SCIENCE

FRIDAY, APRIL 27, 1900.

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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor, J. McKeen Cattell, Garrison-on-Hudson, N. Y.

*LIQUID HYDROGEN.**

FROM the year 1878, when the experiments of Cailletet and Pictet were attracting the attention of the scientific world, it became a common habit in textbooks to speak of all the permanent gases, without any qualification, as having been liquefied, whereas these experimentalists, by the production of an instantaneous mist in a glass tube of small bore, or a transitory liquid jet in a gas expanding under high compression into air, had only adduced evidence that sooner or later the static liquid form of all the known gases would be attained. Neither Pictet nor Cailletet in their experiments ever succeeded in collecting any of the permanent gases in that liquid form for scientific examination. Yet we meet continually in scientific literature with expressions which lead one to believe that they did. For instance, the following extract from the 'Proceedings' of the Royal Society, 1878, illustrates this point very well: "This award (Davy Medal) is made to these distinguished men (Cailletet and Pictet) for having independently and contemporaneously liquefied the whole of the gases hitherto called permanent." Many other quotations of the same kind may be made. As a matter of fact six years elapsed, during which active investigation in this department was being prose-

* Lecture before the Royal Institution of Great Britain.

the posterior cornua of the cord. On p. 94 we find the statement that the fibers of olfactory and optic nerves are specialized for recognition of odors and light. Is not this rather a matter of nerve termination? In treating of the ear we find the statement that "in the vestibular sac and attached to the hair-like nerve terminals there are several little sand-like grains of carbonate of lime (otoliths)" and here and elsewhere the author seems to regard the sensory hairs as the terminations of nerves. On p. 218 it is stated that animals lower than hexapods are not known to make sounds intended to be heard. What shall be said of the stridulation of spiders and crabs? On p. 399 the aëration of the crustacean gill is in part attributed to ciliary action regardless of the fact that cilia are unknown in arthropods. The scaphognathite of the decapods is ignored. P. 342, the function of the echinid pedicellariæ is stated to be to convey food to the mouth. In the account of the evolution of the ruminant stomach (p. 317) the author is again at fault, for this complicated structure is not derived by simple division of a stomach like that of man, but by the incorporation of a part of the œsophagus into the organ. Again (p. 435), renal organs are stated to occur only in vertebrates, molluscs and arthropods. Where is the nephridial system of the worms, and have not the contractile vacuoles of the ciliates been shown to void sodium urate? P. 404, the respiration of the star-fish is said to be produced by drawing water into the perivisceral cavity through a multitude of pores but the branchiæ are ignored; while *Echinus* is stated to have tufted external gills around the mouth. The worst feature, physiologically, of the book is the recognition of a vital force.

On the morphological side the errors are far more numerous and we can only call attention to a few. Thus (p. 7) 'all animals must have a stomach"; how about tapeworms? P. 85, 'It is difficult, indeed impossible, to conceive how the vertebrate nervous system could have been evolved out of that of the articulates." Cannot exact homologies be shown between the two? Cannot we compare the distribution of white and gray matter and the origin of the ganglionated roots in both? On p. 91 a pedal ganglion is denied to the oyster. On p. 165 the optic ganglion is stated to act as a retina in the arthropod eye. On p. 172 the vertebrate lens is stated to be comparable to the invertebrate eye. Amphibians are stated (p. 184) to lack a middle ear; this is not true of Anura. On p. 186 the mosquito is credited with two pairs of antennæ. On p. 247 it is stated that we cannot trace homologies except within the primary branches —vertebrates, articulates, molluscs and radiates. What has become of Huxley's comparisons of ectoderm and entoderm of coelenterates and mammals, to say nothing about such homologies as can be drawn between nervous system, nephridia, cœlom and the like? Here and there we meet with statements regarding a radiate type of structure and a recognition of close affinities between coelenterates and echinoderms.

Again, the vertebral theory of the skull is maintained in several places, although it is stated that there is 'some doubt' if it be strictly true. Then there is no recognition of the fact that ribs are not homologous throughout the vertebrates. At various places it is stated that serial homology (metamerism) is mostly limited to the skeleton and the nervous system and is denied to the organs of vegetative life. There is no recognition of the fact that metamerism is mesodermal in origin; and none of metamerism in nephridia, blood vessels, gonads, etc. In the final section we meet this astounding statement (p. 481): "On the east coast of the United States we have two abrupt changes of coast fauna, one at Cape Cod and the other at Cape Hatteras. Scarcely a single species passes from north to south of these points, or *vice versa*."

