 2 km., and are rarely observed between 2 and 4 km. Above 4 km. they increase in frequency and reach a decided maximum between 8 and 9 km.; then decrease again in frequency to almost zero between 11 and 15 km. The upper parts of the two zones of maximum frequency of the adiabatic gradients of dry air are regions of maximum cloud frequency, the one zone being characterized by a prevalence of cumulus clouds, and the other by a prevalence of cirrus clouds. Cold waves, the author believes, are inclined strata of descending air, felt first at the earth's surface, and successively later at greater altitudes. The following statement is of special interest (pp. 81–82):

> At each successive rise of 2 km., the position of the area of cold in the anticyclone, and the position of the area of warmth in the cyclone, shifts northward in a semicircular course around the centers of the anticyclones and cyclones, until at 10 km. the area of cold is in the northern portion of the anticyclone, and the area of warmth is in the northeastern portion of the cyclone.

Our notice is already unduly long. We can but mention a final paper, by Mr. Clayton, on "The Distribution of the Meteorological Elements around Cyclones and Anticyclones up to 3 Kilometers at Blue Hill," an important contribution to a discussion to which our author has already devoted much time during recent years.

It is a pleasure to call the attention of the readers of SCIENCE to these valuable memoirs. Although the interest in meteorology is not as active or as widespread in this country as it should be, we feel sure that we are expressing the sentiments of a large number of our fellow-workers in science when we congratulate Professor Rotch, and his colleagues, most heartily, on their latest achievements in the field of meteorological research.

R. DEC. WARD

Bulletin of the American Museum of Natural History. Twenty-fourth Volume.

This large volume is only slightly less

formidable than its predecessor, and maintains the standard of excellence, the expression of *authority,* and the high typographical precision which has always distinguished this annual contribution to zoological literature. There are thirty-four separate articles—covering 647 pages, with thirty-three plates, one hundred and fifty-three text figures, which describe and illustrate two families, fifteen genera and subgenera, and two hundred and eleven species and subspecies "first described or renamed in this volume."

The initial impression made by an examination of the *Bulletin* is that of a voluminous contribution to systematology, in harmony with the first impulses that originated the work. Generalized articles are this year almost completely absent, and the rigorous, more technical requirements of science are only in a few places forgotten, as in some animated verbal excursions by Professor Wheeler, and the admirable historical review of the "North Atlantic Right Whale and its Near Allies," by Dr. Allen.

Mammalogy furnishes nine articles, ornithology two, entomology fourteen, vertebrate paleontology seven, invertebrate paleontology one, botany one. A serial notice of the articles as they succeed each other, with the most moderate epitomization of their contents, or, a reference to them by titles solely, will acquaint all interested with their nature and bearings.

In article I. Dr. J. A. Allen offers a "List of the Genera and Subgenera of North American Birds" according to article 30 of the International Code of Zoological Nomenclature. The subject is one identified with the author's name whose work in codification is historic. The work is confessedly intricate, and an inspection of the paper shows a master's hand. Dr. Allen remarks:

> Our present fabric of nomenclatural rules has been of slow growth. Without going into detail, it may be noted that prior to 1842 there was no official code of nomenclature; each author was his own arbiter, not only as to the sources from which names might be taken and to whom they should be accredited, but in respect to the sense in which they should be employed.

There seems to be an argumentative intention in the paper, and it might not inconsiderately be classed as a polemic on the topic of "*Elimination* Versus the *First Species* Rule." A short but very interesting paper by Professor Whitfield on "Carboniferous Fossils and Semifossils from the Arctic" follows. The most important conclusions are the eminent expression of an American Coal Measure fauna in the north, and the determination of a new inarticulate brachiopod, *Arctitreta.* Professor T. D. A. Cockerell contributes two articles on the insect fossil fauna and fossil flora of Florissant, Colorado. A copy of the rare Pennant's "Indian Zoology" has recently been exhumed in the library of the American Museum, and furnishes a topic for Dr. Allen in article V. He remarks of it, that:

> Like the copy in the British Museum, described by Newton, it lacks the original wrapper, and has no title page, and in all probability never had any, it being the first fasciculus of a work of which no more was published.

