Dec. 17. 1886

PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON.

WITH THE ADDRESSES READ ON THE OCCASION OF THE

DARWIN MEMORIAL MEETING,

MAY 12, 1882.

PUBLISHED WITH THE CO-OPERATION OF THE SMITHSONIAN INSTITUTION.

VOLUME I.

NOVEMBER 19, 1880, TO MAY 26, 1882.

WASHINGTON:
PRINTED FOR THE SOCIETY.
1882.

PUBLICATION COMMITTEE.

G. BROWN GOODE.

RICHARD RATHBUN.

LESTER F. WARD.

INTRODUCTORY NOTE.

THIS volume of Proceedings is published in obedience to the vote of the Society, passed May 26, 1882. The BIOLOGICAL SOCIETY OF WASHINGTON was organized December 3, 1880, and at the time of its summer adjournment, in 1882, carries upon its roll the names of one hundred and thirty-nine active members, one honorary member, and twenty corresponding members. It has held thirty-one regular meetings, three special meetings, and one field meeting. At its regular meetings fifty-four communications have been presented, nearly all of which, except informal verbal communications, have already been published, as is indicated in the bibliographical foot notes. It has inaugurated and, in conjunction with the Anthropological Society, carried on a course of eight popular scientific lectures, four of which were delivered in its special behalf, and all of which were delivered by its members.

The meetings of the Society have always been held in rooms provided by the courtesy of the Secretary of the Smithsonian Institution; the first fifteen in the Regents' Room of the Smithsonian Institution; the sixteenth to the twenty-fourth in the Archive Room of the National Museum; the subsequent meetings in the Lecture Room of the Museum.

In preparing the proceedings of the Society for publication, the Secretaries have omitted the record of the election of members from the minutes of the several meetings, the information there contained being presented in a much more convenient form in the "List of Members."

LIST

OF THE

Council and Officers

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON.

1882.

COUNCIL.

THEODORE GILL, *President.*

TARLETON H. BEAN.
JOHN W. CHICKERING, Jr.
G. BROWN GOODE.
JEROME H. KIDDER.
OTIS T. MASON.
D. WEBSTER PRENTISS.
RICHARD RATHBUN.
ROBERT RIDGWAY.
CHARLES V. RILEY.
HENRY ULKE.
GEORGE VASEY.
LESTER F. WARD.

OFFICERS.

PRESIDENT.

THEODORE GILL.

VICE PRESIDENTS.

CHARLES V. RILEY.
JOHN W. CHICKERING, Jr.
LESTER F. WARD.
HENRY ULKE.

SECRETARIES.

G. BROWN GOODE.
RICHARD RATHBUN.

TREASURER.

ROBERT RIDGWAY.

LIST OF MEMBERS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON.

JULY 1, 1882.

HONORARY MEMBERS.

Date of Election.	
1881, Jan. 14.	BAIRD, SPENCER FULLERTON, M. D., LL. D., M. N. A. S. Secretary of the Smithsonian Institution and Director of the U. S. National Museum. U. S. Commissioner of Fish and Fisheries. *Smithsonian Institution, and 1445 Massachusetts Avenue N. W.*

CORRESPONDING MEMBERS.

1882, Mar. 31.	AGASSIZ, ALEXANDER, A.B., S. B., M. N. A. S. Curator of the Museum of Comparative Zoology, Cambridge. *Cambridge, Massachusetts.*
1881, April 8.	ALLEN, JOEL ASAPH, M. N. A. S. Assistant in Ornithology in the Museum of Comparative Zoology, Cambridge. *Cambridge, Massachusetts.*
1882, April 28.	BREWER, WILLIAM HENRY, Ph. D., M. N. A. S. Professor of Agriculture in the Sheffield Scientific School, Yale College, New Haven. *New Haven, Connecticut.*
1881, Feb. 25.	BREWSTER, WILLIAM, *Cambridge, Massachusetts.*
1881, Feb. 25.	BROOKS, WILLIAM KEITH, Ph. D. Associate Professor of Biology and Director of the Marine Laboratory of Johns Hopkins University, Baltimore. *Baltimore, Maryland.*
1882, Jan. 6.	COLLETT, ROBERT, Docent and Assistant in the Zoological Museum of the University of Christiania. *Christiania, Norway.*
1882, April 14.	DERBY, ORVILLE ADELBERT, M. S., Chief of the Geological Survey of Brazil. *Rio de Janeiro, Brazil.*
1882, Jan. 6.	FARLOW, WILLIAM GILSON, A. M., M. D., M. N. A. S. Professor of Cryptogamic Botany in Harvard University. *Cambridge, Massachusetts.*

Date of Election.	CORRESPONDING MEMBERS—Continued.
1881, Mar. 11.	GIGLIOLI, ENRICO HILLYER, Director of the Royal Zoological Museum of Vertebrates, and Professor of Vertebrate Zoology in the Royal Institute, Florence. *R. Instituto de Studi Superiori, Florence, Italy.*
1882, Jan. 6.	GRAY, ASA, M. D., LL. D., M. N. A. S. Fisher Professor of Natural History in Harvard University. *Botanic Garden, Cambridge, Massachusetts.*
1882, Mar. 31.	GRIMM, OSCAR VON, Ph. D., Professor of Natural History in the *Forest Academy*, St. Petersburg. *St. Petersburg, Russia.*
1882, Jan. 6.	HYATT, ALPHEUS. S. B., M. N. A. S. Professor of Zoology and Paleontology in the Massachusetts Institute of Technology. Custodian of the Boston Society of Natural History. *Cambridge, Massachusetts.*
1881, April 8.	LAWRENCE, GEORGE N., *45 East 21st St., New York City.*
1882, Mar. 31.	MORSE, EDWARD S., M. N. A. S. Director of the Peabody Academy of Science, Salem. *Salem, Massachusetts.*
1882, Mar. 31.	PACKARD, ALPHEUS SPRING, Jr., M. D., M. N. A. S. Professor of Zoology and Geology in Brown University, Providence. *Providence, Rhode Island.*
1882, Mar. 3.	SMITH, SIDNEY IRVING, Ph. B. Professor of Comparative Anatomy in Yale College, New Haven. *New Haven, Connecticut.*
1881, Feb. 25.	VELIE, JOHN W., M. D. Secretary and Curator of the Chicago Academy of Sciences. *263 Wabash Avenue, Chicago, Illinois.*
1882, Mar. 31.	VERRILL, ADDISON EMORY, A. M., S. B., M. N. A. S. Professor of Zoology and Curator of the Zoological Collections in Yale College, New Haven. *New Haven, Connecticut.*
1882, April 28.	WATSON, SERENO, Ph. D., M. N. A. S. Curator of the Herbarium of Harvard University. *Botanic Garden, Cambridge, Massachusetts.*
1882, Mar. 3.	WILSON, EDMUND BEECHER, Ph. D. Assistant in the Biological Laboratory of Johns Hopkins University, Baltimore. *Baltimore, Maryland.*

ACTIVE MEMBERS.*

Date of Election.	
Orig. Member.	ASHFORD, FRANCIS ASBURY, M. D. Dean of Faculty and Professor of Surgery in the Medical Department of the University of Georgetown. *1330 New York Avenue N. W.*
1881, Jan. 14.	BAKER, FRANK, M. D. Assistant Demonstrator of Anatomy and Prosector to the chair of Anatomy in the Medical Department of Columbian University. *Office of Light House Board, and 326 C Street N. W.*
1882, Mar. 3.	BARKER, JOHN SHEPARD, *715 H Street N. W.*
1881, Nov. 11.	BARNARD, WILLIAM STEBBINS, S. B., Ph. D. Assistant in the Entomological Division, U. S. Department of Agriculture. *1303 Q Street N. W.*
Orig. Member.	BEAN, TARLETON HOFFMAN, M. D. Curator, Dep't of Fishes, U. S. National Museum. *National Museum, and 1404 S Street N. W.*
1881, Mar. 25.	BESSELS, EMIL, M. D., Ph. D. *1441 Massachusetts Avenue N. W.*
1881, Nov. 11.	BEYER, HENRY G., M. D. Passed Assistant Surgeon, U. S. Navy. *Naval Hospital.*
1882, Mar. 17.	BILLINGS, JOHN SHAW, A. M., M. D. Surgeon and Brevet Lieutenant Colonel, U. S. Army. Librarian of the Surgeon General's Office. *Surgeon General's Office, and 3027 N Street N. W.*
1881, Jan. 14.	BIRNEY, HERMAN HOFFMAN, *1901 Harewood Avenue, Le Droit Park.*
1882, Jan. 20.	BIRNEY, GEN. WILLIAM, *1901 Harewood Avenue, Le Droit Park.*
1882, Feb. 17.	BLISH, JOHN BELL, Midshipman U. S. Navy, on duty in the National Museum. *Smithsonian Institution.*
1881, Nov. 11.	BRANSFORD, JOHN FRANCIS, M. D. Passed Assistant Surgeon, U.S.N., on duty at the Smithsonian Institution. *Smithsonian Institution.*
Orig. Member.	BROWN, JAMES TEMPLEMAN, Aid, U. S. National Museum. *National Museum, and 1425 S Street N. W.*

* When not otherwise expressly stated, all addresses are in Washington. By the word "Founder" are designated those who signed the call for the meeting for organization, November 26, 1880; by "Orig. Member" those who attended this and the succeeding meeting.

Date of Election.	ACTIVE MEMBERS—Continued.
Orig. Member.	BROWN, STEPHEN CARVOSSO, Registrar, U. S. National Museum. *National Museum, and 928 B Street S. W.*
Orig. Member.	BURDICK, EDSON ALMERON, *Pension Office, and 406 Spruce Street N. W.*
1882, Mar. 17.	BURNETT, SWAN MOSES, M. D. Lecturer on Ophthalmology and Otology in the Medical Department of the University of Georgetown. *1215 I Street N. W.*
Orig. Member.	BUSEY, SAMUEL CLAGETT, M. D. Professor of the Theory and Practice of Medicine in the Medical Department of the University of Georgetown. *1525 I Street N. W.*
1881, June 3.	CANBY, WILLIAM JACKSON, *413 Tenth Street N. W.*
1881, June 3.	CARMAN, MYRON ALBERT, D.D.S., *1015 Fourteenth St. N. W.*
1882, Feb. 17.	CHASE, HENRY SANDERS, Midshipman, U. S. Navy, on duty in the National Museum. *Smithsonian Institution.*
Founder.	CHICKERING, REV. JOHN WHITE, Jr., A. M. Professor of Natural Science in the Columbia Institution for the Deaf and Dumb. *Kendall Green, N. E.*
1881, May 20.	CHICKERING, JOHN JAMESON, A. M. Teacher in the Public Schools. *Kendall Green, N. E.*
1882, Mar. 17.	CHRISTIE, ALEXANDER SMYTH, Astronomical Computer in the U. S. Coast and Geodetic Survey. *Coast Survey Office, and 207 New Jersey Avenue N. W.*
1881, Jan. 28.	CLARK, ALONZO HOWARD, Special Agent in the Fishery Division of the Tenth Census. *National Museum, and 933 G Street N. W.*
1881, Feb. 25.	COLLINS, JOSEPH WILLIAM, Special Agent in the Fishery Division of the Tenth Census. *National Museum, and Gloucester, Massachusetts.*
Orig. Member.	COMSTOCK, JOHN HENRY, S. B. Assistant Professor of Ethnology and Lecturer on the Zoology of Invertebrates in Cornell University, Ithaca. *Ithaca, New York.*
1881, Dec. 23.	CONANT, WOODBURY PAGE, Assistant Botanist, Department of Agriculture. *Agricultural Department.*
1881, Dec. 23.	COUES, ELLIOTT, M. D., Ph. D., M. N. A. S. Professor of Anatomy in the Medical Department of Columbian University. *Smithsonian Institution, and 1321 N Street N. W.*

Date of Election.	ACTIVE MEMBERS—Continued.
1881, Nov. 11.	COX, WILLIAM VAN ZANT, A. B. *Fish Commission Office, and 1011 Twelfth Street N. W.*
1881, Feb. 25.	DALE, FRANK C., M. D. Passed Assistant Surgeon, U. S. N., on U. S. Steamer "Palos" on China Station.
1881, Jan. 28.	DALL, WILLIAM HEALEY, Assistant, U. S. Coast and Geodetic Survey. Honorary Curator, Dept. of Mollusks, U. S. National Museum. *Coast Survey Office, and 1119 Twelfth Street N. W.*
1882, Feb. 3.	DAVIS, HARRY C., A. B. Adjunct Professor of Greek in Columbian University. *637 Maryland Avenue S. W.*
1881, Feb. 25.	DEHAAS, WILLS, M. D. *Care of Bureau of Ethnology, Smithsonian Institution.*
1881, Nov. 11.	DEWEY, FREDERICK PERKINS, Ph. B. Assistant, Dept. of Metallurgy, U. S. National Museum. *National Museum, and Whitney Avenue N. W.*
1881. Nov. 11.	DODGE, CHARLES RICHARDS, Special Agent, Tenth Census, Division of Fruit and Orchard Statistics. *1336 Vermont Avenue N. W.*
1882, Jan. 20.	DOSH, FRANK BOWMAN. *Johns Hopkins University, Baltimore.*
1881, Jan. 28.	EARLL, ROBERT EDWARD, S. B. Special Agent in the Fishery Division of the Tenth Census. *National Museum, and 601, M Street N. W.*
1881, Feb. 25.	ELLIOTT, HENRY WOOD. *Smithsonian Institution, and Cleveland, Ohio.*
1881, Nov. 25.	ELLZEY, MASON GRAHAM, A. M., M. D. Lecturer on Hygiene and Medical Jurisprudence in the Medical Department of the University of Georgetown. *1012 I Street N. W.*
1881, Jan. 28.	FERGUSON, THOMAS B., Assistant Commissioner of Fisheries. *1435 Massachusetts Avenue N. W.*
1881, Mar. 25.	FLETCHER, ROBERT, M. D,, Acting Assistant Surgeon, U. S. Army. *Surgeon General's Office, and 1326 L Street N. W.*
1881, Feb. 11.	FLINT, JAMES MILTON, M. D. Surgson, U. S. Navy. Honorary Curator, Section of Materia Medica, U. S. National Museum. *National Museum, and Riggs House.*
1881, Dec. 9.	FOREMAN, EDWARD, M. D. Assistant, U. S. National Museum. *National Museum, and 200 Eleventh Street S. W.*

Date of Election.	ACTIVE MEMBERS—Continued.
1882, Feb. 17.	GARRETT, LEROY MASON, Midshipman, U. S. Navy, on duty at the National Museum. *Smithsonian Institution.*
1881, Mar. 25.	GANNETT, HENRY, S. B., A.Met.B. Geographer of the Tenth Census and of the U. S. Geological Survey. *Office of Geological Survey, and 1881 Harewood Ave., Le Droit Park.*
Orig. Member.	GEDNEY, CHARLES DEFOREST, *Coast Survey Office, and 115 F Street N. E.*
1881, Mar. 11.	GIHON, ALBERT LEARY, A. M., M. D. Member of Naval Board of Inspection. Medical Director, U. S. Navy. *1736 I Street N. W.*
1882, April 28.	GILBERT, GROVE KARL, Geologist, U. S. Geological Survey. In charge of the Division of the Great Basin. *Office of Geological Survey, and 1881 Harewood Ave., Le Droit Park.*
Founder.	GILL, THEODORE NICHOLAS, M. D., Ph. D., M. N. A. S. Lecturer on Natural History in Columbian University. *Cosmos Club, and 321 and 323 Four-and-a-half Street.*
Founder.	GOODE, GEORGE BROWN, A. M. Assistant Director of the U. S. National Museum. Chief of Division of Fisheries, U. S. Fish Commission, and Special Agent in charge of Fishery Division, Tenth Census. *Smithsonian Institution, and 1620 Massachusetts Avenue N. W.*
Orig. Member.	GORE, JAMES HOWARD, S. B. Adjunct Professor of Mathematics in Columbian University. Honorary Curator of the Food Collection, U. S. National Museum. *Columbian University, and 1305 Q Street N. W.*
1881, Nov. 11.	GRIFFITH, SAMUEL HENDERSON, M. D. Passed Assistant Surgeon, U. S. Navy. *Bureau of Medicine, U. S. Navy.*
Orig. Member.	HASSLER, FERDINAND AUGUSTUS, M. D. *1234 Thirteenth Street N. W., and Tustin City, Los Angeles Co., California.*
1881, Feb. 25.	HAWES, GEORGE WESSON, Ph. D. Curator, Dept. of Mineralogy, U. S. National Museum. Special Agent in charge of the Building Stone Division, Tenth Census. **Died at Colorado Springs, Colorado, June 23, 1882.**
1882, Feb. 3.	HAWKES, WILLIAM HIMES, A. B., M. D. Acting Assistant Surgeon, U. S. Army. *U. S. Army Dispensary, and 1105 F Street N. W.*
1882, Feb. 17.	HAYDEN, EDWARD EVERETT, Midshipman, U. S. Navy, on duty at the National Museum. *Smithsonian Institution.*

Date of Election.	ACTIVE MEMBERS—Continued.
1882, Mar. 31.	HENSHAW, HENRY WETHERBEE, Special Agent in the Indian Division of the Tenth Census. *Bureau of Ethnology, Smithsonian Institution, and 903 M Street N. W.*
1881, Jan. 14.	HESSEL, RUDOLPH, Ph. D., Superintendent of Government Carp Ponds. *514 Tenth Street N. W.*
Orig. Member.	HOFFMAN, WALTER JAMES, M. D. *Bureau of Ethnology, Smithsonian Institution, and 222 E Street N. W.*
1882, April 14.	HORNADAY, WILLIAM TELL, Chief Taxidermist U. S. National Museum. *National Museum, and Harewood Avenue, Le Droit Park.*
1882, May 26.	HOUGH, FRANKLIN BENJAMIN, Ph. D. Chief of Division of Forestry, U. S. Department of Agriculture. *Agricultural Department.*
1882, April 27.	HOUGH, MYRON BEACH WARNER. *U. S. Treasurer's Office, and 312 Indiana Avenue N. W.*
Orig. Member.	HOWARD, LELAND O., S. B. Assistant in the Entomological Division, U S. Department of Agriculture. *Agricultural Department, and 1407 Fifteenth Street N. W.*
1881, Feb. 25.	HOWLAND, EDWIN PERRY, M. D. *211 Four-and-a-half Street N. W.*
Founder.	INGERSOLL, ERNEST. *New York City.*
1882, Mar. 3.	JOHNSON, ARNOLD BURGESS, A. M., Chief Clerk, U. S. Light House Board. *Le Droit Park.*
1882, Jan. 20.	JOHNSON, BLANCHARD FREEMAN. *Le Droit Park.*
1882, Feb. 3.	JOHNSON, JOSEPH TABER, A.M., M.D. Professor of Obstetrics and Diseases of Women and Infants, in the Medical Department of the University of Georgetown. Gynecologist to Providence Hospital. *937 New York Avenue N. W.*
Orig. Member.	JOUY, PIERRE LOUIS, Assistant Naturalist of U. S. Steamer "Palos" on China Station.
Orig. Member.	KIDDER, JEROME HENRY, A.M., M. D. Surgeon, U. S. Navy. *Bureau of Medicine, U. S. Navy, and 1601 O Street N. W.*
Orig. Member.	KING, ALBERT FREEMAN AFRICANUS, M. D. Professor of Obstetrics and Diseases of Women and Children, in the Medical Department of Columbian University. *726 Thirteenth Street N. W.*

Date of Election.	ACTIVE MEMBERS—Continued.
1881, Nov. 25.	KOEBELE, ALBERT, Aid, U. S. National Museum. *1700 Thirteenth Street N. W.*
Orig. Member.	LEE, WILLIAM, M. D. Professor of Physiology in the Medical Department of Columbian University. *2111 Pennsylvania Avenue N. W.*
1882, Mar. 17.	LEECH, DANIEL, *Smithsonian Institution, and 1507 Vermont Avenue N. W.*
1882, Jan. 20.	LEHNERT, REV. E., Pastor, German Lutheran Church.
1881, Jan. 28.	MCDONALD, MARSHALL, Chief of Division of Propagation and Transportation, U. S. Fish Commission. Commissioner of Fisheries for the State of Virginia. Special Agent Fishery Division of Tenth Census. *Fish Commission Office, and 909 Twenty-third Street N. W.*
1881, May 20.	MCMURTRIE, WILLIAM, E. M., M. S., Ph. D. Examiner of Wool in the U. S. Department of Agriculture. *Agricultural Department, and 1728 I Street N. W.*
1881, Nov. 11.	MANN, BENJAMIN PICKMAN, A.M. Assistant in the Entomological Division, U. S. Department of Agriculture. *Agricultural Department, and 1203 Q Street N. W.*
1882, Feb. 17.	MARSH, CHARLES CARROLTON, Midshipman, U. S. Navy, on duty at National Museum. *Smithsonian Institution.*
1882, Jan. 20.	MARTIN, FRANK, Aid, U. S. National Museum. *National Museum, and 1835 G Street N. W.*
Orig. Member.	MARX, GEORGE, Zoological Draughtsman, U. S. Department of Agriculture. *Agricultural Department, and 1626 Fourteenth Street N. W.*
Orig. Member.	MASON, OTIS TUFTON, Ph. D. Principal of the Preparatory Department of Columbian University. *1305 Q St. N. W.*
1881, Jan. 28.	MERRILL, GEORGE PERKINS, M. S. Aid, U. S. National Museum. *National Museum, and 3033 N Street N. W.*
1881, June 3.	MILLER, BENJAMIN, Jr. *1516 Thirty-first Street N. W.*
1882, Feb. 17.	MINER, RANDOLPH HUNTINGTON, Midshipman, U. S. Navy, on duty at National Museum. *Smithsonian Institution.*
1881, Dec. 9.	NELSON, EDWARD W., U. S. Signal Service observer at St. Michael's, Alaska. *Smithsonian Institution.*
Orig. Member.	NORRIS, BASIL, M. D. Surgeon and Brevet Colonel, U. S. Army. *1829 G Street N. W.*

Date of Election.	ACTIVE MEMBERS—Continued.
Founder.	PATTON, WILLIAM HAMPTON, A. B. *New York City.*
Orig. Member.	PERGANDE, THEODORE, Assistant in Entomological Division, U. S. Department of Agriculture. *321 D Street N. W.*
Orig. Member.	PORTER, JOHN HAMPDEN, M.D. *2720 M Street N. W.*
1881, Feb. 11.	POWELL, JOHN WESLEY, Ph. D., LL. D., M. N. A. S. Director, U. S. Geological Survey, and Director, Bureau of Ethnology, Smithsonian Institution. *National Museum, and 910 M Street N. W.*
Orig. Member.	PRENTISS, DANIEL WEBSTER, A.M., M.D. Professor of Materia Medica and Therapeutics, in the Medical Department Columbian University. Commissioner of Pharmacy, District of Columbia. *1224 Ninth Street N. W.*
Founder.	RATHBUN, RICHARD, Curator, Dep't of Marine Invertebrates, U. S. National Museum. *Smithsonian Institution, and 1622 Massachusetts Avenue N. W.*
1881, May 20.	RAU, CHARLES, Ph. D. Curator, Dept. of Antiquities, U. S. National Museum. *Smithsonian Institution.*
1881. Dec. 9.	REYBURN, ROBERT, A. M., M. D. Professor of Physiology and Hygiene, Medical Department, Howard University. *2129 F Street N. W.*
Founder.	RIDGWAY, ROBERT, Curator, Dep't of Birds, U. S. National Museum. *Smithsonian Institution, and 218 Eleventh Street S. W.*
Founder.	RILEY, CHARLES VALENTINE, Ph. D. President, U. S. Entomological Commission. Entomologist U. S. Department of Agriculture. Honorary Curator, of Insects in the U. S. National Museum. *Agricultural Department, and 1700 Thirteenth Street N. W.*
1882, Mar. 17.	RICHEY, STEPHEN OLIN, M. D. *1426 New York Avenue.*
1882, April 28.	RUSSEL, ISRAEL COOK, Assistant Geologist U. S. Geological Survey. *Salt Lake City, Utah.*
1882, Mar. 31.	RYDER, JOHN ADAM, Embryologist, U. S. Fish Commission. *Smithsonian Institution, and Chambersburg, Pa.*
Orig. Member.	SCHÆFFER, EDWARD MARTIN, M. D. *St. Cloud Building, and 1114 Nineteenth Street N. W.*
1882, Jan. 20.	SCHÖNBORN, HENRY. *213 Seventh Street N. W.*
1881, Mar. 11.	SCHUERMANN, CARL WILHELM, *U. S. National Museum and 916 D Street S. W.*

Date of Election	ACTIVE MEMBERS—Continued.
Orig. Member.	SCHWARZ, EUGENE AMANDUS, Assistant in the Entomological Division, U. S. Department of Agriculture. *606 H Street N. W.*
1881, Jan. 14.	SCUDDER, CHARLES WILLIS, Clerk, U. S. Fish Commission. *127 F Street N E.*
Orig. Member.	SCUDDER, NEWTON PRATT, A.M. Aid, U. S. Fish Commission. *127 F Street N. E.*
1882, May 26.	SEATON, CHARLES W., Superintendent of the Tenth Census. *Census Office, and 303 M Street N. W.*
Orig. Member.	SEAMAN, WILLIAM HENRY, A. M. Professor of Chemistry in the Medical Department of Howard University. *1424 Eleventh Street N. W.*
Orig. Member.	SHELDON, CHARLES STILES. *Census Office.*
1881, Nov. 11.	SHUFELDT, ROBERT WILSON, M.D. Assistant Surgeon and Captain U. S. Army. Hon. Curator, Section of Bird Skeletons U. S. National Museum. *National Museum, and 819 Seventeenth Street N. W.*
1882, Feb. 17.	SHUTE, DANIEL KERFOOT, A. B. Children's Hospital. *Columbian College Hill.*
1881, Nov. 11.	SMITH, WILLIAM ROBERT, Superintendent of U. S. Botanical Garden. *Botanical Garden.*
Orig. Member.	SMILEY, CHARLES WESLEY, A. M. Chief of Division of Records, U. S. Fish Commission. Special Agent, Fishery Division, Tenth Census. *Fish Commission Office, and 1207 Eleventh Street N. W.*
1881, Nov. 11.	STEJNEGER, LEONHARD, (of Bergen, Norway.) Aid U. S. National Museum. Absent in Siberia.
1881, Mar. 25.	STERNBERG, GEORGE MILLER, M.D. Surgeon, U. S. Army. Secretary of the National Board of Health. *Fort Point San José, San Francisco, Cal.*
1882, Mar. 17.	STEVENSON, JAMES, Executive Officer of the U. S. Geological Survey. *National Museum.*
1881, Feb. 25.	STIMPSON, WILLIAM GORDON. *National Museum, and 211 Twelfth Street S. W.*
1882, Feb. 17.	STREETS, THOMAS HALE, M. D. Passed Assistant Surgeon, U. S. Navy. *Bureau of Medicine, U. S. Navy.*

Date of Election.	ACTIVE MEMBERS—Continued.
1882, Mar. 17.	TAYLOR, FREDERICK WILLIAM, Chemist, U. S. National Museum. *National Museum, and 1120 Vermont Avenue N. W.*
Orig. Member.	TAYLOR, THOMAS, M. D. Microscopist, U. S. Department of Agriculture. *Agricultural Department, and 238 Massachusetts Avenue N. E.*
1881, Dec. 9.	THOMPSON, JOHN FORD, M. D. Professor of Surgery, Medical Department, Columbian University. *1000 Ninth Street N. W.*
1881, Jan. 28.	TODD, JAMES EDWARD, Ph. D. Professor of Natural History in Tabor College and Lecturer in Beloit College. *Tabor, Iowa.*
Orig. Member.	TONER, JOSEPH MEREDITH, M. D. *615 Louisiana Avenue N. W.*
Founder.	TRUE, FREDERICK WILLIAM, M. S. Librarian, and Curator Dep't of Mammals, U. S. National Museum. *National Museum, and 3033 N Street N. W.*
1881, Dec. 23	TURNER, LUCIEN M., Observer, U. S. Signal Service. *Ungava, Labrador.*
Orig. Member.	ULKE, HENRY, *1111 Pennsylvania Avenue N. W.*
1881, Mar. 25.	UPHAM, EDWIN PORTER, Aid, U. S. National Museum. *Smithsonian Institution, and 1317 Eleventh Street N. W.*
Founder.	VASEY, GEORGE, M. D. Botanist, U. S. Department of Agriculture. *Agricultural Department, and 1437 S Street N. W.*
Founder.	WARD, LESTER FRANK, A. M., LL. B. Paleo-botanist, U. S. Geological Survey. Honorary Curator, Dep't of Fossil Plants, U. S. National Museum. *National Museum, and 1464 Rhode Island Avenue N. W.*
Orig. Member.	WHITE, CHARLES ABIATHAR, A.M., M.D. Curator, Dep't of Fossil Invertebrates, U. S. National Museum. Palæontologist U. S. Geological Survey. *National Museum, and 409 Maple Avenue, Le Droit Park.*
1881, May 20.	WHITE, MAURICE PUTNAM, Teacher, Public Schools. *507 Sixth Street N. W.*
1881, Jan. 28.	WILLIAMS, ALFRED, *Department of State, and 134 C Street N. E.*

Date of Election.	ACTIVE MEMBERS—Continued.
Orig. Member.	WILSON, JOSEPH MCMUNN. *U. S. Pension Office, and 1108 Maryland Avenue S. W.*
1881, Dec. 9.	WINSLOW, FRANCIS, Lieutenant, U. S. Navy, on duty with U. S. Fish Commission. *Brightwood, D. C.*
1881, Jan. 28.	WOLFLEY, WILLIAM IRVIN, A. M., M.D. *140 C Street N. E.*
1882, Feb. 17.	YARNALL, JOHN HEPBURN, M. D. *3028 P Street N. W.*
Orig. Member.	YARROW, HENRY CRÉCY, M. D. Acting Assistant Surgeon U. S. Army. Hon. Curator, Dept. of Reptiles U. S. National Museum. *Surgeon General's Office, and 814 Seventeenth Street N. W.*
1881, Feb. 25.	YEATES, WILLIAM SMITH, A. M. Aid, U. S. National Museum. *National Museum, 2522 L Street N. W.*
1882, Jan. 6.	ZUMBROCK, ANTON, M. D., Electrotyper and Photographer, U. S. Coast and Geodetic Survey. *Coast Survey Office, and 306 C Street N. W.*

THE BIOLOGICAL SOCIETY OF WASHINGTON

CONSTITUTION.

Adopted December 3, 1880.

ARTICLE I.

NAME.

The name of this Society shall be "THE BIOLOGICAL SOCIETY OF WASHINGTON."

ARTICLE II.

OBJECTS.

Its objects shall be to encourage the study of the Biological Sciences, and to hold meetings at which papers shall be read and discussed.

ARTICLE III.

MEMBERS.

The Society shall consist of active, corresponding and honorary members. Candidates for membership shall be proposed to the Council, in writing, by at least three members, and, upon recommendation of the majority of the Council present at its regular meeting, shall be balloted for at the earliest ensuing meeting. A majority vote of the members present when the ballot is taken shall be necessary to election.

ARTICLE IV.

OFFICERS.

The officers shall be a President, four Vice Presidents, two Secretaries, and a Treasurer. There shall be a Council, consisting of the officers of the Society and five members, to be elected by the Society. A quorum of the council shall consist of seven members.

Its duties shall be to act on nominations for membership, have the direction of the finances, audit the accounts of the Treasurer, and provide a programme for each meeting of the Society.

The officers shall be elected by ballot at each annual meeting, and shall serve one year, or until their successors are elected.

ARTICLE V.

PRESIDENT AND VICE PRESIDENTS.

The President, or, in his absence, one of the Vice Presidents, shall preside at meetings of the Society and Council. The presiding officer shall appoint all committees in the Council and in the Society, unless otherwise ordered. It shall be the duty of the retiring president to deliver an address at the second meeting in January.

ARTICLE VI.

SECRETARIES.

The Secretaries shall take and preserve correct minutes of the proceedings of the Society and Council and a record of the members, shall conduct its correspondence, give due notice of all meetings, and inspect and count all ballots.

ARTICLE VII.

TREASURER.

The Treasurer shall have charge of all money and other property of the Society, and shall make disbursements under the direction of the Council. He shall collect all fees and assessments, and notify members who may be in arrears.

ARTICLE VIII.

SECTIONS.

Sections for special work in any department of Biology may be formed upon the recommendation of the Council.

ARTICLE IX.

MEETINGS.

Stated meetings shall, unless otherwise ordered, be held on Friday of each alternate week, at eight o'clock P. M. The annual meeting for the election of officers shall be the first meeting in January. Special and field meetings may be called by the Council.

ARTICLE X.

FEES.

The initiation fee shall be one dollar; the annual fee one dollar. Members in arrears for one year shall, after due notification by the Treasurer, be dropped from the rolls. No member in arrears shall be entitled to vote at the annual meeting for the election of officers.

ARTICLE XI.

AMENDMENTS TO THE CONSTITUTION.

The constitution of the Society may be amended by a two-thirds vote of the members present at any regular meeting, after at least four weeks' notice.

ARTICLE XII.

ORDER OF BUSINESS.

The order of business at each regular meeting, unless otherwise provided by the Council, shall be as follows:

I. Reading of minutes.
II. Reports of Committees.
III. Balloting for members.
IV. Nominations for membership.
V. Miscellaneous business.
VI. Reading of papers, discussions and exhibition of specimens.

Article XII may be suspended at any time by a two-thirds vote of the members present.

PROCEEDINGS.

PRELIMINARY MEETING, November 19, 1880.

In response to a letter of invitation signed by C. V. Riley and G. Brown Goode, ten gentlemen met at the house of the former, No. 1700 Thirteenth Street N. W., to take into consideration a project for the organization of a natural history society in the city of Washington. Capt. C. E. Dutton, U. S. A. was chosen chairman. After an informal interchange of views and a discussion of various propositions advanced by those present, it was decided to send out a call for a general meeting to be held on the following Friday evening, to which all known to be interested in the objects of the proposed society should be invited. The following persons were in attendance at this preliminary meeting: Captain Clarence E. Dutton, Prof. Theodore Gill, Messrs. G. Brown Goode, Ernest Ingersoll, W. H. Patton, Richard Rathbun, C. V. Riley, Frederick W. True, Lester F. Ward, and Dr. George Vasey.

MEETING FOR ORGANIZATION, November 26, 1880.

In response to a call signed by C. E. Dutton, J. W. Chickering, Jr., Theodore Gill, G. Brown Goode, Ernest Ingersoll, W. H. Patton, Richard Rathbun, Robert Ridgway, C. V. Riley, F. W. True, Lester F. Ward, and George Vasey, about thirty gentlemen assembled in the Regents' Room, at the Smithsonian Institution. Prof. Riley was elected chairman, and Mr. Goode, Secretary. After much discussion it was decided to organize a society to be called THE BIOLOGICAL SOCIETY OF WASHINGTON. A committee consisting of Messrs. Gill, Goode, Rathbun, Riley, and Ward was appointed to draw up a form of constitution for the proposed society, and to submit the same at a meeting to be held on the evening of Friday, December 3.

FIRST MEETING, December 3, 1880.

Thirty-five gentlemen assembled in the Regents' Room of the Smithsonian Institution, to hear the report of the Committee appointed to prepare a constitution for the projected society. Prof. Riley acted as chairman and Mr. Goode as secretary. The committee presented its report, and the form of constitution proposed by them was read article by article, and article by article modified and adopted. The constitution as a whole, in the form appended to these proceedings, was then adopted. The Society then adjourned to Friday evening, December 10, at which time a meeting was appointed for the completion of the organization of the Society by the election of a board of officers.

SECOND MEETING, December 10, 1880.

Twenty-two persons met in the usual place. Professor Gill was called to the chair, and, on the motion of Prof. Ward, the Society proceeded to ballot for officers for the ensuing year. The following board of officers was elected:

President—THEODORE GILL.

Vice-Presidents—C. V. RILEY, J. W. CHICKERING, LESTER F. WARD, HENRY ULKE.

Secretaries—G. BROWN GOODE, RICHARD RATHBUN.

Treasurer—ROBERT RIDGWAY.

Members of Council—J. H. COMSTOCK, O. T. MASON, J. H. KIDDER, A. F. A. KING, GEORGE VASEY.

The Society then adjourned to meet on the 24th of December.

THIRD MEETING, December 24, 1880.

The President occupied the chair, and thirty-one members were present.

Messrs. Riley, Goode and King were announced as having been appointed a committee on communications. Dr. Tarleton H. Bean presented a communication entitled NOTES ON A VOYAGE ALONG THE COASTS OF ALASKA AND SIBERIA IN THE SUMMER OF 1880.*

* Published in part in the *New York Times* for September 17, November 21, and December 6, 1880.

FOURTH MEETING, January 14, 1881.

(First Annual Meeting.)

The President occupied the chair and thirty members were present.

In accordance with the recommendation of the Council one of the Secretaries of the Society was instructed to cast the vote of its members for the entire board of officers elected at the meeting of December 10, such having been the understanding at the time of that election. The officers elected at that time were then announced as having been re-elected to serve during the coming year.

The President announced that the Secretary had been authorized to have printed 250 copies of the constitution, with list of officers and members, and requested all members to send in their full names, that the customs of similar societies might be conformed to.

Prof. L. F. Ward read a paper entitled THE FLORA COLUMBIANA OF 1830 AND 1880, which contained comparisons between the list of the plants of the District of Columbia printed in 1830 by Dr. Brereton and the lists perfected by the resident botanists of to-day.*

Prof. D. S. Jordan, of the Indiana State University, read a paper entitled THE SALMON OF THE PACIFIC COAST.†

FIFTH MEETING, January 28, 1881.

The President occupied the chair, and thirty-six members were present.

The President delivered his first annual address upon THE PRINCIPLES OF BIOLOGY WITH REFERENCE TO TAXONOMY.‡

In the discussion of the presidential address, Messrs. Comstock, Mason, Ward, Riley and White participated.

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* Included in the following paper:

1882. WARD, LESTER F. Guide | to | the Flora | of | Washington and Vicinity | By | Lester F. Ward, A. M. | —— | Washington: Government Printing Office, | 1881. *8vo.*, pp. 264 + 2, *with map* = Bulletin of the U. S. National Museum, No. 22. (U. S. National Museum, No. 26.)

† 1881. JORDAN, DAVID S., AND CHARLES H. GILBERT. Observations on the Salmon of the Pacific. <American Naturalist. XV, 1881, (March,) pp. 177–186.

‡ The essentials of this address are embodied in the articles BIOLOGY (Vol. I, 1875,) and MORPHOLOGY (Vol. III, 1877,) in *Johnson's Cyclopedia*. New York, 1875–8

Sixth Meeting, February 11, 1881.

The President occupied the chair, and thirty-seven members were present.

An hour was devoted to the completion of the discussion of the presidential address, Messrs. White, Ward, King and Gill taking part. Dr. J. H. Kidder, U. S. N., exhibited a series of photo-micrographs of objects obtained floating in the air of Washington. He also exhibited photo-micrographs of the dry rot fungus from the U. S. Steamer "Portsmouth," after its infection by yellow fever, of spores of various organisms collected in the yellow fever hospitals of Cuba, and of blood corpuscles from patients affected by various febrile diseases.*

Seventh Meeting, February 25, 1881.

Prof C. V. Riley, V. P., occupied the chair and thirty-two members were present.

Prof Riley read a paper entitled The Fertilization of Yucca.† Dr. C. A. White gave an account of a collection of fossils, including 1500 species, duplicates of the celebrated collection of James Hall, State Geologist of New York, recently received by the National Museum from the American Museum of Natural History in New York. Mr. Frederick W. True read a paper entitled Suctorial Prehension in the Animal Kingdom.‡

Eighth Meeting, March 11, 1881.

The President occupied the chair, and thirty-four members were present.

In discussing Mr. True's paper on "Suctorial Prehension" Prof.

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* 1881. Kidder, Jerome H. Report | on | an examination | of the | external air of Washington | by J. H. Kidder, M. D., | Surgeon, U. S. Navy. | —— | [Extracted from the Report of the Surgeon General | of the Navy for 1880.] | —— | Washington: | Government Printing Office. | 1882. | 8vo., pp. 22 + 1 (+ 1), 10 plates.

† 1881. Riley, Charles V. Further notes on the Pollination of Yucca and on Pronuba and Prodoxus. <Proceedings of the American Association for the Advancement of Science. 1881, Vol. XXIX, Part II, pp. 617–639, figs. 1–16.

‡ To be published in the proceedings of the U. S. National Museum.

Seaman referred to the climbing organs of the Virginia creeper, *Ampelopsis quinquefolia*, and of the so called "suckers" of various sea-weeds, which though perhaps not suctorial in action seem to cling to objects in a manner which is similar to suctorialism. Prof. Riley spoke of a suctorial organ of prehension in the thoracic proleg and anal pseudopod of *Simulium* larvæ and to the ventral branchiæ of the helgramite or dobson, *Corydalis cornutus*, larva, which are suctorial in function. Prof. Gill, speaking of the suctorial powers of young marsupiates stated that he believed them to exert an actual suctorial power, even though the teats be somewhat modified to aid them in clinging. Their first attachment to the teat is purely suctorial, though afterward probably the result of a spasm-like action of the sphincter-oris muscle. He also referred to the suctorial organs possessed by certain bats. Mr. Patton called attention to the peculiar structure of the larva of *Blepharocera* which inhabits torrents and has six segments, each provided with a separate suctorial organ, probably prehensive.

Dr. A. F. A. King read a paper entitled SEPTENARY PERIODICITY IN LIVING ORGANISMS; in the discussion of which Messrs. Prentiss, Riley, Scudder, Ward, and many others participated.

NINTH MEETING, March 25, 1881.

The President occupied the chair, and thirty-five members were present.

Col. Marshall McDonald read a communication ON THE LAWS OF THE RELATION OF PERIODICITY IN DEVELOPMENT TO TEMPERATURE. This paper was discussed by Messrs. Prentiss, King, Busey, Gill and Chickering.

Prof. J. W. Chickering, Jr., read a paper entitled ROAN MOUNTAIN AND ITS FLORA.*

Prof. J. E. Todd read a paper entitled ON THE FLOWERING OF SOLANUM ROSTRATUM, AND CASSIA CHAMÆCRISTA.†

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*See 1882. CHICKERING, JOHN W., Jr. Notes on Roan Mountain, North Carolina. < Bulletin, Philosophical Society of Washington. IV. 1881. pp. 60-64. (Flora, p. 63).

†1882. TODD, JAMES E. On the Flowers of *Solanum rostratum*, and *Cassia chamæcrista*. <American Naturalist. XVI, 1882. (April). pp. 281-287.

TENTH MEETING, April 8, 1881.

The President occupied the chair, except when reading his paper, at which time he was replaced by Vice President Ward. Twenty-three members were present.

Prof. Gill read a paper entitled A CRITICAL REVIEW OF GUNTHER'S STUDY OF FISHES,* and a short discussion upon the merits of this article ensued, participated in by Messrs. Goode, Gill and Ward.

ELEVENTH MEETING, April 22, 1881.

The President occupied the chair, and thirty-eight members were present.

A committee of the Council submitted the following report upon the formation of sections, in accordance with one of the provisions of the Constitution:

The committee recommends, (1.) That five sections be formed as follows: I, Vertebrates; II, Articulates; III, Mollusks; IV, Radiates; V, Plants. For these sections the following members are suggested as chairmen: I, Mr. Goode; II, Prof. Riley; III, Mr. Dall; IV, Mr. Rathbun; V, Prof. Ward. (2.) The members of the Society shall be requested to inform the Secretary what section or sections they desire to co-operate with. (3.) New members on joining the Society shall be requested to signify to the Secretary what departments of Biology they are each respectively interested in. Signed by the Committee: C. V. Riley, O. T. Mason, George Vasey, G. Brown Goode, Robert Ridgway.

The President announced that the temporary chairman would be authorized to call meetings of the sections, and that members were expected to hand in their decisions as to the sections which they desire to join.

Dr. George M. Sternberg, U. S. A., Secretary of the National Board of Health, read a paper entitled A FATAL FORM OF SEPTI-

* 1881. GILL, THEODORE. Reprinted from the "Forest and Stream." | —— | Günther's | Literature and Morphography of Fishes. | A review of | Dr. Günther's introduction to the | study of Fishes. | —— | By Theodore Gill, M. A., M. D., Ph. D., | Member of the National Academy of Sciences, etc., etc. | —— | New York: | Forest & Stream Publishing Co., | 1881. 12mo., pp. 16. See also *The Critic*, I, (May 21, 1881,) pp. 132–3; *The New York Times*, May 29, 1881; *Forest & Stream*, XVI, p. 428, (June 30, 1881;) *Science*, VII, pp. 323–6, (July 9, 1881;) *The Nation*, XXXIII, pp. 120–2, (August 11, 1881.)

CÆMIA IN THE RABBIT, PRODUCED BY THE SUBCUTANEOUS INJECTION OF HUMAN SALIVA.*

This paper was discussed by Messrs. Thomas Taylor, Fletcher, King, Comstock, Ward, and Gill.

Mr. Ernest Ingersoll read a paper entitled ON THE MORTALITY OF MARINE ANIMALS IN THE GULF OF MEXICO.*

At the close of the meeting the roll of members was called, and the following persons enrolled themselves as members of the several sections:

Section I. Messrs. Baker, Birney, Clark, Earll, Gill, Goode, Hoffman, King, Mason, Prentiss, Ridgway, N. P. Scudder, C. W. Scudder, Smiley, Thomas Taylor, True, Ward, Wolfley, Fletcher, Flint, Schuermann, Sternberg.

Section II. Messrs. Birney, Comstock, Merrill, Patton, Pergande, Riley, Schwarz, Marx, Howard, and Ulke.

Section III. Messrs. Gill, Sheldon, and Ingersoll.

Section IV. Messrs. Gill and Rathbun.

Section V. Messrs. Comstock, Earll, Goode, Gore, Merrill, Patton, Riley, Schwarz, Seaman, Sheldon, Smiley, Thomas Taylor, Vasey, Ward, Williams, Wolfley, Sternberg, Hawes, Flint, and Hoffman.

FIRST FIELD MEETING, April 30, 1881.

On Saturday, April 30, the Botanical Section held a field meeting at High Island, in the Potomac River, above the Chain Bridge. Seventeen members were present.

TWELFTH MEETING, May 6, 1881.

Vice-President Ward occupied the chair. Twenty-three members were present.

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* 1881. STERNBERG, GEORGE M. A fatal form of Septicæmia in the Rabbit, produced by the sub-cutaneous injection of Human Saliva. <Studies from the Biological Laboratory of Johns Hopkins University. II. 1882, pp. 183–200. Plate XIV. (March.)

* 1881. INGERSOLL, ERNEST. On the Fish Mortality in the Gulf of Mexico. IV. <Proceedings, U. S. National Museum, IV, 1881, pp. 74–80.

Prof. Lester F. Ward read a paper entitled A STATISTICAL VIEW OF THE FLORA OF THE DISTRICT OF COLUMBIA.*

Prof. J. H. Comstock read a paper entitled NOTES ON SCALE INSECTS, illustrating his remarks by a collection of specimens.†

THIRTEENTH MEETING, May 20, 1881.

The President occupied the chair. Thirty-one members were present.

Prof. Riley made some remarks upon Prof. Comstock's paper on Scale Insects, and was responded to by Prof. Comstock. Dr. George M. Sternberg, U. S. A., read a paper entitled ON MICROCOCCUS SEPTICUS‡ illustrating his remarks by photo-micrographs thrown upon a screen by the lantern. This paper was discussed by Messrs. Seaman, Ward, and Taylor.

FOURTEENTH MEETING, June 3, 1881.

The President occupied the chair. Thirty-five members were present. It was announced that after the next meeting the Society would be adjourned until the first Friday in October.

Dr. D. W. Prentiss read a paper entitled THE PHYSIOLOGICAL ACTION OF JABIRANDI, (PILOCARPUS PINNATIFOLIUS.)§

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* 1881. WARD, LESTER F. Field and Closet Notes on the Flora of Washington and Vicinity. <Bulletin, Philosophical Society of Washington. IV. 1881. pp. 64–120. (Statistical View pp. 88–104, 116–119.) See also in Bulletin 22 U. S. National Museum, cited above, p. 26.

† 1881. COMSTOCK, JAMES H. Report on Scale Insects. <Report of the Entomologist of the U. S. Department of Agriculture for the year 1880. pp. 235–373. (Scale Insects, pp. 276–349. Plates III–XXII.)

‡ STERNBERG, GEORGE M. A Contribution to the Study of the Bacterial Organisms commonly found upon exposed Mucous Surfaces, and in the Alimentary Canal of Healthy Individuals. <Studies from the Biological Laboratory of Johns Hopkins University. II. 1882. pp. 157–181. Plates XI–XIII: and in Proceedings, American Assoc. Adv. Sci., XXX, 1881.

§ 1881. PRENTISS, D. WEBSTER. Remarkable change of color of the hair from light blonde to nearly jet black in a patient, while under treatment by pilocarpin. Report of pyelo-nephritis, with unusually prolonged anuria. <Philadelphia Medical Times. XI. 1881. (No. 335, July 2, 1881.) pp. 609–12; also reprinted with following title:

—— 1. | Remarkable change in the color of the | hair from light blonde to

Mr. G. Brown Goode read a paper entitled THE MACKEREL,* and was followed by Captain J. W. Collins who explained and illustrated the uses of the various kinds of apparatus used in the mackerel fishery.†

FIFTEENTH MEETING, June 17, 1881.