The foregoing errors have been selected to emphasize the charge of inaccuracy, but a more serious fault is the lack of a broader grasp of the results of recent morphological and physiological research. This is not easy to illustrate, but is very apparent on reading the pages.

J. S. Kingsley.
Tufts College.

BOOKS RECEIVED.

The Norwegian North Polar Expedition, 1893–1896 Scientific Results, Edited by Fridtjof Nansen. New York, London and Bombay. Longmans, Green & Co., 1900. Vol. I. Pp. viii+141, 44 plates. $15.00.

The Unknown. CAMILLE FLAMMARION. New York and London, Harper & Brothers, 1900. Pp. xii + 488. $2.00.

Brief Guide to the Commoner Butterflies of the Northern United States and Canada. SAMUEL HUBBARD SCUDDER. New York, Henry Holt & Co., 1899. Pp. xi+210.

Commercial Organic Analysis. ALFRED H. ALLEN. P. Blakiston's Son & Co., 1900. Vol. II., Part II. Pp. viii+330.

Inorganic Evolution as studied by Spectrum Analysis. New York and London, The Macmillan Co., 1900. Pp. x+191. $1.75.

SCIENTIFIC JOURNALS AND ARTICLES.

THE March number of the *Bulletin of the American Mathematical Society* contains the following articles: 'Mathematical instruction in France,' by Professor James Pierpont; a review, by Professor E. W. Brown, of Poincaré's Cinématique et Mécanismes, Potential et Mécanique des Fluides; 'Shorter Notices'; 'Notes'; and 'New Publications. The April number of the *Bulletin* contains a report of the February meeting of the Society, by the Secretary; 'Some theorems concerning linear differential equations of the second order,' by Professor Maxime Bôcher; 'Note on the enumeration of the roots of the hypergeometric series between zero and one,' by Dr. M. B. Porter; 'The summer meeting of the Deutsche Mathematiker-Vereinigung, at Munich, September, 1899,' by Professor James Pierpont; reviews of Hilbert's Grundlagen der Geometrie, by Dr. J. Sommer, and of König's Leçons de Cinématique, by Professor E. O. Lovett; 'Notes'; and 'New Publications.'

THE *Journal of the Boston Society of Medical Sciences* for March 20th, is largely devoted to abstracts of the papers read at the first meeting of the Society of American Bacteriologists, held at New Haven, Dec. 27–30, 1899. Several of these dealt with the question of purification of sewage and contamination of water supply. Charles S. Minot has a paper 'On the Solid Stage of the Large Intestine in the Chick, with a Note on the Ganglion Coli.' W. T. Councilman discusses 'The Lobule of the Lung and its Relation to the Lymphatics,' and Thomas Dwight notes a case of 'Absence of the Inferior Vena Cava below the Diaphragm.'

SOCIETIES AND ACADEMIES.

THE NATIONAL ACADEMY OF SCIENCES.

THE annual stated session of the National Academy of Sciences was held in Washington, April 17–19, 1900, with Dr. Wolcott Gibbs in the chair, and the following members in attendance: Messrs. Abbe, Agassiz, Allen, Barus, Beecher, Bell, Billings, Boss, Brewer, Brooks, Brush, Chandler (S. C.), Chittenden, Comstock (G. B.), Dall, Dana, Dutton, Elkin, Emmons, Farlow, Gibbs (W.), Gilbert, Gill, Hague, Hall, Hill (G.W.), Langley, Mitchell (S. W.), Morse, Powell, Putnam, Remsen, Rowland, Schott, Smith (E. F.), Walcott, Welch, White and Wilson.

The resignation of Dr. Wolcott Gibbs as President of the Academy was reluctantly accepted to take effect at the close of the session. His successor will be elected at the next April sess sion.

Six additional members of the Council were chosen for the ensuing year, as follows: Messrs. J. S. Billings, H. P. Bowditch, G. J. Brush, Wolcott Gibbs, Arnold Hague, Simon Newcomb.

The following gentlemen were elected members of the Academy: James E. Keeler, Director of the Lick Observatory, Mt. Hamilton, Cal.; Henry F. Osborn, of Columbia University, New York City; Samuel L. Penfield, of Yale University, New Haven, Conn.; Franz Boas, of Columbia University, New York City.

The Academy adopted a report from the Trustees of the Barnard Medal recommending that the medal be awarded to Wilhelm Conrad Röntgen for his discovery of the X-rays. This medal is awarded at the close of every quinquennial period to such person as shall, within the five years next preceding, have made such discovery in physical or astronomical science, or made such novel application of science to purposes beneficial to the human race, as, in the judgment of the National Academy of Sciences of the United States, shall be esteemed most worthy of such honor.

Mr. Agassiz offered to give to the Academy