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~~VOL. II.~~

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PREFACE.

IN presenting to the public the fourth volume of the series of the "Annual Record of Science and Industry," some remarks may be fitly introduced in explanation of the aim and scope of the work.

In each of the successive numbers already published new features have been introduced, suggested by experience as well as by the advice of the scientific collaborators and friends of the editor. These are exemplified in part by the increasing number of communications and criticisms on progress in the various branches of science, and by the greater extent of the historical résumés given under the caption of "General Summary of Progress." These have increased in the successive years from 16 pages for 1871, to 50 pages for 1872, and 114 pages for 1873. At the same time, the volumes have successively increased in the number of pages from 634 in 1871, to 651 in 1872, and 714 in 1873.

The editor has been pleased to notice that his endeavors thus to increase the value of the work have been on the whole cordially appreciated by the public at large. With much of praise, however, sundry friendly suggestions for modifications and improvements have been made which merit attention. It has been urged, on the one hand, that some discoveries and memoirs deserving of attention have not been referred to; on the other, that the preliminary Summaries of Progress would be sufficient alone, without any paragraphs recording individual discoveries. It would of course be impossible to satisfy such discrepant opinions, and in this dilemma the only resource left to the editor has been to follow a mean which he hopes will be regarded by most as a tolerably happy one. It must be remembered

that far more than ten times the space contained in the present volume would be necessary to give even an approximately complete abstract of the progress of science in each of the departments embraced within the scope of this work; much more than that amount will in fact be employed in the annual reports that are hereafter to be made and published on the progress of the several departments of science for the past year. These reports, however—unlike the present volume—will not appear till at least one and in some cases two or three years have elapsed from the year in question. These too are, to a certain extent, addressed rather to experts and special students in the various branches of science than to the general reader, for whom the "Annual Record" is more especially designed. In them the several branches embraced herein are respectively reported upon in volumes varying from little less than five hundred pages to nearly two thousand each year. Each special department of science has now its own organ for the record of discoveries within its domain. All these are extremely useful to the investigator, and enable him to economize precious time that would otherwise be spent in frequent references to numerous volumes, some of which are almost or quite inaccessible to all save a favored few. Several are also very elaborate, and the special subdivisions within a single branch are reported upon by experts in the respective subdivisions. Excellent examples of such reports are found in the *Jahresberichte* and *Jahrbücher*, published in Germany, on the mathematical,¹ physical,² and chemical³ sciences, the titles of some of which are

¹ *Jahrbuch über die Fortschritte der Mathematik im Verein mit anderen Mathematikern herausgegeben von Carl Ohrtmann, Felix Müller, und Albert Wangerin.* Berlin: Druck und Verlag von Georg Reimer. . . . [8vo].

² *Die Fortschritte der Physik im Jahre . . . Dargestellt von der Physikalischen Gesellschaft zu Berlin. . . . Jahrgang.* Redigirt von Dr. B. Schwalbe. Berlin: Druck und Verlag von Georg Reimer. . . . [8vo].

³ *Jahresbericht über die Fortschritte der reinen, pharmaceutischen und technischen Chemie, Physik, Mineralogie und Geologie. Bericht über die Fortschritte der Chemie und verwandter Theile anderer Wissenschaften.* Für . . . Giessen. J. Neumann'sche Buchhandlung. . . . [8vo].

With a second title-page, viz.: *Jahresbericht über die Fortschritte der*

given in the foot-notes. Some branches have even two or more annual works devoted to the record of progress in their several spheres; such are especially Zoology,⁴ on which one report is published in Germany and another in England; Botany,⁵ which has one in Holland and another in Germany; while for Anatomy⁶ there are two in Germany alone. To reports like these must the student refer who desires to obtain information respecting the more technical or special facts or generalizations that have been announced. The present volume can administer to their needs only to a slight extent. The editor simply hopes and believes that by the relations which he has established with a number of the most eminent cultivators of the different departments of science in this country, and through their co-operation, he has been enabled to present as complete and reliable a résumé of discovery as can reasonably be expected within

Chemie und verwandter Theile anderer Wissenschaften. Unter Mitwirkung von A. Laubenheimer, Al. Naumann, F. Nies, F. Rose herausgegeben von Adolph Strecker. Für . . . Giessen. J. Neumann'sche Buchhandlung. . . . Jahresbericht über die Leistungen der chemischen Technologie für das Jahr 1873. Herausgegeben von Rudolf Wagner. Leipzig, O. Wigand. 1874 [8vo].