The President occupied the chair. Fifty-two members were present.

Mr. Robert Ridgway exhibited a collection of wild and domesticated turkeys. Mr. Newton P. Scudder made a communication upon the breeding habits of the Painted Tortoise, *Chrysemys picta*. Dr. Thomas Taylor exhibited some specimens of a tapeworm from the common hog.‡ Mr. Frederick W. True exhibited the first volume of the new annual, *Zoologischer Jahresbericht*, published in Leipzig, and compared its merits with those of the London *Zoological Record* Prof. C. V. Riley exhibited specimens of the seventeen-year locust, and the Rocky Mountain locust, explaining the difference between them and describing their habits.§

The Society then adjourned to the basement of the Smithsonian Building, where Col. Marshall McDonald described some recent

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black in a | patient while under treatment by | pilocarpin.—Report of a | pyelo-nephiritis, with unusu- | ally prolonged anuria. | 2. | Care of membranous croup treated suc- | cessfully by pilocarpin. | By | D. W. Prentiss, A.M., M. D., | Professor Materia Medica and Therapeutics, National Medical College, Washington, D. C. | — | Printed by | J. B. Lippincott & Co., Philadelphia. | 1881. 8vo., pp. 15+1.

Also—Change in the color of the human hair under the use of pilocarpin. <Cincinnati Lancet and Clinic. XLVI. 1881. (Sept. 3.) pp. 202–205; colored plate and < Proceedings of American Association for the Advancement of Science, XXX, (Cincinnati Meeting,) 1881.

* 1882. GOODE, G. BROWN. Natural History of the Mackerel. <Materials for a History of the Mackerel Fishery in Report U. S. Fish Commission. Part VII for 1881, pp. (1)–(48.)

† 1882. COLLINS, JOSEPH W. (With G. Brown Goode.) The Mackerel Fishery of the United States. Ibid. pp. (49)–(140+.)

‡ 1882. TAYLOR, THOMAS. On a tape-worm from the common hog. <Report of the Commission of Agriculture for 1882, pp.——. (In press.)

§ 1881. RILEY, CHARLES V. The Periodical Cicada *alias* "Seventeen-year Locust." <American Naturalist, XV, 1881, pp. 479–481, one figure.

experiments in fish culture, illustrating his remarks by apparatus in which the eggs of the shad, *Clupea sapidissima,* were in process of hatching. He announced that he had succeeded in keeping shad eggs for twenty-four hours in a half dry condition in moist cloth, and in thus transporting them from place to place, instead of the old cumbersome vessels filled with water.*

Mr. John A. Ryder exhibited, under the microscope, eggs of the shad in various stages of development, and announced the discovery of teeth in shad four or five days old. †

Sixteenth Meeting, October 28, 1881.

The President occupied the chair. Thirty-two members were present.

This evening the Society met for the first time in the Archive Room of the National Museum. Prof. Lester F. Ward exhibited a supposed petrifaction, resembling the hand of a mammal, from near Granger's Station, Wyoming. A discussion followed upon the phenomena of opalization, and the formation of pseudomorphs, in which Messrs. Taylor, Gill, Schaeffer, Dall, and Ulke participated. Mr. Henry W. Elliott read a paper On the Habits of the Sea Otter, (Pusa lutris,) of the Northwest Coast, illustrating his remarks by specimens and sketches on the blackboard.‡

Dr. Thomas Taylor exhibited a new form of freezing microtome, invented by himself, and demonstrated its manner of working.§

Seventeenth Meeting, November 11, 1881.

The President occupied the chair. Twenty-eight members were present.

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* See Report of the U. S. Commission of Fisheries for 1881, (Part VIII,) and Transactions of the American Fish Cultural Association for 1882.

† 1882. Ryder, John A. The Protozoa and Protophytes considered as the primary or indirect source of the food of fishes. <Bull., U. S. Fish Comm., I, 1882, pp. 236–251. (Eggs and food of young shad, pp. 248–9.)

‡ To be printed in the forthcoming Census report on the Fisheries of the United States.

§ 1882. Taylor, Thomas. On a new form of freezing microtome. <Proc. Amer. Assoc. Adv. Sci., XXX, (Cincinnati Meeting,) 1881, p. 119.

Prof. C. V. Riley read a paper entitled ON THE PHILOSOPHY OF THE RETARDATION OF GROWTH AMONG LOWER ANIMALS.* A discussion followed, participated in by Messrs. Ulke, White, Gill, Earll, King, and Ward. Dr. C. A. White read a paper entitled ANTIQUITY OF CERTAIN TYPES OF NORTH AMERICAN NON-MARINE MOLLUSCA, AND THE EXTINCTION OF OTHERS.† This paper was discussed by Messrs. Gill and Dall.

EIGHTEENTH MEETING, November 25, 1881.

The President occupied the chair. Thirty-four members were present.

Mr. Richard Rathbun presented a communication ON THE RECENT EXPLORATIONS OF THE U. S. FISH COMMISSION. After sketching the history of the Commission since its organization, in 1871, and describing the new exploring steamer "Fish Hawk," he spoke at some length of the wonderful wealth of life discovered in 1880 and 1881 on the inner edge of the Gulf Stream, about one hundred miles off Newport and Martha's Vineyard. Mr. Rathbun's remarks were illustrated by numerous specimens, and a large model of the steamer "Fish Hawk." Messrs. Gill, Dall, Goode, and Schaeffer took part in the discussion of this paper.

NINETEENTH MEETING, December 9, 1881.

The President occupied the chair. Forty members were present.

Col. Marshall McDonald described some recent observations upon young shad in confinement. Prof. L. F. Ward read a paper on THE CAUSES OF THE ABSENCE OF TREES ON THE GREAT PLAINS.‡

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* 1882. RILEY, CHARLES V. Retarded Development in Insects. <Proceedings, Amer. Assoc. Adv. Sci., XXX, Cincinnati Meeting, and in separate "Retarded Development, &c.," pp. 4. (February, 1882.)

† 1882. WHITE, CHARLES. A. On Certain Conditions attending the Geological Descent of some North American types of Fresh-water Gill-bearing Mollusks. <American Journal of Science and Arts. XXIII. 1882, (May.) pp. 382–6. Annual Report of the U. S. Geological Survey for 1882.

‡ 1882. WARD, LESTER F. On the Cause of the Absence of Trees on the Great Plains. <Kansas City Review of Science and Industry. V. 1882, pp. 697-702. (March.)

Prof. Gill read a paper entitled ON THE AFFINITIES OF THE "GREAT SWALLOWER," CHIASMODUS NIGER.* He stated the genus *Chiasmodus* to be the representative of a peculiar family, *Chiasmodontidæ*, and not at all allied to the *Gadidæ*. Its first dorsal has inarticulate spines and its ventrals are of the Acanthopterygian type. The group is indeed related to the *Harpagiferidæ* and *Chænichthyidæ* and should have been referred by Dr. Günther to his heterogeneous "family *Trachinidæ*."

TWENTIETH MEETING, December 23, 1881.

The President occupied the chair. Thirty members were present.

Dr. R. W. Shufeldt, U. S. A., read a paper entitled ON THE OSTEOLOGY OF THE GLASS SNAKE, (OPHEOSAURUS VENTRALIS.)† Prof. Otis T. Mason read a paper entitled THE INVASION OF THE DOMAIN OF BIOLOGY BY ANTHROPOLOGISTS. Mr. Frederick W. True read a paper entitled THE LAND TORTOISES OF NORTH AMERICA.‡

TWENTY-FIRST MEETING, January 6, 1881.

(Second Annual Meeting.)

The President occupied the chair. Thirty-five members were present.

The following officers were elected for the year 1882:

President—Prof. THEODORE GILL.

Vice Presidents—C. V. RILEY, Prof. J. W. CHICKERING, Jr., LESTER F. WARD, and HENRY ULKE.

Secretaries—G. BROWN GOODE and RICHARD RATHBUN.

Treasurer—ROBERT RIDGWAY.

Members of Council—Dr. J. H. KIDDER, U. S. N., Dr. GEORGE VASEY, Dr. T. H. BEAN, Dr. D. WEBSTER PRENTISS, Prof. O. T. MASON.

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*1879. GILL, THEODORE. The Great Swallower. <Forest & Stream. XIII. 1879, p. 906, (Dec. 18,) with figures. (A part only of the remarks made to the Society.)

† 1882. SHUFELDT, ROBERT W. Remarks upon the Osteology of Opheosaurus ventralis. <Proceedings U. S. National Museum. IV. 1882. pp. 392–400. Nine figures.

‡ 1882. TRUE, FREDERICK W. On the North American Land Tortoises of the Genus Xerobates. <Proceedings U. S. National Museum. IV. 1882. pp. 434–449. Three figures.

TWENTY-SECOND MEETING, January 20, 1882.

The President occupied the chair. Forty-five members were present.

The President delivered the annual address on the topic THE HISTORY OF CLASSIFICATION IN ZOOLOGY.

In his introductory remarks he congratulated the Society upon its present flourishing condition, stating that during the year its membership had nearly doubled. He also reviewed the history of other scientific societies of the city, mentioning the National Institute, the Botanical Society, the Potomac Side Naturalists' Club, the Physical Club, and the Geological and Geographical Society, all now extinct, and the existing Philosophical, Anthropological, and Biological Societies. He also spoke of the eminent zoologists who had been, in the early days of its history, identified with the Potomac Side Naturalists' Club, the predecessor of the Biological Society, mentioning the names of Prof. S. F. Baird, Count L. F. de Pourtales, Dr. William Stimpson, Mr. Robert Kennicott, Prof. J. S. Newberry, Mr. H. Ulke, Dr. Harrison Allen, Dr. Elliott Coues, Dr. D. W. Prentiss, Dr. F. V. Hayden, Mr. F. B. Meek, Baron R. von Osten Sacken, Dr. William A. Hammond, Prof. Burt G. Wilder, Dr. George Suckley, Mr. Titian R. Peale, and others.

TWENTY-THIRD MEETING, February 3, 1882.

Prof. Lester F. Ward, V. P., occupied the chair. Thirty-three members were present.

Mr. Frederick W. True read a paper ON THE ARCTIC SEA COW, (RHYTINA STELLERI.)* Mr. Henry W. Elliott exhibited drawings of the same extinct animal, and submitted a restoration by himself, the merits of which he advocated.

Mr. Frederick W. True exhibited an immense specimen of *Siren lacertina*, twenty-six inches in length, captured in the mud flats in front of the city of Washington. This species had not previously been recorded north of North Carolina.

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* To be published in the forthcoming Census Report on the Fishery industries of the United States.

TWENTY-FOURTH MEETING, February 3, 1882.

The President occupied the chair. Thirty-three members were present.

An animated discussion concerning the form of the tail, as well as the relationship and history of the Arctic Sea Cow, *Rhytina Stelleri*, took place. This was participated in by Messrs. Elliott, True, Coues, and Gill.

TWENTY-FIFTH MEETING, March 3, 1882.

The President occupied the chair. Ninety members were present. Mr. G. Brown Goode, chairman of the Committee on Lectures appointed by the Council, announced that, in co-operation with a similar committee, appointed by the Anthropological Society in response to an invitation from the Council of the Biological Society, a course of lectures had been arranged for; these lectures to be given on consecutive Saturdays, at 3: 30 P. M., in the lecture room of the National Museum. These lectures were to be free, and the public was to be invited. The discussion of the form of the tail and affinities of the Arctic Sea Cow was resumed; and by special vote, continued until 10: 30 P. M. The speakers were Messrs. Elliott, Coues, True, and Gill.

FIRST SATURDAY LECTURE, March 11, 1882.

An audience of about six hundred were present on the occasion of the first Saturday lecture.

Prof. Theodore Gill delivered a lecture entitled SCIENTIFIC AND POPULAR VIEWS OF NATURE CONTRASTED.*

The introductory address was delivered by Major J. W. Powell.†

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* 1882. GILL, THEODORE N. Scientific and Popular Views of Nature Contrasted. <The Saturday Lectures, | delivered in the | Lecture Room of the U. S. National Museum, | under the auspices of the | Anthropological and Biological Societies | of Washington, | in March and April, 1882 | — | D. Lothrop & Co., | 30 and 32 Franklin Street, Boston, Mass. | Washington, D. C.:—Judd & Detweiler, Printers and Publishers. | 1882. | 8vo., pp. (4) 185: (pp. 5-22). Also separately as Saturday Lecture No. 1, with title page, pp. 24.

† 1882. POWELL, JOHN W. Introductory Address (to the Saturday Lectures.) <The Saturday Lectures, pp. 1-3.

TWENTY-SIXTH MEETING, March 17, 1882.

The President occupied the chair. Forty-five members were present.

Dr. Elliott Coues read a paper entitled ON RECENT ADVANCES IN ORNITHOLOGY, on the occasion of laying before the Society, in advance of publication, a complete copy of the work below cited.* Remarks were made by Messrs. Gill, Ward, and Coues.

Dr. Edward Foreman exhibited a map of the Cretaceous fossil beds of Maryland.

SECOND SATURDAY LECTURE, March 18, 1882.

About six hundred persons listened to the lecture of Prof. Otis T. Mason on the topic: WHAT IS ANTHROPOLOGY? †

THIRD SATURDAY LECTURE, March 25, 1882.

An audience of about six hundred persons listened to the lecture by Prof. J. W. Chickering, Jr., on CONTRASTS OF THE APPALACHIAN MOUNTAINS.‡

TWENTY-SEVENTH MEETING, March 31, 1882.

Prof. Lester F. Ward, V. P., occupied the chair. Eighty members were present.

Dr. D. Webster Prentiss read a paper entitled MESMERISM IN

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* 1882. COUES, ELLIOTT. The | Coues Check List | of | North American Birds. | Second Edition, | Revised to Date, and entirely Rewritten, under Direction of the Author, | with a Dictionary of the | Etymology, Orthography, and Orthoepy | of the | Scientific Names, | the Concordance of Previous Lists, and a Catalogue of his | Ornithological Publications. | [Monogram.] | Boston: | Estes and Lauriat. | 1882.—1 vol., imp. 8vo., pp. 1-165.

† 1882. MASON, OTIS T. What is Anthropology? <The Saturday Lectures, &c., pp. 25-43; also separate as Saturday Lecture No. 2. with title page, 8vo., pp. 21.

‡ 1882. CHICKERING, JOHN W., Jr. Contrasts of the Appalachian Mountains. <The Saturday Lectures, &c., pp. 44-59; also separate with title page as Saturday Lecture No. 3, 8vo., 16 pp.

Animals, and at its close mesmerized a canary bird and a fowl. The paper was discussed by Messrs. Schaeffer, Billings, Ellzey, Coues, Wolfley, Riley, True, King, Gilbert and Gihon.

Fourth Saturday Lecture, April 1, 1882.

About eight hundred persons listened to the lecture of Major J. W. Powell on Outlines of Sociology.*

Fifth Saturday Lecture, April 8th 1882.

About seven hundred and fifty persons listened to the lecture of Prof. C. V. Riley, on Little Known Facts About Well Known Animals.†

Twenty-eighth Meeting, April 14, 1882.

The President occupied the chair. Sixty-five members were in attendance. Prof. William H. Brewer, of Yale College, was present as a guest.

Dr. Frank Baker proposed amendments to the Constitution as follows:

In Article III. Strike out the words, "upon recommendation of the majority of the members present at its regular meeting;" and substitute for the words "a majority vote of the members present when the ballot is taken shall be necessary to an election," the words "seven affirmative votes shall be necessary to an election."

In Article IV. Strike out the words, "its duty shall be to act on nominations," &c., and substitute—"It shall conduct all the business of the Society except the election of officers."

In Article XII. Strike out sections III, IV and V.

A committee of five, consisting of Messrs. Ward, Goode, Chickering, Riley, and Rathbun, was appointed to confer with the

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* 1882. Powell, John W. Outlines of Sociology. <The Saturday Lectures, &c., pp. 60–82, also separate with title page as Saturday Lecture No. 4. 8vo. p. 25.

† 1882. Riley, Charles V. Little Known Facts About Well Known Animals. <The Saturday Lectures, &c. pp. 83–112. Also separate with title page as Saturday Lecture No. 5. 8vo., pp. 32. Fifteen woodcuts.

committees appointed by the Anthropological and Philosophical Societies in reference to the proposed scheme for the consolidation of the Scientific Societies of Washington and the formation of an Academy of Sciences and to report the result of their conferences.

Dr. Frank Baker read a paper entitled ON THE RAMIFICATIONS OF THE ARTERIES. This was discussed by Messrs. Gill, Barnard, and Scudder.

Mr. G. Brown Goode exhibited several remarkable specimens of taxidermic skill from the work shops of the National Museum.*

SIXTH SATURDAY LECTURE, April 15, 1882.

About six hundred persons listened to the lecture of Dr. Robert Fletcher upon PAUL BROCA AND THE FRENCH SCHOOL OF ANTHROPOLOGY.†

SEVENTH SATURDAY LECTURE, April 22, 1882.

Abot six hundred and fifty persons assembled to hear the lecture by Mr. William H. Dall upon DEEP-SEA EXPLORATIONS.‡ Among the audience was Captain Sir George S. Nares, R. N., late commander of the British corvette "Challenger" during its three years cruise of deep-sea exploration.

TWENTY-NINTH MEETING, April 28, 1882.

The President occupied the chair. Forty-five members were present. The Society voted that the next regular meeting of the Society should be a "Darwin Memorial Meeting." A committee

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* See Report of the Assistant Director of the U. S. National Museum. <Report of Smithsonian Institution for 1881.

† 1882. FLETCHER, ROBERT. Paul Broca and the French School of Anthropology. <The Saturday Lectures, &c. pp. 113–142. Also as separate, with title page. 8vo., pp. 32.

‡ 1882. DALL, WILLIAM H. Deep-Sea Explorations. <The Saturday Lectures, &c. pp. 143–162. Also separate, with title page, as Saturday Lecture No. 7. 8vo., pp. 22.

consisting of Messrs. Goode, Riley, Ward, Rathbun, and Gill, having been appointed by the Council to arrange for the same, and having anticipated the action of the Society by making certain preliminary arrangements.

Mr. Edmund B. Wilson, of Johns Hopkins University, a corresponding member, presented a paper on THE EMBRYOLOGY OF RENILLA.*

Mr. Frank H. Cushing spoke on the topic ZUÑI BIOLOGY, describing some of the peculiar plants and animals occurring in the deserts of the Southwest, and referring to the manner in which animals are regarded by the Zuñi Indians.

EIGHTH SATURDAY LECTURE, April 29, 1882.

About six hundred persons listened to the lecture of Dr. Swan M. Burnett upon the topic HOW WE SEE.†

SPECIAL MEETING, May 5, 1882.

The President occupied the chair. Thirty-eight members were present.

Mr. Goode presented the report of the Committee on the Darwin Memorial Meeting, which was accepted. Prof. Ward submitted the report of the Committee on the Consolidation of the Scientific Societies in Washington, as follows:

The joint committee composed of the several committees appointed by the Philosophical, Anthropological, and Biological Societies of Washington to consider the desirability of a federation of those societies—

Recommend to the several societies a federation on the following basis, and for the purposes set forth:

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* The remarks of Mr. Wilson were in part included in the following papers:

1880. WILSON, EDMUND B. The Early Stages of Renilla. <American Journal of Science, XX, 1880, pp. 446–9, plate VII.

1882. WILSON, EDMUND B. On Animal Polymorphism. <Johns Hopkins University Circulars, No. 15, May, 1882, pp. 203–4.

† 1882. BURNETT, SWAN M. How We See. <The Saturday Lectures, &c. pp. 163–185. Also separate, with title page. 8vo., pp. 25. Three woodcuts.

I. The purposes of this federation shall be—

First, the publication of a common body of transactions;
Second, periodic meetings of the united societies;
Third, the management of courses of popular lectures; and,
Fourth, such other objects as may be agreed upon.

II. The federation shall be known as the Washington Academy of Sciences.

III. The several societies shall retain their own organizations, excepting as hereinafter modified.

IV. The three societies shall have the same annual fees of membership.

V. The uniform fee for each of the three societies shall be three dollars.

VI. The Academy shall be organized by the election of a president, a secretary, a treasurer, and two councilmen, by the Academy. The presidents of the several societies shall be *ex officio* vice presidents of the Academy, and members of its council, one secretary from each society shall be a member of the council, and each society shall elect two additional councillors for the council of the Academy.

VII. A grade of fellowship shall be established in the Academy.

VIII. The annual fee of fellowship shall be five dollars.

IX. The existing members of all the societies shall be fellows of the Academy, on the payment of the fellowship fee.

X. The council of the Academy may subsequently elect fellows from the members of the Academy.

XI. The fellows of the Academy shall be *ex officio* members of all the societies.

XII. It is recommended to the several societies that the existing committees of conference be continued, for the purpose of collecting the sense of the said societies on the above propositions, and of carrying out such scheme of organization as may be mutually accepted.

WILLIAM B. TAYLOR,
Chairman of Joint Committee.

Committee of Philosophical Society.—John W. Powell, Theodore Gill, James C. Welling, John S. Billings, William B. Taylor.

Committee of Biological Society.—Lester F. Ward, G. Brown Goode, Charles V. Riley, Richard Rathbun, John W. Chickering.

Committee of Anthropological Society.—John W. Powell, Garrick Mallery, James C. Welling.

Mr. Goode submitted the following table of statistics, showing the comparative membership in the three societies:

Total membership in the three Societies	329
Membership in Philosophical Society	160
" Anthropological Society	115
" Biological Society	134
Common to all	22
" Philosophical and Anthropological Societies	32
" Philosophical and Biological Societies	38
Anthropological and Biological Societies	36
Members of Philosophical Society only	97
" Anthropological Society only	61
" Biological Society only	20

The reports of the committee were discussed by Messrs. Wilson, Bean, True, Riley, Kidder, Seaman, and Ellzey, a strong feeling of opposition to any scheme of consolidation being manifest. The motion of Prof. Riley, "*Resolved*, That it is the sense of this (informal) meeting that a federation with the Anthropological and Biological Societies is desirable," was carried by a vote of 22 to 8. The first six articles of the report of the committee were provisionally approved one by one, and the committee was continued, with instructions to report further action at a regular meeting of the Society.

THIRTIETH MEETING, May 12, 1882.

DARWIN MEMORIAL MEETING.

The President occupied the chair. In addition to the members of the Society, the members of the other societies and their friends had been invited to attend; and although the night was stormy, about seven hundred ladies and gentlemen were present to attend the memorial service in honor of Charles Darwin, who died at Down, Kent, England, April 19, 1882. On the stage sat, in addition to the officers of the Society, Dr. W. B. Taylor, President of the Philosophical Society; Major J. W. Powell, President, Dr. Robert Fletcher and Prof. O. T. Mason, Vice-Presidents, and Col. F. A. Seely, Secretary, of the Anthropological Society. A large portrait of Darwin, painted by Henry Ulke, V. P., and a bust, by Mrs. Mica Heideman, decorated the stage. The order of exercises was as follows:

Introductory	Theodore Gill.
Biographical Sketch	Wm. H. Dall.
The Philosophic Bearings of Darwinism	John W. Powell.

Darwin's Coral Island Studies .... Richard Rathbun.*

Darwin's Investigations on the Relation
of Plants and Insects .... Charles V. Riley.

Darwin as a Botanist .... Lester F. Ward.

Darwin on Emotional Expression .... Frank Baker.

A Darwinian Bibliography .... Frederick W. True.

A Portrait of Darwin .... Henry Ulke.

The addresses delivered on this occasion are printed in full in the appendix.

THIRTY-FIRST MEETING, May 26, 1882.

The President occupied the chair. Thirty-five members were present.

Mr. Wm. H. Dall made an appeal for aid in the exploration of the molluscan fauna of the District of Columbia.

Dr. Tarleton H. Bean exhibited a specimen of a rare arctic bird, the Spoon-billed Sandpiper, *Eurynorhynchus pygmæus*, obtained by him on the coast of Siberia.†

Dr. M. G. Ellzey made a brief communication upon the natural history of mules.

The Society ratified the action of the council in voting that the proceedings of the Society, together with the addresses at the Darwin Memorial Meeting, should be printed, and that the funds of the Society now in the treasury should be used for that purpose. A resolution to the effect that women should be admitted to membership in the Society was referred to a committee consisting of Gen. William Birney, Messrs. Dall and Goode, and Doctors Prentiss and Kidder.

The Society then adjourned to meet in October.

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* Omitted on account of the illness of Mr. Rathbun.

† 1882. BEAN, TARLETON H. Notes on Birds collected during the summer of 1880, in Alaska and Siberia. <Proc. U. S. Mus., V, 1882, pp. 144+ (*E. pygmæus*, p. 165.)

Also, 1881. BEAN, TARLETON H. Our unique Spoon-billed Sandpiper. <Forest and Stream, XVI, April 12, 1881.

ADDRESSES

DELIVERED ON THE OCCASION OF THE

DARWIN MEMORIAL MEETING,

HELD IN THE LECTURE-ROOM OF THE U. S. NATIONAL MUSEUM,

MAY 12, 1882.

THE DOCTRINE OF DARWIN.*

BY THEODORE GILL.

The chief for many years of the leaders in science knows no longer the world he erstwhile knew so well. CHARLES DARWIN has closed a life illustrious in the annals of biology, scarce full of years but very full of honors.

How fruitful was that life and how potent its influence on philosophy and on sociology the united voice of the civilized world proclaims—how grievous the loss the lamentations of mankind testify. Less than a quarter of a century has elapsed since the publication of the "Origin of Species by means of Natural Selection." How great is the contrast between the beliefs and practice of naturalists before its appearance and those of their present successors! He would, indeed, have been a bold man who would have predicted that, in two decades after its appearance, the views therein promulgated would be universally accepted and be taken as the recognized platform of biologists. But the incredible has actually happened; all the students of nature, and in every land; zoologists and botanists, palæontologists and geologists—in America and Europe, at the confines of Asia, the extreme of Africa, and in distant Australia—all meet on common ground as evolutionists; all recognize to a greater or less extent the operation of natural selection in the survival of the fittest. To appreciate the cause of the profound impression produced by the deceased naturalist's greatest work, some reference to the antecedent and succeeding conditions is fitting.

It had been, from time immemorial, a generally accepted idea that the living beings which people the globe had, in some mys-

* Several of the paragraphs in this address were published in advance, with a few modifications, in "The Critic," of New York, for May 6, 1882.

terious manner, been each "created" separately; but how, few ventured to express in words, for the mere attempt to do so conjured up such strange fancies that the intelligent mind drew back in revolt and refused to consider them. Now, it is a recognized scientific creed that the animals and plants which have successively inhabited the earth, were the descendants, with modification, from previous inhabitants since the dawn of life. A glimmer of the truth had now and then occurred to contemplative students. Philosophers had ventured to think that living forms like ancient ones might have descended from them. The investigators in various departments of biology had gradually deduced generalizations which all tended in a similar direction. The taxologists, in their very nomenclature, compared the animal kingdom to a tree of which the principal types were "branches" diverging from a common trunk, while the minor groups were successive offshoots; and the idea of genetic relationship suggested by the various degrees of likeness was expressed in the names conferred on other groups—"tribe," "family," etc. The embryologists had recognized a coincidence between the stages of development of the "superior" animals and the adults of animals inferior in the system. The palæontologists had discovered an approximate coincidence between the successive inhabitants of the earth and the successive stages in the development of the living animals of the same types. The series of facts thus obtained had even, to some extent, been coordinated.

All these series of facts were such as would have been the result of the derivation of existing types from previous ones. But the possibility that the seeming was the real did not commend itself to the consideration of naturalists. Instead thereof, it was assumed that the facts were "in accordance with a plan of the Creator;" that the Deity had conceived a few patterns, and that by those he constructed the animals which successively appeared on the globe, to be in time swept off and replaced by others. If answer was made that such was a puerile conception of creation and that it limited the power of Deity, excessive anger was displayed, and its opponents called infidels and atheists. But even those who doubted whether the accepted views of creation were tenable, hesitated to take the alternative view. An efficient factor in variation remained to be discovered, and a full presentation of the data had yet to be made.

It was in 1859 that the desiderata indicated were supplied in "The Origin of Species by means of Natural Selection." "Variation under Domestication" was compared and contrasted with "Variation under Nature." The "Struggle for Existence" which is the result of the progressive increase of living beings was considered, and "Natural Selection" was designated as the factor which determined the development and existence as "species" of forms which had descended, with modifications, from countless antecedent generations. With the successive changes in temperature and other conditions ensuing in the ever-changing world, the animals and plants which peopled it were compelled to keep pace by corresponding changes in structure, or to give place to others who could adapt themselves to the new conditions.

So much were the views thus enunciated opposed to the current ideas that a brief period of astonished silence ensued, and men felt about before they could realize their full purport, or that such opinions were broached in sober earnest. Then followed on every hand torrents of detraction and abuse. The naturalists of the old school and the priests of revelation met on common ground, and loud and bitter was the denunciation. Numerous were the arguments against the new theory.

But why this great turmoil and uproar? Darwin was not the first to believe that species had been derived and not created. So had philosophers believed before; the grandfather of Darwin believed and urged the belief; a great naturalist at the commencement of the century—Lamarck—boldly and wisely formulated a theory of evolution; the "Vestiges of Creation" took up the view, and gained marked attention in Britain. Even a clergyman of the English

Church, the Savilian professor in orthodox Oxford, the Rev. Baden Powell, in 1855, had considered the "Philosophy of Creation" in a "masterly manner," and Darwin bore testimony that nothing can be more striking than the manner in which the enlightened priest showed that the introduction of new species is a regular phenomenon in contradistinction to a miraculous process. Darwin was not the first even to conceive of the principle of natural selection. An American resident in England, Dr. W. C. Wells, as early as 1813, had recognized the operation of the principle in the distribution of the human race. In 1831, Patrick Matthews also appreciated the principle of natural selection; so Darwin himself witnesses.

It was not, then, the mere enunciation of the theory of evolution, nor of the principle of natural selection, that characterized the "Origin of Species," and drew the attention of mankind to it. It was the recognition of the incessant and universal operation of the factors, the masterly co-ordination of the facts of biology—zoology, botany, anatomy, general morphology, physiology, embryology, palæontology—and geology, the marshalling in orderly array and concentration in one direction of all natural knowledge, the force of the logic, the clearness of the exposition, the judicial candor of the argument that arrested men's attention, and provoked serious consideration of what before had been ignored as being beyond the domain or possibilities of investigation. In the time of Lamarck the world was not ready for a consideration of the question. Lamarck's was the prophesy of intuitive genius—genius the greater in that the facts that had then been garnered were few. The "Vestiges of Creation" was so replete with errors of fact and misconceptions as to attract more attention to the fault of its details that to the logic of its argument. The principle of natural selection had been applied to very special fields by Wells and Matthews; no evidence had been furnished of its wide extension, and it even occupied a subordinate position in the thoughts of those investigators.

The author of the "Origin of Species" was a different man from his predecessors, and lived in a happier time. The facts had been accumulated and co-ordinated; men were ready to consider the reason why facts were such, and none was better fitted than Darwin —I should rather say none was so well fitted—to arrange and present the facts and to draw the deductions therefrom. Ever a close observer, practiced in many lands, student of all nature—especially skilled as a geologist, a botanist, and a zoologist—endowed with a severely judicial mind, honest above all, none like him had ever grappled with the mystery of creation. For more than twenty years he had pondered on the subject; with impartial severity he had weighed the evidence. He was, perforce, led to the conclusion that all the living had been derived from past forms, with modifications incident to individuality; the sums of the divergencies, small in themselves, became large in the aggregate, became enormous in time. The increasing beings, crowding upon each other, invading each other's domains, struggled for the life into which they were born. Happy were those possessing some slight advantage—strength, swiftness, dexterity, or adaptability resulting from modification of structure—for they could procure place or food at the expense of their competitors, and the characters that gave them victory secured, likewise, the temporary ascendancy of their kind. How great is this variability our domesticated animals attest; how ancient is our globe geology teaches; that the race is to the strong or the cunning observation of inferior nature assures. With known variability, time, and space, what could not result? Which, then, was the more probable that Nature—or, if you will, the Creator—had always operated under law, or that there had been constant interference?

Thus were the issues fairly joined. On the one hand, Creation was the rallying cry; on the other, Evolution and Darwin. But what meant the opposed terms? It is surely but reasonable to ask the question. The evolutionists conceded the reasonableness, and gladly accepted the ordeal. Could less be required of the creationists? In reverential mood would I submit the alternatives. If they repel, blame not me. I have long and fruitlessly searched for better.

Creation implies the actual fashioning of forms in full panoply, and with all the characteristics of their kind. But when it was asked how this had been effected the answer was vague and evasive. Did "elemental atoms flash into living tissues?" Was there vacant space one moment and an elephant apparent the next? Or did a laborious God mould out of gathered earth a body to then endue with life? The questions are surely pertinent, for only by such means can we conceive of creation. But passionate disclaimers and angry denunciations greeted him who would frame such conceptions in exact language. Metaphysical jargon and rhetoric about divine purposes might sophisticate, but could not answer.

Evolution denotes the derivation of living beings from preceding in endless succession. Variation in progeny, limited heredity, and time are its correlatives. These being conceded, the peopling of the globe with its life, past and present, is conceivable.

What was the evidence to support the conflicting conceptions?

For creation it was urged that the universal consensus of mankind supported it; that divine revelation taught it; and that the diversities and specialization of organic forms forbade the idea of their derivation from a common parentage.

The universal consensus of mankind maintained till the sixteenth century the doctrine that the earth was flat; that the sun and other planets circled round the earth; and that the earth was the great centre of the universe. The universal consensus of mankind for thousands of years is not the universal concensus of the enlightened man, nor of the present century.

The teachers of revelation have been often mistaken. Many are they who once were contemned and denounced because their utterances were not in accordance with the opinions of their day, who are now accepted as the champions of a purer religion. One of the wisest priests of England has said that "with a certain class of religionists every invention and discovery is considered impious and unscriptural as long as it is new. Not only the discoveries of astronomy and geology, but steam, gas, electricity, political economy, have all in their turn been denounced; and not least, chloroform. Its use in parturition has been anathematized as an infraction of the penalty pronounced on Eve!"* It is not I, but a great clergyman, who expresses such sentiments.

The objection that the differentation and specialization of organic beings gainsay their derivation from a common source is a most weighty one. In the infancy of our own knowledge it was unanswerable, and the less we know of nature the more we are impressed with these diversities. It is not, however, simply a question of whether evolution is true; but which is the more probable of two alternatives—that all the phenomena which point in one direction and which could have occurred in natural sequence, have taken place in such sequence; or that direct creative intervention has ensued again and again, when the same ends could have been produced without such intervention.

Nature was true to her disciple, and herself furnished the replies.

It was contended that if evolution were true, the evidence should be forthcoming in the existence in previous geological epochs of forms of a generalized character intermediate between still earlier ones and later widely separated forms; and that of such there were very few.

The graves of the distant past gave up their dead, and the ossuaries of our own far West yielded most cogent testimony to the truth. Forms from the eocene and later beds, resurrected by the wand of the anatomist, rising in successive lines behind the wide gaps in the living files, proclaimed that all were of one blood, and showed the genealogy of the contemporaries of man.

Many were the forms thus connected. Few are those that may be mentioned on this occasion. The horse-like animals, the rhinoceroses, and tapirs are so unlike, that proof of their derivation from one source might be thought to be impossible. But as we go back into the ages we find equines with lateral digits and hooflets

*Rev. Baden Powell's Essay on the Spirit of the Inductive Philosophy, etc., p. 455.

becoming larger and longer, teeth shorter and more generalized, skeletons less characteristic; rhinoceroses with cutting teeth, and more slender forms; tapir-like animals without the peculiar tapirine teeth, with rhinocerotoid skulls, and with otherwise modified structure; all these accompanied by innumerable other modifications, till finally we are almost at a loss to tell whether it is a horse-like, a rhinocerotoid or a tapiroid animal that is before us, and *they* become lost in earlier forms with special characters of their own. And as we go still further back we are confronted with still other forms that are connected by series projected backward from the ruminants and from the elephantids. We do, in fine, know the genealogy of our own contemporaries—imperfectly it is true, but still we know it.

It was objected that animals were segregated by such very wide intervals that they must be isolated in different branches, and that there could be no community of structure between such branches; they expressed fundamentally different plans of structure.

One by one zoology, anatomy, and embryology supplied the links between the old branches; the branches were at length completely uprooted, and it has even become a matter of simple convention what should be considered major groups. Plans of structure can no longer be claimed to be peculiar to different types.

That branch of which man is the primate—the vertebrates—was supposed to be perfectly unassailable and isolated; but zoology and anatomy have revealed to us amphioxus, and embryology the earlier stages of the tunicates. The evidence is now conclusive that these forms which once appeared to be among the most distant are now the most closely related. The affinities of the tunicates with invertebrates are evident, and thus we may look far back to that time when vertebrates did not exist, but when the common ancestors, from which they and the related invertebrates should diverge, held sway.

It was even pretended that the evidence was insufficient to show that variation was possible or could be propagated.

From every hand testimony was forthcoming. The breeder could point to every domesticated animal—the horticulturist and pomologist to all cultivated plants—the systematist and zoögeographer to the limits of species which varied with knowledge of their distribution—the palæontologist to the gradation between the extinct forms and widely separated living species, as well as to that between forms which lived in successive earlier epochs.

It was urged that the Darwinian theory was opposed to revelation, and subversive of Christianity.

As students of nature and seekers after truth alone—so far as nature is concerned—we only ask whether the views of Darwin are true or not. But now, from many a pulpit, and from the most enlightened of the clergy, we hear the claim that evolution is in perfect accordance with revelation, and is a witness to the power, prescience, and goodness of God.

It was contended that acceptance of the teachings of Darwin would have a pernicious tendency, and entail riot, lawlessness, and crime in the world.

A long life of singular purity and blamelessness in the person of Darwin was an answer. An unsullied heritage from an ancestor entertaining like views has been transmitted to heirs of his body without flaw. Sons of the great philosopher continue the studies of their great sire, and worthily wear the heavy mantle left to them.

One after another the scientific opponents of evolution became convinced of its verity, or died out. The naturalists of a new generation with one accord accepted "Darwinism" as a starting point for their more profound studies. The methods and aims of biology became changed. Biology became exalted from empiricism into a science. Long before "The Origin of Species" had even "come of age," acceptance of its teachings had become an essential of scientific creed, and Darwin was acknowledged to have effected a greater revolution in science than any Englishman since the time of Newton. Most meet was it then that he should rest by the side of his great predecessor whose rival he will ever be in fame.

BIOGRAPHICAL SKETCH.

BY WILLIAM H. DALL.

Charles Robert Darwin, son of Dr. Robert Waring Darwin, F. R. S., and Emma Wedgewood, grandson of Dr. Erasmus Darwin and Josiah Wedgewood, was born at Shrewsbury, England, February 12th, 1809. He died of disease of the heart at his residence, Downe Court, Beckenham, Kent, at 4 P. M., April 19, 1882, and consequently had attained the age of 73 years, 2 months, and 7 days. At Shrewsbury his childhood was passed and his education was obtained at the once famous Shrewsbury Grammar School, presided over by the Rev. Dr. Samuel Butler, afterward Bishop of Litchfield and Coventry.

At the age of sixteen he entered the University of Edinburgh (1825) where he remained two years. Even at this early period he had become a student of natural history, and read his first scientific paper before the Plinian Society. It was "On the Movement of the Ova of Flustra," one of the incrusting marine corallines.

In 1827 he entered Christ's College, Cambridge, where he graduated as a Bachelor of Arts four years later. Here he fell under the influence of the teachings of Prof. John Stevens Henslow, an excellent botanist, whose instruction doubtless did much to determine the field of study subsequently occupied by his pupil.

In 1831 Captain Fitzroy, R. N., offered to share his cabin with any competent naturalist who would accompany him on his prospecting voyage to South America in H. M. S. Beagle, detailed for surveys in that region. Mr. Darwin, then only twenty-two years of age, offered his services with the stipulation that he should control the collections made, and was accepted. The Beagle sailed November 27, 1831, from Plymouth, and returned to England on the 2d of October, 1836. During a large part of the voyage Mr. Darwin suffered greatly from sea-sickness, or some difficulty which simulated it, and which, in some form, returned at intervals throughout his whole life, as sudden fits of illness which prostrated him for days together, and which were followed by long periods of wakeful convalescence. Under the circumstances, the amount of keen and patient observation, the vast accumulation of facts, and the extensive collections obtained by Mr. Darwin during his voyage, appear more marvelous than ever.

After his return his health was much shattered, and his studies more or less interrupted for some years. He took his Master's degree in course, and shortly after his return was elected a Fellow of the Royal Society, (of which his father and grandfather were previously Fellows,) and of the Geological Society, of which last he was made secretary.

In 1839 he published his epoch-making work "A Journal of Researches into the Geology and Natural History of the Various Countries visited by H. M. S. Beagle;" the first of that long series of investigations to which his life was devoted, and the publication of which revolutionized the study of biology, and gave to Darwin a position as a naturalist unparalleled in the history of science.

In the same year, 1839, Mr. Darwin married his cousin, Emma Wedgewood, and retired to the secluded and beautiful district of Kent where, in his country-house of Downe Court, near Orpington, more than forty years of his life were spent. The district is purely agricultural, a plateau of chalk, some 400 feet above the sea, interrupted by the wavy hollows characteristic of the English chalk country, with beech woods here and there on the slopes. His dwelling is one of the old square-built, red-brick mansions of the last century, to which has been added in more recent times a gable-fronted wing, with another square-built wing and pillared portico on the corresponding side. Shut in and almost hidden from the roadway by a high wall and belt of trees it offers ideal seclusion for a quiet student. On the southern side the walled garden opens into a secluded meadow bounded by a tract of underwood through which there is a lovely view of the narrow valley which descends toward Westerham.

Here, and in the by-paths of adjacent woods and meadows, Mr. Darwin was accustomed to take daily exercise with a characteristic regularity. Up to ten or twelve years ago, his tall figure, mounted on a favorite old black horse, was a familiar object in the country lanes. This animal fell and died suddenly one day, after which it was noted that Mr. Darwin rode no more. His invariable hours for walking, in these later years, were seven in the morning, noon, and four o'clock in the afternoon, usually accompanied by one or more of his sons; one of whom, Mr. Francis Darwin, has long been established as a surgeon in the hamlet of Downe. His habits were extremely regular. He rose at six, took a cold plunge bath (which was repeated in the evening), breakfasted alone, and after his first morning walk was usually in his library by 8 A. M. At nine he would spend a little time in the dining-room opening his mail, and in the evening would linger an hour or two in the society of his family, or that of some of his scientific friends who occasionally visited him; but the greater part of his time was spent in his library, his garden, and the adjacent grounds. A few friends, among whom were Sir John Lubbock and Dr. Farr, near residents, were often with him, and with such he was social, frank and ever ready to enjoy a joke or frolic; with all men he was unpretentious, kind, and devoid of any artificiality of manner; but his life was essentially a secluded one, as may be judged from the fact that the news of his death did not reach London until noon of the following day.

Nevertheless, his life was far from solitary, for his family formed quite a colony in itself until the children reached maturity. Two children, a boy and girl, were lost in infancy, one dying in 1842 and the other in 1858, and are buried in the village churchyard of Downe, near by some of the Wedgewoods.

In the family who lived Mr. Darwin was fortunate. His eldest son, William, is a banker at Southampton; the second, George, took high honors at Cambridge, and is now a Fellow of Trinity College and a distinguished mathematician; the third, Frank, having inherited his father's delicate constitution, acted as his secretary; the fourth, Leonard, an officer of artillery, has distinguished himself in the direction of astronomy; the fifth, Horace, is an excellent mathematician. One married and one unmarried daughter complete a family whose constant care has always been to relieve its head from any trouble and anxiety.

Mr. Darwin has always been in easy circumstances, financially, so that he could use his time as he chose, without care. When young he pursued field-sports, with the combined interest of the hunter and the naturalist; in later years he found his chief relaxation in reading popular novels. His work was taken up with great method, and he never wrote for more than two hours at a time.

In 1853 he received the gold medal of the Royal Society for his various works; in 1859 that known as the Wollaston medal from the Geological Society; in 1871 he received the Prussian Order of Knighthood "For Merit," and was elected a corresponding member of the Austrian Academy of Sciences; and in 1878, foreign associate of the French Academy. He received honorary degrees from Leyden and Cambridge, and other scientific honors almost without number.

His death was unexpected. He had been slightly unwell for several weeks, and the weakness of the heart's action was such that he was not permitted to ascend the stairs, but in the main, he was still able to pursue his ordinary routine. On Tuesday morning Sir John Lubbock found him apparently about as usual. That he was seriously ill, was first known in the village Wednesday afternoon by the arrival of his groom on horseback, horse and man reeking with foam, having galloped for ice six miles and back from the nearest point where it could be procured; but in vain, the relief arrived too late, Charles Darwin had already passed away, surrounded by his family, including several of his sons, Mrs. Darwin, and a married daughter. On the 26th his mortal remains were laid in Westminster Abbey, near by the ashes of Isaac Newton, and were followed to the tomb, not only by dignitaries of Church and State, but by the universal reverence of the scientific world.*

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*It is hardly necssary to state that this sketch is a compilation from all the different sources which happened to be available at the time.

DARWIN'S CONTRIBUTIONS TO PHILOSOPHY.

By John W. Powell.

Many are the definitions of philosophy. If we wish not to define what is *true* philosophy, but simply to define the term in all its uses when referring to all times and all men, this definition will do: *Philosophy is the explanation of the phenomena of the universe.*

Now, the phenomena of the universe are embraced in many vast categories.

First, we have the constitution of the heavenly bodies, and their real and apparent motions to be explained. What are they, and how came they to be what they are?

Then we have the earth itself; its forms, its lands and seas, its mountains and valleys, its rivers and lakes, the winds which blow about it, the storms which fall upon it, the lightnings that flash athwart the sky, the thunders that roll among the clouds. What are all these things, and whence came they, and why are they? Again, in the constitution of the earth we find rocks with their minerals, and geologic formations with their fossils. What are rocks and minerals, formations and fossils, and whence came they?

Look at the innumerable forms of plants covering the earth with verdure—the whole vegetable kingdom on the land and on the sea; forests, mosses, and confervæ. Who shall explain the meaning of the phenomena of the vegetable kingdom?

The oceans teem with animal life; reptiles crawl over all the land; the hills and the valleys, the mountains and the plains, are all inhabited by beasts; and the air itself is populated. Who shall tell us of all the living things, and then explain life itself?

Turn to the contemplation of man, organized into tribes and nations; man possessed of innumerable languages; man engaged in arts and industries; man endowed with reason and will; man in search of moral principles to guide his conduct. Whence came this man, and whither does he go?

Among all tribes and nations of the globe, and in all times, men have sought to discover the whence, the how, and the why, of all things—the phenomena of the universe.

The explanation of the universe is philosophy.

The philosophies of the world may be classified as—

I. Mythologic.
II. Metaphysic.
III. Scientific.

Mythology and science constitute the two grand systems of philosophy, but between them stands metaphysic philosophy as a stepping-stone from the former to the latter.

In the lower stages of society philosophy is purely mythologic. All savage and barbaric peoples explain the phenomena of the universe by a system of myths. A mythology is always a growth, and among every people there grows up by the employment of diverse and superficial analogies—curious suggestions—a body of mythic explanations which constitute its philosophy.

Among the Wintuns of California the world is three-storied. There is a world—a great chamber—above, and there is this world, and a world below. The waters fall from the world above because the sky, the floor of that upper world, leaks; and the waters come from the world below through the springs that issue from the flanks of the dead volcanoes of that land; so the waters from above and the waters from below meet and flow down the great Sacramento to the sea, where again they divide; the waters from above taking their way to their upper home, and the waters from below taking their way to the lower world.

The mountains were formed by the great mole-god, who crawled under the land and upheaved the mountain ranges that stand on either side of the Sacramento Valley. And so they explain all of the phenomena of the universe, with which they are acquainted, in a system of myths which constitutes the philosophy of the Wintuns.

Now such a system of philosophy, a mythology, is found in every savage and barbaric tribe of the world.

But there came a time in the history of mankind when some of the peoples changed their philosophy—their explanation of the phenomena of the universe—by changing their methods of reasoning.

ORIGIN OF METAPHYSIC PHILOSOPHY.

From three to two thousand years ago Europe, Asia, and Africa established a commerce in ideas—an exchange in philosophies—carried on by the navigation of the Mediterranean. During that and some previous time there were built on the shores of this sea many cities. Through the building of these cities, and through the industries and arts which sprang up therewith, society was reorganized, and placed upon a new basis—tribal society developed into national society—barbarism into civilization.

The peoples of these cities spoke diverse languages, and entertained diverse mythologic philosophies. Through the intercourse which sprang up between them each learned of the philosophy of the other, and the scholars of that day attempted to discover in all of these diverse mythologies a common body of truth upon the theory then widely accepted, that they had all sprung from a common source—a primitive philosophy itself the truth—and that all the philosophies then existing were degenerations therefrom. This line of investigation led to a curious result.

All of the mythologies of the cities of the Mediterranean were found to be baseless—each a fabric of poetic but superficial analogies. In the mental activity of that time many new philosophies were proposed, diverse and contradictory, and the wisest philosophers said, "How shall we know the truth?" And they endeavored to discover some criterion by which truth should be known. This resulted in the development of *formal logic* as a testing machine into which opinions were put for the purpose of sifting truth from error.