The plates are uncolored. Articles VI., VII., VIII., IX. and X. embrace characteristically elaborated descriptions of the ants of Porto Rico, the Virgin Islands (Culebra Vieques), of Jamaica, of Moorea, Society Islands, and of the Azores, the latter based on very insufficient and vestigial material.

Roy C. Andrews, a new author on the pages of the *Bulletin,* gives some new measurements of the North Atlantic right whale secured from the stranded Amagansett, L. I., specimen, which "exceeded in size the largest hitherto recorded." "A Four-horned Pelycosaurian from the Permian of Texas" is described in article XI. by Dr. Matthew, which is significantly called *Tetraceratops,* a new genus, whose "most noticeable feature is the presence of *two pairs* of prominent bony bosses or 'horns,' one rising from the premaxillaries, the other from the prefrontals."

This paper is succeeded by an important diagnosis of a new family of armored dinosaurs—the Ankylosauridæ—by Barnum Brown, the striking features of which are the "sculptured, plated skull; large flat or low-ridged body plates, some of which are united

as a shield; short spined vertebræ with parapophyses never rising above the centra; posterior ribs coossified to vertebræ."

In article XIII. Roy E. Andrews describes a new species of cetacean, *Mesoplodon bowdoini*. Article XIV. contains "Notes on Two Porpoises from the Pacific," by John Treadwell Nichols. "A Revision of the American Eocene Horses (*Hyracotheres*)," by Walter Granger is a very valuable study conducted along morphological lines with much care. In speaking of distribution the author says:

> The horizon of their greatest abundance is the Wasatch, especially the Wasatch of the Big Horn Basin, where they predominate over all other forms, with the possible exception of *Systemidon*, a very closely related genus.

He remarks that "One of the progressive characters of the Eocene Horses is the gradual *molarization* of the second, third and fourth premolars in both the upper and lower jaws," and the concluding section of his paper deals with "Premolar Development." This article precedes a paper by President Osborn on "New Fossil Mammals from the Fayûm Oligocene of Egypt," wherein some anomalous characters indicative of new family relations are recorded. The paper is preliminary, and reports that the expedition into the Fayûm region of northern Egypt in the winter of 1906–7 obtained a collection of about 550 specimens, "including more or less complete remains of most of the fossil forms so far known to be characteristic of this region."

A comprehensive paper, dealing with the history, the relationships and nomenclature, the geographical distribution and external and osteological characters of the "North Atlantic Right Whale and its near Allies," by Dr. Allen, arrests both eye and attention in the middle of this big *Bulletin*. The article possesses a notable strength, and seems to be a compressed result of laborious and extended previous study. It is excellent reading, and reveals the solid emphasis of authority. It comprises about fifty pages, with six contributory plates.

The ornithologist W. De Witt Miller reviews the beautiful manakins (genus *Chiroxiphia*) in article XIX. The genus "is a small group difficult to define by structural characters alone, on account of the great variations in external form among the several species, but well characterized by the coloration of the adult males, all of which have a blue black and a red or yellow crest." Mr. Miller has prepared a most instructive map of the geographic range of the genus which is new, and original for the birds discussed.

Embracing articles XX. and XXI., and covering 139 pages Professor W. M. Wheeler elucidates the taxonomy and the economy of the Honey Ants, and describes the ants of Texas, New Mexico and Arizona. It is difficult at this point to specialize. The subject is engrossing and the author brings to the discussion an extraordinary wealth of experience, observation and reading. Comment is naturally impossible except by myrmecologists, but the most inexpert eye can not fail to linger over many paragraphs descriptive of the positively amazing economies of these insects, especially such differentiated abnormalities as the "nepletes," individuals who become "living repositories for the surplus honey of the colony, which in time of need answers the purpose of the full honey-combs of the bee."

Article XXII. describes the Peary caribou, differing from its nearest allies *R. groenlandicus* and *R. arcticus* "in being much smaller, taking the skull as a basis of comparison, the females of *groenlandicus* and *arcticus* being as large as the *males* of *pearyi*." The paper is by Dr. Allen.

Dr. Allen also furnishes article XXIII., which discusses the rare *Solenodon paradoxus* Brandt from San Domingo. These notes are based upon specimens collected by A. Wyatt Verrill, and the collector's remarks "based on actual observation of the animal in life," are probably the most trustworthy description of its habits known.