⁴ *Archiv für Naturgeschichte.* Gegründet von A. F. A. Wiegmann, fortgesetzt von W. F. Erichson. In Verbindung mit Prof. Dr. Leuckart in Leipzig herausgegeben von Dr. F. H. Troschel, Professor an der Friedrich-Wilhelms-Universität zu Bonn. . . . Jahrgang. Zweiter Band. Berlin, Nicolaische Verlags Buchhandlung. . . . [8vo].

Zoological (The) Record for 1872, being volume ninth of the *Record of Zoological Literature*. Edited by Alfred Newton, M.A., F.R.S. London: John Van Voorst. 1874 [8vo].

⁵ *Repertorium annum literaturæ botanicæ periodicæ curavit J. A. van Bemmelen.* Tom. I. 1872. Harlemi.

Botanischer Jahresbericht. Systematisch geordnetes Repertorium der botanischen Literatur aller Länder. Herausgegeben von Dr. Leopold Just, Professor am Polytechnikum in Carlsruhe. Erster Jahrgang. Band I. Berlin. 1874 [8vo].

⁶ *Bericht über die Fortschritte der Anatomie und Physiologie im Jahre . . .* Herausgegeben von J. Henle, G. Meissner, und H. Grenacher. Leipzig, C. F. Winter. . . . [8vo].

Jahresbericht über die Leistungen und Fortschritte in der Anatomie und Physiologie. Unter Mitwirkung zahlreicher Gelehrten herausgegeben von Rudolf Virchow und Aug. Hirsch. Unter Special-Redaktion von Professors D. D. E. Guitt und A. Hirsch. Berlin: Hirschwald. [8vo].

the limited space to which an annual like the present must be restricted.*

As now presented, the "Record" has two distinctive parts: (1) the historical summaries of progress during the past year; and (2) the paragraphs communicating in brief the results of investigations by special scientists or respecting certain subjects. The advantages of the paragraph method, so generally in vogue in analogous publications in the English and other languages, are combined with the more consecutive and eliminating characteristics of the historical; the latter is a much more prominent feature in the present volume than in any of its predecessors, and special attention will be devoted to it in future.

A list of some of the more prominent publications on scientific subjects which have appeared during the past year is added in this volume for the first time; the determination to introduce it was, however, carried into execution too late to render it as complete or critical as could be desired. The labor attendant on the preparation of such a list is very inadequately represented by its length, and the co-operation of the book fraternity is necessary for its thoroughness. It is proposed to make the Bibliography of succeeding volumes an instructive guide for the selection of works, and the views of the collaborators of the editor will be accordingly invoked for the appreciation of their merits.

SPENCER F. BAIRD.

SMITHSONIAN INSTITUTION, WASHINGTON, *February 10, 1875.*

* Among those who have taken part in the preparation of the historical summaries, or of abstracts of articles belonging to their respective specialties, or who have supplied early reports of their own original researches, may be mentioned: Professors Simon Newcomb, Cleveland Abbe, Edward S. Holden, Theodore Gill, and O. T. Mason, of Washington; Professors G. F. Barker, E. D. Cope, and Dr. William Wahl, of Philadelphia; Professor C. F. Himes, of Carlisle, Pa.; Dr. Charles Rau, of New York; Professor A. M. Mayer, of Hoboken; Professor A. E. Verrill and Dr. E. S. Dana, of New Haven; Professor W. O. Atwater, of Middletown, Conn.; Dr. T. Sterry Hunt, of Boston; Dr. A. S. Packard, Jr., of Salem; Dr. W. G. Farlow and Mr. Sereno Watson, of Cambridge; Professor Hamilton L. Smith, of Geneva, N. Y.; Professor F. W. Clarke, of Cincinnati; Mr. A. W. Bennett, of London, and other gentlemen who prefer to remain unnamed for the present.