Now the machine called logic, the tool of the metaphysician, is curiously constructed. Its chief hypothesis is that man was primitively endowed with fundamental principles as a basis of reasoning, and that these principles can be formulated. These fundamental principles are supposed to be universal, and to be everywhere accepted by mankind as self-evident propositions of the highest order, and of the broadest generalization. These fundamental propositions were called *major* propositions. The machine, in formal logic, was a verbal juxtaposition of propositions with the major propositions at the head, followed by the minor propositions, and from this truth was supposed to flow.

This formal logic of the Aristotelian epoch has lived from that period to the period of science. Logic is the instrument of metaphysics, and metaphysic philosophy, in its multifarious forms, is the product of logic. But during all that time—2,000 years—no truth has been discovered, no error has been detected by the use of the logical machine. Its fundamental assumption is false.

It has been discovered that man is not endowed with a body of major propositions. It is found that in the course of the evolution of mind minor propositions are discovered first, and major propositions are reached only by the combination of minor propositions; that always in the search for truth the minor proposition comes first, and that no major proposition can ever be accepted until the minor propositions included therein have been demonstrated.

The error in the metaphysic philosophy was the assumption that the great truths were already known by mankind, and that by the proper use of the logical machine all minor truths could be discovered, and all errors eliminated from philosophy. As metaphysic methods of reasoning were wrong, metaphysic philosophies were false; the body of metaphysic philosophy is a phantasmagoria.

THE ORIGIN OF SCIENTIFIC PHILOSOPHY.

While metaphysic philosophers have been playing with their logical kaleidoscopes, another body of philosophers have been at work gathering the materials for the philosophy of science. Their method is to collect facts and to discover their relations, and they accept no conclusions that are not reached by this method. All other conclusions they hold as undetermined or indeterminate.

And now must be given a definition of science. *Science is the discernment, discrimination, and classification of facts, and the discovery of their relations of sequence.* This is a simple statement, but for its full comprehension a little illustration may be necessary.

A savage hears the voice of his fellow-man, he hears the voice of the beast, and of the bird; he also hears the noise of the thunder, and he supposes that the noise is a voice. In these cases he *discerns* noises, but he does not *discriminate* one noise from the other, and supposes them all to be voices, and that the noise of the thunder is the voice of the Thunder Bird. To understand facts we must not only discern, but discriminate.

The next step in the progress of science is classification. Having discerned and discriminated facts, they must be classified—all those of like nature thrown together. All noises made by living beings for conveying intelligence may be grouped into one class and called voices; all noises made by explosions grouped in another class; and so, as we go on discerning, discriminating, and classifying, we collect the materials of philosophy.

But this is not all of philosophy. Facts have genetic relations. If one thing is done something else will follow, and the highest function of scientific philosophy is to discover the order of succession of phenomena—how phenomena follow phenomena in endless procession, how every fact has had its antecedent fact, and every fact must have its consequent fact. This part of science is called *evolution*, and by this expression scientific men mean to be understood that phenomena go on in endless consequences, and that every act has been preceded by some other act, and that every act will be followed by some other act; that the causes of all of the phenomena of the universe that we wish to explain in a system of philosophy run back into the infinite past; that the consequences of all of the phenomena which we may now observe in the universe will run on into the infinite future. This is evolution.

The statement now given of the three great systems of philosophy is perhaps sufficient for our purposes this evening, and it remains for us to point out the part contributed to scientific philosophy by Darwin, whom we mourn to-night.

When Darwin rose as a light in the scientific world, scientific philosophers had already discovered that the philosophic method of research should include the discernment, discrimination, and classification of facts. At that time the scientific men of the world were engaged chiefly in the collection and arrangement of facts. To some extent they were engaged in discovering their relations of sequence. Important and interesting sequences had been discovered in the vast realm of astronomy; other interesting sequences of facts had been discovered in the realm of geology; some interesting sequences of facts had been discovered in the realm of human history. In the realm of biology, in plant and animal life, the order of succession of facts, the method of evolution, had not been discovered; yet many men were thinking on this subject, many men searching for the method and course of biologic evolution. The facts relating thereto were partly known, and the course and laws of biologic evolution were dimly discerned.

It remained for Darwin to demonstrate the laws of biologic evolution, and the course of the progress of life upon the globe. This he has done in a manner so masterly that there lives not in the world a working biologist, a scientific man engaged in this field of research, who has not directly or indirectly accepted his great conclusions, and the larger body of biologists have accepted them directly.

Let us now go back to the statement that prior to the time of Darwin, scientific men engaged in researches relating to vegetal and animal life were occupied chiefly in the discernment, discrimination, and classification of facts.

Botanists and zoölogists were engaged in describing species, and classifying species, and this did not always enlist the highest talent: and naturalists had become wearied with discussions over minute differences and obscure resemblances, the origin and meaning of which were not understood.

The discovery, largely made by Darwin, of the laws of succession, or genesis, gave to this department of scientific research a wonderful impetus, and since that day thousands of men have sprung up throughout the civilized world to take part in biologic research.

In this field the greatest talent of the latest time is absorbed. The philosophy of biology satisfies the reason. In the universe of life, system is discovered, and biologists see visions of the origin of living beings and dream dreams of the destiny of living beings.

Had philosophers discovered that the generations of living beings were degenerating they would have discovered despair. Had they discovered that life moves by steps of generations in endless circles—that what has been is, and what is shall be, and there is no progress, the gift of science to man would have been worthless.

The revelation of science is this: Every generation in life is a step in progress to a higher and fuller life; science has discovered *hope*.

Darwin demonstrated what others vaguely believed or dimly saw: The course and methods of biologic evolution. Darwin gave hope to philosophy.

The universe of phenomena may be classed in three great categories.

I. Physical.
II. Biologic.
III. Anthropologic.

Physical phenomena may be thrown into three categories: 1. Molar or mechanical physics; 2. Stellar or astronomical physics; 3. Molecular physics.

Biologic phenomena may be classed as: 1. Vegetal; 2. Animal.

Anthropologic phenomena may be classed as: 1. Sociologic; 2. Philologic; 3. Philosophic; 4. Psychologic.

To the discovery of the methods and course of physical evolution, *i. e.*, the order of succession in physical phenomena, many great men have contributed. Among these, Newton stands pre-eminent.

The discovery of biologic evolution, *i. e.*, the succession of phenomena in vegetal and animal life, is in like manner due to the researches of many men, but among these Darwin stands preeminent. By his discoveries the discoveries of all other biologists have been correlated and woven into systematic philosophy. The methods and course of anthropologic evolution have yet to be systematized. Important discoveries have been made, but this portion of philosophy is yet inchoate.

WORKING HYPOTHESES.

But Darwin's investigations have not ended research or completed philosophy. He brought scientific men to the frontiers of truth, and showed them a path across the border. Yet more than this he did. He pointed out one of the fundamental methods of research. Before his time philosophers talked about deductive methods and inductive methods. Darwin has taught us that both are fruitless.

Deductive methods are the logical or metaphysical methods which have been already described, by which men arrived at conclusions from general principles supposed to be innate in the human mind. The vanity of these methods has already been characterized.

Inductive methods have found their best expression in the Baconian philosophy. By inductive methods men are to collect facts, unbiased by opinions, or preconceived theories. They are to gather the facts, put them together, arrange and combine them to find higher and still higher generalizations.

But there are facts and facts—facts with value, and facts without value. The indiscriminate gathering of facts leads to no important discoveries. Men might devote themselves to counting the leaves on the trees, the blades of grass in the meadows, the grains of sand on the sea shore;—they might weigh each one, and measure each one, and go on collecting such facts until libraries were filled, and the minds of men buried under their weight, and no addition would be made to philosophy thereby. There must be some method of selecting, some method of determining what facts are valuable, and what facts are trivial. The fool *collects* facts; the wise man *selects* them.

Amid the multiplicity of facts in the universe, how does the wise man choose for his use? The true scientific man walks not at random through the world making notes of what he sees; he chooses some narrow field of investigation. Within this field he reviews what is already known and becomes conversant with the conclusions already reached. He then seeks to discern more facts in this field, and to make more careful discriminations therein, and then to make more homologic classifications; and, finally, more thoroughly to discover the complexity of sequences.

If he attain to success in doing all this his investigations are always suggested by some hypothesis—some supposition of what he may discover. He may find that his hypothesis is wrong, and discover something else; but without an hypothesis he discovers nothing. A scientific man taking up a subject reviews the facts that are known, and imagines that they lead to conclusions that have not yet been reached by others. His imagination may lead him quite astray, yet he follows it, and says "Now if this be true, then there must be certain yet undiscovered facts," and he seeks for them. He may find that which he seeks, or he may find something quite other. If he be an honest thinker, a true philosopher, it matters not to him. He substantiates his hypothesis or constructs a new one. If such hypothesis leads to many new discoveries scientific men accept it, and call it a working hypothesis, and if it still leads on to discovery scientific men call it a theory; and so working hypotheses are developed into theories, and these theories become the fundamental principles, the major propositions of science, the widest generalizations of philosophy.

Sometimes the inductive method—the Baconian method—is said to have been modified or improved by the addition of the method by working hypotheses, and then modern scientific methods are said to be inductive. With this understanding, it may be said that the deductive methods of metaphysics have been supplanted by the inductive methods of science. It would, perhaps, be better to say that deductive and inductive methods have been superseded by the method of working hypotheses.

Working hypotheses are the instruments with which scientific men select facts. By them, reason and imagination are conjoined, and all the powers of the mind employed in research.

Darwin, more than any other man, has taught the use of working hypotheses. Newton and Darwin are the two great lights of science—the Gemini in the heavens of philosophy; stars whose glory is the brightest of all.

There be good folk in the world who love mythologic and metaphysic philosophy—one or both. In the ears of such the praise of Darwin is not sweet music. Let me beg of such who may be here to consider that we come to-night to praise our dead, and to tell of our love for the man who gave us hope. You and I cannot contend over an open grave, and in my soul I find no cause for angry contention elsewhere. Every man's opinions are honest opinions—his opinions are the children of his own reasoning, and he loves his offspring.

When I stand before the sacred fire in an Indian village and listen to the red man's philosophy, no anger stirs my blood. I love him as one of my kind. He has a philosophy not unlike that of my forefathers, though widely separated from my own, and I love him as one near akin.

Among civilized men I find no one who has not a philosophy in part common with my own; and of those smaller portions of our philosophies which are not alike I see no cause why anger should be kindled between us thereby. They and I are bound together by the same cord of honesty in opinion.

In Darwin's writings I find no word of reproach. Denunciation and ridicule, greater than any other man has endured, never kindled a spark of hatred in his breast. Wrapped in the mantle of his philosophy he received no wounds, but lived with and loved mankind.

Let us not gird science to our loins as the warrior buckles on his sword. Let us raise science aloft as the olive branch of peace and the emblem of hope.

DARWIN'S WORK IN ENTOMOLOGY.

By Charles V. Riley.

Charles Robert Darwin was one of the original members of the London Entomological Society, of whom only six are yet living. He always took the keenest interest in the science of entomology, and drew largely from insects for illustrations in support of the theory with which his name will forever be associated. Indeed, I have the authority of my late associate editor of the *American Entomologist*, Benjamin Dann Walsh, who was a classmate of Darwin's, at Cambridge, that the latter's love of natural history was chiefly manifested, while there, in a fine collection of insects; so that, as has been the case with so many noted naturalists, Darwin probably acquired from the study of insects that love of nature, which, first forever afterward, inspired him in his endeavors to win her secrets andi nterpret aright her ways!

Though he has left no descriptive or systematic work of an entomological character, yet his writings abound in important facts and observations anent insects, and no branch of natural science has more fully felt the beneficial impulse and stimulus of his labors than entomology. Indeed, the varying conditions of life in the same individual or species; the remarkable metamorphoses; the rapid development; the phenomena of dimorphism and heteromorphism; of phytophagic and sexual variation; the ready adaptation to changed conditions, and consequent rapid modification; the great prolificacy and immense number of individuals; the three distinctive states of larva, pupa, and imago, susceptible to modification, as well as other characteristics in insects—render them particularly attractive and useful to the evolutionist, and the changed aspect which natural history in general has assumed since the publication of the "Origin of Species" is perhaps more marked in entomology than in any other branch, for its author helped to replace ridicule by reason. During his voyage on the "Beagle" he collected a very large number of interesting species, especially in Coleoptera, and they formed the basis of many memoirs by Walker, Newman, and White, and particularly by G. R. Waterhouse, who named *Odontoscelis Darwinii* after him. These memoirs were published either in the Annals and Magazine of Natural History, and in the Transactions of the London Entomological Society, or in various entomological periodicals, and I append a list, which, in this connection, it is not necessary to read.

Scattered through his memorable works, a "Journal of Researches into the Natural History and Geology of the countries visited during the voyage of H. M. S. Beagle round the world," (which is best known by the publisher's title, "A Naturalist's Voyage Round the World,") and "The Origin of Species by means of Natural Selection," are many interesting entomological facts, and in almost every instance they are illumined by his masterly genius and his keen, penetrating mind. These are so numerous, so varied, and withal so widely dispersed, that I can only make reference, at this time, to a few of the most important and striking of them.

He pointed out the great preponderance of phytophagous over predaceous species in the tropics as exemplifying the relation of the insect and plant worlds, both of which attain their maximum in those zones. Carabidæ are few; Scavengers and Brachelytra very common; Rhyncophora and Chrysomelidæ astonishingly numerous. (Journal of Researches, etc., p. 34.)

He showed by minute observations that the insect faunas of Tierra del Fuego, separated from Patagonia only by the Straits of Magellan, have nothing in common, and he discussed the influence of primary barriers on the distribution of species, as shown in the marked divergence of the faunas on the eastern and western slopes of the Cordillera. "We ought not," he remarks, "to expect any closer similarity between the organic beings on the opposite sides of great mountain ranges than on the opposite shores of the ocean, except for species which have been able to cross the barrier, whether of rock or salt water." (*Ibid*, pp. 326–7.)

I believe he was the first to draw attention to the paucity of insects on islands, and to establish the principle that the smaller the area, the less favorable it is for the development of insect life. (*Ibid*, p. 391.)

It is a fact of observation that islands predispose to the apterous condition among insects, a fact that is especially noticeable in Kerguelen's Land, as observed by Dr. Hooker, and particularly by our fellow member, Dr. Kidder. Darwin (Origin of Species, etc., p. 109,) first suggested the most plausible reason, viz: that the indiscriminate use of wings might prove injurious to an insular species by tempting it out to sea and to destruction, so that the loss of the power of flight is a positive advantage to the species. The argument against this explanation, viz: that insular species should be gifted with strong powers of flight to fortify themselves against being blown to sea in heavy gales, has little force, because either requirement may be fulfilled; and, in reality, where flight is absolutely necessary, as in the majority of Lepidoptera, and flower-frequenting Coleoptera, the wing capacity, in insular species, is actually increased, or correlated with a diminution of bulk; whereas, in those less dependent on aërial progression, natural selection would decrease wing-power, and there would be just such a correlated increase of bulk as is generally the case.

The principle he laid down, that the accidental introduction of organic beings amongst others to whose interest they are hostile, may be a powerful means of keeping the latter in check, and of finally destroying them, finds vivid exemplification in insects, as I have shown in discussing those imported into this country.*

*Second Annual Rep. on the Insects of Missouri, 1879, pp. 8–13.

He gave reasons for the belief (now generally accepted) that the usual gaudy coloring of intertropical insects is not related either to the heat or light of those zones, but rather to the conditions of existence being generally favorable to life.—(Journal of Researches, etc., p. 381.) He has written on the Phosphorescence of Fire-flies, and on the habits of the larva of one of them—*Lamphyris occidentalis*. —(*Ibid*, pp. 29–30.) He discussed the food-habits of stercovorous beetles, with reference to the origination of a new habit and the power of adaptation to new conditions.—(*Ibid*, p. 490, note.)

At Port St. Julian, Patagonia, he found a species of Tabanus extremely common, and remarks: "We here have the puzzle that so frequently occurs in the case of mosquitoes—on the blood of what do these insects commonly feed? The guanaco is nearly the only warm-blooded quadruped, and is found in quite inconsiderable numbers compared with the multitude of flies." He has discussed the question of hibernation of insects, and shown that it is governed by the usual climate of a district, and not by absolute temperature. (*Ibid*, 98–9.) He gave the first true explanation of the springing power of the Elateridæ when laid on their backs, showing how much depended on the elasticity of the sternal spine. (*Ibid*, p. 31.) He was the first, I believe, to record the exceptional powers of running and of making sound, in a butterfly, viz., *Ageronia feronia* of Brazil.

In his most famous work he lays stress particularly on the following facts and generalizations, for which he draws from insects: the individual differences in important characters; the remarkable manner in which individuals of the same brood often differ, dimorphism and trimorphism being only the extreme exaggeration of this fact; the difficulty of distinguishing between species and varieties; that geographical races are local forms completely fixed and isolated; that representative species are better distinguished from each other than local forms and sub-species; that the species of large genera vary more frequently than those of small genera, and that specific differences in the former are often exceedingly small;

that fecundity does not determine the rate of increase; that the struggle for life is most severe between species of the same genus; that secondary sexual characters are generally displayed in the same parts of the organization in which the species of the same genus differ from each other; that distinct species present analogous variations; that similar structures are often independently developed; the varying importance for classification of the same important organ in the same group of beings; that analogical or adaptive resemblances are misleading for classification; that the great frequency of mimicry among insects is associated with their small size and general defencelessness, as no species furnished with a sting, or other defensive property, is known to mimic other species; the importance of relative position or connection in homologous parts; the remarkable changes of structure effected during development; that adaptation to the conditions of life in the insect larva is just as perfect and beautiful as in the adult animal, and that, consequently, larvæ of different orders are often similar, and larvæ belonging to the same order often very dissimilar; that larval and pupal stages are acquired through adaptation, and not through inheritance; that rudimentary organs plainly declare their origin and meaning.

Finally he brought together a large body of interesting facts in entomology, bearing on the development and perpetuation of mimicry, and of secondary sexual characters—all more or less explicable by, and furnishing convincing argument for, the general theory of natural selection; while he freely acknowledged that he found among insects facts that seemed to be most fatal to the theory. This is especially the case in social insects where the colony contains neuters and sterile females which often differ widely in instinct and in structure from the sexual forms, and yet cannot propagate their kind. This is not the place to enter into a discussion of the subject, and I will simply remark that there are reasons for the belief that, in his candor, he has been led to exaggerate the difficulties in this case.

But Darwin's chief investigation into insect life were in its relations to plant life, and his work "On the Various Contrivances by which British and Foreign Orchids are Fertilized by Insects, and on the good effect of crossing," as also that on "Insectivorous Plants," are monuments of skill, industry, and lucid exposition.

Entomologists had often noticed the pollen masses of orchids attached to the proboscis of various moths, and in commenting upon the fact had pronounced it "curious." Darwin in this, as in so many other cases, gave meaning to the curious, and brought light out of darkness.

Before his time we find frequent reference to the injury caused to plants by insects, and Sprengel, Gaertner, Herbert, and others had shown that insects were, also, in many cases, beneficial and even necessary to plants, the color, form, odor, secretions, and general structure of which have reference to their necessary insect pollinizers.

Yet their writings had produced but slight impression outside of a limited circle. It remained for Darwin to impress the world with a broader sense of the actual interrelation between the two, and to inspire a number of observers in this field, in all parts of the globe, who are now constantly adding to the rich store of facts we already possess on the subject. I need only refer to the work of Hooker, Bennet, Axell, Delpino, Hildebrand, H. Müller, and others abroad, and to that of Dr. Gray, and Mr. Wm. Trelease at home.

The importance of insects, as agents in cross-fertilization, was never properly appreciated till after Darwin's remarkable work on Primula, and his researches on Orchids, Linum, Lythrum, etc.

He established the principle that "nature abhors close fertilization," and though some less careful observers in this country—exaggerating the importance of their isolated and often inaccurate observations—have opposed his views, the scientific world has been convinced alike by the force of his logic as by the eloquence of his innumerable facts.

We all know how palæontology has verified many of his anticipations as to missing links being supplied with increased knowledge of the geological record, and in connection with his work on the fertilization of orchids, we have a remarkable instance of similar verification. The nectaries of *Angræcum sesquipedale* were found by him to sometimes reach 11½ inches in length, with only the lowest 1½ inches filled with nectar. He said "there must be moths with probosces capable of extension to a length of between 10 and 11 inches." In *Nature* for July 17, 1873, or some years later, Fritz Müller recorded, through his brother, Herman Müller, the finding of a Brazilian Sphingid having a length of proboscis of 0.25 meters, or between 10 and 11 inches.

I cannot do justice to Darwin's work on Insectivorous Plants within the time to which these remarks have been limited, nor without trenching on the ground to be covered by Prof. Ward. I must be content to remark, therefore, that he demonstrated the new and wonderful fact in physiology that many plants are capable of absorbing soluble matter from captured insects, and that they have special contrivances and sensibilities that facilitate the capture of their prey: in other words, that plants actually capture and digest animal food; for the secretion of *Drosera*, and other insectivorous plants, with its ferment acid belonging to the acetic series, resembles the gastric juice of animals with its pepsin and hydrocloric acid. The fact of absorption demonstrated, it follows that the process would prove serviceable to plants growing in very poor soil, and that it would tend to be perfected by natural selection.

The pleasure Darwin took in observing the habits and ways of insects, and the simple and lucid manner in which he recorded his observations are frequently exemplified in his Journal of Researches, and his account of sundry Brazilian species on page 35, and following, may be consulted as an example.

In the same way that he has influenced all lines of thought and investigation, he has influenced entomology. We find everywhere, in his treatment of insects, the same acute perception, the same candor and impartiality, the same clearness of expression, the same aptitude to get at the significance and bearing of facts observed, as well as the same readiness to deduce a theory which is only equaled by the devotion with which he clings to the truth, whether favorable or unfavorable to the theory.

In the light of Darwinism, insect structure and habit have come to possess a new significance and a deeper meaning. It has, in short, proved a new power to the working entomologist who, for all time, will hold in reverence the name of him who, more than any other man, helped to replace scholasticism by induction and who gave to the philosophic study of insects as great an impetus as did Linnæus to their systematic study.

In his private life Darwin has given us a lesson of patience, courtesy, and consideration, that will be best appreciated by those who have the misfortune to be endowed with more irritable and aggressive natures.

As the above account of Darwin's entomological work is doubtless rather uninteresting to most of those gathered here, I will close, by request, with a few personal impressions.

I have had the pleasure on two occasions of visiting Darwin at his invitation. On the first occasion, in the summer of 1871, I was accompanied by Mr. J. Jenner Wier, one of his life-long friends and admirers. From Mr. Weir I first learned that Darwin was, in one sense, virtually a confirmed invalid, and that his work had been done under physical difficulties which would have rendered most men of independent means vapid, self-indulgent, and useless members of society.

It is eloquent of the indomitable will and perseverance of the man that, during the long voyage on the Beagle, he suffered so from sea-sickness that he never fully recovered from the shock to his system, and could not again venture on the ocean. He had, in fact, on his return from the voyage, to go through a long course of hydropathic treatment. We also now know that though he had suffered much for some months past from weakness and recurring fits of faintness, and had been confined to the house, yet as late as

Tuesday evening before the day of his death, at 4 P. M., Wednesday, he was in his study examining a plant which he had had brought to him, and that he read that night before retiring, while as late as the 16th of March, he read two papers on special botanical subjects before the Linnean Society.

The village of Down is fifteen miles southeast of London, four miles from Orpington station on the Southeastern Railway. The country is among the most beautiful agricultural suburbs of London, and I shall never forget the impression of peaceful, quiet seclusion experienced, as we drove from the station and finally through one of those characteristic English lanes, just wide enough for one vehicle, and worn down several feet below the general level—the sense of confinement being enhanced by the luxuriant hedge on either side. This lane skirts the orchard wall for 100 yards and then goes in front of the house, from which it is separated by a grass plot and flint wall overgrown with ivy.

The Darwin residence is a plain, but spacious, old-fashioned house of the style so common in England, and which, with the surrounding well-kept grounds and conservatory, convey that impression of ease and comfort that belong to the average home of the English country gentleman. A noticeable feature is a bow window extending through three stories and covered with trellis and creepers. In Darwinian phrase the environment was favorable for just such calm study and concentration as he found necessary to his health and his researches.

Upon introduction I was at once struck with his stature (which was much above the average, and I should say fully six feet,) his ponderous brow and long white beard—the moustache being cut on a line with the lips and slightly brown from the habit of snuff-taking. His deep-set eyes were light blue-gray. He made the impression of a powerful man reduced somewhat by sickness. The massive brow and forehead show in his later photographs, but not so conspicuously as in a life-sized head of him when younger, which hung in the parlor.

In the brief hours I then spent at Down the proverbial modesty and singular simplicity and sweetness of his character were apparent, while the delight he manifested in stating facts of interest was excelled only by the eagerness with which he sought them from others, whether while strolling through the greenhouse or sitting round the generously spread table.

Going to him as a young entomologist with no claim on his favor, he seemed to take delight in manifesting appreciation. I had occasion in my third report on the insects of Missouri, published in the spring of that year, to discuss the question of Natural Selection in its bearings on Mimicry, as exemplified in two of our North American butterflies, (*Danais archippus* and *Limenitis disippus.*) This report I found in his study with many leaves turned down, and he appeared to take especial pleasure in conveying a sense of his appreciation of particular parts.

The few letters which I received from Darwin were in his own hand-writing, which was rapid and better calculated to save time than to facilitate the reading. I take the liberty of reproducing here the first and last as indicating his attitude toward all workers in the field of natural science, however humble or however undeserving of his praise they may have been; and this generous trait in his character will explain, in some measure, the stimulus and encouragement which he gave to investigators:

DOWN,
JUNE 1, [1871.] BECKENHAM, KENT.

MY DEAR SIR: I received some little time ago your Report on Noxious Insects, and have now read the whole with the greatest interest. There is a vast number of facts and generalizations of value to me, and I am struck with admiration at your power of observation. The discussion on mimetic insects seems to me particularly good and original. Pray accept my cordial thanks for the instruction and interest which I have received.

What a loss to natural science our poor mutual friend, Walsh, has been: it is a loss ever to be deplored.

Pray believe me, with much respect,

Yours, very faithfully,

CH. DARWIN.

DOWN,
SEPTEMBER 28, 1881. BECKENHAM, KENT.

MY DEAR MR. RILEY: I must write half-a-dozen lines to say how much interested I have been by your "Further Notes" on Pronuba, which you were so kind as to send me. I had read the various criticisms, and though I did not know what answer would be made, yet I felt full confidence in the result, and now I see I was right. * * * *

If you make any further observation on Pronuba it would, I think, be well worth while for you to observe whether the moth can or does occasionally bring pollen from one plant to the stigma of a distinct one; for I have shown that the cross-fertilization of the flowers on the same plant does very little good and, if I am not mistaken, you believe that the Pronuba gathers pollen from the same flower which she fertilizes.*

What interesting and beautiful observations you have made on the metamorphoses of the grass-hopper destroying insects!

Believe me,
My dear sir,
Yours sincerely,
CH. DARWIN.

My own experience in this regard is the common experience, for an interest in natural science was an open sesame to his generous soul. His consideration, without aggression, was the secret of the gratitude and respect which all felt who had the honor to know him, either personally or through correspondence.

His approval of the work of others was coupled with a depreciation of his own, which was very marked on the occasion of my second visit to Europe, in 1875, when I crossed the ocean with his son Leonard on his way from the Transit of Venus expedition. "Insectivorous Plants" was just finished and Darwin was worn and in feeble health, staying, in fact, at Abinger Hall for rest. He was quite disgusted with the book, to use his son's expression, and doubted whether it could prove of sufficient interest, with its long and dry records of experiments, to be read by any one.

*This is a misapprehension. Pronuba is an effectual cross-fertilizer, running from flower to flower, and often flying from raceme to raceme with one and the same load of pollen. The omitted passages in this letter refer to the work of a gentleman still living.

DARWIN AS A BOTANIST.

BY LESTER F. WARD.

Appointed by the committee to furnish a brief sketch on this occasion of the contributions of Charles Darwin to the science of plants, I have purposely chosen the title, "Darwin as a Botanist," in order to emphasize the contrast which may be drawn between different classes of botanists, and to do what I can to accustom the public mind to associate with the terms *botanist* and *botany* certain great fields of investigation which are now rarely suggested by these words.

If I had entitled my paper: Darwin's researches into the phenômena of the vegetable kingdom, I fear it might not have occurred to some of you that this great investigator was a botanist, as he is not generally known as such. Yet I fail to see why the science of botany is not fully entitled to receive its share of the dignity and the luster which Darwin's investigations have reflected upon biology in general.

The popular idea of botany, however, is very different from this. Not ignorant people alone, but scientific men as well, place all botanists under two general classes: "Field Botanists" and "Closet Botanists."

The field botanist is one who, being passionately fond of plants and having mastered the rudiments of botany and become familiar with the names and classification of plants, searches the country for new and rare species, and for new localities for old ones, and makes large collections. Success in these objects is his triumph, and occasionally becoming the proud discoverer of hitherto unknown forms of vegetable life, he finds the scientific world quick and generous in awarding him due credit.

The closet botanist is one who, disdaining the boyish pursuit of flowers, devotes himself to the study of the characters of plants as revealed by the herbarium specimens which the field botanist so copiously furnishes, and by which method he, too, can discover "new species," and obtain prompt recognition. The closet botanist performs the further useful service of "revising" intricate families and genera of plants, unraveling the entanglements of previous authors, and making such changes in the classification and names as are best suited to secure the maximum personal credit.

I need not tell this audience that Charles Darwin belonged to neither of these classes of botanists. A lover of nature, he yet never wasted precious time in the idle pursuit of rarities. Thoroughly familiar with the distinctive characters upon which botanical classification rests, he yet never pursued to any marked extent the investigation of specimens from the *hortus siccus*. I doubt whether a single species of plant was ever named after him by reason of his having either discovered it in a wild state or detected its specific distinct ness by the examination of its characters. I even doubt whether he possessed an herbarium, in the accepted sense of the word.

And yet this man has probably contributed more to our real knowledge of plants than any other single botanist.

In what, then, have Darwin's botanical investigations consisted?

There is a little French book entitled "Voyage d'un Botaniste dans sa Maison," a title which, allowing for the characteristic hyperbole of the French tongue, suggests the general nature of Darwin's botanical studies. His researches were conducted in his laboratory, in pots of plants at his window, in his aquarium, in his green-house, in his garden. He worked with instruments of precision, recorded his observations with exactness, and employed every mechanical device for making his results reveal important truths, of which the genius of man would seem to be capable.

Darwin looked upon plants as *living things*. He did not study their *forms* so much as their *actions*. He interrogated them to learn what they were *doing*.

The central truth, towards which his botanical investigations constantly tended, was that of the universal *activity* of the vegetable kingdom—that all plants *move* and *act*. He has, so to speak, *animated* the vegetable world. He has shown that whichever kingdom of organic nature we contemplate, to *live* is to *move*.

He blandly rebukes the vulgar notion that "plants are distinguished from animals by not having the power of movement," and still more modestly says that "plants acquire and display this power only when it is of some advantage to them." But is this the whole? Do animals display this power except when it is of some advantage to them? Certainly not.

Darwin shows us that certain parts of all plants are at all times in motion; not merely the molecular activities of their tissues and of the living protoplasm in their cells, but organized movement of parts. Every leaf, every tendril, every rootlet, possesses the power of spontaneous movement, and under nearly all circumstances actually exercises that power.

There are a great many distinct kinds of movement, depending in all cases upon the special advantages thereby gained to the plant. The laws under which these movements take place have received from him an admirable terminology. Most of them are conditioned either by light, by gravity, by radiation, or by insect agency.

We thus have of the first class, *heliotropism*, or movement towards the light; *apheliotropism*, or movement from the light; *diaheliotropism*, or movement at right angles to the source of light; and *paraheliotropism*, embracing such movements as screen the plant from excess of light.

To the second class belong: *geotropism*, or movement towards the earth or into the soil; *apogeotropism*, or movement contrary to the force of gravity; and *diageotropism*, or movement at right angles to the force of gravity.

The third class embraces the so-called *nyctotropic* movements of plants by which they appear to sleep, and which prove to be devices for the prevention of excessive radiation of the plants' heat.

Under the fourth class fall all those wonderful movements which aid the plant in preventing self-and securing cross-fertilization, a subject of the most absorbing interest, and of which you have already listened to so able a presentation by Prof. Riley from the point of view of the entomologist.

But Darwin's great service has been to show that these varieties of activity are simply modes in which inherent and spontaneous activities manifest themselves under these varying external influences.

His preliminary investigations into the nature of these innate powers of movement were directed to that large class of plants known as twiners and climbers, whose revolving motions were so thoroughly described in his work on "Climbing Plants." It was here that he laid the foundation for those later studies which eventually resulted in that great work, almost his last, on the "Power of Movement in Plants." In this work he demonstrates by an enormous induction that the ample sweeps of the twining plant are but the most obvious manifestations of a class of phenomena which are common to the entire vegetable kingdom.

Amid the varied forms of movement which plants present Darwin has succeeded in finding one fundamental and generic one to which every other may be referred. To this universal form of plant activity he gives the name "circumnutation." Not only twining stems and tendrils, but parts of flowers, tips of growing shoots, caps of penetrating roots and rootlets, radicles, epicotyls, cotyledons, and even full-grown leaves, are incessantly describing circles, ellipses, and other more or less regular geometrical figures; and he conclusively shows that it is out of this primary form of activity that all the more specialized forms already mentioned have been developed. All movements of the parts of plants are thus to be interpreted as modified forms of this innate periodic circumnutation which is common to all plant life. Such modifications are always in the direction of the plant's advantage and may be so great as to become difficult of recognition as forms circumnutation.

I need not labor to convince you that any modification which is an advantage to the plant will be secured by the process of natural selection. It is the glory of the great genius whose labors we are here to commemorate to have demonstrated this truth to the entire satisfaction of the united scientific world.

Darwin has actually solved the great problem of phytology, so long supposed to be incapable of solution, viz: Why does the root grow downward and the stem upward? Briefly and roughly stated, the answer to this question is that, as the bursting seed pushes out its two germinal points these circumnutate from the first, and thus explore their surroundings for the means of benefiting the plant. To employ Darwin's own word, they "perceive" the advantage that would result from the penetration of the soil, on the one hand, and from the ascent into the free air and sunlight, on the other, and through the pre-Darwinian law of the "physiological division of labor," the one becomes *geotropic* and the other *heliotropic* —the one develops into a radicle and then into a root, while the other develops into an epicotyl and then into a stem.

I will only add to the thoughts already presented that Darwin's discovery of the existence in all plants of an innate and spontaneous mobility belonging to them as forms of organic life, possesses an important ulterior significance.

The law of natural selection, as a fundamental process, has long since passed the stage of discussion. But there has always remained one unsettled question lying at its very base which Darwin himself admitted to be an open one. That question concerns the cause itself of variation. It is granted that, admitting the *tendency to vary*, all the results claimed for natural selection must follow; but many declare that, in this very tendency to vary, there is a mystery as great as the mystery of life itself.

It is only in this work on the "Power of Movement in Plants" that Darwin has really assailed this last fortress of supernaturalism. Not that he has avowed any such purpose, for of this he would have been incapable, but so skilfully and so powerfully has he marshaled the facts that the conclusion follows without being stated. No one can doubt that he perceived this, and I, for one, am convinced that he saw it from afar, and that it was the great end of his labors;

but with his characteristic wisdom he has declined to invoke the *odium theologicum,* correctly judging that the truth must ultimately assert itself.

The tendency to vary, then, is a mechanical result of the proved fact of universal movement coupled with the admitted law of natural selection. By means of the former all plants and growing parts of plants are perpetually exploring their immediate surroundings in search, as it were, for conditions favorable to development. By means of the latter they are able to avail themselves of such favorable conditions when found. Nothing further than this is required to complete the natural explanation of all the phenomena presented by the organic world, and thus, at last, the whole domain of biology is emancipated from teleological fetters, and placed on the high plane of rational investigation.

In conclusion, let me simply say that, while we can but deeply mourn the irreparable loss which science has sustained in the death of Charles Darwin, we have still the highest grounds for congratulation in the fact that he lived to complete that great work which, next to the "Origin of Species," will, I firmly believe, be awarded by posterity the highest place, viz. ," The Power of Movement in Plants;" for, while the former auspiciously opened the great debate by stating the profoundest of all biological problems, the latter has fittingly closed the argument by answering the last objection.

DARWIN ON THE EXPRESSION OF THE EMOTIONS.

By Frank Baker, M. D.

From the tendency of the imagination to magnify the unknown and remote, arises a popular error that to attain eminence a man of science must be able to gather facts from great distances—from the sources of the Nile, and from polar snows. But the near and commonplace are subject to the same laws as the atoms of interstellar space, and true scientific insight may discover in the very dust under our feet secrets hitherto concealed.

Darwin's work upon the Expression of the Emotions is continuous with and supplementary to his larger and better-known treatise on the Descent of Man. As with other matter bearing directly upon the development hypothesis, its publication was deferred as long as possible, in order that the evidence might be fully weighed. Projected in 1838, it was not published until thirty-five years later. One class of objections to the hypothesis was not considered in the main work. It was generally held that, by his emotional expression, man was widely separated from the lower animals. The eminent anatomist, Duchenne, who remains to-day the best authority on muscular movements, merely expressed the views of the time when he stated that no cause could be assigned for facial expression, except the "divine fantasy" of the Great Artificer.

Having projected his work, how does Darwin proceed? From the gentlemen who have preceded me you have learned of his methods. To test the truth of his conceptions he commences a series of most minute and careful observations, omitting nothing within his reach. His most important field is that which is nearest; his own children, his friends and companions, even the dogs that accompany his daily walks, come under that powerful scrutiny. Where, indeed, can we find so perfect an observer? The calm sanity of his mind keeps him equally aloof from egotism and from self-depreciation. A fact is a *fact*, to be stated with the fairness and openness of perfect daylight. Here is a man who cares more for the truth than for himself. The black spot in man's sunshine, the shadow of himself, seems non-existent for him. He stands by his work, that is enough; if it has worth, well—if not, still well; the elemental drift of action and reaction will continue, the outcome will still be good. As Carlyle has said, "A noble unconsciousness is in him. He does not engrave *truth* on his watch-seal; no, but he stands by truth, speaks by it, works and lives by it."

But not as a fact gatherer do we find him greatest. Many others have struggled with ant-like toil to amass piles of facts which, like the ant-heap, remain but sand after all. Darwin brings to his work an informing spirit, the genius of scientific hypothesis. Breathed upon by this spirit, the dry bones of fact come together "bone to his bone," the sinews and the flesh come upon them, they become alive and stand upon their feet "an exceeding great army." He searches always for the principles which underlie the facts and make them possible, realizing that the *phenomena*, the things which are seen, are temporal and transitory; the things which are not seen, the cosmical forces which govern and control, are eternal.

In his examination of the expression of the emotions he found that both in man and animals they can be referred to three general principles which may be termed habit, antithesis, and nervous overflow. By habit, or repetition, serviceable movements become fixed—involuntary, or semi-voluntary. By antithesis, opposite frames of mind are expressed by opposite actions, even though those actions may not be serviceable. The theory of nervous overflow is that unusual quantities of force generated by the cerebro-spinal system are discharged by unusual channels of expression when the ordinary channels are insufficient.

He finds that emotional expressions are generally direct consequences of anatomical structure, and clearly shows the interdependence of anatomy and physiology. For structure can no more be divorced from function than matter can be dissociated from force. All the complex expressions of grief—from the twitching of the eyelids and mouth to the shedding of tears—he has shown to depend upon the necessity for preventing engorgement of the eyes during screaming, an act originally useful solely to attract attention. The steps by which he arrived at this conclusion are typical of his method. Starting first with animals, he finds that their expressions of grief are much less complex and various than those of man. They are confined to noises, such as screaming, barking, whining, in higher forms accompanied by changes in facial expression, particularly by contraction of the muscles surrounding the eye. There is a physiological necessity for this, as otherwise the expiratory effort caused by screaming might engorge and rupture the small ocular blood-vessels. By pressing on the lachrymal gland this causes, in some of the higher animals, a flow of tears. What at first was accidental, merely occasioned by the proximity of the gland, becomes at last habitual, and the nervous force automatically follows the line of its accustomed action, causing a flow of tears after emotional excitement, even though no screaming take place. The correctness of this view is supported by the fact that infants do not shed tears until several weeks old, although they scream violently. The functional activity of the lachrymal gland, in connection with grief, is, therefore, later in phylogenetic development. The laws of heredity and adaptation are found to be operating here, as elsewhere, in the domain of life; the supposed gap between the emotions of man and of other animals is successfully bridged over, and another anthropocentric fallacy is consigned to the limbo of ignorant superstitions.

Many expressions of the lower emotions are found to be disfiguring vestiges of acts useful to lower animals for offense and defense, or for obtaining food. These survive—relics of the previous history of our race—as rudimentary organs are preserved long after their use has ceased. The erection of the hair during fear is remotely derived from the same cause that makes puss bristle when attacked and the puff adder swell out when approached. Originally used for the purpose of exciting fear in an enemy by an increase of size, it now involuntarily accompanies the somewhat changed emotion of which some of the phases are extinct. It is not very rare to find persons who can make the hair over the front of the head bristle at will. Rage is habitually expressed by uncovering the teeth, which is, in the lower animals, an attempt to frighten their enemies by a show of weapons. This expression may become softened and modified to express the milder emotions of contempt and disdain. I have met a lady who has to perfection the rather rare accomplishment mentioned by Darwin of drawing up the upper lip in a triangular notch directly over the canine teeth so as to display them alone, usually on one side at a time. This most expressive gesture of disdain can be performed under the influence of the emotion by many who cannot do it at will.

Of an opposite class are certain higher expressions, which, having arisen later, are not yet entirely fixed. Blushing is one of the most curious of these. It is not found in infants, and varies greatly in frequency and amount in adults, accompanying the sentiment of modesty, almost unknown among animals. The reddening is usually confined to the face and neck. Darwin suggests an ingenious explanation for this. The blood-vessels most exposed to variations of temperature acquire the habit of expanding and contracting—their vaso-motor nerves become more sensitive. The chief expression of personal appearance is in the face; the attention of the mind is, therefore, directed there whenever the emotion of modesty is aroused. This interferes with the ordinary tonic contraction of the blood-vessels, and an excess of blood suffuses the surface.

A remarkable confirmation of Darwin's views is the recent discovery of localized centers in the brain which control emotional expression, and exist in animals as well as in man. It may sometime be possible to read the currents and counter-currents of the brain by means of feature-play with a precision approaching that by which we estimate the force of a distant battery by the play of a galvanometer needle. Many phenomena of expression, which were obscure before this discovery, can now be satisfactorily explained. Among these are the phenomena of associated movements. It has been stated that the variety and complexity of the movements involved in the simple act of walking are such that it would be impossible ever to perform it were it necessary to *think* what had to be done, and weigh in the judgment the precise amount of force necessary to distribute to each muscle at each moment of the act. It is now known that the cerebral centers which control the separate muscles put in action are closely contiguous in the brain, and that they probably intercommunicate and excite each other in a definite manner, predetermined by habit and heredity. The conscious mind has only to set in motion the subordinate apparatus, when it goes on, and works out the problem with matchless skill, like the system of cogs and eccentrics that produce the intricate pattern in an engraver's lathe. All have noticed the uncouth manner in which children and untrained persons follow with lips and tongue the motions of their hands when using a tool of any kind. Darwin ascribes this to unconscious imitation, but it can be explained more strictly in accordance with his own principles. The facial muscles are actuated from a cerebral center in close proximity to those which move the arms and hands. In the lower animals this is necessary, for the mouth is an organ of prehension, used in strict association with the fore-limbs in seizing prey, and in other acts. As this associated movement became strongly fixed by long habit, it survives with great obstinancy, and though it has not been useful to the race since the historical period, we have yet to caution our children not to put their tongues out when they write.

My limit of time forces me to conclude this hasty and imperfect summary. The practical bearing of these views is not without importance. Physicians have always depended greatly upon emotional expression as a means of diagnosis. Unconsciously the face of the patient reveals his physical state. Yet too much has been left in the empirical border-land of science. *Why* a certain pathological state should be indicated by a definite combination of expressions has not always been clearly shown. To-day the whole subject is studied from the point of view of anatomy and physiology. No occult force is admitted, the correlative nerve-supply of muscles and the effect of excitation of nerve-centers are rationally investigated.

Aside from the great special value of the work, of what tremendous import to the race are Darwin's deductions! For he has shown us that our every thought and act mold our physical frames, and through them the generations yet unborn, either to beauty and grace, or to uncouth ugliness and deformity. As the struggle for existence filled the rocks with organisms forever extinct, because not for the highest use, so may we, too, fossilize and outgrow habits and desires of ignoble birth, ascending by the "power of leasts," by that wondrous calculus of nature, to purer and nobler existence. Darwin has taught us that the forces which, acting through countless cycles, have brought us up from formless slime, now remain in our hands to use for good or ill—

> "That life is not as idle ore,
> But iron dug from central gloom,
> And heated hot with burning fears,
> And dipt in baths of hissing tears,
> And battered with the shocks of doom
> For shape and use."

A DARWINIAN BIBLIOGRAPHY.

BY FREDERICK W. TRUE,

Librarian of the U. S. National Museum.

The complete bibliography of Darwinism should contain, not alone the works which emanated from the busy brain and ready pen of Darwin himself, but the many other productions which these called into life. The aquiescences of friends, the objections of critics, the censures of foes, should all be enrolled in their proper places as representing the ripples and counter-ripples in the sea of thought, produced by the weighty ideas which dropped from the clear mind of the philosopher. It is not to the merits of these, however, that I can call your attention, but only to a few facts relative to the books of Darwin himself.

I would not have you suppose, if, indeed, one could, after the lucid remarks to which you have listened, that the faulty—and, I fear, almost indiscernible—list of published works, which I have attempted to exhibit before you, reveals more than a moiety of Darwin's writings.* A large number of comprehensive papers, pregnant notes, and incisive queries are contained in those storehouses of precise knowledge, the journals of science, and the publications of learned societies. During more than half a century, from the beginning of Darwin's career to its very close, scarcely a year passed in which a number of articles did not issue from his pen. His first paper, on the Ova of Flustra, and another of similar nature, were read before the Plinian Society, of Edinburgh, in 1825. His last note on the Distribution of Fresh-water Bivalves appeared in *Nature* but a few days before his death.

During the first twenty-five years the articles have mostly a geological and zoological bearing, but later botanical and anthropological subjects come into prominence. They were contributed to many publications, including a few American, German, and French journals. The mass of papers, however, are to be found in the Proceedings and Transactions of the Geological Society of London, the Philosophical Transactions, the Philosophical Magazine, the Annals and Magazine of Natural History, and Nature.

It is in these papers that we first find the germs of many of those more elaborate works, to which general attention has been attracted. Thus the works on the Origin of Species, the Fertilization of Plants by Insects, the Action of Earth Worms, and others were foreshadowed at a time considerably antedating their final appearance.

* The speaker referred to two large scrolls hanging on the lecture room walls, upon which were inscribed a list of Darwin's most important publications.

Darwin seemed to prefer to work out and write out his ideas alone. Once at least, however, he shared the toil with his friend, Mr. Wallace, and later, in several instances, with his sons, Francis and George Darwin.

Regarding the separately published works of Darwin, there is much of interest from the bibliographical point of view. The conscientiousness with which the author profited by the criticisms of others, revising, improving, and extending his generalizations, makes each new edition seem like a separate production. Whole chapters were stricken out and new ones inserted; facts of doubtful character were replaced by others of a more positive nature and more recent acquisition.

Time forbids that I should refer to the details of publication of more than one work. The inquiring student will find his wants satisfied in the several lists which have already been published.

I will give the history of but one work, the most important of all, the "Origin of Species by Means of Natural Selection." The first edition of this work received the signature of the author on November 24, 1859, and was published the same year. The second edition, which appeared soon after, "was little more than a reprint of the first." "The third edition was largely corrected and added to, and the fourth and fifth still more largely." The sixth edition, which appeared in 1872, was likewise largely amended, and had reached its twenty thousand in 1878. In the meantime foreign editions and translations began to appear. The American and French editions at first kept pace with the English, the second American being from the second English, and the third French from the third English. The Germans, coming in a little later, published their second edition from the third English, and their third, from the fourth English one. The last editions in all these languages were derived, I believe, from the sixth English one. "The Italian is from the third, the Dutch and three Russian editions from the second English editions, and the Swedish from the fifth English edition."

At least twelve of the more important works have been issued in one or more editions in German and French, and a number in other European languages as well.

The sage of Down was undoubtedly honest in his surprise at the ever-extending circle of his influence. A wider and more intelligent audience could scarcely be desired. The number of books in which his opinions are discussed or alluded to is legion. As the illustrious Asa Gray has remarked, "Dante literature and Shakespeare literature have been the growth of centuries, but Darwinism filled teeming catalogues during the life time of the author."

CHRONOLOGICAL LIST OF THE WRITINGS OF CHARLES DARWIN.

1835. [Extracts from Letters addressed to Professor Henslow.]
Tract, privately printed, 8vo., Cambridge, 1835.