Mr. Verrill says:

> In its habits the *Solenodon* resembles a hog, rooting in the earth and cultivated ground, tearing rotten logs and trees to pieces with its powerful front claws, and feeding on ants, grubs, insects, vegetables, reptiles and fruit, and at times

proving destructive to poultry. On several occasions it has been known to enter the houses in search of roaches and other vermin, and has been captured in rat-traps.

It is strictly nocturnal, and spends the day in caves, holes in the coral limestone rocks and in hollow trees and logs. It is a slow, stupid creature. It is unable to run rapidly, but shambles along with the zigzag, sidewise motions of a plantigrade. It is, doubtless, owing to this that it obtained the native name of "Orso" (bear).

Article XXIV. by S. A. Rohwer is on "A Fossil Larrid Wasp"; the same author contributes article XXV., a discussion of the fossil saw-flies (Tenthredinoidea) of the Florissant Shales. Article XXVI. comprises notes on the skull of *Lysorophus tricarinatus* Cope, by E. C. Case, of which the author remarks, that

Were it not for the extreme specialization of this limbless Gymniophiona-like form it would *occupy almost exactly the transitional position between the amphibians and reptiles.*

Article XXVII., by Dr. Matthew, particularly describes the osteology of *Blastomeryx,* and discusses the phylogeny of the American Cervidæ, in which the writer asserts that

Blastomeryx proves to be a very primitive deer, approximately ancestral to the American Cervidæ, and derivable in its turn from the Oligocene genus *Leptomeryx,* whose relationship to the Cervid phylum had not been suspected. We are thus enabled to trace the ancestry of the American Cervidæ back to the Oligocene, by successive stages known from the entire skeleton, and not merely from the inadequate evidence of teeth and jaws.

Article XXVIII. is by Filippo Silvestri, on the Myriopoda from Porto Rico and Culebra; article XXIX. consists of "Mammalogical Notes," by Dr. Allen; article XXX. is a further contribution by S. A. Rohwer on the saw-flies from Florissant, Colorado.

President Osborn contributes article XXXII. on "New or Little Known Titanotheres from the Eocene and Oligocene." Professor Wheeler discusses the "Ants of Casco Bay, Maine," in a very attractive paper, filled with descriptions of predatory expeditions, slave-making hunts and colonial devices and aspirations, which are picturesque enough in themselves, and are treated with very circumstantial seriousness. Professor Wheeler in this paper engages again in an extended debate on the origin of slavery (*dulosis*), and social parasitism in ants, wherein we are told that Wasmann has repeated Professor Wheeler's experiments on the formation of colonies, has corroborated them, and that "an outstanding difference in interpretation" only now remains between these distinguished naturalists.

The volume concludes with a paper by Dr. Allen, on "Mammals from Nicaragua."

L. P. GRATACAP

SPECIAL ARTICLES

RADIUM IN SPIRAL NEBULÆ AND IN STAR CLUSTERS

IN consequence of a prolonged study of the relation to celestial spectra of the spectrum of radium emanation as published by Sir William Ramsay and Professor J. Norman Collie,[1] I announced on January 19, 1905, the principle of "critical radioactivity" or the transformation of the chemical elements at critical pressures and temperatures in the stars. This explosive transformation of the elements at critical physical states, occurring in the heavenly bodies, I have named "radioaction," in order to distinguish it from ordinary radioactivity.

Radioaction, hypothesis *a,* was announced as a tested theory in the face of Rutherford's statement:

The transformation of matter occurring in the radio-elements is, on the other hand, spontaneous, and independent of temperature over the range examined.[2]

It was also in challenge of the natural inference to be drawn from the statement of Runge and Precht, made at the close of their account of the measurement of the lines of the radium spectrum:

Concerning all strong radium lines, it may be affirmed with certainty that, according to our measurements, they are not found among the measured solar lines of Rowland.[3]

Changes in pressure and temperature are, on all sides, said to produce no marked changes

[1] *Proc. Roy. Soc.,* 73, p. 470, May, 1904.
[2] "Radioactivity," first edition, p. 350.
[3] *Ann. der Phys.,* 317, 412, June, 1903.