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* In the arrangement of articles in the body of the *Record*, it was found impracticable to place them in proper systematic sequence, especially as many belonged as much to one division as to another, sometimes even to three or four equally. The present systematic Table is intended to remedy the difficulty, by bringing together in proper order all the titles of articles, and, by a system of cross references and duplications, to point out all matter relating to any one subject, whatever be its situation in the volume. The references in Roman letters preceding the page references of the headings relate to the pages of the introductory "Summary."

which the ichneumon is held by the ancient Egyptians.—13 A, May 16, 1874, 545.

ORIGIN AND FORMATION OF DOUBLE MONSTERS.

An elaborate paper by Dareste upon the origin and mode of formation of double monsters discusses the subject in all its details. He comes to the conclusion that these, among the vertebrate animals, always result from the union, or more or less complete confusion, of two embryos produced upon a single cicatricule.—*Dalliers' Archives*, 1874, I, 118.

HEIGHT OF THE HUMAN SPECIES.

M. Silberman shows that the average height of the male and female population of France, taken in a certain position which he names the "geometric," is 1.600040 meters, or two meters if, in the same position, the hands are comfortably extended over the head. Two individuals laid lengthwise, with fingers touching, will thus measure four meters; and this he terms the base of the harmonic proportions of the human race. Thus this harmonic base is four times one meter, just as the meridian is four times ten million meters, and the relation of the two integers is as 1 to 10,000,000. From these considerations he draws proof of the equality of the sexes, as they exhibit woman, not as a complement to the male portion of the race, but as constituting normally, and by right, half of the human family. M. Silberman arrives at the conclusion, as the result of his various investigations and studies, that the average height of the human race has remained unchanged since the Chaldean epoch, 4000 years ago.

THE THEORY OF ERRORS OF OBSERVATION.

Mr. C. S. Peirce, in an interesting article on the laws of errors of observation, and the nature of the so-called personal equation, gives the results of some experiments made upon an entirely untrained observer, a young man about eighteen years of age, who had had no previous experience whatever in observations. He was required to answer a signal consisting of a sharp sound like a rap, his answer being made by tapping upon a telegraph operator's key nicely adjusted. Both the original rap and the observer's tap were recorded by means of a delicate chromoscope, and five hundred ob-

servations were made on every week-day during a month. It was found that on the first day the observations were scattered through a very large range of error, the difference in time between the records of the event and of the observation varying in fact between the extreme values from 0.16 to 0.98 of a second. The personal equation proper on the second day was between 0.2 and 0.3 of a second, and from that time it steadily decreased until it amounted only to one seventh of a second; it then gradually increased until the twelfth day, when it amounted to 0.22 of a second. While this variation in personal equation occurred, the range of errors or discordances was constantly decreasing, until on the twenty-fourth day the probable error of the result does not exceed one eightieth of a second. This is considered to clearly demonstrate the value of such practice in training the nerves for observation; and he recommends that transit observers be kept in constant training by means of similar observation of an artificial event, which can be repeated with ease and rapidity, it not being essential, he thinks, that those observations should very closely imitate the transit of a star over the wires of a telescope, inasmuch as it is the general condition of the nerves which it is important to keep in training more than any thing peculiar to this or that kind of observation.—*Report Supt. Coast Survey*, 1870, 224.

THE EARLY RACES OF MANKIND IN IRELAND.

Sir William Wilde made a communication before the British Association upon the early races of mankind in Ireland, and ascribes the greater bulk of the Keltic population to the "Firbolgs," the "Tuatha-de-Dannans," and the "Milesians." The *Firbolgs* were described as a pastoral and agricultural people, small in stature, oval-headed, straight-haired, and of swarthy complexion; this associated with blue-gray eyes and dark eye-lashes. These are supposed to have been the first builders of the earthen forts, and to have buried their dead without cremation, but erecting tumuli or cromlechs as their monuments. They, with the fair-skinned *Dannans*, constitute the bulk of the farm-laborers who migrate to England during the harvest season.

The *Tuatha-de-Dannans* are described as large-sized, fair-skinned, and round-headed. They were warlike, musical, and