1837. Note sur la Decouverte de quelques Ossemens Fossiles dans l'Amerique du Sud.
Ann. Sci. Nat., 2d series, (Zoology,) VII, 1837, pp. 319–320.

1837. [Notes upon the Rhea Americana.]
Proc. Zool. Soc., London, V, 1837, pp. 35–36.

1837. Remarks upon the Habits of the Genera *Geospiza*, *Camarhynchus*, *Cactornis*, and *Certhidea* of Gould.
Proc. Zool. Soc., London, 1837, p. 49.

1838. Sur Trois Espèces du Genre *Felis*.
l'Institut, VI, 1838, no. 235, pp. 210–211.

1838. On the Formation of Mould.
Trans. Geol. Soc., 2d ser., V, 1840, pp. 505–510: Proc. Geol. Soc., II, 1838, pp. 574–576: Philos. Mag., 3d ser., XII, p. 89: Gardener's Chronicle, 1844, p. 218: Frorieps Notiz., VI, 1738, coll. 180–183.

1838. Observations of Proofs of the Recent Elevation of the Coast of Chili, made during the Survey of H. M. S. "Beagle," commanded by Capt. Fitzroy.
Proc. Geol. Soc., II, 1838, pp. 446–449: Philos. Mag., 3d ser., XI. p. 100.

1838. A Sketch of the Deposits containing Extinct Mammalia in the neighborhood of the Plata.
Proc. Geol. Soc., II, 1838, p. 543: Philos. Mag., 3d ser. XI, p. 206: Ann. Sci Nat., VII. Zool., 1837, pp. 319–320.

1838. On certain Areas of Elevation and Subsidence in the Pacific and Indian Ocean, as deduced from the study of Coral Formations.

Proc. Geol. Soc., II, 1838, pp. 552–554: Philos. Mag., ser. 3, XI, p. 307: Froriep. Notiz., IV, 1838, coll. 100–103.

1838. Geological Notes made during a Survey of the East and West Coasts of South America, in the years 1832, 1833, 1834, and 1835, with an Account of a Transverse Section of the Cordilleras of the Andes between Valparaiso and Mendoza.

Proc. Geol. Soc., II, 1838, p. 210–212: Philos. Mag., ser. 3, VIII, p. 156.

1838. Origin of Saliferous Deposits. Salt Lakes of Patagonia and La Plata.

Journ. Geol. Soc., II, 1838, pt. 2, pp. 127–128.

1838. On the Connexion of Certain Volcanic Phænomena, and on the Formation of Mountain-chains and the effects of Continental Elevations.

Proc. Geol. Soc., II, 1838, pp. 654–660: Trans. Geol. Soc., V, 1840, pp. 601–632: Poggend. Annal., LII, 1841, pp. 484–496.

1839. Journal of Researches into the Geology and Natural History of the Various Countries Visited by H. M. S. "Beagle," under the Command of Captain Fitzroy, R. N., from 1832 to 1836. By Charles Darwin, Esq., M. A., F. R. S., Secretary to the Geological Society. 8vo., London, 1839.

1839. [Narrative of the Surveying Voyages of H. M. SS. "Adventure" and "Beagle," describing their Examination of the Southern Shores of South America, Vol. III.]

Journal and Remarks, 1832–1836, 8vo, London, 1839.

1839. Note on a Rock seen on an Iceberg in 61° South Latitude.

Journ. Royal Geog. Soc., IX, 1839, pp. 528–529.

1839. Ueber die Luftschifferei der Spinnen.

Fror. N. Not., Bd., 77, no. 222, 1839, pp. 23–24.

1839. Observations on the Parallel Roads of Glen Roy and of other parts of Lochaber, in Scotland, with an attempt to prove that they are of Marine Origin.

Philos. Trans., 1839, CXXIX, p. 39–82: Edinb. New Philos. Journal, XXVII, 1839, pp. 395–403.

1840. Geological Observations (with numerous Maps and Sections) made during the Voyage of H. M. Ship "Beagle," under the command of Capt. Fitzroy, R. N., on the Volcanic Islands of the Atlantic and Pacific Oceans, and on Coral Formations; together with a Brief Notice of the Geology of the Cape of Good Hope, and of parts of Australia. By Charles Darwin, Esq., M.A., Secretary to the Geological Society of London.

1840–1844. The Zoology of the Voyage of H. M. S. "Beagle," under the command of Capt. Fitzroy, during the years 1832 to 1836. Edited and Superintended by Charles Darwin. 8vo. London, 1840–1844.

Fossil Mammalia. By R. Owen. With a Geological Introduction by Charles Darwin.

1841. On a Remarkable Bar of Sandstone off Pernambuco, on the Coast of Brazil.

Philos. Mag., 3d ser., XIX, 1841, pp. 257-260.

1842. Notes on the Effects produced by the Ancient Glaciers of Caernarvonshire, and on the Boulders Transported by Floating Ice.

Philos. Mag., 3d ser., XXI, 1842, p. 180: Edinb. New Philos. Journal, XXXIII, 1842, pp. 352-353.

1842. On the Distribution of Erratic Boulders, and on the Contemporaneous Unstratified Deposits of South America.

Trans. Geol. Soc., 2d ser., 1842, VI, pp. 415-432: Proc. Geol. Soc., III, 1842, pp. 425-430: Philos. Mag., 3d ser., XIX, p. 536: Leonhard & Bronn, Neues Jahrb. for Min., Geol., &c., 1843, p. 741.

1842. The Structure and Distribution of Coral Reefs. 8vo. London, 1842.

1843. Remarks on Charles Maclaren's paper "On Coral Islands and Reefs, as described by M. Darwin."

Edinburgh New Philos. Journal, XXXIV, 1843, pp. 47-50.

1844. Observations on the Structure and Propagation of the genus *Sagitta*. By Charles Darwin, F. R. S., V. P. G. S.

Ann. and Mag. of Nat. History, 13, 1844, pp. 1-6, pl. 1, figs. A-D: Ann. de Sci. Nat., 3d series, Zoologie, I, 1844, pp. 360-365, figs.: Fror. N. Not., Bd XXX, no. 639, 1844, pp. 1-6.

1844. Brief Descriptions of several Terrestrial *Planariæ* and of some remarkable Marine Species, with an Account of their Habits. By Charles Darwin, F. R. S., V. P. G. S.

Ann. and Mag. of Nat. History, 14, 1844, pp. 241-251, pl. V, figs. 1-4.

1844. Geological Observations on the Volcanic Islands, visited during the voyage of *H. M. S. Beagle*, together with some brief notices on the Geology of Australia and the Cape of Good Hope. Being the second part of the Geology of the Voyage of the "Beagle," under the command of Capt. Fitzroy, R. N., during the years 1832 to 1836. 8vo. London, 1844.

Journ. Geol. Soc., I, p. 556.

1846. Geological Observations on South America. 8vo. London, 1846.

1846. An account of the Fine Dust which often falls on Vessels in the Atlantic Ocean.

Journ. Geol. Soc., II, 1846, pp. 26-30.

1846. On the Geology of the Falkland Islands.

Journ. Geol. Soc., II, 1846, pp. 267-274.

1848. On the Transportal of Erratic Boulders from a Lower to a Higher Level.

Jour. Geol. Soc., IV, 1848, pp. 315-323.

1849. [Geological Instructions, in Admiralty Manual of Scientific Instructions. Edited by Sir J. Herschel. 8vo. London, 1849.]

1850. On British Fossil *Lepadidæ*.

Quart. Journ. Geol. Soc. London, VI, 1850, pp. 439-440.

1851. A Monograph of the Fossil Lepadidæ, or Pedunculated Cirripedes of Great Britain. London. Printed for the Paleontographical Society, 1851. 4to.

1851. A Monograph of the Sub-Class Cirripedia, with Figures of All the Species. The Lepadidæ; or, Pedunculated Cirripedes. London, printed for the Ray Society, 1851. 8vo.

1851. Analogy of the Structure of some Volcanic Rocks with that of Glaciers.
Edinburgh Proc. Roy. Soc., II, 1851, pp. 17-18.

1854. A Monograph on the Fossil Balanidæ and Verrucidæ of Great Britain. London, printed for the Paleontographical Society, 1854. 4to.

1854. A Monograph of the sub-Class Cirripedia, with Figures of All the Species. The Balanidæ, (or Sessile Cirripedes); the Verrucidæ, etc., etc., etc. Printed for the Ray Society, 1854. 8vo.

1855. On the power of icebergs to make rectilinear uniformly-directed grooves across a sub-marine undulatory surface.
Phil. Mag., X, 1855, pp. 96-98.

1857. On the action of Sea-water on the germination of Seeds.
Journ Linn. Soc., I, 1857, (Botany,) pp. 130-140.

1858. On the Agency of Bees in the Fertilization of Papilionaceous Flowers, and on the crossing of Kidney Beans.
Gardeners' Chronicle, Nov. 13, 1858: Ann. and Mag. of Nat. Hist., 3d series, 1858, pp. 450-465.

1858. Darwin, Charles and Wallace, Alfred. On the Tendency of Species to Form Varieties, and on the Perpetuation of Varieties and Species by Natural Means of Selection.
Journal Proc. Linn. Soc., London, III, 1858, pp. 45-62.

1859. On the variation of organic beings in a state of nature; on the natural means of selection; on the comparison of domestic races and true species.
Journ. Linn. Soc., III, (Zoology,) 1859, pp. 46-53: Halle. Zeitsch. Gesell. Nat., XVI, 1860, pp. 425-459.

1859. On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life. 8vo. London, 1859.

1862. On the Two Forms, or Dimorphic Condition, in the species of Primula, and on their remarkable Sexual Relations.
Journ. Linn. Soc., VI, 1862, (Botany) pp. 151-157.

1862. On the three remarkable sexual forms of Catasetum tridentatum, an Orchid in the possession of the Linnean Society.
Journ. Linn. Soc., 1862, (Botany,) pp. 151-157.

1862. On the Various Contrivances by which British and Foreign Orchids are Fertilized by Insects. 8vo. London, 1862.

1863. Observation sur l'hétéromorphisme des fleurs, et des conséquences pour la fécondation.
Ann. Sci. Nat., XIX, 1863, (Botany,) pp. 204-255.

1863. On the thickness of the Pampean formation near Buenos Ayres.
Journ. Geol. Soc., XIX, 1863, pp. 68-71.

1863. On the existence of two forms, and on their reciprocal sexual relation, in several species of the genus Linum.
Journ. Linn. Soc., VII, 1863, (Botany,) pp. 69-83.

1863. On the so-called "Auditory Sac" of Cirripedes.
Nat. Hist. Review, 1863, pp. 115-116.

1864. On the Sexual Relations of the Three Forms of Lythrum.
Journ. Linn. Soc.. Vol. VIII, 1864, p. 169.

1867. On the Character and Hybrid-like Nature of the Illegitimate Offspring of Dimorphic and Trimorphic Plants.
Jour. Linn. Soc., Vol. X, 1867, (Bot.,) p. 393.

1867. On the specific difference between Primula veris and P. vulgaris; and on the Hybrid Nature of the Common Oxslip.
Jour. Linn. Soc., Vol. X, 1867, (Botany,) p. 437.

1867. Queries about Expression for Anthropological Inquiry.
Report, Smithsonian Institution, 1867, p. 324.

1868. The Variation of Animals and Plants under Domestication. 2 vols., 8vo. London, 1868.

1869. Notes on the Fertilization of Orchids.
Ann. and Mag. of Nat. Hist., 4th series, IV, 1869, pp. 141-159.

1870. Note on the Habits of the Pampas Woodpecker (*Colaptes campestris.*)
Proc. Zool. Soc., London, 1870, pp. 705, 706.

1871. The Descent of Man, and Selection in relation to Sex. 2 vols., 16mo. London, 1871.

1872. The Expression of the Emotions in Man and Animals. 12mo. London, 1872.

1874. Flowers of the Primrose destroyed by Birds.
Nature, X, 1874, pp. 24, 25.

1875. Insectivorous Plants. 8vo. London, 1875.

1876. Effects of Cross and Self-Fertilization in the Animal Kingdom.

1876. Movements and Habits of Climbing Plants. 8vo. London, 1876.

1876. Sexual Selection in relation to Monkeys.
Nature, XV, 1876, pp. 18, 19.

1877. The Different Forms of Flowers on Plants of the same Species. 8vo. London, 1877.

1877. [Testimonial to Mr. Darwin. Evolution in the Netherlands.]
Nature, XV, 1877, pp. 410-412. Letter of Mr. Darwin.

1877. The Contractile Filaments of the Teasel.
Nature, XVI, 1877, p. 339.

1877. A Biographical Sketch of an Infant.
Mind, II, (No. 7, July, 1877,) pp. 285-294.

1878. Transplantation of Shells.
Nature, XVIII, p. 120.

1879. Fritz Müller on a Frog having Eggs on its Back; On the Abortion of the Hairs on the Legs of certain Caddis Flies, &c.
Nature, XIX, 1879, pp. 462-464.

1879. Rats and Water Casks.
Nature, XIX, 1879, p. 481.

1879. Erasmus Darwin. By Ernst Krause. Translated by W. S. Dallas. With a preliminary notice by Charles Darwin. 8vo. London, 1879.

1880. Fertility of Hybrids from the Common and Chinese Goose.
Nature, XXI, 1880, p. 207.

1880. The Sexual Colors of certain Butterflies.
Nature, XXI, 1880, p. 237.

1880. The Omari Shell Mounds.
Nature, XXI, 1880, pp. 561, 562.

1880. Sir Wyville Thomson on Natural Selection.
Nature, XXIII, 1880, p. 32.

1880. Black Sheep.
Nature, XXIII, 1880, p. 193.

1881. The Power of Movement in Plants. By Charles Darwin, LL. D., assisted by Francis Darwin. 8vo. London, 1881.

1881. Movements of Plants.
Nature, XXIII, 1881, p. 409.

1881. Mr. Darwin on Vivisection.
Nature, XXIII, 1881, p. 583.

1881. The Movements of Leaves.
Nature, XXIII. 1881, p. 603.

1881. Inheritance.
Nature, XXIV, 1881, p. 257.

1881. Leaves Injured at Night by Free Radiation.
Nature, XXIV, 1881, p. 459.

1881. [On the Bodily and Mental Development of Infants.]
Nature, XXIV, 1881, p. 565.

1881. The Parasitic Habits of Molothrus.

Nature, XXV, 1881, pp. 51-52.

1881. The Formation of Vegetable Mould through the action of worms, with observations on their habits. With illustrations. 12mo. London, 1881.

1882. The Action of Carbonate of Ammonia on the Roots of certain Plants, and on Chlorophyll Bodies.

Jour. Linn. Soc., London, X ? 1881, p. ?: Abstract in Nature, XXV, 1882, pp. 489-490.

1882. On the Dispersal of Freshwater Bivalves.

Nature, XXV, 1882, pp. 529-530.

APPENDIX.

THE PROPER USE OF THE TERM BIOLOGY.*

By Theodore Gill.

From the Presidential Address delivered January 28, 1881.

The father of modern natural history, following in the footsteps of his predecessors, recognized three kingdoms of nature, and allowed them equal rank in his scheme of classification. These were severally the subjects of the sciences designated as mineralogy, botany, and zoology. The contrasts between the characteristics of the first and the last two, and the generalities which have since compelled us to employ a term in common for botany and zoology, were not then appreciated. The same method and the same system of terminology were used by Linnæus for the description of the mineral as for the vegetable and animal kingdoms. Nevertheless suggestions had been made still earlier towards a segregation under a common head of the kingdoms of organic nature.

As early as 1587, Cristofle de Savigny, in a scarce and little-known work (Tableaux accomplis de tous les arts libéraux, Paris,) contrasted the organic kingdoms under a common denominator, *psychologie*, now universally accepted with a very different signification. The suggestion in question, however, fell still born. It was not till 1802 and 1803 that a term destined to general adoption was proposed. Then the illustrious Lamarck made use of the word Biologie as a common name under which to consider the phenomena presented by organic nature. A number of words were subsequently urged as substitutes and as better, *e. g.*, *Somiologie* by Rafinesque, in 1814; *Physique Organique* by Comte, in 1830; *Organomie* by d'Omalius d'Halloy, in 1838; *Zoologie* by Jean Reynaud, in 1843; *Organologie* by Gerdy, in 1844; and, lastly, *Zoonomy* by Baden Powell. None of them, however, have been received with favor, and, slowly at first, afterward by general consent, Biology was accepted as a term much needed to group the many generalities enunciable respecting animals and plants. The old professorships of natural history or of zoology and botany combined are now being replaced by professorships of biology, and almost *pari passu* with excessive (because exclusive) cultivation of special departments of botany and zoology has been a tendency to combine on common ground to consider the general laws and principles affecting alike the organic kingdoms of nature, and by students agreeing in the method which they employ in their several pursuits. As a result of this feeling has been born the Biological Society of Washington.

* Much discussion having attended the consideration of a name for the "Biological Society of Washington" the subject was treated of in the first presidential address, and that portion thereof relating to the question at issue is here reproduced.

The applicability of the term biology, in the sense now so generally accorded to it, is doubtless debatable, and has been strongly objected to by an eminent scholar, Baden Powell. That gentleman, in the first essay of his "Order of Nature," (§ 4, p. 173, note,) while discussing the "Theory of Life" and "Life in Geological Epoch," has uttered a protest against the use of the word in the following terms:

"While on this subject I cannot omit to take this occasion of recording my protest against the now prevalent, but barbarous use of the term 'Biology.' βιος never means 'life' in the sense of 'vitality;' it means the 'life' of a man as progressing in *time*—his birth, actions, and death. Plato has 'βιος ζωῆς,' the lifetime of a life. (Epinomis, [or the Philosopher,] 982.) Unfortunately the term 'Zoology,' which would be the proper one for this branch of science, has been already appropriated to what ought to have been called 'Zoography;' but there is still 'Zoonomy,' the science of the laws of life, open to adoption, and, at any rate, much better than '*biology*,' which, if it means anything, would be a theory of the facts of *biography*." *

On the other hand, a still more eminent and probably better scholar in Greek philology, William Whewell, has preferred the term biology to any other. In his "History of Scientific Ideas," under the caption of "The Philosophy of Biology," (Vol. 2, p. 170,) he urges that "the word *Physiology*, by which they [that is, to use again his own words, 'the organical sciences'] have most commonly been described, means the *science of nature;* and though it would be easy to explain, by reference to history, the train of thought by which the word was latterly restricted to *living nature*, it is plain that the name is, etymologically speaking, loose and improper. The term *biology*, which means exactly what we mean to express, *the science of life*, has often been used, and has of late become not uncommon among good writers."

It may be added that the word βιος, although doubtless generally used in the sense of lifetime, as urged by Baden Powell, nevertheless does not appear to have been limited to such meaning, but to have had practically the same range as our word life. Even if it were so limited, however, it would be eminently appropriate from the standpoint from which all scientific students of nature now take view, for it is the lifetime of nature and the questions of how organisms have been evolved and how grown and developed that must interest the students of life, plants and animals, as well as those organisms neither plants nor animals that formerly existed and still survive.

It is in fact the sum of those phenomena which may be aptly described as constituting the lifetime of nature that forms the true aim of what may, with the strictest and exact propriety, be called BIOLOGY.

The word seems to have been also used quite generally by entomologists in a very restricted sense; that is, as a common denominator for whatever relates to the special habits and manners of insects in contradistinction to Physiology. Thus Hagen, in his *Bibliotheca Entomologica*, (1863,) groups all entomological

* Powell, Order of Nature, Essay 1, § 4, p. 172, note, Theory of Life.

treatises under eight categories, viz: (1) Accessories and Generals; (2) Genera Entomology; (3) Special Entomology, *i. e.*, the subordinate groups, orders, etc. (4) Anatomy; (5) Physiology; (6) *Biology*; (7) Benefits from Insects; and (8) Injuries from Insects. This summary will give some idea of what entomologists intend by the word, and the original sense of the word, as indicated by Plato in the connection already indicated, might be used as an argument in justification. There would, indeed, be no strong objection to the use of the word to signify a study of habits had it not been abready, by general consent, used in another sense. Our well considered rules, as well in zoology as in botany, that priority determines the use of a name, and that the same name cannot be well used in two different senses, combine with the universal consecration of the term otherwise, to forbid us to use it in the limited sense indicated.

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July 2, 1885

PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON.

PUBLISHED WITH THE CO-OPERATION OF THE SMITHSONIAN INSTITUTION.

VOLUME II.

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PUBLICATION COMMITTEE.

CONTENTS.

* Author's extras of each of the special papers here enumerated were published at the dates given in parentheses following the author's name.

LIST

OF THE

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OF THE

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Elected January 11, 1884.

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LIST OF MEMBERS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON.

JANUARY 25, 1884.

HONORARY MEMBERS.

Date of Election.	
1881, Jan. 14.	BAIRD, SPENCER FULLERTON, M. D., LL. D., M. N. A. S., Secretary of the Smithsonian Institution and Director of the U. S. National Museum; U. S. Commissioner of Fish and Fisheries; Foreign Member of the Zoological and Linnean Societies of London. *Smithsonian Institution, and 1445 Massachusetts Avenue N. W.*

CORRESPONDING MEMBERS.

1882, Mar. 31.	AGASSIZ, ALEXANDER, A. B., S. B., M. N. A. S., Curator of the Museum of Comparative Zoology, Cambridge; Foreign Member of the Zoological and Linnean Societies of London. *Cambridge, Massachusetts.*
1882, Dec. 22.	ALLEN, HARRISON, M. D., Professor of Physiology in the University of Pennsylvania. *117 South Twentieth Street, Philadelphia, Pennsylvania.*
1882, April 8.	ALLEN, JOEL ASAPH, M. N. A. S., C. M. Z. S., Assistant in the Museum of Comparative Zoology, Cambridge; President of the American Ornithologists' Union; Editor of "The Auk." *Cambridge, Massachusetts.*
1882, April 28.	BREWER, WILLIAM HENRY, Ph. D., M. N. A. S., Professor of Agriculture in the Sheffield Scientific School, Yale College, New Haven. *New Haven, Connecticut.*
1881, Feb. 25.	BREWSTER, WILLIAM. *61 Sparks Street, Cambridge, Massachusetts.*
1881, Feb. 25.	BROOKS, WILLIAM KEITH, Ph. D., Associate Professor of Biology and Director of the Marine Laboratory of Johns Hopkins University, Baltimore. *Baltimore, Maryland.*

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1882, Dec. 22.	ALLEN, HARRISON, M. D., Professor of Physiology in the University of Pennsylvania. *117 South Twentieth Street, Philadelphia, Pennsylvania.*
1882, April 8.	ALLEN, JOEL ASAPH, M. N. A. S., C. M. Z. S., Assistant in the Museum of Comparative Zoology, Cambridge; President of the American Ornithologists' Union; Editor of "The Auk." *Cambridge, Massachusetts.*
1882, April 28.	BREWER, WILLIAM HENRY, Ph. D., M. N. A. S., Professor of Agriculture in the Sheffield Scientific School, Yale College, New Haven. *New Haven, Connecticut.*
1881, Feb. 25.	BREWSTER, WILLIAM. *61 Sparks Street, Cambridge, Massachusetts.*
1881, Feb. 25.	BROOKS, WILLIAM KEITH, Ph. D., Associate Professor of Biology and Director of the Marine Laboratory of Johns Hopkins University, Baltimore. *Baltimore, Maryland.*

Date of Election.	CORRESPONDING MEMBERS—Continued.
1882, Jan. 6.	COLLETT, ROBERT, C. M. Z. S., Conservator of the Zoological Museum of the University of Christiania. *Christiania, Norway.*
1882, Dec. 22.	COPE, EDWARD DRINKER, M. A., M. N. A. S., C. M. Z. S., Editor of "The American Naturalist." *2100 Pine Street, Philadelphia, Pennsylvania.*
1881, April 14.	DERBY, ORVILLE ADELBERT, M. S., Curator of the Geological Section of the National Museum of Brazil. *Rio de Janeiro, Brazil.*
1882, Jan. 6.	FARLOW, WILLIAM GILSON, A. M., M. D., M. N. A. S., Professor of Cryptogamic Botany in Harvard University. *Cambridge, Massachusetts.*
1881, Mar. 11.	GIGLIOLI, ENRICO HILLYER, D. Sc., C. M. Z. S., Director of the Royal Zoological Museum of Vertebrates, and Professor of Vertebrate Zoology in the Royal Institute, Florence. *R. Istituto di Studi Superiori, Florence, Italy.*
1882, Jan. 6.	GRAY, ASA, M. D., LL. D., M. N. A. S., Fisher Professor of Natural History in Harvard University; Foreign Member of the Royal Society of London, and of the Institute of France. *Botanic Garden, Cambridge, Massachusetts.*
1884, Jan. 11.	HUBRECHT, A. A. W., C. M. Z. S., &c., Professor of Natural History in the University of Utrecht. *Utrecht, Holland.*
1882, Jan. 6.	HYATT, ALPHEUS, S. B., M. N. A. S., Professor of Zoology and Paleontology in the Massachusetts Institute of Technology; Custodian of the Boston Society of Natural History; President of the Society of Naturalists of the Eastern United States. *Cambridge, Massachusetts.*
1883, Jan. 5.	JORDAN, DAVID STARR, M. S., M. D., Professor of Natural History in Indiana State University. *Bloomington, Indiana.*
1881, April 8.	LAWRENCE, GEORGE N., C. M. Z. S. *45 East 21st St., New York City.*
1883, Dec. 14.	LYMAN, HON. THEODORE, A. M., M. N. A. S., Member of Congress from Massachusetts. *1407 Massachusetts Avenue N. W., Washington.*
1882, Dec. 22.	MARTIN, HENRY NEWELL, A. M., M. D., D. Sc., Professor of Biology in Johns Hopkins University. *Baltimore, Maryland.*
1882, Mar. 31.	MORSE, EDWARD S., Ph. D., M. N. A. S., Director of the Peabody Academy of Science, Salem. *Salem, Massachusetts.*

Date of Election.	CORRESPONDING MEMBERS—Continued.
1883, Nov. 30.	MOSELEY, HENRY NOTTIDGE, A. M., F. R. S., F. L. S., F. Z. S., &c., Linacre Professor of Human and Comparative Anatomy in the University of Oxford. *14, St. Giles, Oxford, England.*
1882, Mar. 31.	PACKARD, ALPHEUS SPRING, Jr., A. M., M. D., M. N. A. S., Professor of Zoology and Geology in Brown University, Providence; Editor of "The American Naturalist." *Providence, Rhode Island.*
1882, Dec. 22.	SCUDDER, SAMUEL HUBBARD, A. M., M. N. A. S., President of the Boston Society of Natural History; Editor of "Science." *Cambridge, Massachusetts.*
1882, Mar. 3.	SMITH, SIDNEY IRVING, Ph. B. Professor of Comparative Anatomy in Yale College, New Haven. *New Haven, Connecticut.*
1881, Feb. 25.	VELIE, JOHN W., M. D., Secretary and Curator of the Chicago Academy of Sciences. *263 Wabash Avenue, Chicago, Illinois.*
1882, Mar. 31.	VERRILL, ADDISON EMORY, A. M., S. B., M. N. A. S. Professor of Zoology and Curator of the Zoological Collections in Yale College, New Haven. *New Haven, Connecticut.*
1882, April 28.	WATSON, SERENO, Ph. D., M. N. A. S. Curator of the Herbarium of Harvard University. *Botanic Garden, Cambridge, Massachusetts.*
1882, Mar. 3.	WILSON, EDMUND BEECHER, Ph. D. Acting Professor of Natural History in Williams College. *Williamstown, Massachusetts.*

ACTIVE MEMBERS.*

1883, Jan. 19.	ACKER, GEORGE N., A. M., M. D., Demonstrator of Practical Physiology and Pathological Histology, National Medical College. *1403 New York Avenue N. W.*
1883, Dec. 28.	ACKERMAN, ALBERT AMMERMAN, Ensign, U. S. Navy, on duty on U. S. Fish Commission Steamer "Albatross." *Smithsonian Institution.*

* When not otherwise expressly stated, all addresses are in Washington. By the words "Original Member" are designated those who attended the meetings for organization, November 26 and December 3, 1880.

Date of Election.	ACTIVE MEMBERS—Continued.
1883, Jan. 19.	AMES, DELANO, Student. *1600 13th Street N. W.*
Orig. Member.	ASHFORD, FRANCIS ASBURY, M. D. Dean of Faculty and Professor of Surgery in the Medical Department of the University of Georgetown. **Died, 1883.**
1881, Jan. 14.	BAKER, FRANK, M. D., Professor of Anatomy in the Medical Department, University of Georgetown. *Office of Light House Board, and 326 C Street N. W.*
1882, Mar. 3.	BARKER, JOHN SHEPARD, Law Student. *715 H Street N. W.*
1881, Nov. 11.	BARNARD, WILLIAM STEBBINS, S. B., Ph. D. Assistant Entomologist, U. S. Department of Agriculture. *917 New York Avenue.*
Orig. Member.	BEAN, TARLETON HOFFMAN, M. D., M. S., Curator, Dep't of Fishes, U. S. National Museum. *National Museum, and 1404 S Street N. W.*
1883, Jan. 5.	BENEDICT, JAMES EVERARD, Naturalist of the U. S. Fish Commission Steamer "Albatross." *Smithsonian Institution, and 140 B Street N. E.*
1881, Mar. 25.	BESSELS, EMIL, M. D., Ph. D. *1444 N Street N. W.*
1881, Nov. 11.	BEYER, HENRY G., M. D., Passed Assistant Surgeon, U. S. Navy. *U. S. Steamer "Blake," Navy Yard, Brooklyn, New York.*
1884, Jan. 11.	BIGELOW, HORATIO RIPLEY, M. D. *1228 N Street N. W. (office), and 2 Iowa Circle.*
1883, Mar. 2.	BIGELOW, ROBERT PAYNE, Student. *1501 Eighteenth Street N. W., and Harvard University, Cambridge, Massachusetts.*
1882, Mar. 17.	BILLINGS, JOHN SHAW, A. M., M. D., Surgeon and Brevet Lieutenant Colonel, U. S. Army; Curator of the Army Medical Museum. *Army Medical Museum, and 3027 N Street N. W.*
1881, Jan. 14.	BIRNEY, HERMAN HOFFMAN, Student in Lehigh University. *1901 Harewood Avenue, Le Droit Park.*
1882, Jan. 20.	BIRNEY, GEN. WILLIAM, A. M. *1901 Harewood Avenue, Le Droit Park.*
1882, Feb. 17.	BLISH, JOHN BELL, Ensign, U. S. Navy. *Navy Department, Washington.*
1881, Nov. 11.	BRANSFORD, JOHN FRANCIS, M. D. Passed Assistant Surgeon, U. S. N. *Navy Department, Washington.*

Date of Election.	ACTIVE MEMBERS—Continued.
1882, Nov. 24.	BRITTON, WILEY, Agent, Quartermaster's Dept., U. S. Army. *Quartermaster General's Office, Washington.*
1883, Dec. 14.	BROMWELL, JOSIAH ROBSON, M. D. *1138 Connecticut Avenue, N. W.*
Orig. Member.	BROWN, JAMES TEMPLEMAN, Aid, U. S. National Museum. *National Museum, and 1607 Fifteenth Street N. W.*
Orig. Member.	BROWN, STEPHEN CARVOSSO, Registrar, U. S. National Museum. *National Museum, and 311 Eleventh Street S. W.*
1882, Nov. 24.	BROWNE, JOHN MILLS, M. D., Medical Director, U. S. N.; Curator of Naval Museum of Hygiene. *Bureau of Medicine and Surgery, U. S. Navy.*
1882, Dec. 22.	BRUNER, LAWRENCE, Assistant, Entomological Division, Department of Agriculture. *Department of Agriculture.*
1883, Dec. 28.	BRYAN, JOSEPH H., Passed Assistant Surgeon, U. S. Navy. *Museum of Hygiene, U. S. Navy.*
Orig. Member.	BURDICK, EDSON ALMERON. *Pension Office, and 406 Spruce Street N. W.*
1883, Jan. 5.	BURGESS, EDWARD SANDFORD, A. M., In charge of Department of Natural Science, Washington High School. *1214 K Street N. W.*
1882, Mar. 17.	BURNETT, SWAN MOSES, M. D., Professor of Clinical Ophthalmology and Otology, Medical Department, University of Georgetown. *1215 I Street N. W.*
Orig. Member.	BUSEY, SAMUEL CLAGETT, M. D., Emeritus Professor of the Theory and Practice of Medicine, Medical Department, University of Georgetown. *1525 I Street N. W.*
1881, June 3.	CANBY, WILLIAM JACKSON. *413 Tenth Street N. W.*
1881, June 3.	CARMAN, MYRON ALBERT, D. D. S. *New York City.*
1883, Jan. 19.	CHAPPEL, JOHN WILLIAM, M. D. *Tennallytown, D. C.*
1882, Feb. 17.	CHASE, HENRY SANDERS, Ensign, U. S. Navy, on duty in the National Museum. *Smithsonian Institution.*
1883, Apr. 27.	CHESTER, COLBY M., Commander, U. S. N.; Hydrographic Inspector, U. S. Coast and Geodetic Survey. *Coast Survey Office.*
Orig. Member.	CHICKERING, REV. JOHN WHITE, Jr., A. M., Professor of Natural Science in the National Deaf-Mute College. *Kendall Green, N. E.*

Date of Election.	ACTIVE MEMBERS—Continued.
1881, May 20.	CHICKERING, JOHN JAMESON, A. M., Teacher in the Public Schools. *Kendall Green, N. E.*
1882, Mar. 17.	CHRISTIE, ALEXANDER SMYTH, Astronomical Computer, U. S. Coast and Geodetic Survey. *Coast Survey Office, and 513 Sixth Street N. W.*
1881, Jan. 28.	CLARK, ALONZO HOWARD, Assistant, U. S. National Museum. *National Museum, and 1527 S Street N. W.*
1883, Dec. 14.	COLLINS, JOHN F. *Pension Office, and 1007 L Street N. W.*
1881, Feb. 23.	COLLINS, JOSEPH WILLIAM. *National Museum, and Gloucester, Massachusetts.*
Orig. Member.	COMSTOCK, JOHN HENRY, S. B., Professor of Entomology and General Invertebrate Zoology in Cornell University, Ithaca. *Ithaca, New York.*
1881, Dec. 23.	CONANT, WOODBURY PAGE, Assistant Botanist, Department of Agriculture. *Agricultural Department.*
Orig. Member.	COUES, ELLIOTT, A. M., M. D., Ph. D., M. N. A. S., C. M. Z. S., Professor of Anatomy, Medical Department, Columbian University. *Smithsonian Institution, and 1726 N Street N. W.*
1881, Nov. 11.	COX, WILLIAM VAN ZANT., A. B. *Smithsonian Institution.*
1881, Jan. 28.	DALL, WILLIAM HEALEY, Assistant, U. S. Coast and Geodetic Survey; Honorary Curator, Dept. of Mollusks, U. S. National Museum. *Coast Survey Office, and 1119 Twelfth Street N. W.*
1883, Feb. 3.	DAVIS, HARRY C., A. B., Professor of Greek, Wilkesbarre Academy. *248 Franklin Street, Wilkesbarre, Penn.*
1881, Nov. 11.	DEWEY, FREDERIC PERKINS, Ph. B., Curator, Dept. of Metallurgy, U. S. National Museum. *National Museum, and 920 N Street N. W.*
1881, Nov. 11.	DODGE, CHARLES RICHARDS, Special Agent, Tenth Census, Division of Fruit and Orchard Statistics. *1336 Vermont Avenue N. W.*
1882, Jan. 20.	DOSH, FRANK BOWMAN. **Died, 1883.**
1882, Dec. 22.	DRESEL, HERMAN GEORGE, Ensign, U. S. N., on duty in the National Museum. *Smithsonian Institution.*
1881, Jan. 28.	EARLL, ROBERT EDWARD, S. B. *Smithsonian Institution.*
1881, Feb. 25.	ELLIOTT, HENRY WOOD. *Smithsonian Institution, and Cleveland, Ohio.*

Date of Election.	ACTIVE MEMBERS—Continued.
1881, Nov. 25.	ELLZEY, MASON GRAHAM, A. M., M. D., Lecturer on Hygiene and Medical Jurisprudence, Medical Department, University of Georgetown. *1012 I Street N. W.*
1882, Oct. 27.	ENTHOFFER, JOSEPH, U. S. Coast Survey. *68 I Street N. W.*
1883, May 11.	FALLS, MOOR S., Medical Student. *1200 Eighteenth Street N. W.*
1881, Jan. 28.	FERGUSON, THOMAS BARKER, Assistant Commissioner of Fisheries. *1435 Massachusetts Avenue N. W.*
1881, Mar. 25.	FLETCHER, ROBERT, M. D., Acting Assistant Surgeon, U. S. Army; Editor of "Index Medicus." *Surgeon General's Office, and 1326 L Street N. W.*
1881, Feb. 11.	FLINT, JAMES MILTON, M. D., Surgeon, U. S. Navy; Honorary Curator, Section of Materia Medica, U. S. National Museum. *National Museum, and Riggs House.*
1881, Dec. 9.	FOREMAN, EDWARD, M. D., Assistant, U. S. National Museum. *National Museum, and 200 Eleventh Street S. W.*
1883, Apr. 13.	FOSTER, RICHARD, B. S., Instructor of Natural History in Howard University. *Howard University.*
1883, Apr. 27.	FOX, WIILIAM HENRY. *1828 H Street N. W.*
1883, Dec. 14.	FRANZONI, CHARLES WLLIAM, Ph. B., M. D. *810 H Street N. W.*
1883, Mar. 30.	FRIEDRICH, LEON L., M. D., Prosector to the Chair of Anatomy, National Medical College. *323 East Capitol Street.*
1883, Jan. 5.	FRISTOE, EDWARD T., A. M., LL. D., Professor of Chemistry in Columbian University and National Medical College. *1434 N Street.*
1881, Mar. 25.	GANNETT, HENRY, S. B., A.Met.B., Chief Geographer of the U. S. Geological Survey. *Office of Geological Survey, and 1881 Harewood Ave., Le Droit Park.*
1882, Feb. 17.	GARRETT, LEROY MASON, Ensign, U. S. Navy, on duty on Steamer "Albatross." *Smithsonian Institution.*
Orig. Member.	GEDNEY, CHARLES DEFOREST. *Coast Survey Office, and 115 F Street N. E.*
1881, Mar. 11.	GIHON, ALBERT LEARY, A. M., M. D., Medical Director, U. S. Navy. In charge of the U. S. Naval Hospital, Washington, D. C. *2019 Hillyer Place N. W.*

Date of Election.	ACTIVE MEMBERS—Continued.
1882, April 28.	GILBERT, GROVE KARL, M. N. A. S., Geologist, U. S. Geological Survey. *May Building, and 1424 Corcoran Street N. W.*
Orig. Member.	GILL, THEODORE NICHOLAS, M. D., Ph. D., M. N. A. S. *Cosmos Club, and 321 Four-and-a-half Street.*
1883, Mar. 30.	GILPIN, GEORGE E., M. D. *Tennallytown, D. C.*
1882, Nov. 24.	GODWIN, HARRY P., Journalist. *Office of "Evening Star," and 15 Second Street S. E.*
Orig. Member.	GOODE, GEORGE BROWN, A. M., Assistant Director of the U. S. National Museum. *Smithsonian Institution, and 1620 Massachusetts Avenue N. W.*
1882, Oct. 27.	GOODRICH, JOSEPH KING, Assistant, U. S. National Museum. *National Museum.*
Orig. Member.	GORE, JAMES HOWARD, S. B., Professor of Mathematics in Columbian University; Astronomer, U. S. Geological Survey. *Columbian University, and 1305 Q Street N. W.*
1881, Nov. 11.	GRIFFITH, SAMUEL HENDERSON, M. D., Passed Assistant Surgeon, U. S. Navy. *Bureau of Medicine, U. S. Navy.*
1882, Nov. 24.	GURLEY, REVERE R. *Children's Hospital.*
1883, Dec. 14.	HAGNER, CHARLES E., M. D. *1400 H Street N. W.*
1882, Nov. 24.	HAMILTON, JOHN B., M. D., Supervising Surgeon General, U. S. Marine Hospital Service. *9 B Street N. W.*
Orig. Member.	HASSLER, FERDINAND AUGUSTUS, M. D. *Tustin City, Los Angeles Co., California.*
1881, Feb. 25.	HAWES, GEORGE WESSON, Ph. D. **Died, 1882.**
1882, Feb. 3.	HAWKES, WILLIAM HIMES, A. B., M. D. *1330 New York Avenue.*
1882, Feb. 17.	HAYDEN, EDWARD EVERETT, Ensign U. S. Navy, on duty at the National Museum. *Smithsonian Institution.*
1882, Mar. 31.	HENSHAW, HENRY WETHERBEE, Ethnologist, Bureau of Ethnology, Smithsonian Institution. *1114 M Street N. W.*
1881, Jan. 14.	HESSEL, RUDOLPH, Ph. D., Superintendent of Government Carp Ponds. *514 Tenth Street N. W.*
1883, Feb. 16.	HICKLING, DANIEL PERCY. *301 Pennsylvania Avenue N. W.*

Date of Election.	ACTIVE MEMBERS—Continued.
1883, Feb. 16.	HICKLING, DANIEL PERCY, Jr., Student. *301 Pennsylvania Avenue N. W.*
1883, Nov. 16.	HITCHCOCK, ROMYN, F. R. M. S., Assistant, U. S. National Museum; Editor of "American Monthly Microscopical Journal." *1316 Tenth Street N. W.*
1882, Dec. 22.	HOADLY, FREDERICK H., M. D. *New Haven, Connecticut.*
Orig. Member.	HOFFMAN, WALTER JAMES, M. D., Assistant Ethnologist, Bureau of Ethnology, Smithsonian Institution. *222 E Street N. W.*
1882, April 14.	HORNADAY, WILLIAM TELL, Chief Taxidermist U. S. National Museum. *National Museum, and 404 Spruce Street, Le Droit Park.*
1882, May 26.	HOUGH, FRANKLIN BENJAMIN, A. M., M. D., Ph. D., Statistician. *Lowville, N. Y.*
1882, April 27.	HOUGH, MYRON BEACH WARNER. *U. S. Treasurer's Office, and 312 Indiana Avenue N. W.*
Orig. Member.	HOWARD, LELAND O., M. S., Assistant, Entomological Division, U. S. Department of Agriculture. *Agricultural Department, and 1407 Fifteenth Street N. W.*
1883, Feb. 6.	HOWE, FRANK T., M. D., City Editor "National Republican." *Office of "Republican," and 1434 Corcoran Street N. W.*
1881, Feb. 25.	HOWLAND, EDWIN PERRY, M. D. *211 Four-and-a-half Street N. W.*
Orig. Member.	INGERSOLL, ERNEST. *New Haven, Connecticut.*
1882, Dec. 22.	ISRAEL, GEORGE ROBERT, A. B., LL. B., Teacher in Washington High School. *903 New York Avenue N. W.*
1882, Mar. 3.	JOHNSON, ARNOLD BURGES, A. M., Chief Clerk, U. S. Light House Board. *501 Maple Avenue, Le Droit Park.*
1882, Jan. 20.	JOHNSON, BLANCHARD FREEMAN, Student. *501 Maple Avenue, Le Droit Park.*
1882, Feb. 3.	JOHNSON, JOSEPH TABER, A. M., M. D., Professor of Obstetrics and Diseases of Women and Infants, Medical Department of the University of Georgetown; Gynecologist to Providence Hospital. *926 Seventeenth Street N. W.*
1882, Nov. 24.	JOHNSTON, WILLIAM WARING, M. D., Professor of the Theory and Practice of Medicine, National Medical College. *1603 K Street N. W.*

Date of Election.	ACTIVE MEMBERS—Continued.
1883, Mar. 2.	JONES, HENRY ALEXANDER, Inspector of Fuel for the District of Columbia. *1004 N Street N. W.*
Orig. Member.	JOUY, PIERRE LOUIS, Attaché of the Corean Embassy. *Seôul, Corea.*
1882, Oct. 27.	KELLY, THOMAS. *Absent from the city.*
Orig. Member.	KIDDER, JEROME HENRY, A. M., M. D., Surgeon, U. S. Navy. Chemist, U. S. Fish Commission. *Smithsonian Institution and 1816 N Street N. W.*
Orig. Member.	KING, ALBERT FREEMAN AFRICANUS, M. D., Professor of Obstetrics and Diseases of Women and Children, Medical Department, Columbian University. President of the Medical Society of the District of Columbia. *726 Thirteenth Street N. W.*
1881, Nov. 25.	KOEBELE, ALBERT. *Entomological Division, Department of Agriculture.*
Orig. Member.	LEE, WILLIAM, M. D., Professor of Physiology in the Medical Department of Columbian University. *2111 Pennsylvania Avenue N. W.*
1882, Mar. 17.	LEECH, DANIEL, Corresponding Clerk, Smithsonian Institution. *1507 Vermont Avenue N. W.*
1882, Jan. 20.	LEHNERT, REV. ERNEST, Pastor of St. John's Lutheran Church. *325 Four-and-a-half Street.*
1882, Oct. 27.	LUCAS, FREDERIC AUGUSTUS, Osteologist, U. S. National Museum.
1882, Dec. 22.	MCARDLE, THOMAS EUGENE, A. M., M. D., Secretary of the Medical Society of the District of Columbia. *707 Twelfth Street N. W.*
1883, Dec. 28.	MCCLAIN, CHARLES SUMNER, Ensign, U. S. Navy, on duty in the U. S. National Museum. *Smithsonian Institution.*
1883, Apr. 27.	MCCONNELL, JAMES CULBERTSON, M. D., Army Medical Museum. *425 M Street N. W.*
1881, Jan. 28.	MCDONALD, MARSHALL, Chief of Division of Distribution, U. S. Fish Commission; Commissioner of Fisheries for the State of Virginia. *1136 Twelfth Street N. W.*
1883, Apr. 13.	MCELHONE, JAMES FRANCIS, Student in Georgetown University. *1318 Vermont Avenue.*

Date of Election.	ACTIVE MEMBERS—Continued.
1883, Dec. 14.	McGEE, W. J., Assistant, U. S. Geological Survey. *512 Thirteenth Street N. W.*
1881, May 20.	McMURTRIE, WILLIAM, E. M., M. S., Ph. D., Professor of Chemistry in Illinois Industrial University. *Champaign, Illinois.*
1881, Nov. 11.	MANN, BENJAMIN PICKMAN, A. B., Assistant, Entomological Division, U. S. Department of Agriculture; Editor of "Psyche." *Agricultural Department, and 924 Nineteenth Street N. W.*
1883, Nov. 3.	MARCOU, JOHN BELKNAP, Assistant, U. S. Geological Survey. *National Museum, and 1319 Eleventh Street N. W.*
1882, Feb. 17.	MARSH, CHARLES CARROLTON, Ensign U. S. Navy, on duty in the National Museum. *Smithsonian Institution.*
1882, Jan. 20.	MARTIN, FRANK. *1835 G Street N. W.*
Orig. Member.	MARX, GEORGE, Zoological Draughtsman, U. S. Department of Agriculture. *Agricultural Department, and 1626 Fourteenth Street N. W.*
Orig. Member.	MASON, OTIS TUFTON, A. M., Ph. D., Principal of the Columbian University Preparatory School. *1305 Q Street N. W.*
1881, Jan. 28.	MERRILL, GEORGE PERKINS, M. S., Acting Curator, Department of Lithology, U. S. National Museum. *National Museum, and 1221 M Street N. W.*
1881, June 3.	MILLER, BENJAMIN. *1516 Thirty-first Street N. W.*
1882, Feb. 17.	MINER, RANDOLPH HUNTINGTON, Ensign U. S. Navy, on duty on Steamer "Albatross." *Smithsonian Institution.*
1883, Nov. 30.	MURDOCH, JOHN, A. M., Naturalist and Observer, Point Barrow Expedition, on duty at Smithsonian Institution. *Smithsonian Institution.*
1881, Dec. 9.	NELSON, EDWARD W. *Colorado Springs, Colorado.*
1883, Feb. 2.	NELSON, HENRY CLAY, M. D. Medical Inspector, U. S. Navy. *Navy Department.*
1882, Dec. 22.	NETTO, SENHOR FELIPPE LOPES. Brazilian Minister. *1710 Pennsylvania Avenue.*
1883, Jan. 19.	NIBLACK, ALBERT PARKER. Ensign, United States Navy, on duty in the National Museum. *Smithsonian Institution.*

Date of Election.	ACTIVE MEMBERS—Continued.
Orig. Member.	NORRIS, BASIL, M. D., Surgeon and Brevet Colonel, U. S. Army. *1829 G Street N. W.*
1882, Nov. 24.	OURT, A. J., M. D. *Absent from the city.*
1883, Mar. 2.	PALMER, WILLIAM GRAY, M. D. *929 H Street N. W.*
1882, Dec. 22.	PARKER, PETER, JR. Aid, U. S. National Museum. *2 Lafayette Square N. W.*
1883, April 13.	PARSON, REV. WILLIAM EDWIN, A. M., Pastor of the Church of the Reformation. *309 New Jersey Avenue S. E.*
1882, Dec. 22.	PATTON, HORACE B., A. B., Student. *Leipzig, Germany.*
Orig. Member.	PATTON, WILLIAM HAMPTON, A. B. *New York City.*
Orig. Member.	PERGANDE, THEODORE, Assistant, Entomological Division, U. S. Department of Agriculture. *321 D Street N. W.*
1883, Feb. 16.	PERSONS, REMUS CHARLES, A. M., M. D., Surgeon, U. S. Navy. *U. S. Steamer Wyandotte, Navy Yard, Washington.*
1883, Nov. 16.	PHILLIPS, LOUIS E., Law Student. *1428 New York Avenue N. W.*
Orig. Member.	PORTER, JOHN HAMPDEN, M. D. *2720 M Street N. W.*
1882, Dec. 22.	POTTER, ZIBA H., M. D., Medical Examiner, U. S. Pension Office. *Pension Office, and 1609 Nineteenth Street N. W.*
1881, Feb. 11.	POWELL, JOHN WESLEY, Ph. D., LL. D., M. N. A. S., Director, U. S. Geological Survey, and Director, Bureau of Ethnology, Smithsonian Institution; President of the Anthropological Society of Washington. *National Museum, and 910 M Street N. W.*
Orig. Member.	PRENTISS, DANIEL WEBSTER, Ph. B., A. M., M. D., Professor of Materia Medica and Therapeutics, Medical Department, Columbian University; Commissioner of Pharmacy, District of Columbia.. *1224 Ninth Street N. W.*
Orig. Member.	RATHBUN, RICHARD, M. S., Curator, Dep't of Marine Invertebrates, U. S. National Museum. *Smithsonian Institution, and 1622 Massachusetts Avenue N. W.*
1881, May 20.	RAU, CHARLES, Ph. D., Curator, Dep't of Antiquities, U. S. National Museum. *Smithsonian Institution.*
1881, Dec. 9.	REYBURN, ROBERT, A. M., M. D., Professor of Physiology and Hygiene, Medical Department, Howard University. *2129 F Street N. W.*

Date of Election.	ACTIVE MEMBERS—Continued.
1882, Oct. 27.	RHEES, WILLIAM JONES., A. M., Chief Clerk, Smithsonian Institution. *Smithsonian Institution, and "The Oaks," Spring Road, near Fourteenth Street, Mt. Pleasant, D. C.*
1882, Mar. 17.	RICHEY, STEPHEN OLIN, M. D. *1426 New York Avenue.*
Orig. Member.	RIDGWAY, ROBERT, C. M. Z. S., Curator, Dep't of Birds, U. S. National Museum. *Smithsonian Institution, and 1214 Virginia Avenue S. W.*
Orig. Member.	RILEY, CHARLES VALENTINE, A. M., Ph. D., Entomologist, U. S. Department of Agriculture; Honorary Curator of Insects, U. S. National Museum. *Agricultural Department, and 1700 Thirteenth Street N. W.*
1882, April 28.	RUSSELL, ISRAEL COOK, Assistant Geologist, U. S. Geological Survey. *1424 Corcoran Street.*
1882, Mar. 31.	RYDER, JOHN ADAM, Embryologist, U. S. Fish Commission. *Smithsonian Institution.*
1882, Nov. 24.	SAFFORD, WILLIAM EDWIN, Ensign, U. S. Navy, on duty at National Museum. *Peabody Museum of Yale College, New Haven, Connecticut.*
1883, May 25.	SALMON, DANIEL ELMER, D. V. M., Veterinarian, U. S. Department of Agriculture. *1221 I Street N. W.*
Orig. Member.	SCHÆFFER, EDWARD MARTIN, M. D., Lecturer on the Microscope and Microscopical Anatomy, Medical Department, University of Georgetown. *1321 F Street N. W.*
1882, Jan. 20.	SCHÖNBORN, HENRY. *213 Seventh Street N. W.*
1882, Mar. 11.	SCHUERMANN, CARL WILHELM, Property Clerk, U. S. National Museum. *916 D Street S. W.*
Orig. Member.	SCHWARZ, EUGENE AMANDUS, Assistant in the Entomological Division, U. S. Department of Agriculture. *949 Virginia Avenue S. W.*
1881, Jan. 14.	SCUDDER, CHARLES WILLIS, Clerk, U. S. Fish Commission. *939 C Street S. W.*
Orig. Member.	SCUDDER, NEWTON PRATT, A. M., Clerk, Smithsonian Institution. *939 C Street S. W.*
Orig. Member.	SEAMAN, WILLIAM HENRY, M. D., B. L., Professor of Chemistry, in the Medical Department of Howard University. *1424 Eleventh Street N. W.*

Date of Election.	ACTIVE MEMBERS—Continued.
1882, May 26.	SEATON, CHARLES W., Superintendent of the Tenth Census. *Census Office, and 242 North Capitol Street N. W.*
Orig. Member.	SHELDON, CHARLES STILES. *Absent from the city.*
1881, Nov. 11.	SHUFELDT, ROBERT WILSON, M. D., Captain, Medical Corps, U. S. Army, in charge of Section of Comparative Anatomy, Museum and Library, Surgeon General's Office, War Department. *2125 L Street N. W.*
1882, Feb. 17.	SHUTE, DANIEL KERFOOT, A. B., M. D. *Washington Asylum Hospital.*
Orig. Member.	SMILEY, CHARLES WESLEY, A. M., Chief of Division of Records, and Editor of the Bulletin of the U. S. Fish Commission. *Fish Commission Office, and 1207 Eleventh Street N. W.*
1883, Mar. 2.	SMILLIE, THOMAS WILLIAM, Photographer, U. S. National Museum. *National Museum.*
1883, Feb. 16.	SMITH, THOMAS CROGGON, M. D. *1133 Twelfth Street N. W.*
1881, Nov. 11.	SMITH, WILLIAM ROBERT, Superintendent of U. S. Botanical Garden. *Botanical Garden.*
1882, Jan. 6.	SPERR, FREDERICK W. *Absent from the city.*
1881, Nov. 11.	STEJNEGER, LEONHARD. *Smithsonian Institution.*
1881, Mar. 25.	STERNBERG, GEORGE MILLER, M. D., Surgeon, U. S. Army. *Fort Mason, San Francisco, Cal.*
1882, Mar. 17.	STEVENSON, JAMES, Executive Officer of the U. S. Geological Survey. *National Museum.*
1883, Dec. 14.	STEWART, ALONZO HOPKINS. *204 Fourth Street S. E.*
1881, Feb. 25.	STIMPSON, WILLIAM GORDON, Aid, U. S. National Museum. *1447 Q Street N. W.*
1882, Feb. 17.	STREETS, THOMAS HALE, M. D., Passed Assistant Surgeon, U. S. Navy. *Bureau of Medicine and Surgery, U. S. Navy, and 2021 N Street N. W.*
1882, Nov. 24.	TARR, RALPH STOCKMAN. *45 Warren Street, Gloucester, Massachusetts.*
1882, Mar. 17.	TAYLOR, FREDERICK WILLIAM, Chemist, U. S. National Museum. *National Museum, and 1120 Vermont Avenue N. W.*

Date of Election.	ACTIVE MEMBERS—Continued.
1882, Dec. 22.	TAYLOR, JAMES HEMPHILL, Lawyer. *482 Louisiana Avenue N. W.*
Orig. Member.	TAYLOR, THOMAS, M. D., Microscopist, U. S. Department of Agriculture. *Agricultural Department, and 238 Massachusetts Avenue N. E.*
1882, Oct. 27.	TAYLOR, WILLIAM BOWER, A. M., Editor, Smithsonian Institution. *306 C Street N. W.*
1883, Jan. 5.	THOMAS, CYRUS, Ph. D., Ethnologist, Bureau of Ethnology of the Smithsonian Institution. *1246 Eleventh Street N. W.*
1881, Dec. 9.	THOMPSON, JOHN FORD, M. D., Professor of Surgery, Medical Department, Columbian University. *1401 H Street N. W.*
1881, Jan. 28.	TODD, JAMES EDWARD, A. M., Professor of Natural Sciences in Tabor College; Assistant Geologist, U. S. Geological Survey. *Tabor, Iowa.*
Orig. Member.	TONER, JOSEPH MEREDITH, M. D. *615 Louisiana Avenue N. W.*
Orig. Member.	TRUE, FREDERICK WILLIAM, M. S., Librarian, and Curator, Dep't of Mammals, U. S. National Museum. *National Museum.*
1883, Nov. 30.	TUPPER, JAMES BRAINERD TAYLOR, A. M. *Internal Revenue Bureau, Treasury Department, and 510 I Street N. W.*
1882, Oct. 27.	TURNER, HENRY W., Assistant Geologist, U. S. Geological Survey. *San Francisco, California.*
1881, Dec. 23.	TURNER, LUCIEN M., Observer, U. S. Signal Service. *Ungava, Labrador.*
Orig. Member.	ULKE, HENRY. *411 Fifteenth Street N. W.*
1881, Mar. 25.	UPHAM, EDWIN PORTER, Aid, U. S. National Museum. *Smithsonian Institution, and 2010 Thirteenth Street N. W.*
Orig. Member.	VASEY, GEORGE, M. D., Botanist, U. S. Department of Agriculture. *Agricultural Department, and 2012 Fourteenth Street N. W.*
1883, Nov. 3.	WALCOTT, CHARLES DOOLITTLE, Paleontologist, U. S. Geological Survey. *Smithsonian Institution, and 810 Twelfth Street N. W.*

Date of Election.	ACTIVE MEMBERS—Continued.
Orig. Member.	WARD, LESTER FRANK, A. M., LL. B., Geologist, U. S. Geological Survey; Honorary Curator, Dep't of Fossil Plants, U. S. National Museum. *National Museum, and 1464 Rhode Island Avenue N. W.*
1882, Nov. 24.	WELD, GEORGE FRANCIS, Student. *Smithsonian Institution, and 1600 Thirteenth Street.*
1882, Dec. 22.	WEST, HENRY LITCHFIELD, City Editor, "Washington Post." *Office of the "Post," and 111 E Street N. W.*
Orig. Member.	WHITE, CHARLES ABIATHAR, A. M., M. D., Curator Dep't of Fossil Invertebrates, U. S. National Museum; Palæontologist, U. S. Geological Survey. *National Museum, and 409 Maple Avenue, Le Droit Park.*
1883, Dec. 14.	WHITE, CHARLES HENRY, M. D., Surgeon, U. S. Navy. *Museum of Hygiene, Navy Department.*
1881, May 20.	WHITE, MAURICE PUTNAM, Teacher, Public School, Boston, Massachusetts. *523 Columbus Avenue, Boston.*
1881, Jan. 28.	WILLIAMS, ALFRED. *Department of State, and 232 North Capitol Street N. W.*
1883, Feb. 16.	WILSON, JAMES ORMOND, Superintendent of Public Schools, District of Columbia. *1439 Massachusetts Avenue.*
Orig. Member.	WILSON, JOSEPH McMINN. *Department of the Interior, and 1108 Maryland Avenue S. W.*
1881, Dec. 9.	WINSLOW, FRANCIS, Lieutenant U. S. Navy, on duty with U. S. Fish Commission. *1446 N Street N. W.*
1881, Jan. 28.	WOLFLEY, WILLIAM IRVIN, A. M., M. D. *140 C Street N. E.*
1882, Feb. 17.	YARNALL, JOHN HEPBURN, M D. *3028 P Street N. W.*
Orig. Member.	YARROW, HENRY CRÉCY, M. D., C. M. Z. S., Acting Assistant Surgeon, U. S. Army; Hon. Curator, Dep't of Reptiles, U. S. National Museum. *Surgeon General's Office, and 814 Seventeenth Street N. W.*
1882, Oct. 28.	YARROW, JOHN, Aid, U. S. National Museum. *814 Seventeenth Street, N. W.*
1881, Feb. 25.	YEATES, WILLIAM SMITH, A. M., Aid, U. S. National Museum. *National Museum, and 401 G Street N. W.*
1882, Jan. 6.	ZUMBROCK, ANTON, M. D., Electrotyper and Photographer, U. S. Coast and Geodetic Survey. *Coast Survey Office.*

ADDITIONAL LIST OF MEMBERS,

CORRECTED TO JULY 1, 1884.

CORRESPONDING MEMBERS.

Date of Election.	
1884, Feb. 8	FLOWER, WILLIAM HENRY, LL. D., F. R. S., Pres. Z. S., F. L. S.; Director of the Natural History Departments of the British Museum. *South Kensington, London, S. W.*
1884, Feb. 8	HORN, GEORGE HENRY, M. D.; Pres. American Entomological Society. *874 North Fourth Street, Philadelphia, Pennsylvania.*
1884, Feb. 8	MARSH, OTHNIEL CHARLES, M. A., Pres. N. A. S.; Professor of Palæontology in Yale College, and Palæontologist to the U. S. Geological Survey. *New Haven, Connecticut.*

ACTIVE MEMBERS.

1884, April 19	BATES, HENRY HOBART, Examiner in Chief, U. S. Patent Office. *U. S. Patent Office, and "The Portland."*
1884, Mar. 22	BECKHAM, CHARLES WICKLIFFE, Aid, Department of Birds, U. S. National Museum. *Smithsonian Institution, and 1315 Connecticut Avenue.*
1884, Mar. 22	BENDIRE, CHARLES, Captain 1st Cavalry, U. S. A.; Honorary Curator, Section of Oology, U. S. National Museum. *Fort Custer, Montana Territory.*
1884, Feb. 8	DILLER, JOSEPH SILAS, S. B., Assistant Geologist, U. S. Geological Survey. *1804 Sixteenth Street N. W.*
1884, May 17	EGGLESTON, NATHANIEL HILLYER, Chief of Bureau of Forestry, U. S. Department of Agriculture. *Agricultural Department, and 1302 L Street N. W.*
1884, May 3	GEARE, RANDOLPH ILTYD. *U. S. National Museum, and 803 T Street N. W.*
1884, Feb. 23	JOHNSON, WILLARD DRAKE, Topographer, U. S. Geological Survey. *Washington, D. C., and Worcester, Massachusetts.*
1884, Mar. 22	KNAPP, E. B. *Skaneateles, New York.*

Date of Election.	ACTIVE MEMBERS—Continued.
1884, April 5	MOSER, JEFFERSON FRANKLIN, Lieutenant, U. S. N.; Assistant Hydrographic Inspector, U. S. Coast and Geodetic Survey. *Coast Survey Office, and 7 Second Street S. E.*
1884, April 19	NICHOLS, HENRY E., Lieutenant Commander, U. S. Navy, commanding U. S. S. Pinta. *Sitka, Alaska.*
1884, May 3	SAYLES, IRA, Geologist, U. S. Geological Survey. *511 F Street N. W.*
1884, Feb. 8	SMITH, THEOBALD, Ph. B., M. D., Assistant, Bureau of Animal Industry, U. S. Department of Agriculture. *Agricultural Department, and 917 New York Avenue N. W.*
1884, Mar. 22	WILSON, Hon. WILLIAM LYNE, Member of Congress from West Virginia. *1008 N Street N. W.*
1884, April 19	WORTMAN, JACOB L., Osteologist, Army Medical Museum. *628 Penn. Ave. N. W.*

THE BIOLOGICAL SOCIETY OF WASHINGTON.

CONSTITUTION.

Adopted December 3, 1880.

ARTICLE I.

NAME.

The name of this Society shall be "THE BIOLOGICAL SOCIETY OF WASHINGTON."

ARTICLE II.

OBJECTS.

Its objects shall be to encourage the study of the Biological Sciences, and to hold meetings at which papers shall be read and discussed.

ARTICLE III.

MEMBERS.

The Society shall consist of active, corresponding and honorary members. Candidates for membership shall be proposed to the Council, in writing, by at least three members, and, upon recommendation of the majority of the Council present at its regular meeting, shall be balloted for at the earliest ensuing meeting. A majority vote of the members present when the ballot is taken shall be necessary to election.

ARTICLE IV.

OFFICERS.

The officers shall be a President, four Vice-Presidents, two Secretaries, and a Treasurer. There shall be a Council, consisting of the officers of the Society and five members, to be elected by the Society. A quorum of the council shall consist of seven members.

Its duties shall be to act on nominations for membership, have the direction of the finances, audit the accounts of the Treasurer, and provide a programme for each meeting of the Society.

The officers shall be elected by ballot at each annual meeting, and shall serve one year, or until their successors are elected.

ARTICLE V.

PRESIDENT AND VICE-PRESIDENTS.

The President, or, in his absence, one of the Vice Presidents, shall preside at meetings of the Society and Council. The presiding officer shall appoint all committees in the Council and in the Society, unless otherwise ordered. It shall be the duty of the retiring President to deliver an address at the second meeting in January.

ARTICLE VI.

SECRETARIES.

The Secretaries shall take and preserve correct minutes of the proceedings of the Society and Council and a record of the members, shall conduct its correspondence, give due notice of all meetings, and inspect and count all ballots.

ARTICLE VII.

TREASURER.

The Treasurer shall have charge of all money and other property of the Society, and shall make disbursements under the direction of the Council. He shall collect all fees and assessments, and notify members who may be in arrears.

ARTICLE VIII.

SECTIONS.

Sections for special work in any department of Biology may be formed upon the recommendation of the Council.

ARTICLE IX.

MEETINGS.

Stated meetings shall, unless otherwise ordered, be held on Friday of each alternate week, at eight o'clock P. M. The annual meeting for the election of officers shall be the first meeting in January. Special and field meetings may be called by the Council.

ARTICLE X.

As amended February 2, 1883.

FEES.

The initiation fee shall be one dollar; the annual fee two dollars. Members in arrears for one year shall, after due notification by the Treasurer, be dropped from the rolls, except in the case of those absent from the city for a year or more, who may be retained on the list as non-resident members during their absence. No member in arrears shall be entitled to vote at the annual meeting for the election of officers.

ARTICLE XI.

AMENDMENTS TO THE CONSTITUTION.

The constitution of the Society may be amended by a two-thirds vote of the members present at any regular meeting, after at least four weeks' notice.

ARTICLE XII.

ORDER OF BUSINESS.

The order of business at each regular meeting, unless otherwise provided by the Council, shall be as follows:

I. Reading of minutes.
II. Reports of Committees.
III. Balloting for members.
IV. Nominations for membership.
V. Miscellaneous business.
VI. Reading of papers, discussions and exhibition of specimens.

Article XII may be suspended at any time by a two-thirds vote of the members present.

PROCEEDINGS.

THIRTY-SECOND MEETING, October 13, 1882.

The President occupied the chair. Thirty-two members were present. Both secretaries being absent, Dr. Tarleton H. Bean was designated Secretary *pro tempore.*

General William Birney, Chairman of the Committee on the Admission of Women to Membership in the Society, submitted a report in the form of the following resolution :

> "*Resolved,* In view of the fact that this Society has not prescribed scientific attainments as a qualification for membership, it is inexpedient at present to declare women eligible; but, if it should hereafter prescribe such qualifications, there is no sufficient reason for their exclusion."

On motion of Prof. Riley, the report was adopted and the Committee discharged.

Mr. Frederick W. True read a paper ON THE BITE OF THE CORAL SNAKE,* describing the effects of the attack of one of the specimens in the National Museum upon Mr. A. Z. Shindler, one of the artists in the Museum, and citing the testimony of several correspondents in the southwestern United States. Remarks were made by Professors Ward and Gill. Prof. Theodore Gill read a paper entitled THE RELATIONS OF THE ECHENEIDIDS,† demonstrating the claims of this group of fishes to isolation, not only as a family, but as a suborder, related rather more closely to the Gobioidea and Blennioidea than to the Scombroidea. He characterized the suborder *Discocephali,* and the family *Echeneididæ* and sub-family *Echineidinæ,* and gave a detailed history of the views of ichthyological writers from Artedi to Cope.

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* 1883. TRUE, FREDERICK W. On the Bite of the North American Coral Snakes (Genus Elaps). <American Naturalist, 1883, pp. 26–31.

† 1883. GILL, THEODORE. Note on the Relationships of the Echeneidids, <Proceedings U. S. National Museum, V, pp. 561–6, Plate XII, 1883.

Mr. Wm. H. Dall made some remarks on CLUSTER FLIES,* exhibiting specimens of *Musca rudis* from Geneva, N. Y., where, for thirty years or more, this fly has been regarded as a household pest in the spring and fall, when it gathers in swarms in the corners of apartments in country houses.

THIRTY-THIRD MEETING, October 27, 1882.

The President occupied the chair. Thirty-eight members were present.

The President announced the presentation to the Society by Dr. John J. Mason of his work entitled MINUTE STRUCTURE OF THE CENTRAL NERVOUS SYSTEM OF CERTAIN REPTILES AND BATRACHIANS OF AMERICA.

Mr. Goode, on behalf of the Council, announced his intention of proposing at the second meeting from date, the following amendment to the Constitution:

Section X to be amended so as to read, "Members in arrears for one year shall, after due notification by the Treasurer, be dropped from the rolls, except in the case of those absent from the city for one year or more, who may be retained on the list as non-resident members during their absence." †

A committee, consisting of Messrs. Goode, Gill, Mason, Ward, True, and Rathbun, was appointed to arrange for courses of lectures, similar to the Saturday lectures of the previous season.

Mr. Wm. H. Dall made a few remarks in extension of his paper on the "Cluster Fly," presented at the previous meeting, and read a letter from Professor C. V. Riley in relation to its name and geographical distribution.*

Dr. W. S. Barnard made a communication upon the subject of ECTOPARASITIC TREMATODES, describing two species believed to be new, for which, however, no names were proposed.

Mr. W. P. Conant made some remarks upon TWO CASES OF SNAKE BITE IN MASSACHUSETTS, relating instances in which the bites of unknown species of snakes had been attended by very serious results.

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* 1883. DALL, W. H. Note on Cluster Flies. < Proceedings U. S. National Museum, V, pp. 635–7, 1883. Includes a letter from C. V. Riley.

† This amendment was adopted at the meeting of February 2, 1883.

Mr. Frederick W. True read a paper ON THE CINNAMON BEAR,* exhibiting a specimen recently received by the National Museum from Lycoming county, Pennsylvania. He quoted the opinions of several authorities as to the relationship of this form to the black bear, but did not express a decided personal opinion. He also exhibited the skin of a young black bear from Alaska, with a broad white ring around the neck.

THIRTY-FOURTH MEETING, November 10, 1882.

The President occupied the chair. Forty-two members were present.

Mr. True announced that he had in preparation a paper on the mammals of the District of Columbia, and requested information concerning rare forms and concerning the dates when deer and other mammals became extinct in the District.

Professor Chickering read a paper on THE "BALDS" OF THE SOUTHERN MOUNTAINS.

Dr. George Vasey made a communication on the PINE TREES OF NORTH AMERICA, which was discussed by Mr. Dall, Dr. Schaeffer, and Prof. Gill.

Mr. John A. Ryder read a paper on THE RATIONALE OF THE SO-CALLED FATTENING PROCESS IN THE OYSTER;† and in his remarks explained the cause of the green color in certain oysters especially prized by oyster eaters in Europe.

THIRTY-FIFTH MEETING, November 24, 1882.

The President occupied the chair. Forty-four members were present.

Professor Lester F. Ward read a letter from Doctor Edward Foreman, suggesting the importance of the appointment of a com-

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* 1883. TRUE, FREDERICK W. On a Cinnamon Bear from Pennsylvania. <Proceedings U. S. National Museum, V, pp. 653-6, 1883.

† 1881. RYDER, JOHN A. An account of Experiments in Oyster Culture and observations relating thereto, etc. <Report of T. B. Ferguson, a Maryland Commissioner of Fisheries, for 1881, Appendix A, pp. 1-64. Also in A Contribution to the Life History of the Oyster. <The Fishery Industries of the United States, pp. 711-750, 1885.

mittee to take action looking toward the preparation of a list of the trees and shrubs growing in the streets, parks, cemeteries, and other public grounds of the District of Columbia. In accordance with the suggestions in this letter, the following committee was appointed to act in co-operation with the Secretary of the Smithsonian Institution in the preparation of such a list: Prof. Lester F. Ward, Dr. George Vasey, Mr. Wm. R. Smith, Dr. F. B. Hough, and Dr. Edward Foreman.

Dr. Elliott Coues read a paper on THE PRESENT STATUS OF THE AVIFAUNA OF THE DISTRICT OF COLUMBIA,* presenting extracts from the new list of the birds of the District, just compiled by himself and Dr. D. W. Prentiss. The total number of species of birds now known to occur in the District is 248, 23 having been added to the list since 1862.

Prof. C. V. Riley made remarks upon JUMPING SEEDS AND GALLS,† and exhibited specimens of the so-called "Mexican jumping seeds" or "devil-beans," the seeds of a Euphorbia-like plant, in the interior of which are the larvæ of a species of moth, *Carpocapsa saltitans*, which, by their uneasy motions, cause peculiar twitching movements of the seeds. He also showed a peculiar gall from the under side of the leaves of various oaks of the white oak group, which is moved in a similar manner by the larvæ of a species of Cynips, *Cynips saltatorius*, which lives curled up within it.

Dr. Thomas Taylor spoke on the PEAR-TREE BLIGHT, its cause and prevention, illustrating his remarks with specimens.

Prof. Lester F. Ward presented a paper on ADDITIONS MADE TO THE FLORA COLUMBIANA DURING THE SEASON OF 1882,‡ exhibiting specimens of 27 species of plants added to the flora of the District of Columbia.

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* Included in—

1883. COUES, ELLIOTT, and D. WEBSTER PRENTISS. Avifauna Columbiana; being a list of birds ascertained to inhabit the District of Columbia, &c. <Bulletin U. S. National Museum, No. 26. 8°. pp. 133, 4 maps.

† 1883. RILEY, CHARLES V. Jumping Seeds and Galls. <Proceedings U. S. National Museum, V, pp. 632–635, with one cut, 1883.

‡ 1884. WARD, LESTER F. List of plants added to the Flora of Washington from April 1, 1882, to April 1, 1884. <Proc. Biol. Soc. Washington, II, pp. 84–87, 1882–4. Extras, April 10, 1884.

The President announced the proposal to publish a second edition of Vol. I of the *Proceedings of the Biological Society*, should a sufficient number of subscriptions for copies of the same be made.*

THIRTY-SIXTH MEETING, December 8, 1882.

The President occupied the chair. Thirty-seven members were present.

The President announced that the Lecture Committee had arranged for a course of Saturday lectures to young people, as follows:

December 16, 1882: Prof. O. T. MASON. The Circle of the Sciences.

December 23, 1882: Mr. WILLIAM H. DALL. Ocean Currents.

December 30, 1882: Mr. FREDERICK W. TRUE. Swimming Quadrupeds.

January 6, 1883: Prof. J. W. CHICKERING, Jr. The Grasses.

Prof. L. F. Ward stated that the committee appointed at the last meeting to prepare a list of the trees and shrubs growing in the streets, parks, cemeteries, and other public grounds of the District of Columbia had held a meeting and apportioned the work.

Prof. J. W. Chickering, Jr., being called to the chair, Prof. Gill discussed THE CHARACTERS AND RELATIONS OF THE STROMATEIDÆ.†

Dr. D. W. Prentiss followed with remarks on CHANGES PRODUCED IN THE BIRD FAUNA OF THE DISTRICT OF COLUMBIA BY MODIFICATION OF ITS TOPOGRAPHY.‡

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* A supplementary edition of 100 copies was eventually printed at the cost of the Society.

† 1884. GILL, THEODORE. Notes on the Stromateidæ. <Proc. Amer. Phil. Soc., 1884, pp. 664–72.

‡ Included in—

COUES and PRENTISS. Avifauna Columbiana, already cited.

THIRTY-SEVENTH MEETING, December 22, 1882.

The President occupied the chair. Thirty-four members were present.

Dr. T. H. Bean read a paper ON THE OCCURRENCE OF THE ALEWIFE IN CERTAIN LAKES OF NEW YORK.* The alewife (*Clupea vernalis*) which is identical with the branch herring of the Potomac, has been observed in immense numbers in Lake Ontario, and Cayuga and Seneca Lakes, New York—its first appearance having been in 1873. It is supposed to have been accidentally introduced by fish-culturists when planting young shad. In the discussion of this paper Messrs. Smiley, Barnard, True, Ryder, and Goode participated. Mr. Ryder spoke of observations on a supposed hybrid between the shad and the rock-fish.

Prof. Riley read a paper on THE LIGNIFIED SERPENT OF BRAZIL,† a curious object lately discussed in scientific journals in France and the United States, and pronounced by M. Olivier, a French *savant*, to be an actual serpent converted into woody tissue. This he demonstrated to be a woody formation developed in the burrow of the larva of a wood-boring insect, which, by some slight artificial changes, had been made to resemble a serpent still more than in its original condition.

THIRTY-EIGHTH MEETING, January 5, 1883.

(Third Annual Meeting.)

The President occupied the chair. Sixty-six members were present.

The following board of officers was elected:

President—Prof. C. A. WHITE.

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* 1884. BEAN, TARLETON H. On the Occurrence of the Branch Alewife in Certain Lakes of New York. <The Fishery Industries of the United States. Part I. pp. 588-593.

† 1883. RILEY, CHARLES V. The Lignified Serpent of Brazil. <Washington *Evening Star*, Jan. 20, 1883; *Scientific American* Supplement, Feb. 17, 1883, and various other journals.

Vice-Presidents—Prof. THEODORE GILL, Prof. C. V. RILEY, Prof. L. F. WARD, Mr. WILLIAM H. DALL.

Secretaries—Mr. G. BROWN GOODE, Mr. RICHARD RATHBUN.

Treasurer—Dr. TARLETON H. BEAN.

Council—Prof. O. T. MASON, Dr. GEORGE Vasey, Dr. D. WEBSTER PRENTISS, Mr. FREDERICK W. TRUE, Dr. ELLIOTT COUES.

SATURDAY LECTURES, 1883.

The second regular course of Saturday Lectures, under the auspices of the Biological Society and the Anthropological Society, was begun January 13, 1883, and the following programme was carried out:

January 13: Capt. C. E. DUTTON, U. S. A. On Rivers.

January 20: Prof. O. T. MASON. The Races of Men.

January 27: Mr. GEORGE KENNAN. Mountains and Mountaineers of the Caucasus.

February 3: Dr. D. W. PRENTISS. Mesmerism in Animals.

February 10: Prof. THEODORE GILL. Mythical Animals.

February 17: Dr. JOHN S. BILLINGS, U. S. A. Germs and Epidemics.

February 24: Prof. LESTER F. WARD. The Plant Life of the Globe, past and present.

March 3: Mr. WILLIAM H. DALL. Pearls and Pearl Fisheries.

March 10: Major J. W. POWELL. Indian Mythology.

March 17: Prof. C. V. RILEY. Adaptation and Interdependence between Plants and Insects.

March 24: Prof. C. A. WHITE. The Teachings of Paleontology.

March 31: Dr. ROBERT FLETCHER, U. S. A. Human Proportion in Art and Anthropometry.

THIRTY-NINTH MEETING, January 19, 1883.

Thirty-one members were present.

Professor C. A. White, the newly-elected President, took the chair, and, after a few remarks, introduced the retiring President, Professor Theodore Gill, who delivered an address upon THE PRINCIPLES OF ZOOGEOGRAPHY.*

The attendance being small, upon motion of Mr. Goode, it was voted that action upon the pending constitutional amendment be deferred until the next meeting.

FORTIETH MEETING, February 2, 1883.

The President occupied the chair. Forty-three members were present.

Article X of the Constitution was amended to read as follows, the changes made being indicated by italics:

ARTICLE X.

FEES.

The initiation fee shall be one dollar; the annual fee, *two* dollars. Members in arrears for one year shall, after due notification by the Treasurer, be dropped from the rolls, *except in the case of those absent from the city for one year or more, who may be retained on the list as non-resident members during their absence.* No member in arrears shall be entitled to vote at the annual meeting for the election of officers.

In the discussion of the address delivered by the retiring President, Professor Gill, at the last meeting, Prof. Ward, Mr. Dall, Prof. White, and Mr. Elliott participated, and Prof. Gill spoke at some length in continuation of it.

Dr. Elliott Coues read a paper upon ZOOLOGICAL NOMENCLATURE APPLIED TO HISTOLOGY.

FORTY-FIRST MEETING, February 16, 1883.

The President occupied the Chair. Forty members were present.

In the discussion of the paper on Zoological Nomenclature Ap-

* Proc. Biol. Soc. Washington, Vol. II, pp. 1–40, 1882–84. Extras printed, with cover and title page, as follows: The | Principles of Zoogeography, | A Presidential Address | delivered at the | Third Anniversary Meeting of the Biological Society | of Washington, January 19, 1883, | by | Theodore Gill, A. M., M. D., Ph. D., | Member of the National Academy of Sciences, &c., &c. | * * * | Washington, D. C. | Judd & Detweiler, Printers. | 1884. 8vo. 40 pp.

plied to Histology, presented by Dr. Coues at the previous meeting, Mr. N. P. Scudder led with a paper on BIOLOGY AND CLASSIFICATION.

Mr. John A. Ryder read a paper ON THE STRUCTURES OF PROTOPLASM AND KARYOKYNESIS.*

FORTY-SECOND MEETING, March 2, 1883.

The President occupied the chair. Forty-three members present.

Prof O. T. Mason read a paper on THE HUMAN-FAUNA OF THE DISTRICT OF COLUMBIA, and Dr. M. G. Ellzey spoke on HYBRID STERILITY, being a plea against the hypothesis of evolution.

FORTY-THIRD MEETING, March 16, 1883.

The President occupied the chair. Fifty members were present.

Dr. Ellzey's paper, presented at the last meeting, was discussed by Mr. Henry W. Elliott and others.

Mr. Orville A. Derby, Curator of the Geological Department of the National Museum of Brazil, under the title of BIOLOGICAL NOTES FROM BRAZIL, gave an account of the present condition of biological science in that country. Remarks were made by Messrs. White and Elliott.

Lieut. Francis Winslow, U. S. N., read a short paper on THE GIANT CLAMS OF THE PACIFIC,† exhibiting specimens.

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* 1882. RYDER, JOHN A. Observations on the absorption of the yelk, the food, feeding, and development of embryo fishes, comprising some investigations conducted at the Central Hatchery, Armory Building, Washington, D. C., in 1882. <Bulletin U. S Fish Commission, II, pp. 179-205, 1882. (XII—Specific character of protoplasm, pp. 202-205.)

† 1883. WINSLOW, FRANCIS. Catalogue of the Economic Mollusca. <Descriptive Catalogues of the Collections sent from the United States to the International Fisheries Exhibition, London, 1883. Bull. U. S. National Museum, No. 27, Part D, pp. 185-270, 1883.

Mr. John A. Ryder showed some microscopical sections of hermaphroditic oysters.*

A specimen of a fossil log of the Cretaceous age, showing the borings of a ship-worm, was exhibited by the President, and remarks upon similar borings in recent times were made by Mr. A. B. Johnson.

Mr. George P. Merrill exhibited a nodule and microscopic section of carbonate of iron (Siderite) occurring in coal.

Mr. Hornaday read a paper on THE MENTAL CAPACITY OF THE ELEPHANT;† which was discussed by Messrs. Ward, Elliott, and Mason.

FORTY-FOURTH MEETING, March 30, 1883.

The President occupied the chair. Thirty-eight members were present.

Mr. Newton P. Scudder made a communication upon THE LENGTH OF THE HATCHING PERIOD OF THE DOMESTIC FOWL. In the experiments which he made, the period varied from 17 to 21 days. Remarks were made upon the paper by Messrs. Hough, Ellzey, Mason, and Schaeffer.

Dr. Thomas Taylor read a paper upon A NEW PARASITE IN FOWLS OF THE NATURE OF TRICHINA,‡ and also made some remarks upon SECTION CUTTING AND THE MOUNTING OF HARD WOODS, which were supplemented by Dr. F. B. Hough, who exhibited sections of woods prepared in Japan and Germany.

Mr. F. A. Lucas exhibited drawings showing the results of accidents upon the bones of wild animals. Mr. Frederick W. True exhibited bones of the extinct arctic sea-cow, *Rhytina*, collected by Dr.

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* 1882. RYDER, JOHN A. The Microscopic Sexual Characteristics of the American, Portuguese, and Common Edible Oyster of Europe Compared. <Bulletin of the U. S. Fish Commission, II, pp. 205–15, 1882; and Annals and Magazine of Natural History, London, Oct., 1883.

† 1883. HORNADAY, WILLIAM T. The Mental Capacity of the Elephant. <Popular Science Monthly, August, 1883, pp. 497–509.

‡ 1883. TAYLOR, THOMAS. Internal Parasites in Domestic Fowls. <Department of Agriculture, Washington, 1884, 5 pp.; Proc. Am. Micro. Soc., 1883.

Leonard Stejneger, a member of the Society, and recently received from Bering Island. Prof. Chickering read a paper upon THE PHYSICAL FEATURES OF MOUNT KATAHDIN.

FORTY-FIFTH MEETING, April 13, 1883.

The President occupied the chair. Thirty-six members were present.

The Committee on Field Meeting reported favorably upon holding such a meeting at Bladensburg, April 28th, and upon inviting ladies to attend. The report was accepted by the Society.

Prof. Lester F. Ward presented a communication upon THE HYBRID OAKS OF THE DISTRICT OF COLUMBIA. Numerous pressed leaves were exhibited.

Mr. B. F. Johnson presented a note upon THE MODE IN WHICH THE GARTER SNAKE CLIMBS UPON A SMOOTH VERTICAL SURFACE, representing it as somewhat similar to that in which a man climbs. The movement is not a spiral one. The note was commented upon by Messrs. Baker, Schaeffer, Gill, Mason, and Taylor.

Prof. C. V. Riley made a communication upon THE BAG WORM, THYRIDOPTERYX EPHEMERÆFORMIS,* which is abundant in the District of Columbia and elsewhere.

Mr. F. W. True made a few remarks upon A PARASITIC WORM FOUND IN THE EGG OF A COMMON HEN.

Dr. Thomas Taylor presented a communication upon PARASITIC MITES IN THE LUNG-CAVITIES AND TISSUES OF DOMESTIC FOWLS.†

In the discussion which followed, Messrs. Ward and Riley participated. Specimens were exhibited with the two latter communications.

FORTY-SIXTH MEETING, April 27, 1883.

The President occupied the chair. Thirty members were present.

Prof. C. V. Riley exhibited specimens of A MEXICAN JUMP-

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* Proc. Biol. Soc. Washington, vol. II, 1882–84, pp. 80–83. Extras, April 10, 1884.

† See citation at foot of page XL.

ING SEED, and also made REMARKS UPON BEE-FLY LARVÆ AND THEIR SINGULAR HABITS, and upon a BURROWING BUTTERFLY LARVA.

Mr. H. H. Birney read a paper upon THE AILANTHUS MOTH, SAMIA CYNTHIA, which was discussed by Messrs. Riley and Mann.

Dr. Frank Baker read a paper upon THE ORIGIN OF DEXTRAL PREFERENCE IN MAN. It was discussed by Messrs. King, Ellzey, Ward, Mason, Toner, Mann, Gill, and Riley.

FIELD MEETING AT BLADENSBURG, April 28, 1883.

A field meeting was held at Bladensburg, Maryland, and was attended by a number of members of the Society.

FORTY-SEVENTH MEETING, May 11, 1883.

The President occupied the chair. Twenty-two members were present.

Prof. Ward made a communication entitled NOTES ON SOME HITHERTO UNDESCRIBED FOSSIL PLANTS FROM THE LOWER YELLOWSTONE AND COLLECTED BY Dr. C. A. WHITE IN 1882.*

Mr. True made remarks upon A NEW PIGMY SPERM WHALE FROM THE NEW JERSEY COAST,† which he proposed to name *Kogia Goodei.*

Dr. Thomas Taylor offered a communication ON ACTINOMYKOSIS, a new infectious disease in man and the lower animals, and exhibited specimens of the fungus *Actinomyces,* from the viscera of a diseased dog. The discussion was adjourned to the next meeting.

FORTY-EIGHTH MEETING, May 25, 1883.

Prof. Theodore Gill, Vice-President, occupied the chair. Twenty members were present.

Dr. Thomas Taylor continued his remarks upon a recently dis-

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* This paper will be incorporated with a forthcoming report to the Director of the U. S. Geological Survey.

† 1883. TRUE, FREDERICK W. A New Sperm Whale (*Kogia Goodei*). <Science, I, p. 470, 1883.

covered and very dangerous disease, known as *Actinomykosis*, which affects domestic animals.

Dr. D. E. Salmon read a paper on the same disease. The communications called forth an animated discussion, in which Drs. Taylor, Salmon, Schaeffer, and others participated.

The Society then adjourned, subject to call by the President in October.

FORTY-NINTH MEETING, October 19, 1883.

The President occupied the chair. Thirty-five members were present.

Prof. Theodore Gill presented a communication on THE ICHTHYOLOGICAL RESULTS OF THE EXPLORATIONS OF THE U. S. FISH COMMISSION STEAMER "ALBATROSS" IN 1883.* He called attention to a number of new fishes, including two representatives of new orders, for which he proposed the names Lyomeri and Gnathenchelyi.

Dr. C. A. White made some remarks upon THE CHARACTER AND FUNCTION OF THE EPIGLOTTIS OF THE BULL SNAKE (PITYOPHIS).†

Prof. Lester F. Ward exhibited an interesting botanical relic of the District of Columbia, consisting of the original minutes of the Proceedings of the Washington Botanical Society, which became extinct in 1835.

Prof. C. V. Riley read a paper on MANNA IN THE UNITED STATES, and exhibited and remarked upon some specimens of a kind of Manna recently received from Chewelah, Washington Territory. This communication was discussed by Messrs. Taylor, Schaeffer, Vasey, Toner, and Ward.

FIFTIETH MEETING, November 2, 1883.

The President occupied the chair. Forty members were present.

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* The substance of this communication was published in three papers in Forest & Stream, 1883, and in other papers in the American Naturalist and the Proceedings of the U. S. National Museum.

† 1884. WHITE, CHARLES A. On the Character and Function of the Epiglottis in the Bull Snake (Pityophis). <American Naturalist, XVIII, pp. 19–21, 1884.

Dr. G. M. Sternberg, U. S. A., of San Francisco, read a paper ON MICROCOCCI.*

Dr. E. M. Schaeffer made some remarks upon Manna, in continuance of those made by Prof. Riley at the previous meeting. He also exhibited specimens of a possibly new variety or species of *Ceratophyllum*. Dr. T. H. Bean exhibited a curious specimen of a species of flounder, *Paralichthys dentatus*, and spoke of ARRESTED ASYMMETRY IN FLOUNDERS.

Prof. L. F. Ward related the result of his investigations of a supposed deposit of fossil timber on the site of the new "Casino," in process of erection on Connecticut avenue.

FIFTY-FIRST MEETING, November 16, 1883.

The President occupied the chair. Forty-five members were present.

Prof. L. F. Ward read a paper on MESOZOIC DICOTYLEDONS. †

Mr. C. D. Walcott presented a communication on FRESH-WATER SHELLS FROM THE LOWER CARBONIFEROUS, illustrating his remarks with specimens.‡

Mr. Frederick W. True exhibited a specimen of THE WEST INDIAN SEAL, MONACHUS TROPICALIS, recently received by the National Museum, and discussed the history of the specimen and the affinities of the species.

Dr. C. A. White narrated an incident of his experience as an explorer in the Upper Missouri Valley, illustrative of THE PERSISTENCE OF THE DOMESTIC INSTINCT IN THE CAT.§ An animated

* STERNBERG, GEORGE M. Bacteria. | By | Dr. Antoine Magnin, | Licentiate of Natural Science, * * * | and | George M. Sternberg. M. D., F. R. M. S., | Major and Surgeon, U. S. Army; Member of the Biological Society of Wash- | ington; late member of the Havana Yellow Fever Commission of the | National Board of Health; | Corresponding Member of the | Epidermological Society of London, etc. | New York: | William Wood & Company, | 56 and 58 Lafayette Place. | 1884. 8vo. pp. XVIII, 9-494.

† 1884. WARD, LESTER F. Mesozoic Dicotyledons. <Am. Jour. Sci. and Arts, 3d Ser., XXVII, pp. 292-303, 1884; Annals and Mag. Nat. Hist., London, 5th Ser., XIII, pp. 383-396, 1884.

‡ 1883. WALCOTT, CHARLES D. Fresh-water Shells from the Paleozoic Rocks of Nevada. <Science, II, p. 809, 1883.

§ 1884. WHITE, CHARLES A. The Permanence of the Domestic Instinct in the Cat. <American Naturalist, XVIII, pp. 213-14, 1884.

discussion of this incident, and of other topics suggested by it, was participated in by Prof. Riley, Mr. N. P. Scudder, Mr. A. B. Johnson, Mr. Benjamin Miller, Prof. Ward, Dr. Toner, and others.

FIFTY-SECOND MEETING, November 30, 1883.

The President occupied the chair. Fifty members were present.

A letter was read from the Secretary of the Philosophical Society of Washington, inviting the Biological Society to attend the meeting of the Philosophical Society, to be held at the National Museum lecture-hall on the 5th proximo, when the President's annual address would be the order for the evening.

Dr. Thomas Taylor described OIDIUM TUCKERI, THE FUNGUS OF THE FOREIGN GRAPE VINE,* which has of late years been so destructive to European vineyards, giving an account of his discovery of the highest stages of its fruit on the foreign vines now under cultivation in the U. S. Agricultural grounds.

Dr. Frank Baker read an interesting paper entitled THE LOGICAL METHOD OF TEACHING ANATOMY,† which elicited much discussion, participated in by Messrs. Seaman, Prentiss, Johnson, Gill, Norris, Schaeffer, Scudder, Cope, and Ward.

Prof. Theo. Gill exhibited drawings of a very curious deep-sea fish discovered during the past summer in the North Atlantic, at a depth of about two miles, by the U. S. Fish Commission steamer Albatross. It belonged to a new family, which the speaker has denominated the Stephanoberycidæ.‡

The Committee on Lectures announced a provisional programme for the course of Saturday Lectures for 1884, under the auspices of the Anthropological and Biological Societies.

Four courses of these lectures were given, consisting of seventeen lectures, a list of which, as finally arranged, is subjoined.

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* 1884. TAYLOR, THOMAS. On the Fungus of the Foreign Grape Vine. <American Microscopical Journal, V, p. 5, 1884.

† 1884. BAKER, FRANK. The Rational Method of Teaching Anatomy. <Medical Record, N. Y., April 19, 1884; also as extra, 16°, pp. 20, with special title.

‡ 1884. GILL, THEODORE. Three new families of fishes added to the deep-sea fauna in a year. <American Naturalist, XVII, p. 433, 1884.

January 5: Mr. GROVE K. GILBERT. Cliffs and Terraces.

January 12: Prof. OTIS T. MASON. Child Life among Savage and Uncivilized Peoples.

January 19: Prof. EDWARD S. MORSE. Social Life among the Japanese.

January 26: Major J. W. POWELL. Win-tun Mythology.

February 2: Prof. F. W. CLARKE. Lightning and Lightning-Rods.

February 9: Capt. C. E. DUTTON, U. S. A. The Hawaiian Islands and People.

February 16: Prof. E. D. COPE. The Origin of Human Physiognomy.

February 23: Mr. JOHN MURDOCH. Eskimo Life at Point Barrow.

March 1: Prof. HARVEY W. WILEY. The Sugar Industry of the North.

March 8: Prof. SIMON NEWCOMB. Psychic Force.

March 15: Mr. JOHN A. RYDER. Protoplasm in the Light of Recent Investigations.

March 22: Dr. FRANK BAKER. The New Phrenology.

March 29: Capt. C. E. DUTTON, U. S. A. Volcanoes.

April 5: Prof. T. C. CHAMBERLIN. The Great Ice Invasion of North America.

April 12: Dr. W. W. GODDING. What shall we do with the Inebriates?

April 19: Prof. J. S. NEWBERRY. The Industrial Arts as Factors in Modern History.

April 26: Major J. W. POWELL. The Cañons of the Colcrado.

FIFTY-THIRD MEETING, December 14, 1883.

The President occupied the chair. Forty-five members were present.

Prof. C. V. Riley presented a paper, read by Dr. Barnard, on the use of NAPHTHALINE AS AN INSECTICIDE,* in discussing which Dr. Thomas Taylor and Prof. W. S. Barnard participated.

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* 1884. RILEY, C. V. The use of Naphthaline as an Insecticide. <Science, III, pp. 455–456, 1884.

Mr. Henry W. Elliott read a paper CONCERNING THE APPETITE OF THE MUSKRAT,* which was discussed by Dr. Ellzey, Dr. Schaeffer, and others.

Dr. R. W. Shufeldt, U. S. A., read a paper on THE PRESENT CONDITION OF THE ANATOMICAL COLLECTIONS OF THE ARMY MEDICAL MUSEUM.

FIFTY-FOURTH MEETING, December 28, 1883.

The President occupied the chair. Forty-four members were present.

Dr. Thomas Taylor read a paper on NAPHTHALINE AND ITS EFFECTS ON PLANTS, INSECTS, AND OTHER ANIMALS,† exhibiting specimens of plants which had been treated with naphthaline without suffering injury.

Dr. W. S. Barnard read a paper on SOME RESULTS BY MASSAGE ET CONTRE-COUP.‡

Mr. John A. Ryder made a communication on THE STRUCTURE OF THE EGG MEMBRANE IN FISHES.

Mr. Romyn Hitchcock exhibited an improved form of microscope stand.

FOURTH ANNUAL MEETING, January 11, 1884.

The fourth annual meeting of the Biological Society took place on Friday evening, January 11. Thirty-five members were present, President White occupying the chair. Prof. Ward gave notice of a proposition to change the days of meeting to the Saturdays alternating with those of the Philosophical Society.

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* 1884. ELLIOTT, HENRY W. The Destruction of Carp by the Muskrat (Fiber zibethicus). Methods of Trapping the Rodent. <Bull. U. S. Fish Commission, IV, pp. 296–7, 1884.

† 1884. TAYLOR, THOMAS. Naphthaline as an Insecticide, etc. 8vo, 6 pp., 1884.

‡ Proc. Biol. Soc., Washington, II, p. 116, 1882–84.

The Society then proceeded to ballot for the election of officers for the ensuing year, with the following result:

President—Dr. C. A. WHITE.

Vice-Presidents—Mr. W. H. DALL, Prof. L. F. WARD, Prof. THEODORE GILL, Prof. C. V. RILEY.

Secretaries—Mr. G. BROWN GOODE, Mr. RICHARD RATHBUN.

Treasurer—Dr. TARLETON H. BEAN.

Members of Council—Prof. O. T. MASON, Dr. GEORGE VASEY, Mr. F. W. TRUE, Dr. D. WEBSTER PRENTISS, Mr. JOHN A. RYDER.

FIFTY-SIXTH MEETING, January 25, 1884.

The Fourth Anniversary Meeting of the Society was held January 25, on which occasion a large number of guests of the Society, members of the Philosophical and Anthropological Societies, and others, were present, by invitation, in the lecture-room of the National Museum. Dr. White read the presidential address, the topic discussed being CERTAIN PHASES IN THE GEOLOGICAL HISTORY OF NORTH AMERICA, BIOLOGICALLY CONSIDERED,* and was listened to with great pleasure and interest. The Presidents and Vice-Presidents of the Philosophical and Anthropological Societies occupied seats on the stage. The speaker was introduced by Dr. J. C. Welling, President of the Philosophical Society. At the close of the address a vote of thanks was moved by Major J. W. Powell, President of the Anthropological Society.

FIFTY-SEVENTH MEETING, February 8, 1884.

The President occupied the chair. Thirty-six members were present.

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* Proc. Biol. Soc. Washington, II, pp. 41–66, 1882-84. Extras printed, with cover and title page, as follows:

Certain Phases | in the | Geological History of the North American | Continent, Biologically Considered. | By | Charles A. White, A. M., M. D., | Paleontologist to the U. S. Geological Survey, Honorary Curator of the Depart | ment of Fossil Invertebrates in the U. S. National Museum. | Presidential address, | delivered at the | Fourth Anniversary Meeting of the Biological Society | of Washington, January 25, 1884. | * * * | Washington: | Judd & Detweiler, printers. | 1884. 8vo. 26 pp.

Mr. William T. Hornaday read a paper on THE GUACHARO BIRD OF TRINIDAD, *Steatornis caripensis*, in which he said that this strange bird was sometimes found breeding in almost inaccessible caverns opening on the sea, at the northwestern point of the island of Trinidad, in one of which, a large dome-like cave, he had found about two hundred birds. The guacharo was, perhaps, the only frugiverous bird of purely nocturnal habits, and was closely allied to the goat-suckers. The young birds have a thick layer of fat on the abdominal region, which yields a clear, transparent oil of great purity, highly esteemed by the natives for cooking purposes. The nest of the guacharo, the speaker said, resembled a small brown cheese, slightly hollowed on the top, being composed of the undigested remains of fruit firmly adhering together.

Mr. G. Brown Goode read a paper on THE AIMS AND LIMITATIONS OF MODERN FISH-CULTURE.* Modern fish-culture he defined to be fish-culture carried on under government patronage upon an extensive scale, under the direction of men trained to scientific research, as distinguished from the old and insignificant method of fish-culture carried on by private enterprise. Its aims were shown to be, (1) to arrive at a complete understanding of the life histories of useful aquatic animals and the conditions under which they live; and (2) to apply this knowledge so thoroughly that all fishes shall be brought as completely under control as are now the shad, the salmon, the carp, and the whitefish. The limitations of fish-culture were shown to be the same as those of scientific stock-rearing or agriculture.

In the discussion which followed, Prof. L. F. Ward remarked that he had been interested in the paper especially on account of the broad general principles in political economy which had been shown to underlie the subject discussed; that the lessons which the United States, by means of its participation in the London Fisheries Exhibition and its successes in the field of fish-culture, had taught to Europe, and especially to Great Britain, were of great importance. Political economists of the Manchester school need to be shown in just such a way as this that the policy of State con-

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* GOODE, G. BROWN. Article "Pisciculture." <Encyclopædia Britannica, Vol. XIX, 1885.

trol and management for large enterprises, involving large outlays of money, is the only policy which can be successfully carried out.

Mr. C. W. Smiley stated that, in spite of shad-hatching having been prosecuted with increasing vigor annually since 1874, the number brought into the Washington market had decreased from 521,368 in 1881, to 350,292 in 1882, and 261,474 in 1883. But for fish-culture the decrease would have been enormously greater. He affirmed that we are yet ignorant of many essential elements of fish propagation, and only the highest scientific ability can discover them.

Dr. T. H. Bean, referring to Mr. Smiley's statement, said that it was manifestly unfair that fish-culture should be expected to do more than nature could do in keeping up the supply of fish in any body of water; that there were many things for the fish-culturist to do besides the planting of young fish; that the pollution of streams and the artificial obstructions, such as dams, must first be removed, and that in interpreting the results of fish-culture, questions of temperature, freshets, and other natural disturbances of ordinary conditions upon the breeding grounds of fishes, should be taken into account.

Dr. T. H. Bean exhibited a specimen of pipe-fish, *Siphostoma, sp.*, which showed an augmented development of fins, the supernumerary fin being post-anal, and much more developed than the ordinary rudimentary anal of the male *Siphostoma*. In size and general appearance it resembled more nearly a caudal fin, but from its position it must be called post-anal. In the Lophobranchiates he believed that the vertical fins are not developed from an embryonic fin-fold, as is the case in most fishes. This example was to be considered as an illustration of a reversion to a former condition of fishes of this type, in which they did possess at one stage of their existence an embryonic fin-fold.

Mr. Ryder remarked that the specimen of *Siphostoma* with supernumerary anal fin was certainly an example of the restoration towards the ancestral form. Its presence might be explained on the supposition that the fin-fold, which is continuous in the embryo, had been exaggerated into development at this particular point, and mesoblastic tissue thrust out in the process of development into the fold itself, thus furnishing the rudiments upon which there was an attempt to again return to the ancient isocercal form of the vertical fins.

Mr. C. D. Walcott exhibited a specimen of trilobite, *Asaphus platycephalus*, in which twenty-six pairs of legs were plainly seen, no mouth parts being visible. These were shown by a drawing illustrating Mr. Walcott's restoration of the mouth appendages of the trilobite, as published by him in the Bulletin of the Museum of Comparative Zoology, Vol. VIII, No. 10, 1881. The specimen was the same as that described by Prof. Mickleborough, of Cincinnati.* Mr. Walcott also showed a specimen of metamorphic rock having a granitic structure and containing fossil corals, probably of the Devonian age.

Prof. L. F. Ward moved that the meeting day of the Society be changed to Saturday. After remarks by Dr. Baker, Dr. Coues, and others, the motion was carried by a unanimous vote.

FIFTY-EIGHTH MEETING, February 23, 1884.

The President occupied the chair. Thirty-six members were present.

Dr. Elliott Coues read a paper on THE PRESENT STATE OF NORTH AMERICAN ORNITHOLOGY. In discussing the precontemporaneous history of the subject, he spoke of the following epochs:—

(1) The Archaic (prior to 1700); (2) the Pre-Linnæan (1700–1758); (3) the Post-Linnæan (1758–1800); (4) the Wilsonian (1800–1824); (5) the Audubonian (1824–1853); (6) the Bairdian (1853–18—). A number of periods were also defined as follows: (1) the Lawsonian period (1700–1730), named after Lawson, the author of the first American faunal list, that for North Carolina; (2) the Catesbian period (1730–1748), named after Mark Catesby, the first to publish an illustrated work on American birds; (3) the Edwardsian period (1748–1758), named after George Edwards, whose great work on birds was founded largely upon American material; (4) the Linnæan period (1758–1766), the period during which the binomial nomenclature was being developed; (5) the

* 1884. WALCOTT, CHARLES D. Appendages of the Trilobite. <Science, III (No. 57), pp. 279–81, 1884.

Forsterian period (1766–1785), named for George Reinbold Forster, who was the first to publish a catalogue of the birds of North America, and who also first published a special paper on a collection of American birds sent to Europe; (6) the Pennantian period (1785–1791), marked by the labors of Pennant and Latham; (7) the Bartramian period (1791–1799), named for John Bartram, the first resident of America to publish a work on its birds; (8) the Vieillotian period (1800–1808); (9) the Wilsonian period (1808–1824), named after the first great American ornithologist; (10) the Bonapartian period (1824–31), during which the impress of science was laid upon the woodland genius of Wilson; (11) the Richardsonio-Swansonian period (1831–2); (12) the Nuttallian period (1832–4), marked by the appearance of the first of American ornithologists; (13) the Audubonian period (1834–1853), named after the most brilliant of ornithologists, marked by the publication of what Cuvier called the "grandest monument ever erected by art to nature;" (14) the Cassinian period (1853–58), named for John Cassin, the best general ornithologist America has known; (15) the Bairdian period.

The establishment of the American Ornithologists' Union, he thought, would probably mark the beginning of a new epoch—one in which the existing intricacies of ornithological nomenclature will, it is hoped, be straightened out. The present is simply a period of transition.

Dr. Coues laid before the Society the plate proofs of the forthcoming new edition of his Key to North American Birds.

Mr. Walcott having received, since the last meeting of the Society, on February 8, a number of additional specimens of the granitic-like rock containing fossil Stromatopora, corals, plates of crinoid stems, etc., from Litchfield, Maine, exhibited them and said that he was incorrect in calling the rock a granite as it was of sedimentary origin, a plastic rock so changed in the specimens examined that it might be called a conglomerate gneiss.

Mr. J. S. Diller stated that he had examined thin sections of the rock under the microscope, which showed it to be chiefly crystalline, and composed almost entirely of quartz and feldspar. These minerals occur as irregular angular grains, which, for the most part, have crystallized in their present position in such a manner as to fill up the whole space. There is but little trace, as far as can be seen under the microscope, of the sedimentary character of the rock. The irregular angular quartz grains are clouded with liquid inclusions containing dancing bubbles. The feldspar is in large part plagioclase, for, notwithstanding the alteration, the characteristic striæ in polarized light are yet distinct. Distinct silvery scales of muscovite occur sparingly, so that the rock has the composition of a gneiss, which, on account of the distinct quartz fragments it contains, may be called conglomerate gneiss.

Mr. G. P. Merrill thought it was premature to decide upon the character of the rock, but that, as far as he had examined it, he agreed with Mr. Diller as to its characters.

Prof. Lester F. Ward exhibited specimens of the "diamond willow," a form of *Salix cordata* occurring in the Upper Missouri region, distinguished by a great exaggeration of the scars left by the early growth of limbs, which form series of large diamond-shaped cavities in the wood. He also exhibited some remarkable canes carved by the people of that region from saplings of this species.

Prof. Seaman advanced the theory that the scars were produced by a fungus or an insect.

The following papers were read by title:

Mr. ROBERT RIDGWAY. Descriptions of some new North American Birds. Description of a new American Kingfisher. Note on *Psaltriparus grindæ* Belding. Note on the generic name *Calodromas*.*

Mr. LEONHARD STEJNEGER. Diagnoses of new species of Birds from Kamtschatka and the Commander Islands.†

Dr. T. H. BEAN and Mr. H. C. DRESEL. Diagnoses of three new species of Fishes from the Gulf of Mexico.‡

FIFTY-NINTH MEETING, March 8, 1884.

The President occupied the chair, and forty-five members were present.

Dr. J. H. Kidder, U. S. N., exhibited specimens of *Bacillus*

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* Proc. Biol. Soc. Washington, II, pp. 89–97. Extras printed April 10, 1884.

† Ibid., pp. 97-99. Extras printed April 10, 1884.

‡ Ibid., pp. 99-100. Extras printed April 10, 1884.

tuberculosis Koch, the *bacillus* of Phthisis, and summarized the present state of knowledge as to the nature of tuberculosis. Dr. S. M. Burnett stated that tuberculosis frequently occurs spontaneously in the eye. Dr. D. E. Salmon defended the reputation of Toussaint as the discoverer of *micrococcus* in tuberculosis, and remarked that Koch's *bacillus* is not generally admitted to be related to the cause of tuberculosis; that it may or may not be.

Dr. Salmon exhibited specimens of infectious tuberculosis in cattle—the omentum as well as the liver, which was much enlarged, and various glands being thickly covered with large tubercles. These animals were short-horn cattle, of well-known pedigree. in which for thirty years no disease had existed. The disease was, therefore, not hereditary. As soon as one steer had become infected the others in the herd were taken down with the same disease. No traces of *Bacillus tuberculosis* had been discovered.

Mr. C. W. Smiley read a paper on WHAT FISH-CULTURE HAS FIRST to ACCOMPLISH,* in which he stated that fish-culture cannot be expected to perform the impossible task of filling the waters of a continent to overflowing with an inexhaustible supply of fish, but that it will have to put forth the utmost effort to prevent the entire annihilation of the fish supply by the uncontrollable activity of the fishermen.

Dr. Bean, Mr. Earll, and Mr. Goode participated in the discussion of this paper.

Dr. Tarleton H. Bean remarked that, in his opinion, there was no general impression that fish-culture was going to immediately fill the rivers with fish; that fish-culture never had made such a claim. It did, however, profess to be able to produce fish economically and in greater abundance than could be produced by the natural process; that, furthermore, fish-culture was simply one of a series of means to an end—the object aimed at being the restoration of the fisheries; that fish-culture was one of the means for the accomplishment of that end. In his opinion it was quite as necessary to protect fish as to produce them, for if streams are filled with obstructions and impurities, no amount of fish-culture could restore the fishery in them. The obstructions must be overcome and the

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* 1884. SMILEY, CHARLES W. What Fish Culture has first to Accomplish. <Bulletin U. S. Fish Commission, IV, pp. 65–68, 1884.

impurities removed, and then the success of fish-culture would be beyond a doubt, as had already been proved by the results accomplished with the California salmon, and the shad on the Pacific coast.

Mr. Earll thought that many enthusiastic fish-culturists had claimed more for the science than could be hoped in the limited time during which it had been carried on, but, on the other hand, he thought that the author of the paper under consideration had gone to the other extreme. Such broad and far-reaching conclusions as had been stated in the paper should be based upon the fullest and most reliable information, extending over a number of years. The statistics on which these conclusions were based were, in his opinion, not of this character. The receipts of fish at the Washington market were not reliable as indicating the catch in the Potomac river, and much less so for the entire Chesapeake basin, which certainly must be taken as a whole when the question of the increase or decrease of the shad is to be considered. The fisheries of this river system had undergone radical changes within the last few years. At one time the fisheries were confined chiefly to the Potomac and Susquehanna, and Washington received a large part of the catch, while now, owing to an enormous development of the fishery interests in the lower Chesapeake, which must necessarily interfere with the catch in those rivers, Norfolk had become an important fishery center, and was receiving immense numbers of shad and other species annually for distribution through the South and West. The introduction of new methods of refrigeration had also enabled the fishermen to send their catch direct to the larger markets without the aid of the Washington dealers.

He did not know the source of Mr. Smiley's statistics of the Sacramento river catch, and was not disposed to question their accuracy, but a recent interview with Mr. A. Booth, the greatest salmon canner of the Pacific coast, had given him quite a different impression. Mr. Booth had assured him that the catch in the Sacramento had been almost miraculously increased, owing to the work of the U. S. Fish Commission, within the last few years. When the Fish Commission began work on that river the catch was almost wholly utilized fresh in the San Francisco and Sacramento markets, and a cannery, built by Mr. Booth at that time, had to be closed after one year for want of a supply. In 1882, fifteen large canneries were successfully operated on the same river, and about 30,000 pounds beyond what they were able to utilize were thrown away in a single day.

Mr. Earll thought that the time was hardly ripe, and, if it were, the statistics were not available for making such broad generalizations regarding the success or failure of fish-culture. It was gratifying to know that practical business men like Mr. Booth, who had every opportunity of observation, and had large interests at stake, should already be more than satisfied with the results that had come under their observation, and he thought that it might be confidently expected that within the next few years the catch would be very noticeably increased, though, of course, a limit would ultimately be reached, depending upon the enemies of the species and the food which it could find in its natural surroundings.

Col. Marshall McDonald read a paper on THE INFLUENCE OF TEMPERATURE UPON THE MOVEMENTS OF FISH IN RIVERS,* in which the fluctuations of the catch of shad in the Potomac and Susquehanna rivers for 1881, '82, and '83 were explained by reference to the varying temperature of the waters of ocean, bay, and river at the time of their anadromous movements. This paper was illustrated by diagrams. Owing to the lateness of the hour, the Society then adjourned, without discussion.

The following paper was read by title:

Mr. G. BROWN GOODE and Dr. T. H. BEAN. A new genus and species of Pediculate Fishes (*Halieutella lappa*)†.

SIXTIETH MEETING, March 22, 1884.

Prof. C. V. Riley, Vice-President, occupied the chair. Fifty members were present.

Col. Marshall McDonald exhibited a chart showing the natural and restricted river distribution of the shad.

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* 1884. MCDONALD, MARSHALL. Natural Causes Influencing the Movements of Fish in Rivers. <Trans. Amer. Fish-Cultural Association, 13th Meeting, 1884, pp. 164–170.

† Proc. Biol. Soc., Washington, II, p. 88, 1882–84.

Dr. R. W. Shufeldt, U. S. A., in a paper entitled REMARKS ON THE PATELLA,* described the position of this bone, which he considered to be a true sesamoid, in various forms of mammals and birds.

Mr. Romyn Hitchcock exhibited a series of specimens of Orbitolites, and made some remarks upon the results of the work of Dr. William B. Carpenter, as finally set forth in Vol. VII of the report of H. M. S. "Challenger."†

Prof. C. V. Riley presented some PERSONAL REMINISCENCES OF THE LATE DR. GEORGE ENGELMANN, which were supplemented by remarks from Dr. George Vasey and Prof. Lester F. Ward.

Mr. W. H. Dall read a paper ON SOME HYDROCORALLINÆ FROM ALASKA AND CALIFORNIA, exhibiting four new species.‡

Mr. Richard Rathbun exhibited a large mass of coral, *Oculina, sp.*, recently obtained from Key West, growing on the end of a crowbar, which, when further studied, would probably yield some clew as to the rate of growth of the species.

Dr. M. G. Ellzey spoke on THE PREPOTENCY OF THE MALE PARENT, giving the results of twenty-five years' experience in breeding horses, dogs, and other kinds of live stock. The male parent he believes to be prepotent in the transmission of hereditary traits, except where some extraordinary circumstance intervened. In the case of hybrids between the horse and the ass, a cross is always marked by prepotency of the ass; and in all crosses of the two species the male is always prepotent. Mr. Dall called attention to the danger of drawing conclusions from observations upon the external characters of the products of the union of two species.

Dr. Leonhard Stejneger exhibited two finely mounted specimens of the great Kamtschatkan sea eagle, *Thalassoaëtus pelagicus;* also a specimen of the bald eagle. *Haliæetus leucocephalus*, and a specimen in immature plumage of another species, *hypoleucus*, supposed to be new, and probably, in the adult state, entirely white under-

* 1884. SHUFELDT, ROBERT W. Concerning some of the Forms Assumed by the Patella in Birds. <Proceedings U. S. National Museum, VII, pp. 324–31, 1884.

† 1884. HITCHCOCK, ROMYN. The Causes of Variation. <Amer. Jour. Sci. and Art, XXVIII, p. 49, 1884.

‡ Proc. Biol. Soc. Washington, II, pp. 111–115, 1882–84. Extras printed April 28, 1884.

neath. The rivers of Kamtschatka abound greatly in salmon, and eagles are in consequence particularly numerous.*

SIXTY-FIRST MEETING, April 5, 1884.

The President occupied the chair. Forty members were present.

The Secretary gave notice of the following amendment to be proposed to the Constitution: *that ex-presidents of the Society shall be ex-officio members of the Council.*

Dr. Leonhard Stejneger read a paper ON THE SHEDDING OF THE CLAWS IN PTARMIGAN,† exhibiting specimens of *Lagopus albus* and *L. ridgwayi* as illustrating his remarks. Some of the specimens had short claws, others long ones, while in others the claws were loose and ready to slip off. The long claws are assumed in summer, and in the winter áre supposed to be useful in aiding the birds to walk on the snow—in fact, being similar in action to snow-shoes. He stated that Dr. Coues had observed the same phenomenon in the Lemming, *Myodes*.

Prof. C. V. Riley remarked that this curious adaptation of structure could doubtless be explained by the Lamarckian idea—that it had probably resulted from a direct need of this animal.

Mr. William H. Dall read a paper on THE FISHERY EXPORTS OF SAN FRANCISCO IN 1883.‡ He showed that these consisted of dried shrimps to the value of $82,891, prepared by the Chinese for exportation to China and other countries where Chinese congregate, such as Australia and Peru. The shells are used in China as a fertilizer to the value of $26,288. Abalone products were exported to the value of about $26,000, of which about $8,000 is for the dried

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* 1884. STEJNEGER, LEONHARD. Fra det yderste Œsten, II, Andre fjorten Dage i. Kamtschatka. <Naturen, Christiania, VIII, Jan., 1884, pp. 5–10, figure of eagle, p. 7.

† 1884. STEJNEGER, LEONHARD. On the Shedding of the Claws in the Ptarmigan and Allied Birds. <American Naturalist, XVIII, Aug., 1884, pp. 774–776. Ibis, London, 5 ser., III, Jan., 1885, pp. 50–52.

‡ 1884. DALL, WILLIAM H. Notes on Fishing Products exported from San Francisco, Cal., during the year 1883. <Bull. U. S. Fish Commission, IV, pp. 125–8, 1884.

flesh sent to China as food, the shells being sent to England and elsewhere for pearl. Of unspecified shells about $400,000 worth are exported, the total value of invertebrate products being over $570,000. Among other articles specified were canned goods. The value of canned salmon exported was over $2,300,000. The total value of fish products was about $4,000,000.

Prof. C. V. Riley made a communication ON THE RUST OF ORANGES.

The nature of this rust had been carefully studied by the author and also by one of his assistants, Mr. H. G. Hubbard, at Crescent City, Fla. It has always been known and has always given concern. It varies from a more or less pronounced stain beneath the cuticle to a rough, deep brown incrustation. When heavily coated, the surface is chapped like that of a russet apple. It may be first noticed when the fruit is small, or one-third grown (early summer). It rapidly increases in August and September, when the fruit is full grown, and is most noticed when the fruit begins to color, though there is no increase, but rather a decrease, after that time.

Rusts are mostly due to fungi, but there is nothing of this kind about the orange rust. The oil cells are depleted and the epithelial cells clogged with brownish resin. The surface is fissured and the rind shrinks, toughens, and loses essential oil. Carefully examined, a rusty orange will be found covered with cast mite skins—thick in summer or fall, less noticeable in winter. The mites themselves will be found on the non-rusted fruit and all over the tree in spring and summer. They are so minute as to be scarcely noticeable singly, but collectively give the green leaf and fruit the appearance of being sprinkled with fine golden dust. Pine pollen is often mistaken for them, and they, in turn, for the pollen.

The attacks of the mite are always followed by rust on the fruit, but on the leaves the mites produce only a dull, tarnished appearance, contrasting with the polish of the healthy leaf, and a sure indication of depredation even after the mites have left. The leaves look dry and dusty, with slight loss of color, as from drouth. When the foliage of the tree is bright the oranges are bright. The living mites are not found on rusty oranges; they quit both fruit and leaf, and wander to fresh fields when the oil is depleted or the surface too hardened for their beaks.

The mite (*Phytoptus oleivorus*) is elongate, honey-yellow, 0.14 mm. long, and with two pairs of four-jointed legs, each terminating in a curved spine, with opposing bristles. The eggs are laid singly or in small clusters on the leaves. They are spherical, transparent, with a yellow tinge, and hatch in summer in four days. The cast mite skins adhere, as stated above, to the surface of leaf or fruit. The food of the mite is the essential oil which abounds in the succulent parts of citrus plants. It is stationary when feeding, but moves actively, and wanders from one part of the plant to another, especially to new growths. Thousands occur on a single leaf, 75,000 having been computed by Mr. Hubbard in winter time on a leaf averaging fifteen square inches. They are still more numerous in summer.

Rust rings encircle the fruit much as the ecliptic does the earth. There is a penumbral band between brightest sun and deepest shade, indicating the preference of the mite for such half shade. Frosts kill the mites, but not the eggs. Drouth causes both to dry up. Birds, insects, and especially spiders, are the chief agencies in distributing the mites from place to place. The effect of the mite on the fruit, aside from the rusty appearance, which lowers the market value, is in nowise injurious, as the quality is, if anything, improved, and the disposition to rot decreased. The effect on the leaf is to slightly check growth.

The mite is generally distributed in Florida, but not elsewhere. Like most mites affecting growing plants, it is worse on high, dry lands than in low, moist ones.

No method of culture or of manuring—in fact, no method that does not comprehend the true cause, has proved of avail to prevent the rust. Wind-breaks and isolation act as preventives, but insecticides are the only remedial agencies; they must, however, kill mites, *eggs*, and *molting* mites. Whale oil soap, one pound to five gallons of water, in early spring before new growth begins, and weaker solutions at frequent intervals, cause the mites to fall to the ground. *Flowers of sulphur* is deadly to the active mites, but not to the eggs. Kerosene emulsions, as used against scale-insects, with sulphur added, are the most satisfactory.

Dr. E. P. Howland read a paper on THE EFFECT OF ANÆSTHETICS ON ANIMALS, explaining the new invention of Paul Bert.

SIXTY-SECOND MEETING, April 19, 1884.

The President occupied the chair. Forty members were present.

Dr. Cyrus Thomas read a paper on THE GROWTH OF TREES AS A MEANS OF DETERMINING THE AGE OF MOUNDS. The long accepted theory that the age of a tree is indicated by the number of concentric rings can no longer be considered tenable. The only way of testing this theory is by cutting down trees the age of which is known. This has been done in many instances, which were cited, and the result has been the demonstration of the falsity of the long accepted theory.

Mr. John Murdoch made remarks on DREDGING AND MARINE COLLECTING AT POINT BARROW, detailing his experiences as naturalist of the Signal Service Station at that place.

Dr. Bean, in a paper on THE DISTRIBUTION OF THE SALMONIDÆ IN ALASKA, enumerated the following twenty-one salmonoids as occurring there:

Osmerus dentex, *Osmerus spirinchus*, *Mallotus villosus*, *Hypomesus olidus*, *Hypomesus pretiosus*, *Thaleichthys pacificus*, *Thymallus signifer*, *Stenodus Mackenzii*, *Coregonus Laurettæ*, *Coregonus* near *Merkii*, *Coregonus quadrilateralis*, *Coregonus Kennicottii*, *Coregonus Nelsonii*, *Salvelinus malma*, *Salmo purpuratus*, *Salmo Gairdnerii*, *Oncorhynchus chouicha*, *Oncorhynchus keta*, *Oncorhynchus nerka*, *Oncorhynchus kisutch*, *Oncorhynchus gorbuscha*.

Osmerus is known to range only from the Bristol Bay region to the extreme northern limit of the Territory. *O. dentex* is quite similar in appearance to *O. eperlanus* and *O. mordax* of the Atlantic. *O. spirinchus* may be simply the spent condition of *dentex*. In the region in which they occur the smelts are quite abundant, and are extensively used by the natives for food, both fresh and dried.

Mallotus villosus is found in every portion of the Territory, being extensively eaten by the natives, and forming one of the best known foods for the codfish in the Gulf of Alaska.

Hypomesus is represented by two species, one of which, *H. olidus*, is confined to the western shore of Alaska, being most abundant to the northward. *H. pretiosus* is known only from the Gulf of Alaska. *H. olidus* spawns in fresh-water ponds, while *H. pretiosus* is a surf spawner.

Thaleichthys pacificus (the Eulachon) occurs in the Gulf of Alaska at least as far west as Katmai, in Shellikoff Straits, where it is preserved in salt and considered quite a delicacy. The Eulachon literally swarms in the southeastern part of the Territory, and is utilized both in a fresh state and for the manufacture of a fat or oil which the natives use in place of butter, and which has been experimented with as a substitute for cod liver oil.

Thymallus is known to occur from the Bristol Bay region to the extreme northern limit of the Territory, abounding in the rapid rivers. It takes the artificial fly quite readily, according to the testimony of Lieut. Schwatka, and is generally considered an excellent food-fish. To the eastward it is known to reach the Mackenzie river region.

Stenodus might be called the giant white fish. It reaches 50 pounds in weight, and has been recorded as growing to a length of 5 feet. We have it only from the Yukon river region. It was described, however, from the Mackenzie, and occurs also in the tributaries of that river. It is one of the finest food-fishes of Alaska.

The most widely distributed of the species of *Coregonus* is *C. quadrilateralis*, which we now have from the Yukon river region southward to Kodiak. *C. Laurettæ* is also pretty widely distributed, at least from the Kuskoquim to Point Barrow. The species related to *C. Merkii* is a small northern form, which is not of much importance as a food-fish. *C. Nelsonii* is a hump-back species, not important as a food-fish, ranging from the northern limit of the Territory southward to the Yukon, at least, and probably to the Kuskoquim. *C. Kennicottii* ranks next in excellence to *Stenodus*. It is said to reach 30 pounds in weight, and its range is from the Kuskoquim to the northern limit of Alaska. All the *Coregoni* are important for food except *C. Nelsonii* and *C. Merkii*, sub-species.

Salvelinus is abundant throughout the Aleutians and the mainland of Alaska, north to Colville river. In the northern portion of its range it grows to an enormous size, reaching fully 12 pounds in weight. In the sea-run condition it is extensively salted at Kodiak, and exported as salmon trout.

Salmo purpuratus is found in southern Alaska and on the island of Kodiak and Unalashka. It is extremely abundant and attains a weight of 20 pounds. *S. Gairdnerii* occurs in southern Alaska and westward to the Bristol Bay region. It is also known from the islands of Unalashka and Kodiak. It grows to a weight of 30 pounds, and is a very important food-fish.

One species of *Onchorhyncus*, *O. gorbuscha*, extends over the whole coast of Alaska northward to Colville river. All the rest extend at least as far as the Yukon river, and one species, *O. keta*, has been obtained from Hotham Inlet. The *Onchorhynchi* are the most important food-fishes of the Territory, and are the most abundant. The principal centers of export are Kodiak and Cook's Inlet.

Numerous canneries have sprung up lately in these regions, directing their attention mainly to the red-fish, *O. nerka*, a salmon whose flesh is beautifully red, but comparatively inferior. The finest of the salmon, *O. chouicha*, is employed principally for salting, the bellies only being selected for this purpose; the remainder of the fish is made into *ukali*.

SIXTY-THIRD MEETING, May 3, 1884.

The President occupied the chair. Twenty members were present.

Prof. Theodore Gill read a paper ON THE SYSTEM OF THE SQUALI. These belong to the Selachians, which constitute a class quite distinct from the fishes and widely separated from the Ganoids. He briefly reviewed the salient structural features of the various representatives of the order Squali, as well as the history of the classification of the group, and concluded with the assertion that there appeared to be five principal types of structure manifested in the various forms whose anatomy is more or less satisfactorily known.

(1.) The Pternodonta or Selachophichthyoidei are represented by but one known species, lately described by Mr. Garman. Its anatomical characteristics are unknown, but will probably be found to be nearly the same as in the succeeding group, Opistharthri. It is distinguished from all other known sharks by the very elongated and almost anguilliform shape as well as by the peculiar teeth, which have long fixed bases and are not reclinable as in most of the other types. It was also predicted that the Pternodonta would probably be found to have the palato-quadrate element articulated with the posterior portion of the skull behind the orbits, and the vertebral column non-segmented or notochordal.

(2.) The Opistharthri are sharks with the palato-quadrate apparatus articulated with the post-orbital processes of the skull, and a persistent notochord, inferior mouth, and the branchial apertures in increased numbers. The Notidanidæ or Hexanchidæ are the only forms.

(3.) The Proarthri are sharks with the palato-quadrate apparatus articulated with the anterior orbital region of the skull, the vertebral column segmented, the mouth sub-terminal, and the forehead declivous. The Heterodontidæ, represented by the well-known "Port Jackson Shark," form the only existing family.

(4.) The Anarthri are sharks with the palato-quadrate apparatus not articulated directly with the skull, the vertebral column variable but more or less segmented, and the mouth inferior. To this group belong all living sharks, excepting those now specifically eliminated.

(5.) The Rhinæ are sharks with the palato-quadrate apparatus also not directly articulated with the skull, the vertebral column segmented, the mouth terminal (both jaws being advanced well forwards), and the pectorals developing enlarged anterior basal lobes which are separated by notch-like spaces from the branchial regions. To this belongs the family Squatinidæ, including the so-called angel-sharks.

The speaker was inclined to consider several of these more than sub-ordinal, and rather as of ordinal, value, but until they had been better studied he would reserve opinion on this question. He would now only add that the first and second groups might be combined in one order, the third isolated in another, and the fourth and fifth segregated in a third.

There was also one type represented by the extinct Cladodontidæ, whose position is doubtful. For these he had formed the group Lipospondyli, but it is not evident whether it belongs with the true Squali or whether it may not be related to the Holocephali, the character of the branchial arches being dubious.

Mr. N. P. Scudder read a paper on CERTAIN ANATOMICAL DETAILS IN THE MUSKRAT, and exhibited specimens of the skeletons of muskrats, showing the number of the lumbar vertebræ to be six and not three as stated by Professor Flower. He also showed that the malar bone formed part of the continuity of the zygomatic arch, correcting the statement of Dr. Coues in his "Monograph of American Rodentia," page 253, with regard to the jugal of the muskrat, which is there described as "a mere splint, not forming by itself any part of the continuity of the arch, for the squamosal and maxillary spurs are absolutely in contact. This is a strong point of Fiber." Mr. Scudder remarked that muskrats were able to live four to six minutes under water, owing probably to the enlargement of the abdominal aorta. He believed muskrats to be omnivorous, and said that the same individual could be taken repeatedly in the same trap.

Dr. R. W. Shufeldt made a communication UPON THE PRESENCE OF RIBS ATTACHED TO THE OCCIPITAL BONE OF THE BLACK BASS, MICROPTERUS SALMOIDES.* He remarked, in the course of his description, that he had recently made quite a number of dissections of this fish, and in every instance had found a pair of ribs upon the occipital bone, just above and internal to the foramen of the vagus nerve. They are without epipleural appendages, but otherwise like the abdominal ribs. If this fact be new to science, it is a very interesting discovery of great morphological significance, and introduced an important factor in the theory of the segmentation of the skull. It had not been noticed in any of the prominent works upon comparative anatomy generally used as text-books, nor in a recent and very thorough article by Dr. Sagemehl upon the cranial osteology of *Amia calva* (Morph. Jahrb., Vol. 9, pt. 2, 1883). Dr. Shufeldt had also discovered these ribs, thoroughly developed, in the tunny, *Orcynus thynnus*, and thought that they would doubtless be found in others of the *Scombridæ* and *Centrarchidæ*.

SIXTY-FOURTH MEETING, May 17, 1884.

Prof. C. V. Riley, Vice-President, occupied the chair. Thirty-five members were present.

Dr. J. M. Flint, in a paper on CHINESE MEDICINES, after giving

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* 1884. SHUFELDT, R. W. Osteology of the Large-mouthed Black Bass (*Micropterus salmoides*). <Science, III, p. 532, 1884.

a brief account of the history of medicine among the Chinese, according to their own authors, discussed their theories in regard to the nature and causes of disease and the action of remedies. Their ignorance of anatomy and the consequent effects upon their theory and practice was shown. The materia medica of the Chinese was then considered in detail, its peculiarities, as well as its resemblances to our own, present and past, as illustrated by the collections of Chinese drugs now in the possession of the U. S. National Museum.

A paper by Mr. Wiley Britton on the BUFFALO GNAT OF TENNESSEE was read, in which the author stated that its habitat, in his opinion, was confined to the Mississippi Valley, below the mouth of the Ohio river. It generally makes its appearance about the first of April, and remains from two to four weeks; it destroys annually considerable numbers of live-stock, particularly mules and horses, which, however, could be protected by thorough greasing. The bite of this gnat is poisonous, causing a swelling somewhat like a bee sting. Prof. C. V. Riley stated that this gnat is a species of *Simulium*.

Dr. Bean read a paper entitled THE WHITE FISHES OF NORTH AMERICA.* The speaker said there were twelve species indigenous to North America, besides the "Inconnu," which is not properly a white-fish, though related to it. He introduced into the list *Coregonus lavaretus*, the German "Maræna." He made a few general remarks concerning the wide distribution, great abundance, and importance of the white fishes as food, and stated the range of each species, its maximum size and weight, and its variations through age and conditions of habitat. A brief key to the species, intended to facilitate their speedy identification, and based upon natural characters only, was included in the paper.

Dr. Thomas Taylor exhibited a new micrometer of his own invention for measuring accurately and instantly to the 1-2000 inch the thickness of any object. In a second communication he stated that Pseudo Bacteria were produced by the heating of blood at a comparatively low temperature, and proposed to make experiments for the purpose of deciding whether a continuous fever of four or

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* 1884. BEAN, TARLETON H. The White Fishes of North America. <Trans. Amer. Fish Cultural Association, 13th meeting, 1884, pp. 32–39.

five days with the blood at 104° F. would produce the same results as blood artificially heated to 110° F. If so, it would account for mistakes that have been made by persons inexperienced in examining the blood of fever patients, who reported the presence of Bacteria, or broken blood corpuscles, as shown by Beal and others. Dr. Taylor also explained a method of obtaining upon a screen an apparent image of a microscopic object, by placing the microscope horizontally and at right angles to the screen. While looking through the microscope with one eye, the other is directed toward the screen, upon which an image becomes apparent, its magnification depending upon the distance of the observer from the screen.

SIXTY-FIFTH MEETING, May 31, 1884.

The President occupied the chair. Thirty members were present.

Prof. L. F. Ward, Chairman of the Committee on Cultivated Plants growing in the District of Columbia, submitted a report of progress.

Mr. James E. Benedict made REMARKS ON THE RECENT CRUISE OF THE STEAMER "ALBATROSS" IN THE GULF OF MEXICO AND THE CARIBBEAN SEA, describing the events of the voyage, and exhibiting some of the most remarkable objects collected.

Ensign E. E. Hayden, U. S. N., presented, through Prof. Ward, a paper on A NEW METHOD OF FIGURING FOSSIL LEAVES AND OTHER OBJECTS BY THE AID OF PHOTOGRAPHY,* remarking that a saving of time and increase of accuracy was thereby attained. The method consisted in drawing with India ink upon a silver print photograph the outline of the object to be figured, the defects of the photograph being supplied by the draughtsman through comparison with the specimen. The photograph is then dismissed, and a photo-engraving is made from the black lines of the sketch which remains.

In the discussion which followed, it was shown that this process was novel in its successful application by the author to engrave fossil leaves.

Mr. J. A. Ryder read a paper on THE DEVELOPMENT OF VIVIPA-

ROUS MINNOWS.* The species under discussion was the form known as *Gambusia patruelis*, B. & G. The points which were especially alluded to were the following: The fact that the young fish developed within the body of the female parent and within the follicles in which the eggs themselves were developed. It was also pointed out that these follicles, which were covered with a rich net-work of fine capillary vessels, assumed the office of a respiratory apparatus, by which the gases were interchanged between the embryo and the parent fish; and, further, that this follicle also acted as an egg membrane, being actually perforated by a round opening, which the speaker termed the "follicular pore," and which was analogous to the micropyle of the ordinary fish egg. The arrangement of the follicles of the ovary within the body of the female was described at some length, and the peculiar differences between the two sexes in the arrangement of the viscera were pointed out. The fibrous bands, which act as supports, or stays, to the basal portion of the anal fin of the male, which is modified as an intromittent organ, were also described. The great difference in the sizes of the sexes was also referred to, the female weighing over six times as much as the male. The speaker concluded by expressing his earnest desire to investigate the other known forms of viviparous fishes, such as the Embiotocoids of the West coast, the viviparous Blenny, and other bony fishes which have this habit, and which, in his opinion, would throw considerable light upon some of the peculiar physiological processes involved in the viviparous methods of development.

Mr. Romyn Hitchcock exhibited a collection of Foraminifera belonging to the genus *Lagena*, and made a few remarks explaining the relation between this genus and the Nodosarine group; these briefly being that *Lagena* may be taken as the type of the group, passing through *Nodosaria* and ending in *Cristellaria* as the most complete manifestation of its method of growth.

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* 1882. RYDER, JOHN A. Structure and ovarian incubation of *Gambusia patruelis*, a top-minnow. <American Naturalist, Feb., 1882, pp. 109–118.

ADDRESSES AND COMMUNICATIONS.

THE PRINCIPLES OF ZOOGEOGRAPHY.*

By Theodore Gill.

Zoogeography, or the science of the geographical distribution of animals, may be said to have originated with the illustrious French naturalist of the last century, who inaugurated the era of philosophical zoology in about the same degree as Linnæus did that of systematic zoology, and who is also well known as the antagonist and rival of the great Swede. Many of the facts that are the bases of its propositions had indeed been known before the time of Buffon, but the relations of those facts to each other, and to the general doctrine of science, had either been entirely overlooked or were vaguely appreciated.

It is Buffon who is to be credited with having first promulgated precise generalizations respecting the geographical distribution of animals. Buffon, in this respect, not only advanced much beyond his predecessors, but leaped at once to a position which some of the the more pretentious naturalists of our own times have failed to attain. In brief, he recognized (1) that the inhabitants of the tropical and southern portions of the old and new worlds were entirely different from each other; (2) that those of the northern portions of the two were, to a considerable extent, identical; and

*Annual presidential address delivered at the Third Anniversary Meeting of the Society, January 19, 1883, in the lecture room of the U. S. National Museum.

In the present address, previous contributions by the author to Zoogeography—the article "Zoological Geography" in Johnson's New Universal Cyclopædia, and a review of Wallace's "Geographical Distribution of Animals," published in "The Nation" for July 12 and 19, 1877, and republished in "Field and Forest," (vol. iii, pp. 69-74, 78-80, 98-101,) have been borrowed from.

(3) that the confluence of the two was most apparent towards the proximate portions of America and Asia. The truth that animals in fact had, for the most part, originated in the regions of the earth where they are now found, became incontrovertible; and geological research demonstrated that they were preceded by forms which were the ancestors of those now living on the soil. Numerous zoologists from time to time took up the problem of the distribution of animals as a special study.

But it is not incumbent on us at present to enter into a discussion of the steps in our knowledge of the geographical distribution of animals. It will now be sufficient to glance at two of the latest and rival propositions for the partition of the globe into those primary zoogeographical divisions, which, in furtherance of an analogy seized upon by the late Professor Agassiz, in his designation of a well known portion of North America as the "Zoological island of New England," may be figuratively called *Zoological Continents*. The great divisions of this rank have been termed by many American naturalists "realms," and by English writers "regions."

Mr. Alfred Russel Wallace, in his thoughtful work on "The Geographical Distribution of Animals,"* published in 1876, has recognized six primary zoogeographical divisions of the globe, which he has named regions, and, accepting views current in England, has designated and constituted as follows:

I. Palæarctic region, with four sub-regions:
1. North Europe.
2. Mediterranean, or South Europe.
3. Siberia.
4. Manchuria, or Japan.

II. Ethiopian region, with four sub-regions:
1. East Africa.
2. West Africa.
3. South Africa.
4. Madagascar.

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* Vol. i, pp. 81, 82.

III. Oriental region, with four sub-regions:
1. Hindostan, or Central India.
2. Ceylon.
3. Indo-China, or Himalayas.
4. Indo-Malaya.

IV. Australian region, with four sub-regions:
1. Austro-Malaya.
2. Australia.
3. Polynesia.
4. New Zealand.

V. Neotropical region, with four sub-regions:
1. Chili, or South Temp. America.
2. Brazil.
3. Mexico, or Tropical North America.
4. Antilles.

VI. Nearctic region, with four sub-regions:
1. California.
2. Rocky Mountains.
3. Alleghanies, or East United States.
4. Canada.

A corresponding member of this Society, and one of the most learned and thorough of American naturalists, Mr. J. A. Allen, in an elaborate memoir on "The Geographical Distribution of the Mammalia, considered in relation to the principal ontological regions of the earth, and the laws that govern the distribution of animal life,"* published in 1878, has proposed a very different subdivision. He recognized three categories of general areas—viz: (1) "primary divisions or 'realms,'" (2) "secondary divisions or 'regions,'" and (3) "divisions of third rank or 'provinces.'" The several categories have been denominated as follows:

I. An Arctic, or North Circumpolar realm.

* Bulletin U. S. Geological Survey, vol. iv, p. 376.

II. A North Temperate realm, with two regions, viz:

1. American, with four provinces:
   a. Boreal.
   b. Eastern.
   c. Middle.
   d. Western.
2. Europæo-Asiatic, with four provinces:
   a. European.
   b. Siberian.
   c. Mediterranean.
   d. Manchurian.

III. An American Tropical realm, with three regions, viz.:

1. Antillean.
2. Central American.
3. Brazilian.

IV. An Indo-African realm, with two regions, viz:

1. African, with three provinces:
   a Eastern.
   b. Western.
   c. Southern.
2. Indian, with two provinces:
   a. Continental.
   b. Insular.

V. A South American Temperate realm, with two provinces, viz:

   a. Andean.
   b. Pampean.

VI. An Australian realm, with three regions, viz:

1. Australian, with two provinces:
   a. Australian.
   b. Papuan.
2. Polynesian.
3. New Zealand.

VII. A Lemurian realm (undivided).

VIII. An Antarctic or South Circumpolar realm.

On a comparison of the respective schemes of Messrs. Wallace and Allen, it is obvious that they must have been influenced by quite different considerations. Not one of the primary regions of the two authors is accepted with the same limits by both, and sometimes they differ radically. Mr. Allen recognizes as a peculiar realm (the "Arctic realm") a division which is considered neutral territory belonging to the Palæarctic and Nearctic regions by Mr. Wallace; he degrades the Indian and African realms to subdivisions of a common *Indo-African realm,* but subtracts from the former the Malagasy region to raise it to the rank of an independent realm—the Lemurian—co-equal with the Indo-African. He further adds, a *South American temperate realm* and an *Antarctic realm.* The examination and analysis of the evidence which has led to such different results will be instructive and lead up to some interesting deductions. We may aptly commence this examination by a glance at the several "realms" concerning which there is an approximate agreement. But the premises upon which Messrs. Wallace and Allen have worked should be first stated.

The conception of Mr. Wallace as to the character of the primary zoogeographical regions or zoological continents is, that "it is a positive, and by no means an unimportant, advantage to have our named regions approximately equal in size, and with easily defined, and therefore easily remembered, boundaries," providing that "we do not violate any clear affinities or produce any glaring irregularities." It is further claimed that "all elaborate definitions of interpenetrating frontiers, as well as regions extending over three-fourths of the land surface of the globe, and including places which are the antipodes of each other, would be most inconvenient, even if there were not such difference of opinion about them."*

Again, Mr. Wallace says: "On two main points every system yet proposed, or that probably can be proposed, is open to objection; they are,—1stly, that the several regions are not of equal rank;—2ndly, that they are not equally applicable to all classes of

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*Wallace, Geog. Dist. Anim., vol. i, pp. 63, 64.

animals. As to the first objection, it will be found impossible to form any three or more regions each of which differs from the rest in an equal degree or in the same manner. One will surpass all others in the possession of peculiar families; another will have many characteristic genera; while a third will be mainly distinguished by negative characters. There will also be found many intermediate districts, which possess some of the characteristics of two well-marked regions, with a few special features of their own, or perhaps with none; and it will be a difficult question to decide in all cases which region should possess the doubtful territory, or whether it should be formed into a primary region itself."*

As to the question "Which class of animals is of most importance in determining Zoological Regions," Mr. Wallace thinks that we should "construct our typical or standard Zoological Regions in the first place, from a consideration of the distribution of mammalia, only bringing to our aid the distribution of other groups to determine doubtful points. Regions so established will be most closely in accordance with those long-enduring features of physical geography, on which the distribution of all forms of life fundamentally depends; and all discrepancies in the distribution of other classes of animals must be capable of being explained, either by their exceptional means of dispersion or by special conditions affecting their perpetuation and increase in each locality." "If these considerations are well founded," he continues, "the objections of those who study insects or molluscs,—for example, that our regions are not true for their departments of nature,—cannot be maintained. For they will find, that a careful consideration of the exceptional means of dispersal and conditions of existence of each group, will explain most of the divergences from the normal distribution of higher animals."†

Mr. Allen recalls that he had in 1871 "claimed, in accordance with the views of Humboldt, Wagner, Dana, Agassiz, DeCandolle, and others, that life is distributed in circumpolar zones which con-

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* Wallace, Geog. Dist. Anim., vol. i. p. 53.
† Wallace, op. cit., vol. i, p. 57.

form with the climatic zones, though not always with the parallels of the geographer."

Mr. Allen contends* that—

"In fact, so generally is temperature recognized by the leading writers on the distribution of marine life that it seems superfluous to reiterate or emphasize this principle. That the zones of life should be perhaps a little less obvious over the land areas—in consequence of the diversity of contour resulting from differences of elevation, and the interruptions and exceptional conditions due to mountain chains and high plateaus—than over the oceanic expanses, is naturally to be expected. That there is, however, a similar correspondence between climatic belts and the zones of life seems to me abundantly evident. As has been already shown, the broader or primary zones are, first, an Arctic or North Circumpolar Zone, embracing the arctic, subarctic, and colder temperate latitudes of the northern hemisphere, throughout the whole of which area there is a marked homogeneity of mammalian life, as well as of animal and vegetable life in general; secondly, that below this there is a broad belt of life, which, in its general *facies*, is distinctive of the temperate and warm-temperate latitudes, and that these two zones of life are far more closely related *inter se* than with the life of the intertropical regions, with which regions they may be collectively contrasted, and together receive the appropriate name of '*Arctogæa*;' thirdly, it has been shown, so far as the northern hemisphere is concerned, that the life of the tropical and temperate regions of the same continent is more widely different than is the life of corresponding portions of the temperate and colder parts of the (so-called) Old World and the New; fourthly, that the life of Tropical America has very little in common with that of the tropical portions of Asia and Africa; fifthly, that the life of the South Temperate Zone presents a *facies* distinct from that of the tropics, and has still less in common with that of the North Temperate Zone; sixthly, that Australasia is so highly differentiated as to form a distinct primary region, having little in common with other lands, even with those of contiguous regions, or those having a similar geographical position; seventhly, that Madagascar and its contiguous islands, while to some extent African in affinity, form also a highly specialized region; lastly, that the antarctic and cold south-

* Allen, op. cit., pp. 373-375.

temperate oceanic regions are recognizable as a primary region, characterized by a peculiar general *facies* of life, that more strongly recalls that of the corresponding portions of the northern hemisphere than of any other portion of the earth. It has been further shown that the Australian Realm is divisible into temperate and tropical portions, and also that the land surface is separable into zones of even still narrower limits, corresponding in a general way with those recognized by Dana for marine life.

"The almost total absence of identical genera, or even of families, excepting such as are essentially cosmopolitan, in the American and Old World tropics, as well as the distinctness of the Lemurian Realm, and the almost total isolation of the Australian Realm, evidently require for their explanation other causes than merely the existing climates. The geological history of these land-areas and their faunæ must be of course considered in order to understand their present relationships. As the northern hemisphere at present most clearly shows, nearly continuous land surface and similarity of climatic conditions implies identity of fauna, while isolation, especially when joined with diverse climatic conditions, implies diversity of life, and a differentiation proportionate to the degree of isolation, and the length of time such isolation has existed; in other words, that the present want of affinity between the life of the Lemurian and Australian Realms and that of the rest of the world is due rather to their long geographical isolation than to present climatic conditions, and that we here find, for reasons perhaps not wholly apparent, the remnants of a somewhat primitive or early fauna that was formerly shared more largely by other areas than at present—that these regions became isolated before the development of many of the higher and now prevalent types of the larger and more diversified land-areas, and that here differentiation has proceeded less rapidly and along fewer and narrower lines than elsewhere; furthermore, that the present highly diversified fauna of the chief tropical areas, in comparison with the fauna of the north-circumpolar lands, is due in part to the southward migration, near the close of the Tertiary period, of forms adapted to a high temperature, and in part to the high rate of differentiation favored by tropical conditions of climate. Hence, given: 1. Arctic and cold-temperate conditions of climate, and we have a fauna only slightly or moderately diversified; 2. A moderate increase of temperature, giving warm-temperate conditions of climate, and we have the addition of many new types of life; 3. A high increase of temperature, giving tropical conditions of climate, and we have a rapid multiplication of new forms and a maximum of differentiation. Again, given: 1. A long-continued continuity of land surface, and we have an essential identity of fauna; 2. A divergence and partial isolation of land-areas, and we find a moderate but decided differentiation of faunæ; 3. A total isolation of land-areas, and we have a thorough and radical differentiation of faunæ, proportioned to the length of time the isolation has continued. Hence, the present diversity of life is correlated with two fundamental conditions: 1. Continuity or isolation, past as well as present, of land surface; and, 2. Climatic conditions, as determined mainly by temperature."

Without further comment, we will proceed to the consideration (1) of the several regions concerning which there is proximate agreement, and (2) next to those in dispute.

THE NORTH AMERICAN TEMPERATE REALM OR NEARCTIC REGION.

It is with its widest limits that this territory has been admitted by Mr. Wallace, while by Mr. Allen it is deprived of the Arctic region, which has been associated with the isothermal portion of the Eurasia to constitute together an Arctic realm. This will be the subject of consideration hereafter. Issue has also been joined as to the southern limits of the realm and as to the pertinence or non-pertinence to it of the Sonoran and Lower Californian "regions" of Cope, but this is a question of detail which need not detain us at the present time.

THE EUROPÆO-ASIATIC OR PALÆARCTIC REALM.

The only serious point at issue between Messrs. Wallace and Allen affecting this realm is whether the Arctic portion is, or is not, an integer, Mr. Wallace including it and Mr. Allen excluding and uniting it with the American Arctic, and considering the two as the components of a "realm," as will be hereafter seen.

It will be now in order to inquire into the tenability of the other realms whose adoption has been urged by Mr. Allen. These are the Arctic, the Indo-African, the Lemurian, the South American Temperate, and the Antarctic.

THE ARCTIC REALM.

Mr. Allen gives the following reasons for retention of this realm:

"Whether or not an Arctic Region should be recognized as a division of the first rank is a question not easy to satisfactorily answer. Naturalists who have made the distribution of animal life in the boreal regions a subject of special study very generally agree in the recognition of a hyperboreal or circumpolar fauna, extending in some cases far southward over the Temperate Zone. The Arctic portion of this hyperborean region has been frequently set off as a secondary division, or sub-region, and generally recognized as possessing many features not shared by the contiguous region to the southward. For the present I prefer to still retain it as a division of the first rank. It is characterized mainly by the paucity of its life, as compared with every region except the Antarctic, and by what it has not rather than by the possession of peculiar species or groups. It wholly lacks both Amphibian and Reptilian life, is almost exclusively the summer home of many birds, and forms the habitat of the Esquimaux, the Arctic Fox, the Polar Bear, the Musk Ox, the Polar Hare, the Lemmings, the Walruses, the Narwhal, and the White Whale, which are confined within it. It has no *Chiroptera* nor *Insectivora*, two or three species of Shrews, however, barely reaching its southern border. It shares with the cold-temperate belt the presence of the Moose and the Reindeer, several Pinnipeds, a number of boreal species of *Glires*, several fur-bearing *Carnivora*, and a considerable number of birds. Its southern boundary may be considered as coinciding very nearly with the northern limit of arboreal vegetation, and hence approximately with the isotherm of 32° F. Its more characteristic terrestrial forms range throughout its extent, none being restricted to either the North American or Europæo-Asiatic continent. Hence it is indivisible into regions of the second and third grades (regions and provinces,) and may be considered as embracing a single hyperborean assemblage of life."

It cannot be overlooked that the reasons thus urged are very unsatisfactory, and result in part from the confusion of inland and marine faunæ under the same category. The seals, walruses, and cetaceans are not terrestrial mammals, but marine, and their distribution is governed by the same laws which affect marine animals generally. The very few peculiar species, except the musk ox, are but little modified relations of forms common to the adjoining realms, and the absence of most forms is evidently dependent on the cold climate, and furnishes no more reason for assigning a primary rank to the territory so characterized than it would to the mountain peaks and deserts so frequently isolated in the midst of the adjoining regions, and which are equally distinguished by the paucity of their animal life. The fact that it cannot be distinctly relegated to either the North American or Eurasian realms, but is neutral territory, is scarcely sufficient to warrant its entire isolation from both.

The next disputed question involves the union or distinction of the Indian and African territories. The question is thus discussed by Mr. Allen.

INDO-AFRICAN REALM.

According to Mr. Allen, "The Indo-African Realm consists mainly of Intertropical Africa and Intertropical Asia, to which it seems proper to add Extratropical South Africa. The small portion of Africa south of the Southern Tropic lies wholly within the warm-temperate zone. Its small extent and broad connection with Tropical Africa render its separation as a distinct realm (as I at one time rather hastily considered it) almost inadmissible, since it is especially open to the influence of the great intertropical African fauna, as is shown by the extension of many tropical forms down to within a few degrees of its southern extremity. The area really possessing a temperate climate is restricted to its extreme southern border, where alone appear the few generic and family types that do not have a very general range over the tropical portions of the continent. This area is many times smaller than the temperate portion of South America, but, though so small, has quite a number of peculiar genera, which impart to it quite distinctive features. It yet seems better to regard it as an appendage of the great Indo-African Realm rather than as a distinct primary region. Madagascar, with the Mascarene Islands, on the other hand, while perhaps possessing a closer affinity with Africa than with any other continental region, has yet a fauna made up so largely of peculiar types that it seems more in accordance with the facts of distribution to regard it as a separate primary region.

"The Indo-African Realm, as thus restricted, forms a highly natural division. Although its two principal areas are quite widely separated, being in fact geographically almost wholly disassociated, they possess a wonderful degree of similarity. Of the fifty commonly recognized families of mammalia occurring within its limits, three-fifths are distributed throughout almost its whole extent. Of the remainder, one-half are confined to Africa, and one is African and American, leaving only nine in India that are unrepresented in Africa; three only of these latter are, however, peculiar to the Indian Region; all extend beyond it to the northward, five of them even occurring over the greater part of the northern hemisphere. Thus the African region is the more specialized division, only a small portion of the tropical element in the Indian Region, through which it is differentiated from the great Europæo-Asiatic Temperate Region, being unrepresented in the African, while the African has three times as many peculiar families as the Indian."

I am quite unable to appreciate the force of this exposition as an argument in favor of the union of the two regions; it appears to me that it is, indeed, one that tells for the contrary side. Let it be recalled that the ten families* peculiar to the African region are very distinct, and that almost all of the eighteen families "common to both regions" can be added to the twelve "of wide extralimital range," if we take into consideration their distribution in even newer Tertiary or sometimes Quaternary times. Further, the genera even were, for the most part, of wide distribution formerly, and there is strong reason to believe that the thirty forms "common to both regions" were invaders of Africa in the later Tertiary, and that among those now "peculiar to the African region" we have the remnants of older faunæ. If we revert to the fishes we find some striking facts. These can be resolved under two categories. On the one hand a number of forms are peculiar to Africa, or shared in common with South America; on the other are certain genera

* There are really more.

shared in common with Asia, or very closely related to Asiatic forms, and well fitted for extension of their range by tenacity of life or adaptation for limited ærial respiration. The evidence here again leads to the conclusion that the peculiar types are derived from very ancient tenants of the territory, while those common to Asia are of recent introduction. We must of course take cognizance of these contrary indications in our appreciation of the relations of the respective regions, and not allow ourselves to be unduly influenced by the predominance of the recent invaders. Africa is a decidedly distinct region so far as its aboriginal population is concerned. Further, its relations, as indicated by its primitive and more characteristic types, are with South America rather than with India, as I shall hereafter show.

THE LEMURIAN OR MALAGASY REALM.

Whether the Malagasy region or *Lemurian realm* of Allen is independent or an appanage of the African, is the question naturally next in order.

According to Mr. Allen, "As was long since claimed by Dr. Sclater,* Madagascar is faunally so distinct from every other ontological division of the globe as to be entitled to the rank of a primary zoogeographical region. With it, as is generally admitted, should be associated the Mascarene Islands. The very few mammals indigenous to these islands are decidedly Madagascarine in their affinities, as are the birds and other land animals. While the Lemurian fauna shows decided African affinities, it is second only to the Australian in its degree of specialization. It departs most strikingly from all other regions in what it lacks, through the absence of all Carnivores save one peculiar family (*Cryptoproctidæ*), represented by a single species, and four peculiar genera of the family *Viverridæ;* of all Ruminants and Proboscidians; all Pachyderms, except a single African genus of *Suidæ;* and all Rodents, except a few species of *Muridæ*. The Insectivores are almost wholly represented by one or two species of *Crocidura*, and a family, embracing several genera, not found elsewhere, save a single genus in

* Quart. Journ. Sci., vol. i, April, 1864, pp. 213-219 (Allen).

the West Indies. Four families of Bats occur, but are represented, with one exception, by a single species each. They belong to groups of semi-cosmopolitan range, and owing also to the exceptional means of dispersal possessed by the *Chiroptera*, have little weight in determining the affinities of the fauna. The Quadrumanes are represented only by the *Prosimiæ*, of which three-fourths of all the species occur here, while about four-fifths of the remainder are African. The remains of an extinct species of *Hippopotamus* have been found, a type existing at present only in Africa. Although the Indian genus *Viverricula* has recently been established as occurring in Madagascar, the few types that connect the Lemurian mammalian fauna with the faunæ of other parts of the world are preponderatingly African."

There is much that could be said on both sides of this question, thus ably discussed. When, however, we recall the fact, lately urged, that most of the types that now characterize Africa are comparatively recent immigrants into that continent; that the nearest existing allies of the peculiar mammalian types of Madagascar are to be found among the older types of Africa, and that the few fresh-water fishes of Madagascar are of a decided African type, the divergences of the two are materially lessened; there is no dispute that the relations of the Malagasy fauna are most intimate with Africa, and as the question of the distinction of the former from the latter is at least doubtful, and must remain so until its fauna is better known and has been more thoroughly analyzed, we may, provisionally, at least, consider the one as an appanage of the other, having not much less perceptible relations to the main portion than does the Antillean to the South American.

THE SOUTH AMERICAN TEMPERATE REALM.

In Mr. Allen's words, "What is here termed the South American Temperate Realm embraces all that portion of the South American continent and adjacent islands not included in the American Tropical Realm as already defined. It coincides very nearly with Mr. Wallace's 'South Temperate American or Chilian Sub-region.'*

* Geog. Dist. Animals, vol. ii, p. 36, and map of the Neotropical Region.

Its northern limit on the Atlantic coast is near the thirtieth parallel. On leaving the Atlantic coast, the northern boundary passes obliquely northwestward, rising in the region of the Chaco Desert, to, or possibly a little beyond, the Tropic of Capricorn. Again, descending to about the twenty-fifth parallel, it turns abruptly northward and eastward, along the eastern border of the Andean chain, nearly to the fifth degree of south latitude, near which point it strikes the Pacific coast. It thus embraces a large part of the great Andean plateau, with the neighboring coast region to the westward, nearly all the La Plata plains, and the region thence southward to Tierra del Fuego, which belongs also to this region.

"As contrasted with the Tropical Realm to the northward, it is characterized, in respect to mammals, by the absence of all *Quadrumana* and the paucity of Edentates and Marsupials, there being neither Sloths nor Anteaters, while only two or three species of Opossums barely extend over its borders; the absence of all genera of Leaf-nosed bats, and of not less than a dozen important genera of Rodents, the Coatis, the Kinkajou, the Tapirs, and many other genera characteristic of the American tropics.* As noted by Mr. Wallace, it is further characterized by the possession of the entire family of the *Chinchillidæ*, the genera *Auchenia*, *Habrocomus*, *Spalacopus*, *Actodon*, *Ctenomys*, *Dolichotis*, *Myopotamus*, *Chlamadophorus*, to which may be added the marine genera *Otaria*, *Arctocephalus*, *Morunga*, *Lobodon*, and *Stenorhynchus*, very few of which range beyond the northern border of this region. The Spectacled Bear is also confined to it, and here are also most largely developed the Murine genera *Calomys*, *Acodon*, and *Reithrodon*."

Mr. Allen might have derived additional cogent evidence for the independence of this realm from the fresh-water fishes, which, in fact, show more relationship to those of New Zealand and Tasmania than to the tropical American types. Indeed, this relationship is such that an English ichthyologist of some note, Dr. Gün-

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* "Among the genera of the Brazilian region here unrepresented are, aside from the *Quadrumana*, *Cercoleptes*, *Nasua*, *Tapirus*, *Bradypus*, *Chœlopus*, *Myrmecophaga*, *Tamandua*, *Cyclothurus*, *Phyllostoma*, *Glossophaga*, *Arctibeus*, *Dysopes*, (and other genera of *Chiroptera*,) *Hydrochœrus*, *Cercomys*, *Dactylomys*, *Loncheres*, *Echimys*, *Cœlogenys*, *Dasyprocta*, *Chœtomys*, *Cercolabes*, *Lepus*, *Sciurus*, *Habrothrix*, *Oxymycterus*, *Holochilus*, etc., = 27+."

ther, has considered the several countries as constituents of a single "region," called the Antarctic region, whose subdivisions were designated as the Tasmanian, New Zealand, and Patagonian "sub-regions," and which were, in his opinion, "almost identical." On the whole I am now inclined to follow Mr. Allen in differentiating this realm from the South American, somewhat contrary to my former views, although I do so with some hesitation.

THE ANTARCTIC OR SOUTH CIRCUMPOLAR REALM.

Mr. Allen has enunciated the following views respecting an Antarctic Realm:

"The Antarctic Realm is geographically almost wholly oceanic, and its fauna hence consists almost exclusively of marine or pelagic species. It necessarily embraces not only the Antarctic Zone, but a large part of the cold south-temperate, since very few of its characteristic species are wholly restricted to the Antarctic waters. It will hence include not only the few small groups of Antarctic Islands, but also Tierra del Fuego and the Falkland Islands, and perhaps also the extreme southern shores of South America, while some of its characteristic forms also extend to New Zealand, and even Australia and the Cape of Good Hope. The only mammals that can be considered as strictly characteristic of this region are Pinnipeds and Cetaceans, of which several genera of each are almost wholly restricted to it. A "South Frigid," "Antarctic," or "South Circumpolar" "Zone," "Region," or "Realm," has been recognized by various writers for the marine invertebrates, and, by von Pelzeln for birds, with limitations much as here assigned. While the number of species peculiar to it is small, it is large relatively to the whole number represented, especially in the colder latitudes. There is, of course, a broad belt along its northern border of a transitional character, where Antarctic types overlap the range of groups characteristic of south-temperate latitudes."*

As it is admitted that no terrestrial or fresh-water animals have been found in the Antarctic regions, it is not obvious why such a realm should have been proposed in connection with the distri-

*Allen op. cit., p. 372.

bution of terrestrial vertebrates, and it will be premature to even consider it till such animals have been found.

Such are the "realms" or "regions" recognized by Messrs. Wallace and Allen.

But there still remain large extents of land and water which have not been recognized as independent realms by either Messrs. Wallace or Allen, but which have been referred to a heterogeneous Australian one, as a kind of refuge of the destitute. These we shall consider as a sequel to the determination of the "realms," which our inquiries and criticisms have naturally now led us to.

In fine, we see reason for admitting nine primary divisions of the earth's inland surface, characterized by major associations of animals. Beginning with home, and proceeding to the successively more differentiated realms, these are (1) the Anglogæan or North American; (2,) the Eurygæan or Eurasian; (3,) the Indogæan; (4,) the Afrogæan; (5,) the Dendrogæan or Tropical-American; (6,) the Amphigæan or Temperate South American; (7,) the Austrogæan or Australian; (8,) the Ornithogæan, or New Zealand; and (9,) the Nesogæan or Polynesian.

I.—THE ANGLOGÆAN OR ARCTAMERICAN REALM.*

I. The North American or Nearctic Realm embraces North America from its northern boundaries, where it approaches, on opposite sides, the Eurasiatic realm, southward into Northern Mexico, projecting into that country to a considerable distance along the extension of the Rocky Mountains, and ceasing somewhere near the southwestern boundary of the United States on the lowlands. It has representatives of 26 families and about 250 species of mammals, exclusive of the marine types; about 60 families and not far from 800 species of birds (Baird, Brewer, and Ridgway); 25 families, and about 250 species of reptiles; 14 families and about 100 species of amphibians; 17 families and about 600 species of

* Some synonyms of the realm names adopted are given at the commencement of each paragraph.

fresh-water fishes, and 1 family and 6 or 7 species of Marsipobranchiates. Of these, several are wholly or almost peculiar to the region. These are, of mammals, the Antilocapridæ, Zapodidæ, Geomyidæ, and Haploodontidæ; of birds, the Chamæidæ (of very doubtful value); of reptiles, the Lichanuridæ; of amphibians, (according to Cope,) the Scaphiopodidæ, Plethodontidæ, Amblystomidæ, Amphiumidæ, and Sirenidæ; and of fishes, the Centrarchidæ, Elassomidæ, Aphredoderidæ, Amblyopsidæ, Percopsidæ, Hyodontidæ, and Amiidæ. Of the others, those characteristic of the northern portions of the region are shared in common with Europe and Northern Asia, while such as are especially represented in the southern portions are held in common with South America. On the whole, however, the predominant type of the region—and only more decidedly so to the northward—is akin to that of the Eastern hemisphere, and the South American aspect given to the region is apparently due rather to the (geologically) recent intrusion of South American types than to its being the natal abode of such forms.

Of the other classes of animals, those most noteworthy are the gastropods and conchifers; the former is extremely rich in species of the family of Ceriphasiidæ, which includes Melanioids of peculiar genera; the latter is even to a still greater degree exuberant in species representing also numerous sections, or sub-genera, peculiar to the region. In fact, over 400 species of gastropods, most of which belong to the Ceriphasiidæ, and about 600 species of conchifers, the greater portion of which are members of the family of Unionidæ, have been attributed to the region, but these numbers are undoubtedly greatly exaggerated. It may be added, in conclusion, that several of the families and genera now peculiar to the realm were, in early geological epochs, represented elsewhere, the Lepidosteidæ, for instance, having formerly had members in Europe. Several of the peculiar genera are also of great antiquity, characteristic sections or genera of Viviparidæ, Melaniidæ, and

Unionidæ having existed as early as the Cretaceous and even the Jurassic period.

II.—THE EURYGÆAN OR EURASIATIC REALM.

The European or Palæarctic Realm is the largest of all, and embraces the entire northern portion of the Old World. Its southern limits nearly coincide with the tropic of Cancer in the lowlands, and its isotherm projected therefrom in the more rugged countries. In Africa it extends into the Desert of Sahara, and in Asia it is limited by the Himalaya Mountains and their spurs. It possesses members of 31 families of terrestrial mammals, 55 of birds (according to Wallace), 25 of reptiles, 9 of amphibians (according to Günther), and 16 of fresh-water fishes. None of these families, however, are continuous over the entire area and at the same time peculiar to it. It is true that several families are restricted within its limits, such as the Trogonophidæ and Ophiomoridæ among reptiles, and the Comephoridæ among fishes, but these are very limited in their distribution; the family Comephoridæ, *e. g.*, is represented by a single species, confined to a single lake (Baikal) of Siberia. The realm is characterized, therefore, rather by what it has not than by what it has among families, and is based mainly on the structural modifications of minor value (generic or specific) of its constituents.

III.—THE INDOGÆAN REALM.

The Indian or Oriental Realm is of less extent than either of the two preceding ones, but is nevertheless richer than either in the number of species. It extends from the Himalayan range on the north to the Indian Ocean on the south, and toward the S. E. is limited by the narrow but deep strait which intervenes between Celebes Island and its dependencies on the one hand, and Borneo on the other, and also between the island of Lombok on the one hand and Bali on the other; it thus includes the peninsulas of Hither and Farther India, and the Indo-Malayan Archipelago and Philippine Islands. In it are found 33 families of terrestrial mammals, 71 families of birds (according to Wallace), 25 families of reptiles, 9 of amphibians, and 15 of fresh-water fishes. Of these, 12 are peculiar, viz: among mammals, the Tarsiidæ, Galeopitnecidæ, and Tupaiidæ; among birds, the Liotrichidæ, Phyllornithidæ, and Eurylæmidæ; among reptiles, the Xenopeltidæ, Uropeltidæ, and Acrochordidæ; and among fishes, the Luciocephalidæ, Ophiocephalidæ, and Mastacembelidæ. As in the case of other regions, there is considerable diversity of opinion as to its relations to others, and as to its several subdivisions.

IV.—THE AFROGÆAN REALM.

The African or Ethiopian Realm, as the name indicates, includes the greater part of the African continent, but not all, it being limited on the N. by the Desert of Sahara, although on all other sides bounded by the ocean; but it also comprises the island of Madagascar and the Mascarenes, as well as, according to some recent authors, the peninsula of Arabia. It is distinguished especially in that it possesses the highest types, after man, of the order Primates, and which are in all respects the most anthropoid. This region is also further distinguished by the restriction to it of as many as ten isolated families of mammals, viz: Daubentoniidæ, Cryptoproctidæ, Protelidæ, Camelopardidæ, Hippopotamidæ, Lophiomyidæ, Centetidæ, Potamogalidæ, Chrysochloridæ, and Orycteropidæ. Among birds, there are six so-called families peculiar to it—Paictidæ, Musophagidæ, Coliidæ, Leptosomidæ, Irrisoridæ, and Serpentariidæ. The most marked, however, are the fishes, of which there are fourteen families; of these, five are peculiar, viz: Pantodontidæ, Kneriidæ, Mormyridæ, Gymnarchidæ, and Polypteridæ, and three are shared with South America alone—Cichlidæ, Characinidæ, and Lepidosirenidæ. This realm, like all the others, has been subdivided by Wallace into four regions, or, as he designates them, "subregions," viz: (*a*) the East African, (*b*) the West African, (*c*) the South African, and (*d*) the Malagassy.

V.—THE DENDROGÆAN REALM.

The South American or Neotropical Realm extends from the N., near the northern boundaries of Mexico in the lowlands, and lower down in the highlands, to the temperate regions of South America, and its dependencies, for with it are also generally associated the West Indian Islands. It has 30 families of mammals, 73 of birds, 35 of reptiles, 16 of amphibians, and 17 of fresh-water fishes. An unusual proportion of these are peculiar to the region, or nearly so. Among the mammals are the Cebidæ, Mididæ, Desmodidæ, Dinomyidæ, Caviidæ, Hydrochœridæ, Bradypodidæ, Dasypodidæ, Tatusiidæ, and Myrmecophagidæ. Several of the families which are shared in common with North America are also almost as characteristic, the North American species being rather intruders therein from the region under question than true autochthones. Such are the Procyonidæ, Bassarididæ, Saccomyidæ, Cercolabidæ, Phyllostomidæ, and Didelphididæ. Other families are peculiar in their distribution: for example, of the Tapiridæ, two well defined genera and several species are found in South America, and the only other representative is distant as far as the Indo-Malayan Archipelago. These are anomalies, however, that become readily explicable when it is recalled that, in previous geological epochs, both of the said families were extensively distributed over the northern hemisphere, and consequently the widely-separated living forms are evidently simply surviving representatives of formerly widespread types. Of birds, according to the views of Wallace and many ornithologists, 22 families are restricted to the region, and 7 others are common and peculiar to it and the North American region. The peculiar families of birds, according to Wallace, are the Cærebidæ, or sugar-birds; Phytotomidæ, or plant-cutters; Pipridæ, or manakins; Cotingidæ, or chatterers; Formicariidæ, or ant-thrushes; Dendrocolaptidæ, or tree-creepers; Pteroptochidæ; Rhamphastidæ, or toucans; Bucconidæ, or puff-birds; Galbulidæ, or jacamars; Todidæ, or todies; Momotidæ, or motmots; Steatornithidæ, the guacharo or oil-bird; Cracidæ, or curassows; Tinamidæ, or tinamous; Opisthocomidæ, the hoazin; Thinocoridæ; Cariamidæ: Aramidæ; Psophiidæ, or trumpeters; Eurypygidæ, or sun-bitterns; and Palamedeidæ, or horned screamers. The Trochilidæ, or humming-birds, are especially noteworthy on account of their great numbers. Six families of reptiles have also been claimed as peculiar to the realm, and among the lizards the family of Iguanidæ is remarkably developed. Four families of amphibians and four of fishes are also considered as restricted to the realm. The relation between the fishes of South America and Africa is another feature of special significance: there are three families shared between the two, and found nowhere else, and genera of the respective families are not distantly related, although none are actually common to the two realms.

VI.—THE AMPHIGÆAN REALM.

The Temperate South American Realm may retain provisionally the limits assigned to it by Mr. Allen, and as these have already been specified when considering Mr. Allen's views, it is unnecessary to repeat them here. Within its limits occur representatives of several peculiar groups; there are 18 families of terrestrial mammals, two of which (the Chinchillidæ and Chlamyphoridæ) are almost confined to it, and two (Ursidæ and Camelidæ) are shared with the northern realms without occurring in the contiguous realm; 42 so-called families of birds, three of which (the Chionididæ, Thinocoridæ, and Rheidæ) scarcely or not at all encroach northwards; 15 families of reptiles; 11 families of amphibians; 5 families of fishes, two of which are shared with New Zealand and Tasmania, and scarcely extend into Tropical America; and one family of Myzonts, also shared with New Zealand and Tasmania.

VII.—THE AUSTROGÆAN REALM.

The Australian Realm is of all the most distinctly defined by its fauna. As it will be here limited, it comprises Australia and the immediately outlying islands, and the Austro-Malayan Archipelago. It is limited northward by Wallace's line or strait, which separates Lombok from Bali and Celebes from Borneo, including Papua or New Guinea and the Solomon Islands to the eastward, and southward embraces Tasmania or Van Diemen's Land. It is especially distinguished by its numerous marsupial mammals, and by the almost complete restriction of the class to representatives of that order, the rodents and the bats; the Monotremes are also characteristic of the realm, and entirely confined to it. The class of birds likewise has a number of very characteristic types: chief of these are Megapodidæ and Casuaridæ, but there are several others—*e. g.*, the Paradiseidæ, Meliphagidæ, Menuridæ, and Atrichidæ—that are almost equally peculiar. The reptiles and amphibians are perhaps less noteworthy, although they present some interesting features of detail. The fresh-water fishes are, however, especially remarkable; while many of what may be called marine families are represented by fluviatile species, there are several that are peculiar to it or only found elsewhere in South America. Among the former is the family Ceratodontidæ, which in former geological epochs was extensively represented in other parts of the world, but is now peculiar to Australia. Among the latter are the families Percophididæ, Haplochitonidæ, Galaxiidæ, Osteoglossidæ, and Symbranchidæ. The articulates and mollusks also afford a large number of characteristic forms. The primary subdivisions of the realm are two.

VIII.—THE ORNITHOGÆAN REALM.

The New Zealand sub-region of Mr. Wallace cannot be satisfactorily referred to the Australian or any other realm, and, although its peculiar characters are not very salient, it should apparently be isolated as a peculiar realm. The name Ornithogæa, proposed nearly ten years ago, may be retained for it. In prehistoric times, it was the abode of a number of gigantic struthiiform birds, which have been referred to one or two peculiar families—the Dinornithidæ and Palapterygidæ—and a related family—the Apterygidæ—is still represented by four species. There are also many other birds representing genera peculiar to New Zealand. Here also live the only survivors (*Sphenodon* or *Hatteria*) of an order of reptiles (Rhynchocephalia) which, in ancient times, had a wide distribution. The fresh-water fishes are few, but noteworthy. One genus (*Galaxias*) is common to the temperate portions of Australia and South America, another (*Prototroctes*) to New Zealand and South Australia, a third (*Neochanna*) of the family of Galaxiidæ is peculiar, and also peculiar is a genus (*Retropinna*) distantly related apparently to the Argentines (smelts, etc.) of the northern realms. The Gastropod mollusks, and other invertebrates exhibit a peculiar association of types, which, at the same time, re-enforces the distinctness of the realm and gives rise to special problems of zoogeography.

IX.—THE NESOGÆAN REALM.

The restricted Polynesian realm is distinguished by negative rather than positive characters, and is to some extent a "refuge of the destitute." It includes all the islands of the tropical portions of the Pacific Ocean combined under the general name Polynesia. It is distinguished from all others by the total—or almost total—absence of indigenous types of mammals. The other common characters are very few; the avian types, on the whole, recall mostly the Australian forms. There are, according to Wallace, "not more than about 50 genera and about 150 species of land-birds." It is possible that these islands are the remains of one or more continental areas, and that at least most of them have been submerged and lost their mammals, and on emergence, or rather upheaval, have been peopled from other territories. The analysis of this group would detain us too long, and this realm may, for the present, be considered as a provisional one, to be hereafter studied and properly limited.

All the primary zoogeographical divisions recognized by Messrs. Wallace and Allen have now been considered, but the relations of the several realms to one another may be glanced at with profit. As will be remembered, there are fundamental differences involved in this respect between the views of Messrs. Wallace and Allen. Mr. Wallace's sequence of his "regions" implies a reminiscence of an ancient idea, which was expressed in the translation of the terms "Old World" and "New World" into respectively "Palæogæa" and "Neogæa" The realms of Mr. Allen traverse such primary groups, and are rather subordinated to climatic considerations. Still other groupings have been proposed, as, for example, by Professor Huxley, who has segregated the Eurasiatic, Indian, and African realms into an "Arctæoga," and the South American, or Austro-Columbian, Australasian, and New Zealand ones into a "Notogæa." And the present author has proposed to contrast the North American, Eurasiatic, and Indian realms under the denomination *Cenogæa*, with an *Eogæa*, comprising the African, South American, Australian, and New Zealand realms. Let us look at some of the facts which may determine our opinion in the case.

On the one hand, those forms of animal life which are capable of easy extension over extensive bodies of land or water, such as the birds, which represent the highest types, physiologically speaking, of life, are distributed in a manner to a large extent co-ordinate with the present arrangement of land and water. The birds seem to have especially become modified and adapted to the present topographical features of our earth at a (geologically speaking) recent epoch. On the other hand, those animals of a more lethargic character, or which are prevented by physical environments from extending their range, are grouped entirely otherwise. This is especially the case with the fresh-water animals of various kinds, and notably with the fresh-water fishes.

If the inhabitants of the fresh waters of the globe are taken into consideration, the several realms we have defined may be combined in quite a curious manner, which entirely contradicts the relations which the present combinations of land and water would suggest. It will then be seen that the inhabitants of the northern portions of the several continents of North America, Europe, and Asia belong, in a great degree, to the same types; and although the realms thus associated are characterized by a number of forms peculiar severally to each of them, they form a natural whole in contradistinction to the others. Very closely connected with this division is the East Indian, and this forms with them an integral portion of a great super-realm or hemisphere.

In striking contrast with the association of forms characteristic of the several divisions alluded to are the fresh-water types of Australia. Most closely related to Australia in this respect is South America, and in the fresh waters of that continent are to be found several types which are common to the two continents. The only remaining continent—Africa—although presenting some forms that are common to it and India, on the whole furnishes us with an association of fresh-water forms which recalls the South American realm more than it does any other. Several families of fishes and a number of types of other animals are common to the two and are found nowhere else.

Combining these facts into a systematic whole, it has been proposed to segregate the several realms in the manner hinted at, and to combine under the name *Eogæa* (1) the Australian, (2) South American, and (3) African realms; and under the name *Cenogæa* (4) the North American, (5) the European, and (6) the East Indian realms. *Eogæa* gives to us a number of forms which remind us of the ancient inhabitants of the northern hemisphere, and hence the name, while *Cenogæa* has lost most of the forms that were characteristic of the past, and presents the newest aspect of the earth-faunas in contradistinction with the other.

An explanation of these relations may be found in one or other of two hypotheses. (1) The like forms may have originated where they are now found, and have been ever confined within proximately their present limits; or (2) they may be the survivors of anciently widely-distributed races. Neither hypothesis of itself is a sufficient explanation of all the associations in question, but each is applicable to different cases

At this point, I will ask your attention for some problems whose pertinency to our discussion will be evident, anda n answer to which will determine our action in questions yet to be considered.

THE EFFECT OF TEMPERATURE ON DISTRIBUTION.

Our experimental knowledge of the influence of temperature on animal life in isolated cases prepares us to find it a largely controlling factor in the geographical distribution of the various minor types, and the thermo-physiology of many super-generic types is in strict consonance with their morphology. Many of the forms which have been noticed as characteristic of specific realms or common to certain zones are limited in their range by thermometric conditions. As a rule, temperature exerts a paramount influence on the distribution of animal life. Nevertheless, the familiar adage that there is no rule without an exception holds good for all the laws of zoogeography. For instance, the tiger, which is associated, in the minds of most persons, with the jungles of torrid India, flourishes likewise in the frigid Amurland; the humming birds, so characteristic of tropical America, are represented by wanderers in the icy regions of both the north and south, and the cyprinoid fishes live and multiply, with not greatly unequal facility, in the waters of the torrid and frigid zones. Nevertheless, the rule in general is that temperature is a most important factor in distribution, and probably to its influence, in connection with the former distribution of animal types and the bounds of older continents, are due some of the differences which are now so salient, as, for instance, between the North American and Eurasiatic realms.

In former times, families now confined to America were also represented in Europe; such are the Snapping turtles or Chelydridæ and the Lepidosteidæ. Perhaps their present absence from the European fauna is due to their former limitation southward, and the cold of the Quaternary period, which extended over the whole of their European domain and exterminated the species, while in America, although the individuals over a large extent of territory succumbed, the types continued to survive in the south, and the deserted lands were repeopled when a gentler climate again prevailed.

It is well known that the equatorial inhabitants of the old and new worlds are quite dissimilar from one another, and it may be thought that such dissimilarity is antagonistic to the law that temperature is a primary factor in distribution. The facts in the case, however, seem at once to justify the law and to necessitate the invocation of another. Undoubtedly there are no hindrances offered by the climates of the several equatorial regions to the life of any of the tropical types of life in all of the tropical regions. Their limitation, therefore, must be looked for in other causes; the conditions imposed by climate on the north and south, where the continents converge, have forbidden their extension, and the distinctiveness of the types characteristic of the several regions is a result of the laws of evolution acting during the long ages of dissolution of the respective regions.

WHAT TYPE IS MOST FITTED TO EXPRESS FAUNAS?

As will be remembered, Mr. Wallace has especially insisted on the super-eminent availability of the mammals for the determination of faunal regions, and in this respect is cordially endorsed by Mr. Allen. I fail, however, to appreciate the entire force or pertinence of their reasons, although to some extent pertinent. The mammals are certainly the best and the only factors to determine the mammalian faunas, but for general faunas all animals are to be considered. The survey of the chronological and geographical history of the various classes of the animal kingdom reveals marked discrepancies between the several types in both of these cases, and we are led to postulate several propositions as tentative hypotheses for proof or disproof. All other things being equal, (1) the longer a type has been in existence, the more widely should it have been disseminated; (2) the later a type has supervened, the more restricted should it be, and the closer its accommodation to existing conditions; (3) the stricter the environments of a type are, the less are its means of dispersal; and (4) the greater the facilities of a type are for extension of its range, the wider should be its range.

Now, these propositions are such that they might at first appear to be shallow truisms, but the emphatic proviso that *all other things should be equal* is especially necessary to keep us from error in applying the several propositions to the actual faunas. A brief glance at the past history of some classes will render the necessity evident. For example, on the one hand, even in the Palæozoic period, among others, representatives of the classes of Lamellibranchiates, Gastropods, Arachnids, and Insects lived, which are inseparable from families still in existence, while, on the other hand, extremely few, if any, families of mammals or birds have a history which extends back as such into the Eocene Tertiary; between the two categories expressed by such types the fishes form an intervening term. Presumably, we should, therefore, be justified in expecting a wide distribution of the first series of types, and, inversely, from their geographical distribution, we should expect a long life history for them. Our provisions in both cases would be justified by the facts. And further, a study of the distribution of those types shows that their ranges, in higher groups, are very imperfectly co-ordinate with the present distribution of land.

The fresh-water fishes had become more differentiated than the invertebrate types, in Mesozoic and Tertiary times, and are, therefore, better exponents of the later past relations of continental areas than they are. Their presence, as well as their absence, are very significant, and the bearings of such distribution have been partly indicated in connection with the proposition to recognize the Eogæan and Cenogæan worlds. Their study will avail much hereafter in the reconstruction of the continents of the older epochs, and the solution of the derivations of their faunas. Suffice it now to express the opinion that the fishes are among the best indicators of the ancient continental areas, and that the relations of the several southern continents as to their ichthyic faunas can be best understood by the assumption that at some remote epoch or epochs, (but not probably at any one time,) there was a distribution of land which eventually permitted an emigration and immigration of types from one and into another. The absence or slight intrusion of such forms into the northern continent suggests the doubt as to a perfect continuity of the land or fresh-water systems. There are, however, doubtless other explanations available.

Thus far our attention has been confined to the inland—terrestrial and aquatic—animals, and these alone have been relegated to definite realms or regions by Messrs. Wallace and Allen. The marine faunas of the globe have been practically ignored by both of these students, their attention having been chiefly devoted to the inland regions. The marine realms, however, are entirely independent of the fluvio-terrestrial, and their characteristic associations of animals are determined by other factors. The groupings which I shall now adopt were first outlined by me in 1875,* but certain of the fundamental facts were long ago appreciated.

The importance of attention to the temperature of the sea, and especially to that during the coldest month of the year in the two hemispheres, in relation to zoogeography, was, perhaps, most fully appreciated at first by the illustrious and versatile Dana, who, just about thirty years ago, published, for the time, an excellent "Isocrymal Chart to Illustrate the Geographical Distribution of Marine Animals" and an accompanying memoir,† in which zoogeographical principles were discussed with eminent learning and wisdom. The chart is still one of the most useful in existence for the student of zoogeography, but later ones answering the purpose, and embodying more recent observations, have been published by

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* THEODORE GILL. On the Geographical Distribution of Fishes. <Ann. and Mag. Nat. Hist., (4,) vol. 15, p. 251–255; April, 1875. See also Johnson's New Universal Cyclopædia, vol. 2 and 4, and The Nation, vol. 24, pp. 27–29, 42, 43; July 12 and 19, 1877.

† JAMES D. DANA On an Isothermal Oceanic Chart, illustrating the geographical distribution of marine animals. <Am. Journ. Sc. and Arts, (2,) vol. 16, pp. 153–167, 314–327; Sept. and Nov., 1853.

the British admiralty, and in the Encyclopædia Britannica*. Nevertheless, charts based upon the latest observations of the numerous explorations that have been made within the past decade and especially adapted for the zoologist are great desiderata, and it is hoped that our own Coast Survey and Hydrographic Office, or the United States Fish Commission, may supply the want.

Prof. Dana † recognized nine "regions" or categories of temperature, segregated under three "zones," and all these, except the equatorial, were duplicated in the respective hemispheres, thus:

I.—TORRID OR CORAL-REEF ZONE.

Regions.	Isocrymal limits.	
1. Supertorrid, [Eq.]	80° F.	to 80° F.
2. Torrid, [Eq.]	80°	to 74°
3. Subtorrid, [N., S.]	74°	to 68°

II.—TEMPERATE ZONE.

1. Warm Temperate, [N., S.]	68°	to 62°
2. Temperate, [N., S.]	62°	to 56°
3. Subtemperate, [N., S.]	56°	to 50°
4. Cold Temperate, [N., S.]	50°	to 44°
5. Subfrigid, [N., S.]	44°	to 35°

III.—FRIGID ZONE.

1. Frigid, [N., S.]	35°	to 26°

It is suggested that an additional "region, called the Polar, may be added, if it should be found that the distribution of species living in the frigid zone requires it, There are organisms that occur in the ice and snow itself of the Polar regions; but these should be

* The Wind and Current Charts for the Pacific, Atlantic, and Indian Oceans, giving the isothermals of February for the northern hemisphere, and of August for the southern, published in 1872, will be found the most useful. These have been essentially reproduced in the article "Meteorology" of the Encyclopædia Britannica, vol. 16, p. 133, 1883.

† DANA, op. cit., p. 157.

classed with the animals of the continents, and the continental isotherms or isocrymes, rather than the oceanic, are required for elucidating their distribution."

The highest segregations of the marine faunas, as admitted by Prof. Dana, are three divisions or "kingdoms," viz: "1, the *American or Occidental*, including east and west America; 2, the *Africo-European*, including the coasts of Europe and western Africa; and, 3, the *Oriental*, including the coasts of eastern Africa, East Indies, eastern and southern Asia, and the Pacific. Besides these, there are the *Arctic* or *Antarctic* kingdoms, including the coasts of the frigid zones, and, in some places, as Fuegia, those of the extreme temperate zone."

We have thus, from similar data, generalizations tending in opposite directions, (1) that which was postulated as to the distribution of marine life in zones, and (2) the one just recalled, which correlates the distribution rather with the lay of the land.

Much may be said in favor of each proposition, and it is certain, as I long ago contended,* that "the relations between the successive faunas, in a latitudinal direction of the shores of the several continents, are traversed by relations existing, in a longitudinal direction."

But I am inclined to think that an unconscious bias from the long-prevalent ideas respecting the pertinence of marine forms to the inland faunas, may have influenced Prof. Dana more than the facts so well presented in his discussion.

I repeat further what I then also urged. There appears to be a total want of correlation between the inland and marine faunas, and a positive incongruity, and even contrast, between the two in their relations to others. This antagonism has been appreciated by very few. In most works it is quietly assumed or insisted upon that the sea and inland animals of a given region are integral constituents of a homogeneous fauna, and by implication, at least, that

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* The Nation, vol. 24, p. 43, July 19, 1877.

such fauna has in its several parts one and the same relation to others. Such is very far from being the case.

The several tropical faunas are, for example, much more closely related to one another than they are to the faunas along the same reach of shore toward the arctic or antarctic regions. This relationship is evinced more or less in every class and branch of animals, *e. g.*, the mammals, the fishes, the mollusks, the crustaceans, the worms, the echinoderms, and the cœlenterates. Consequently, the marine faunas cannot be at all correlated with the primary realms or regions of the globe. To such an extent does temperature determine the distribution of life in the seas that even bathymetrical conditions may be subordinated, and types of the shallow arctic and antarctic seas represented in the cold deep sea under the equator. Some forms almost identical reappear at the opposite poles. The inference is irresistible that such types have migrated from common ground, and may have originally developed either in the deep sea and thence dispersed in opposite directions, or at one of the extremes, and wandered thence over the bottom to their final resting places. However this may be, a primary combination of the marine faunas is most natural under the categories of Tropicalian, Arctalian, and Notalian, while the temperate ones are rather the complexes of the bounding regions.

The views thus enunciated I propose now to reinforce, but it may be expedient to give specific names to the northern and southern temperate regions. The primary marine regions or realms would, therefore, be (1) the Arctalian, (2) the Pararctalian, (3) the Tropicalian, (4) the Notalian, and (5) the Antarctalian.

I.—THE ARCTALIAN REALM.

Arctalia, or the Arctic realm, for the sake of definition, might be confined to the seas of the northern hemisphere, limited southward by the course of floating ice, which descends on the eastern coast of North America as far as the Gulf of St. Lawrence. But so few types are peculiar to that area, and so many of the characteristic forms, such as families of fishes, (Cottidæ, Anarrhichadidæ, Stichæidæ, Cyclopteridæ, Liparididæ, Agonidæ, Gadidæ,) and of mollusks, (Buccinidæ, Lacunidæ, etc.,) as well as other invertebrates, extend further southward, that the isocryme of 44° seems to be a more natural approximate limit. It has the disadvantage (in which it is not alone) of being an empirical boundary without any known relationship to cause, and must be regarded simply as a provisional limit. The isocryme nearly coincides with Cape Cod on the eastern coast, and the Straits of Fuca on the western. Doubtless its limits will require considerable modification hereafter, and it may be doubted whether the isocryme corresponds with the natural limits of the realm elsewhere. All these questions, however, must be left for future investigation.

II.—THE PARARCTALIAN REALM.

Pararctalia, or the north temperate realm, may include the various coast lines between the isocrymes of 44° and 68°, the last being the northern limit of the reef-growing corals. There are few, and perhaps no families absolutely peculiar to it, and it is chiefly distinguished by generic and specific modifications of the Arctalian and Tropicalian realms, commingling in common waters. On our eastern coast, it is characterized especially by such fish types as the genera Alosa, Cyprinodon, Fundulus, Lucania, Scombresox, Siphostoma, Menidia, Xiphias, Pomatomus, Stromateus, Roccus, Centropristis, Orthopristis, Stenotomus, Archosargus, Pogonias, Liostomus, Menticirrus, Cynoscion, Tautoga, Ctenolabrus, Chætodipterus, Astroscopus, Prionotus, Batrachus, Chasmodes, Hypleurochilus, Ophidium, Urophycis, Paralichthys, Pseudopleuronectes, and Malthe. Not one of these belongs to a family peculiar to either the special region in question or the realm of which it forms a part. Most of these genera are represented by congeneric species, or closely related generic types in other parts of the realm.

III.—THE TROPICALIAN REALM.

Tropicalia, or the Tropical realm, may be accepted with the limits assigned by Dana to the "Torrid Zone or Coral-reef Seas," including all between the isocrymes of 68° F., the reasons urged by Dana being quite satisfactory. "In adopting these lines in preference to those of other degrees of temperature we have been guided by the great fact that the isocryme of 68° is the boundary line of the Coral-reef Seas."* The existence of these fixed animals, and the reefs which they elaborate, are among the best of living thermometers, and the numerous forms that are associated with, or dependent on, them for flourishing life concur to make them the most reliable indicators and coincidents of temperature. The characteristic types are very numerous, and among the families nearly or quite confined to it, but common to all its subdivisions, are, of fishes, the Murænidæ, the Ophichthyidæ, the Albulidæ, the Synodontidæ, the Scombresocidæ, the Sphyrænidæ, the Priacanthidæ, the Serranidæ, the Chilodipteridæ, the Mullidæ, the Pseudochromidæ the Carangidæ, the Chætodontidæ, the Acanthuridæ, the Polynemidæ, the Gerridæ, the Pomacentridæ, the Labridæ, (except Labrinæ,) the Scaridæ, the typical Scorpænidæ (Vert. 10 + 14,) the Eleotrine Gobiidæ, the Antennariidæ, the Triacanthidæ, the Balistidæ, the Ostraciontidæ, and the Diodontidæ. The few representatives of these families or sections which occur in temperate seas are chiefly summer wanderers, although a few have established themselves beyond their legitimate realm. With these are associated numerous invertebrate types, many of which the most of you will be able to recall. It includes a portion of the Floridian coast.

IV.—THE NOTALIAN REALM.

Notalia, or the south temperate realm, may provisionally be said to extend from the southern isocryme of 68° to that of 44°. Like its northern analogue, it is distinguished by the commingling of modified derivatives from the cold and equatorial realms rather than by peculiar family types. Among the most noteworthy and char-

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* DANA, op. cit., p. 155.

acteristic of its fish types are various forms of Nototheniidæ, Percophididæ, Chilodactylines, Haplodactylines, and Agriopodidæ. The Selachian genus *Callorhynchus* is also limited to the realm. It thus differs much from the Pararctalian, but, nevertheless, a number of genera, as was long ago shown, reappear in it, although they are absent in the superficial waters of the tropics.

V.—THE ANTARCTALIAN REALM.

Antarctalia, or the Antarctic realm, corresponds to Arctalia, and may cover the antipodal ocean up the isocryme of 44°, (the only continental area thus embraced being Patagonia) northwards on the east to somewhere near or about the mouth of the Rio Negro, and on the Pacific coast to about the latitude of 50° S. As a rule, the fauna is very different from the Arctalian, and to some extent the characteristic arctic types of fishes are represented by analogous types of entirely different families, the role of the Gadidæ being assumed by Nototheniidæ, and that of the Cottidæ by Harpagiferidæ and Chænichthyidæ. Nevertheless, the Gadidæ have an inconspicuous representative and the genera *Myxine*, *Squalus* (*Acanthias*), and *Merlucius* have typical species scarcely or not at all differentiated from their arctic allies.

Lest an exaggerated idea should still be entertained as to the demarcations of the several regions, I think it necessary to repeat specially that not only are the exact limits of such not fixed or fixable, and variable even according to the season, but they may actually coexist in the same vertical, and one may be superposed over the other, or the reverse. An example among many is to be found off the New England coast. It has been repeatedly adverted to by Prof. Verrill,* and is familiar to many of you present. Indeed, as I shall presently show, there are at varying depths horizontal faunal assemblages of animals as well as those superficial or shallow-water ones more familiar to most persons.

*A. E. VERRILL, in the Report of the U. S. Commission of Fish and Fisheries, part I, pp. 484, 485, 1873, etc.

THE BASSALIAN REALM.

At indefinite distances below the surface, even in the tropics, we find strange forms of animal life which differ, not only specifically and generically from those of the superincumbent water, as well as from those of the cold extremes of the globe, but sometimes represent even peculiar families. Those forms which live at moderate depths, existing as they do, in cold water, are related to, or even belong to, the polar faunas, but as we go still deeper we find still other assemblages of animals. Those of the lowest horizons are often wonderfully modified, and the deep-sea explorations of recent years have brought to light many remarkable forms. Among fishes, for example, are certain types that have long been known from stragglers from the lesser deep, such as the Saccopharyngidæ, Nemichthyidæ, Notacanthidæ, Chauliodontidæ, Stomiatidæ, Paralepididæ, Alepisaurididæ, Alepocephalidæ, Regalecidæ, Trachypteridæ, Berycidæ,* Brotulidæ, Macruridæ, and Ceratiidæ, several of which have been greatly increased of late. Other types have been discovered comparatively recently, as the Eurypharyngidæ, Bathylagidæ, Bathythrissidæ, Halosauridæ, and Chiasmodontidæ. It is obvious, then, that we have, in such an aggregate, a combination of forms very different from any of the superficial faunas we have heretofore considered. We will be justified, therefore, in recognizing for them another realm, which we may call Bassalia† or the Bassalian realm. But caution is timely that it is rather a heterogeneous one, and may hereafter require restriction. The data now available are insufficient, however, for differentiating what are, doubtless, the several constituents or regions of this realm.

One of the characteristic features of the Bassalian animals appears to be their wide dispersion and range. The same species may recur at opposite points of the globe, and they appear to be restricted less by latitude and longitude than by bathymetrical influ-

*The Holocentridæ represent another type.

† *Βάσσων*, Doric Greek equivalent of *Βαθυς*, the deep, and *ἁλία*, an assemblage.

ences. Most of the species hitherto found, it is true, have been obtained only about one locality, but it must be remembered that comparatively few individuals have been found, and their acquisition is often due to happy accidents rather than special collecting. On general principles, we are prepared to expect such a wide range. In the abyssal depths, which these animals inhabit, the conditions are perfectly uniform, and have so remained practically for geological ages, and it is, therefore, quite natural that among such forms we should find representatives of types that long ago disappeared from other parts of the globe.

It will be observed that I have given for the several realms names with a uniform termination, employing the suffix *gæa* for the inland and *alia* for the marine ones; the former has been frequently used before; the latter is a transliteration of the Ionic Greek ἁλία, (an assembly or gathering,) and is selected on account of the flavor or reminiscence it involves of the salt of the sea, or the sea itself.* I think myself that such a system of nomenclature will be convenient on accout of dissociating our ideas of geographical realms from precise geographical regions, and also emphasizing the contrast between the inland and marine faunas. Whether they shall be adopted or not, however, must be left for individual preference.

Permit me now to indicate certain desiderata, and how our knowledge of zoogeography may be extended. Full catalogues of all the animals found at specific points will be especially useful, but to insure their usefulness, data should be given respecting their seasonal or permanent sojourn, their abundance, the depths at which they live, and the temperature of the water at various seasons. Great caution should be exercised, too, in admitting forms which may be simply adventitious wanderers, for the *cacœthes acquisitionis* may impose serious obstacles to the proper appreciation of zoogeographical principles. Of course, I do not mean that the

* Compare συναλίζω (from σύν and ἁλίζω) to assemble or, radically, come together around the salt.

casual visitants to a country should be ignored, but I do think that it is a wrong to science to enumerate, for examples, an European vagrant to America, never found but once, and not likely to recur again for an indefinite time, if ever, or an American bird that has been once found in Britain, in a line with the well-known members of the respective faunas. Their place would be most natural in an appendix or foot note, and they should at least be without the serial numeration, if such is given, of the catalogue of permanent and seasonal members of the fauna. Let me also protest, as I have done several times before, against the incorporation of Bassalian types with the species of littoral faunas nearest to them geographically. With catalogues and data, such as I have indicated, at hand, we could soon determine, as closely as practicable, the limits of most of our faunas, and the general attention now paid to natural history holds out the hope that the coming time may not long be deferred.

In conclusion, I submit a few deductions that naturally result from our observations.

A distinction is to be made between the territory occupied by an association of animals and the occupants thereof, and the limits of faunas cannot be exactly correlated with territory, except in rare cases.

The significance of animal types as indicators of zoogeographical regions is, other things being equal, in ratio to their recent development.

The fresh-water types are the best indicators of the early relations of the respective regions.

The flying, and especially migratory, types are the most accordant with the actual relations of land areas.

Temperature is a prime factor, and land a secondary, in the distribution of marine animals.

The lay of the land is a primary, and temperature a secondary, factor in the distribution of inland animals.

CERTAIN PHASES IN THE GEOLOGICAL HISTORY OF THE NORTH AMERICAN CONTINENT, BIOLOGICALLY CONSIDERED.*

By Charles A. White.

It is quite certain that there has never been a time in the history of mankind when the thoughts of men were so eagerly turned to biological subjects as they are to-day; nor has there ever before been a time when an intelligent knowledge of them was so broadly diffused among cultivated persons. An earnest desire is everywhere manifested by such persons to obtain substantial knowledge concerning the animal and vegetable life of the earth, and of the broad significance of that life, which is revealed by a comparative study of its myriad forms. The investigator immediately finds that this subject, although it is so comprehensive and so complex, is only a fragment of a great history of life, which extends back through unnumbered ages. He finds himself at once confronted by questions concerning successive multitudes of former denizens of the earth, the physical conditions which prevailed when they existed, the probable lines of descent by which they came into being, and by which their successors have come down to the present time; and the manner in which those lines have probably originated and been preserved from destruction through successive geological periods.

This prevalent spirit of inquiry among men has been the cause of a vast amount of patient and exhaustive research, and it has also resulted in a large accumulation of knowledge. But it cannot be denied that every investigating naturalist, although he may fully accept the doctrine of evolution, finds the subject of the origin and derivation of the various groups of animals that now inhabit the earth, and those which have inhabited it during past geological time, to be beset with many difficulties and uncertainties.

* Presidential Address delivered at the Fourth Anniversary Meeting of the Society, January 25, 1884, in the Lecture Room of the U. S. National Museum.

As a rule, too, he finds that the questions which arise in connection with the probable manner in which the various groups of animals have originated and become distributed over the earth are too complex to allow of their reduction to even approximately simple propositions. Still, the accumulated results of the various and extensive investigations which naturalists have made of late years have placed the general subject of the evolution of organic forms in such a condition as a working hypothesis, that some of its various divisions may be treated with considerable detail, even with reference to extinct faunas. Furthermore, in a great number of cases, the facts which have been observed are of such a character as to warrant opinions of so important a nature that they may be legitimately used as a basis for philosophical discussions. It is mainly upon such facts and opinions as these that the following remarks are based; and while the conclusions and opinions which are here expressed are believed to be fully warranted by known facts, it is only too evident that much, which it is very desirable to know in this connection, still remains beyond our reach.

That I may more clearly present my subject, I submit the following statement of certain views which I hold in relation to it; and, for the purpose of greater conciseness of statement in the remarks which are to follow, I shall refer to those views somewhat as if they were supported by established and acknowledged facts.

The general subject of the probable origin of the different forms of animal life, and their perpetuation through geological time being so broad, I must confine myself to such small portions of it as my studies have led me to understand as having an important bearing upon the geological history of the North American continent. I must, furthermore, confine myself to such portions of the subject as relate to terrestrial life only, leaving largely out of consideration the subject of marine life.

Since the points I wish to present are somewhat disconnected by our present imperfect knowledge, I must trust to making their relevancy more apparent when I come to make the proposed application of them. A discussion of formerly existing vegetable forms would also be of great interest, but I must omit all except incidental reference to that subject also.

In all investigations into the history of ancient life upon the earth, regard must be had to the functions that animals perform, and to the conditions under which those functions are executed. The requisite conditions for the performance of the physiological functions in the simplest animal forms, the Protozoa, for example, render it practically certain that the primary origin of animal life occurred in water; and it doubtless occurred in the sea. The first animal life having necessarily been of aqueous origin, we must assume that the first air-breathing animals were developed from those of aqueous respiration.

Fresh-water mollusks and fishes, especially the former, have, I believe, primarily become such by a change from their originally marine habitat, mainly by compulsion; that is, their progenitors lived in the sea and became land-locked by the unequal elevation of the sea bottom upon, or over which, they lived while the continental areas were in process of elevation. The waters of the districts thus inclosed and elevated above the level of the surrounding sea became first brackish, and then fresh, in consequence of the influx of fresh water from the drainage of the surrounding land, and a consequent outflow into the open sea. Those of the sea-born animals which became thus inclosed, and which were capable of conforming to the new conditions, did so, and peopled the river systems which were produced in connection with, and which succeeded, these fresh-water lakes. Those which could not thus conform to the new conditions became extinct; and as these appear to have constituted the larger part of every fauna which became land-locked in the manner referred to, we may reasonably conclude that the lines of descent of many of the groups of marine animals have been broken by this means.

River systems have resulted upon the disappearance, by final drainage, of the fresh-water lakes just mentioned, the inlets having been prolonged across the former lake bed as upper branches of the system, the former outlet becoming the main stream, and the whole a finished river system, with its fauna derived from the lake in which the system originated.

It is a well-known fact that many fishes, in connection with their breeding habits, pass from marine to fresh waters, and return to marine, with entire indifference to the change. Again, some existing so-called land-locked fresh-water fishes are believed by naturalists to have become such by choice, or by a failure on their part to continue their periodical returns to the sea where their kind originated, even when there was no apparent physical obstacle to their returning. It is probable that many similar cases have occurred in former geological periods, and also probable that a few mollusks and other invertebrates have, during those periods, in like manner changed from a marine to a fresh-water habitat; but I believe that, as a rule, fresh-water faunas have primarily become such by compulsion, in the manner that has just been suggested.

Admitting this proposition, we need not attempt to trace the genetic lines of fresh-water fishes as such any further back than the time of the compulsory land-locking of their progenitors; but this would not forbid speculation as to what kinds of marine fishes the fresh-water forms originated from.

It is possible that, in cases of sinking beneath the sea of land areas, upon which fresh waters with their faunas had become established in former geological periods, the sea has reclaimed and preserved alive some of its previously alienated mollusks and fishes; but this is a matter concerning which we can, at best, make only vague conjectures.

The reason why the animal life of fresh waters is so meagre, as regards the number and variety of kinds which they contain, when compared with the teeming and diversified life of the sea, are various. First, the presence of sodium-chloride and other salts in water has evidently been conducive of evolutional differentiation; and there can be no doubt that common salt has played a remarkably important part in the evolution of the different forms of animal life which have existed upon the earth. Second, in those cases of land-locking of marine animals by a rise of the sea bottom in the manner already suggested, only a part of the fauna then existing there would probably have become inclosed, because many of them would no doubt have escaped into the outer sea before they were fully surrounded by land. Third, only a part of those which were finally land-locked were able to survive the change from salt to fresh water. Fourth, a large proportion of marine gill-bearing animals appear to be, and always to have been, wholly incapable of living in fresh water.

Among those marine animals which seem to have been wholly or mainly incapable of surviving a change of habitat to fresh waters, and which, we may assume, did not escape land-locking, together with the other forms, in the numerous cases of the kind which have occurred in past geological periods, are several of the entire comprehensive groups into which the animal kingdom is divided. For example, we learn from the study of existing faunas that, with the exception of a few inconspicuous forms of the Cœlenterata, which are so abundantly represented in marine waters, this important sub-kingdom is not represented in any fresh waters; also, in fresh waters the entire classes, Echinodermata, Tunicata, Brachiopoda, Pteropoda, and Cephalopoda, are without any known representation. Besides these large deficiencies in fresh-water faunas, as compared with those of the sea, there are numerous minor, but no less important, deficiencies, occasioned by the entire absence of a considerable number of orders and families, as well as parts of others.

It would doubtless be unsafe to say that any of those animals could not possibly have survived a change to a fresh-water habitat; but there is much reason to suppose that they possess some inherent quality, which has prevented the survival of their ancient representatives, whenever their habitat may have been changed from a marine to a fresh-water condition. Indeed, if such changes of aqueous condition had been effected suddenly, it is probable that none of the marine animals having aqueous respiration, which may have been thus inclosed by the rising land, would have survived in any instance. The comparatively few forms that did survive in fresh waters doubtless had much time in which to conform to their gradually effected new conditions.

It is probable that air-breathing mollusks have all been originally derived from those of aqueous respiration; and that this important change, and a consequent necessary change of habitat, has been accomplished mainly by a process of natural selection which was voluntary on their part, as compared with that by which the gill-bearing mollusks are assumed to have survived the change from salt to fresh waters. Again, that the air-breathing mollusks are confined to the class Gasteropoda, while other mollusks have evidently had equally good opportunities to become air breathers, is a significant fact, but one which, like that of the origin of the air breathers, I cannot discuss at this time.

While we may not doubt that the whole of the existing life of the globe has come down from former geological periods in unbroken genetic lines, the fact has not been demonstrated by tangible evidence; and it is well to consider briefly some of the causes of the imperfection of the geological record in that respect. By an investigation of this subject, we shall find that, while a multitude of such lines have certainly terminated at various periods before reaching the present time, it is not necessary to infer that any of them have been imperfect simply because we have not found the proof of their continuity in the shape of fossil remains. The lack of such proof is due to various causes. For example, only the hard parts of animals are capable of fossilization, and many animals have no hard parts. The greater part of the fossiliferous strata of the earth, which now exist as such, are not, and never can be, accessible to human investigation; and a vast amount of fossiliferous rocks, now classed as Azoic, may have once contained abundant remains of animal life, but which have become completely obliterated by metamorphism or other causes.

Finally, even the hard parts of animals, and especially those of land animals, are, and always have been, subject to rapid decomposition when exposed to atmospheric influence, although they may be preserved indefinitely when buried beyond the reach of such influence. It is this rapid destruction of the remains of land animals which is largely the cause that their geological history is so incomplete as compared with that of marine life.

An illustration showing how rapidly traces of important land faunas may have disappeared in former geological times is furnished by the living bison, or buffalo, of North America. Perhaps the earth has never witnessed such enormous numbers of any one species of large animals occupying such a broad continental area, as in the case of the buffalo. Its range once extended from the vicinity of the Atlantic to the mountains which border the Pacific coast, and from Mexico to near the Arctic circle, and its numbers were so great, even within the last twenty-five years, as to impede travel across the great plains of the West. So rapidly is this animal now passing away that it has disappeared from all but a fraction of its former range; and I venture the prediction that there are persons now living who will witness its entire extinction in its free state. It is true that relentless man has brought about this wholesale destruction, but that does not alter the force of the application I wish to make of the fact that the buffalo is passing away and leaving, by natural means, hardly any trace of its former existence. In all that region where it has lived so many centuries in abundance, traces of even its bones and teeth are rarely found.

Few places in all its former wide range have furnished the conditions necessary for the preservation, by sedimentary interment, of the bones of the buffalo beyond the reach of atmospheric influence; and the result has been that they have generally disappeared by decomposition as completely as the flesh has done. It is doubtless in a similar manner that the other great terrestrial faunas have been destroyed in former geological periods, for the remains of terrestrial animals have not usually fallen in conditions at all favorable to their preservation, as compared with those of aqueous animals, which have had almost immediate sepulture.

I fear that in consequence of these remarks, following those with which I began to address you, some will be ready to suggest that naturalists have insecure ground to base their generalizations upon, as regards the origin of the existing animals of the earth by lineal descent from extinct faunas. I fully recognize the danger, in such an address as this, of giving undue prominence to the doubtful side of the subject. It is difficult also to satisfactorily present the affirmative side in a brief and concise manner, because that side is supported by evidence which is cumulative in its character, rather than reducible to precise propositions.

My object, however, in showing how completely great faunas may have been destroyed in past geological time is to plausibly account for the absence of their remains in places where our methods of reasoning lead us to expect them; and also to show that, because their remains have never been discovered, we should not necessarily infer that the animals which were necessary to complete a regular genetic scale never existed. Indeed, the fact that certain breaks in the zoological scale occur at certain horizons of the geological scale ought to lead us to infer that the missing animal forms did exist somewhere at such times, rather than that they never existed at all.

Now, as the study of the genetic descent of animals through geological time is based upon plan of structure, and the methods by which form is expressed, these indications may be ranged under two heads, namely, similarity of structure and identity of type. The former is a matter of tangible details, but the latter is in some sense ideal, or a manner in which form, in connection with structure, is expressed. The former is material in its character, but the latter is not the less real and important to the naturalist in the philosophical study of the comprehensive groups of animals.

The word "type," like many other words in the English language, is used with a variety of meanings; and as I use it here in a special sense, I may be excused for adding the following words of definition : I regard a type as an ideal representation of a group of species which may embrace the whole of a comprehensive genus, or possibly more; or it may be only a subordinate division of a genus. I do not use the term as interchangeable with any of the terms which are used in systematic classification, such as species, genus, family, &c.; but sometimes it may be equal in scope to any of them, as, for example, when only a single species of a genus or of a family is known. It may, however, be properly substituted for species, genus, &c., in cases where, as in the Ostreidæ, for example, specific and generic diagnoses cannot be satisfactorily made. I shall, in the following remarks, have somewhat frequent occasion to refer to types, as just defined, and to their persistence through the geological periods, for I shall assume identity of type to be proof of lineal descent.

The fact that genetic lines of descent among animals have come down to the present time through successive geological periods being admitted, we may next inquire as to the manner in which they have been preserved, or rather how some of them may have escaped destruction during the physical changes which have occurred since those lines were established. I must necessarily make occasional reference to marine faunas in the following remarks, but it is my present purpose to discuss only those terrestrial and fresh-water faunas, the remains of which are found within the present limits of North America.

The manner in which lines of descent of the various families and types of animals have been preserved through the geological ages, and in which their perpetuation has been secured, has necessarily been different in the case of different kinds of animals. The sea having always occupied the greater part of the earth's surface, notwithstanding the shiftings of land and sea, which have, from time to time, taken place ever since land and sea first appeared upon the earth, one may readily understand how unbroken perpetuity of marine life may have been secured from the earliest dawn of life to the present time. It is not to be doubted that numberless lines of descent of marine, as well as of land, animals have terminated during past geological periods, both from catastrophal and cosmical causes; but we may reasonably assume that all the multitudinous forms which people the sea to-day have been derived by direct lineal descent from those earliest forms which the sea contained at the dawn of life upon the earth. At least, if this has not been the case, there is nothing in the nature of the proposition that makes it improbable; that is, there have been no such changes upon the earth since life began as would at any time have necessarily destroyed all, or any considerable part, of the marine life previously existing.

The lines of descent of land animals have, however, been subject to greater vicissitudes; and the conditions under which they have originated and been perpetuated have been more various than those which have prevailed in the sea. Still, one may readily understand how land animals, which may have occupied a given region of the earth at any geological period when the physical conditions of the land which they occupied were changing, may, by their power of locomotion, have shifted to more congenial places, because, as a rule, such changes have not been too rapid to hasten unduly even the proverbially slow-moving snail. Thus land and palustral air-breathing mollusks, although they all require a moist habitat, could easily migrate to other congenial ground, as the land they were occupying may have become too dry for them or may have subsided beneath the sea. Therefore, their migration has always been practically unrestricted; and if, as is believed to have been the case, continental areas have been continuous, though subject to material changes and shiftings from early geological times, there appears to be no reason why, at least, many genetic lines of those animals should not have been continued from those ancient times to the present.

The case has been quite different as regards true fresh-water fishes and fresh-water gill-bearing mollusks, all of which can, of course, exist only in fluviatile and lacustrine waters. When we consider how extensively the earth's surface features must have been changed during the successive geological periods, it would at first sight seem impossible that continuous lines of descent of such animals as these could have been preserved through any considerable portion of them. That is, those gill-bearing animals which may have occupied any given river system could not effect their distribution, or even their preservation, by migrating beyond its limits, in case their habitat should be destroyed by movements of the earth's crust. They could not pass over the land to any portions of other river systems, nor could they pass through the sea to reach the mouths of other rivers. We have, however, very satisfactory evidence that a large part of the living gill-bearing animals of North American fresh waters have come down by unbroken genetic lines from some period at least as remote as the close of the Cretaceous.

Now, a continuity of these lines of descent necessarily implies a continuity of their fresh-water habitat from the time of the origin of those lines to the present time. This continuity again implies the integrity of those river systems in which the mollusks originated, from those early times to the present. This last proposition, as a geological one, is comparatively new; but the labors of Powell, Gilbert, and Dutton have shown that rivers, in many instances at least, have been among the most permanent of geological, as well as geographical, features; that even the elevation of mountain ranges across their course has not swerved them from their ground; but that they have cut their way through the ranges as fast as they arose.

A vast number of rivers, which have drained the land in past geological times, have undoubtedly been destroyed by the submergence of the land and other causes; but I think we are justified in the assumption that many of the streams which were established, even as far back as the close of the Cretaceous period, are still flowing as parts of existing river systems. In this way, a large part of the gill-bearing faunas of the rivers of to-day have, by direct lineal descent, and in unbroken habitats, been transmitted from long past geological periods.

As to the manner in which the great vertebrate and articulate land faunas which now exist, and which have existed in former geological periods, have been respectively developed from lower forms, I have, at present, no suggestions to offer; but it is, nevertheless, assumed that they have been thus developed. It may be remarked, however, concerning their origin and perpetuation, that while certain minor faunas of terrestrial animals may have originated and been perpetuated upon comparatively small areas, it seems certain that the development and perpetuation of the great reptilian faunas, which existed during Mesozoic time, and also that of the wonderful mammalian faunas, whose remains are found in Tertiary strata, required large and congenial continental areas. It also seems necessary to infer that those continental areas, although they, from time to time, suffered material losses, and received considerable accessions of land, have been of true continental dimensions from early geological time.

The general subject of the geological history of continents is so complex and far reaching, and our present knowledge of that subject so fragmentary, that I shall not now attempt even an outline of such a history for North America; but I shall confine myself to what I conceive to be some of the more salient points of that history from a biological standpoint only.

If the geological history of animal life is incomplete and fragmentary, a like history of continental areas, especially as regards their location and outlines at different periods, is much more so. In the former case, we are guided in our investigations and conclusions by a known zoological system, which is based upon the abundant and diversified existing life of the earth. In the latter case, we are apparently without any available systematic guide; and the various phases of geological history of continents seem to have been the result of fortuitous movements of the earth's crust, in connection with sedimentation and sub-ærial and aqueous erosion. Not that those movements and processes have not been governed by physical laws, but the events, so far as we have yet learned indications of them from the study of existing continents, appear to have lacked such relations with each other as to give any satisfactory history of continuous continental growth.

The opinion has prevailed among geologists that the North American continent, as a whole, had its origin as a result of the gradual contraction of the mass of the earth, by which certain depressions and elevations were formed upon its crust. The former, it has been understood, became permanently the ocean beds; and the latter, gradually rising above the level of the sea, became continents, whose outlines were changed, from time to time, by continued elevation, alternating with greater or less depressions; and also by coalescence of previously separated parts, and by accretions upon, and erosion from, their borders. This opinion implies that continental areas were pre-determined, that they have been permanent in their location, and that no such areas have ever occupied the broad spaces which are now occupied by the great oceans.

I do not now intend to discuss this theory, but I may say in passing, that a number of important facts do not, in my judgment, agree with it, and I regard it as more probable that continental areas have shifted from place to place in past geological time. But without reference to that theory, certain known geological facts seem to show that the present continent arose from the sea in separate portions, the larger and older being its northeastern portion; and that the western portions were elevated afterwards, and finally coalesced with the eastern. Furthermore, that the continent reached its present dimensions and shape by more or less extensive accessions upon its borders, especially those of the great gulf and the Pacific ocean.

While the following remarks will mainly refer to animal forms, certain known facts concerning the vegetable life of the past are so important in this connection that they should be at least briefly mentioned. If we regard the graphite which has been found in the Archæan rocks, and the petroleum of Silurian strata, as having had their origin in land plants, the history of the land vegetation of the continent begins much further back than the earliest period in the strata of which we have yet discovered any indications of land animals. It is probable that land animals of the simpler kinds co-existed with the first established land vegetation; but with the exception of some imperfect remains of a species of land snail, and those of a few insects, which have been found in Devonian strata, the remains of the earliest known land animals have been found in strata of Carboniferous age. These Carboniferous land animals comprise a few batrachians, insects, and air-breathing mollusks; and although they are so few, they evidently represent portions of a large and varied fauna which then existed. They are also so highly organized and so diversified in character as to indicate that they originated in genetic lines which began in earlier periods, more or less remote.

The Carboniferous air-breathing mollusks referred to are both land and pond snails, and they have been found in widely separated portions of North America. They all belong to types which are represented by mollusks now living upon this continent, and by those also which are known to have existed here at intervening periods. These facts seem to indicate plainly that land surfaces of considerable extent have been continuous from that early period to the present; but they tell us nothing yet of continental movements which may have taken place in the meantime.

Our knowledge of the relations of the different portions of living non-marine molluscan faunas would naturally lead us to suppose that fresh-water gill-bearing mollusks existed simultaneously with those ancient air-breathers. Nevertheless, with the exception of certain bivalves, which have been found in Devonian strata, and others in the Carboniferous, which have been doubtfully referred to a fresh-water origin, fresh-water gill-bearing animals are not known to have existed before the beginning of Mesozoic time. It is, however, reasonable to suppose that such animals did exist in Paleozoic lakes and rivers, although no satisfactory traces of them, or of such bodies of fresh water, have ever been discovered.

As regards Paleozoic fresh-water fishes, they may or may not have existed. According to our present knowledge, teliost fishes, although they have been so abundant in both fresh and marine waters ever since Mesozoic time, had no existence in Paleozoic time. Marine ganoids were then abundant, and the Mesozoic, Tertiary, and living fresh-water ganoids may have been derived from some of them by lineal descent through fresh waters, but they probably originated by land-locking from the sea during later periods.

Viewing the animal and vegetable life of the earth as having been expressed in continuous series of forms, we ought not to expect to find that the geological ages were separated from each other by hard-and-fast lines, as regards the fossil remains of those series which characterize the strata of each age respectively. When such lines appear to be distinct, I think we are justified in assuming that the geological record is incomplete; or, in other words, that the forms necessary to complete that portion of the series really existed at the close of the one age and the beginning of the next; but that they are not represented by any discovered fossil remains.

The division between the Paleozoic and Mesozoic of North America, so far as the geology and paleontology of the continent is yet known, is much more distinctly marked than it is between the Mesozoic and Tertiary. This is especially true as regards plants. The greater part of the peculiar forms which characterized the abundant vegetation of the Carboniferous age seem to have suddenly ceased to exist with the ushering in of the Mesozoic age; and no representative of the dicotyledonous flora, which was so abundant in the Mesozoic and Tertiary, and which is so preponderant upon the earth now, has ever been discovered in any of the Paleozoic strata of the earth. From an evolutional standpoint, however, we cannot suppose that such an extensive and highly organized flora came suddenly into being; and we are left to infer that it was gradually developed somewhere, and during a period prior to that which is represented by the strata which contain the earliest known remains of the kind. The small number of land animals, that are known to have existed in those early periods, do not seem to indicate so distinct a separation of the Paleozoic and Mesozoic as the plant remains do; for the types of the former have come down to the present day. The land snails, before referred to, furnish remarkable examples of types of animal life which have passed from the Paleozoic to the Mesozoic age, and thence down to the present time.

Although the biological evidence seems to be conclusive that, from the earlier Paleozoic to the present time, considerable portions of land have been continuously above the level of the sea within the area which is now occupied by the North American continent, we have no indication from such evidence as to the shape and dimensions which those early land areas successively assumed. We are, however, justified in the opinion that some of them were of great extent. From a biological point of view, also, I regard it as probable that extensive land areas formerly existed adjacent to that which the present continent occupies, and that they have been lost by submergence and erosion. This opinion, I think, derives strong support from the apparent sudden beginning, and the equally sudden termination, of certain extensive faunas of highly organized land animals, which are known to have existed and become extinct.

I do not forget, however, that our knowledge in this respect is slight, and that it is possible that the progenitors of these faunas may have existed within the bounds of the present continent, and that their remains may have been destroyed, so as to have escaped the scrutinizing search that has been made for them. But in view of all the known facts, both geological and biological, I at present hold to the opinion just expressed.

The existence of the immense and diversified dinosaurian faunas of Mesozoic time, subsisting, as they did, largely upon vegetation, seems necessarily to imply the co-existence of large land areas: also their apparent sudden introduction at the beginning of that age seems to make it necessary to conclude that their progenitors existed somewhere before the close of Paleozoic time, although no remains of those progenitors have been discovered. Because no trace of the progenitors of either the dinosaurian faunas or dicotyledonous floras of the Mesozoic age have been discovered in previously existing strata, I am disposed to conclude that those progenitors originated upon, and occupied, land areas, which became gradually submerged, together with their ancient faunal and floral remains; while their living successors escaped by migration and dispersion to adjacent and unsubmerged portions of land, which are now within our continental area.

There is reason to believe that during the Triassic and Jurassic periods large continental areas were above the level of the sea, within and near the present limits of the North American continent; but we know comparatively little of the terrestrial life of those periods from actually discovered fossil remains.

If we except the Paleozoic bivalve mollusca of supposed fresh water origin, which have already been referred to, the remains of the earliest fresh-water molluscan fauna, of which we have any satisfactory knowledge, are found in Jurassic strata. These Jurassic mollusks belong to well-known types now living in the fresh waters of this continent; and they are also so highly organized as to point back to a still more ancient period, as that of their origin. These mollusks suggest the existence during the Jurassic period of fresh-water lakes and rivers within what is now Western North America, and the lakes and rivers in turn suggest the existence then of a considerable continental area. It is possible that those Jurassic rivers were, in part, portions of river systems which had held a persistent existence from former geological periods; but we have no direct paleontological evidence of it. This gill-bearing molluscan fauna seems also to be ancestrally related to faunas which are known to have existed in subsequent periods, as well as to certain fresh-water mollusks now living in North America.

A few species belonging to the fresh-water family Unionidæ have been discovered in Cretaceous strata of the western portion of this continent, but they all appear to be of different types from any of the family now living. I take this to be an indication that the fresh waters in which those Uniones lived were not continued to later periods, as some other ancient streams of fresh water were, together with their molluscan faunas, and that the lines of descent of those mollusks were consequently cut off and their types extinguished.

While many rivers have persistently held their ground through several geological periods, despite even the elevation of mountain ranges across their course; the fact that great numbers of them have been destroyed in past geological time by the physical changes which have taken place in the regions they have occupied, is too evident to be questioned. One of the many examples of the destruction of bodies of fresh water which have become established upon the earth in former geological times is suggested by the presence of a true estuary deposit among the Cretaceous strata of Northern Utah. This deposit, which is a rare one of the kind, was evidently formed at the western border of the oceanic belt, which, it is understood, then traversed the whole North American area in a northward and southward direction, between two separate continental areas, and at the mouth of a river which then drained part of the western area. The region which that oceanic belt then occupied is now the heart of the continent, and all traces of the ancient river referred to are obliterated. Furthermore, the district which it drained to the eastward is now drained by other channels running in the opposite direction, into the Salt Lake Basin. I shall presently have occasion to refer again to this estuary deposit and to others which no doubt co-existed with it along the shores of the same sea.

The period which immediately succeeded that in which the last of the marine Cretaceous deposits were made, and which contains the estuary deposit that has just been referred to, namely, the Laramie period, witnessed the production of one of the most remarkable features which has ever characterized any continent. This feature was a great inland sea, holding both brackish and fresh waters, as the Caspian does now, but which was in other respects more like the Black sea, because the latter has an outlet. It was immensely larger than either, but its full size is not known. Its deposits, however, are now found to occupy large districts, at intervals from Northern Mexico to the British Possessions, and from near the meridian of Great Salt Lake to western Kansas and Nebraska. It occupied the region which, in the immediately preceding period, was occupied by the oceanic belt before referred to. This belt was changed from an oceanic condition to that of an inland sea, by such a rise of the sea bottom at both the northern and southern portions of the belt as connected together the eastern and western continental areas, and gave the inclosed sea its inland position upon the great united continent.

That the waters of this great inland sea were soon considerably freshened, is shown by the fact that its deposits contain no remains of true marine forms. That its waters were in part brackish, is shown by the presence of the remains of a large variety of forms similar to those which now inhabit brackish waters only, and that they were in part fresh, is shown by the presence of fresh-water forms. A commingling of brackish and fresh-water forms is sometimes found in the strata of the Laramie group, but usually the two kinds are found respectively in alternating layers. This last named fact indicates that there were, from time to time, such oscillations of the bottom of this sea and its surrounding shores, as shifted the salt and fresh-water areas respectively, so that their deposits locally alternated with each other. And yet sedimentation in the Laramie sea went on continuously from the time when it was a part of the open ocean, and also continuously into parts of the fresh-water lakes which succeeded it.

That this great inland sea contained, at times, broad islands, and extensive marshes covered with a luxuriant vegetation, is shown by the abundant beds of lignite and other vegetable remains; and that its marshes were peopled by great dinosaurs and other reptiles, is shown by their remains, which are now found in various portions of the Laramie group. That many fresh-water streams emptied into this great inland sea from the surrounding land, and that the sea had at least one great outlet, are necessary conclusions.

Now, the waters of the oceanic belt, which immediately preceded the Laramie sea, contained an abundant marine fauna, a large part of which necessarily died by the subsequent freshening of the waters, and in consequence of this, as we may suppose, many lines of genetic descent were broken. The surviving faunas were able to thrive in brackish and fresh waters respectively, both of which, as already stated, the Laramie sea contained. That the brackish-water forms, which survived in the Laramie sea, originated in the estuaries which existed upon its borders, before that sea was cut off from the open ocean, is probable, from the fact that those forms are largely identical in type with certain forms which are known to have existed in the same region just prior to the Laramie period. That the progenitors of the fresh-water Laramie species may have occupied some of the streams which emptied into the sea before it became land-locked is probable, but I regard it as also probable that they originated, at least in large part, in the Laramie sea.

Accepting the conclusions which have just been expressed, concerning the former existence and the character of the Laramie sea, which conclusions I have reached from a biological standpoint, we obtain a remarkably comprehensive view of the conditions which prevailed, during the Laramie period, upon what was destined to be our continent. There rises before the imagination of the investigator—an imagination chastened and curbed by a rational interpretation of facts—a great continent, whose outlines, it is true, are hidden in the mists of uncertainty; but he sees, resting upon its broad surface, an inland sea, the like of which for magnitude the earth has never known before or since. On every side stretches away a broad expanse of comparatively level country; a few mountains are seen in the distance, but not a peak of the great Rocky Mountain system has yet arisen. The land is covered with verdure and diversified by forests of wonderful growth; the busy hum of insects fills the air; the bright scales of fishes gleam in the waters of the sea;

huge terrapins crawl upon its beaches, and the jungles along its shores are peopled by a strange fauna, of which the dinosaurs are chief.

At the close of the Laramie period, there were such movements of the earth's crust as to change to dry land the greater part of the bottom of the Laramie sea, and the remainder was occupied by large bodies of water, greatly larger than our present great lakes, which then became wholly fresh, and so continued through a large part of the Tertiary period. It is in the deposits which those great fresh-water lakes have left that have been found the remains of the wonderful mammalian faunas, which have become so celebrated in North American geology. Other faunas, equally wonderful, have probably existed elsewhere, which have shared the fate that is now overtaking the buffalo, and that might have overtaken those Tertiary animals also, were it not for the very favorable conditions for entombment of their remains, which the sediments of those lakes afforded.

Up to the close of the Laramie period, through the whole of which a large dinosaurian fauna was continued, and in the strata of which there is a commingling of Cretaceous and Tertiary types, we have no evidence, in the shape of fossil remains, of the existence of any mammals except about a dozen small marsupials. The Eocene Tertiary strata, which rests directly upon those of the Laramie group, contain the remains of a mammalian fauna, which, for magnitude, diversity, and high organization combined, has never been excelled upon the earth. Nevertheless, we know nothing of the ancestry of this great fauna, so far as fossil remains are concerned, although the geological series of the preceding formations is quite complete; and those formations have been carefully searched for such remains. The dinosaurian fauna of the Laramie period seems to have ceased as suddenly as the mammalian fauna was introduced.

Since faunas have originated under favoring, and become extinct under adverse, conditions, the subject of the extinction of faunas is quite separate from that of their origination, although they are in this case brought into immediate juxtaposition. The great dinosaurian fauna of the Laramie period doubtless originated much earlier, and came down under continuously favorable conditions from the earlier Mesozoic periods, and which favorable conditions were not interrupted by the land movements by which the Laramie sea was inclosed. Their final extinction appears to have resulted from an unequal struggle for existence, which ensued upon the introduction upon the land they had previously occupied of the immense mammalian horde whose remains are found in strata immediately overlying those which contain their own. The mammals thus became the leading forms of life upon this continent, as it then existed, as the dinosaurs had been during Mesozoic time.

For reasons already stated, we assume that the progenitors of this great mammalian fauna, whose appearance upon the earth seems to have been so sudden, really existed somewhere long previous to the time which is represented by the strata in which the remains referred to are found. I regard it as probable that those progenitors occupied some continental area, adjacent to that which the present one now occupies, and which, after the migration of the fauna to the region where their remains are now found, superimposed upon those of the dinosaurs, became destroyed or submerged.

It does not seem to me probable that this mammalian fauna could have previously occupied either the eastern or western portion of North America, as they are understood to have existed then, because those portions were already united at the beginning of the Laramie period, when the Laramie sea was formed, and their earliest known remains are found in strata which were deposited after the close of that period; that is, I hold that the known facts warrant the opinion that the immediate predecessors of the Tertiary mammalia referred to, themselves of Tertiary types, originated and long existed contemporaneously with the dinosaurian fauna of the Laramie period, but in a land which was separate from that which the latter occupied. Furthermore, that the land area which the mammalia then occupied is now unknown; but that it became united to the dinosaurian region, as one of the results of those land movements by which the Laramie sea was destroyed.

I am well aware that this proposition is not fully established, but the series of strata preceding those which contain the mammalian remains is so complete as to indicate the prevalence of conditions, through at least the whole of the Laramie period, which were as favorable for mammalian existence as those of any subsequent period. And, although that series of strata has been quite as fully investigated as any other strata of the west, no trace of the ancestry of the mammalian fauna referred to has been discovered.

The immediate superposition of the remains of the mammals upon those of the dinosaurs, at the junction of the two formations which contain them respectively, indicates that the two mighty faunas met upon the same ground, in a contest for supremacy, which was decided in favor of the mammals, and that the dinosaurs then disappeared from the face of the earth. That this veritable "battle of the giants" was sharp and decisive, is probable, from the fact that there is no such association of the remains of the two faunas as to indicate that they lived together any considerable length of time.

Other strange and interesting land faunas succeeded those mammals which have just been referred to, but time will not permit me now to speak of them. I will therefore close my remarks with some reference to the manner in which, as I conceive, a large part of the gill-bearing fauna of the Mississippi river system has originated, effected its descent to the present time, and attained its present broad distribution.

The close similarity which exists between the molluscan fauna of the Laramie group and that of the present Mississippi river system, is apparent even upon casual observation. A large proportion of those mollusks are not only of the same types in each fauna respectively, but it is difficult to say how some of the fossils differ specifically from the living forms. This resemblance is strikingly exemplified among the Unionidæ. Those of that family now living in the Mississippi river system comprise a large variety of peculiar forms, differing so much from those of other parts of the world that they are designated among naturalists as "North American types." The Uniones of the Laramie group, of which a considerable number of species have been discovered, are mainly of these North American types, and I, therefore, conclude that these fossil forms represent the living ones ancestrally. This conclusion of course implies that there has been an unbroken habitat for those fresh-water mollusks, from the Laramie period to the present time. Accepting this conclusion, we necessarily understand that the outlet of the Laramie sea continued to flow as a river after the disappearance of that inland sea and down to the present time, and that that river is now the Missouri, or one of its tributaries. The Laramie deposit also contains the remains of certain ganoid fishes, which are closely relatedto the gars (*Lepidosteus*) and dog-fishes (*Amia*) of the Mississippi, and the fishes doubtless effected their descent in the same waters with the Uniones.

If geologists have read the later history of the North American continent correctly, we learn that at the time those ancient inland bodies of water existed, the great Southern Gulf extended so far to the northward that it probably received the outlets of those bodies of water as separate streams. The same conditions would also have made the Ohio and Upper Mississippi separate rivers, emptying by separate mouths. While these two last-named rivers were separate from the western one, which drained the lakes and the inland sea, they doubtless had faunas which were quite different from that which now characterizes them. When, by a recedence of the borders of the gulf to the southward, all those rivers united their waters to form the main stream of the Mississippi, it is easy to see how the ancient fauna, which had come down the Missouri branch, may have become dispersed throughout the great river system.

I have thus endeavored to point out from among the great mass of evidence of the existence of life upon the earth during successive geological periods what portions of that evidence have reference to then existing land areas, for the bulk of it tells us of the ever present sea. I have tried to indicate some of the relations which those areas probably had with our present continent, and to draw intelligible inferences, from the character of the fossil remains which represent some of the early forms of life, as to the conditions under which those forms then existed, and their relations to the now existing life of this continent. I have also offered suggestions concerning some of the changes of land and sea which, from time to time in the past, have probably taken place within and near the great area which is now occupied by the North American continent, and I have spoken also concerning what seem to be the results of those changes upon the life then existing, as well as upon that which now exists.

If my remarks shall have seemed in some respects desultory, I may, perhaps, claim that the nature of my subject has made them so. If, in the absence of tangible proof of the ancestry of some of the highly organized faunas and floras, whose remains are found in the strata of the different geological periods, I have assumed that such evidence has once existed, but that it has been destroyed or undiscovered; if, in attempting to explain these discrepancies, I have ignored the possibility of special creations—a belief which I am well aware is still popularly held—I have done it with no irreverent or antagonistic intent. As a naturalist, I must accept only natural explanations of natural phenomena. That I may have erred in judgment with regard to these questions, it would be folly for me to deny; but I claim to have been actuated in my study of them by a desire, which is the attribute of every true naturalist, to know the truth and the truth only. If you should not be disposed to accept the conclusions which I have reached, surely the facts I have stated cannot fail to interest you.

The subject which embraces these facts is an exceedingly broad one, and upon them may be based other discussions than those which I have attempted. Other lessons may also be drawn from them, one of which is that, in the accomplishment of her ends, Nature is extravagantly wasteful, and terribly cruel.

And yet, there is so much of order and harmony apparent in all her ways, so much of the genial sunshine of knowledge gained to the naturalist who studies them that, with the optimism which is inseparable from a sound mind in a healthy body, he has an enjoyment of his occupations such, I believe, as other men rarely know.

NOTES ON NORTH AMERICAN PSYLLIDÆ.

By C. V. Riley.

(Read May 25, 1883.)

Having been engaged lately in putting together the material for a study of the Psyllidæ of North America, I would, in this brief paper, offer a preliminary statement of some of the results, and append a few descriptions of the more remarkable forms for publication in the proceedings.

Knowledge of the European Psyllidæ has greatly advanced, both as to morphology and biography, since the time of Linnæus and Latreille, mainly through the labors of Hartig, Förster, Flor, and more especially, in recent years, through the important publications of Dr. Franz Löw, of Vienna. The Psyllid fauna of the United States has, however, received little attention from American entomologists; yet it is rich in species which are of great interest.

What has hitherto been done in the classification of the North American Psyllidæ may be gathered from the following list of the species actually described. A similar list was published in the "Canadian Entomologist" by Mr. Wm. H. Ashmead, (1881,) but it was somewhat incomplete, and contained some inaccuracies.

1. *Diraphia vernalis* Fitch.
2. *Diraphia femoralis* Fitch.
3. *Diraphia calamorum* Fitch.
4. *Diraphia maculipennis* Fitch.
5. *Aphalara arctica* Walker.
6. *Psylla ilecis* Ashmead.
7. *Psylla rhois* Glover.
8. *Psylla quadrilineata* Fitch.
9. *Psylla carpini* Fitch.

10. *Psylla annulata* Fitch.
11. *Psylla pyri* (Linn.), Harris, Fitch, Glover, *et al.*
12. *Psylla pyrisuga* (Förster), Barnard.
13. *Psylla venusta* O.-Sacken.
14. *Psylla celtidis-mamma* Riley.
15. *Psylla tripunctata* Fitch.
16. *Psylla rubi* Walsh and Riley.
17. *Psylla diospyri* Ashm.
18. *Psylla magnoliæ* Ashm.

Thus the number of described species amounts only to eighteen. All other names occurring in Ashmead's list and in Walker's British Museum list, as well as in cabinets, are manuscript names. Of the eighteen species, four are merely synonyms, while one is an importation.

The synonyms have been principally caused by the fact that the imagines of several species quite persistently occur on two or more widely different plants: thus *Psylla tripunctata* is equally common on Rubus and on Pinus; but while this is true of the mature insects, yet each species, so far as we yet know, is confined in its adolescent stages to one genus of plants, and often to one species.

According to the latest classification by Dr. Franz Löw in his paper, "Zur Systematik der Psylloden," * our described species must be placed as follows:

I.—SUB-FAMILY LIVIINÆ.

1. *Livia vernalis*, Fitch, (synonyms: *Diraphia femoralis* F. and *D. calamorum* F.).
2. *Livia maculipennis*, Fitch. (*Diraphia maculipennis* Fitch.)

This sub-family, which has but two representatives in Europe, is at once recognizable by the flat, not prominent eyes, and by the form of the antennæ, the second joint being the largest.

* Verhandlungen der zoologisch-botanischen Gesellschaft in Wien, 1878.

II.—SUB-FAMILY APHALARINÆ.

3. *Aphalara ilicis*, Ashm. (*Psylla ilecis* Ashm.)

This sub-family was established by Löw upon genera in which the petiolus cubiti is as long as, or longer than, the discoidal part of the subcosta, and in which the frontal lobes are either absent or not separated from the vertex. Of the four European genera of this sub-family recognized by Franz Löw I have thus far seen American representatives of but one genus, viz: Aphalara, which appears to be well represented in the United States.

III.—SUB-FAMILY PSYLLINÆ.

4. *Calophya rhois* Glover.* (*Psylla rhois* Glover.)
5. *Psylla pyricola* Förster, (synonyms *Ps. pyri*, Harris, Fitch, Glover, etc.; *P. pyrisuga* Barnard.)

This is the Pear-tree Psylla of our northern and western States, and its reference to Förster's species is made after comparison with European specimens received from Meyer-Dür and Lichtenstein.

6. *Psylla quadrilineata* Fitch.
7. *Psylla arctica*, Walker. (*Aphalara arctica* Walk.)†
8. *Psylla carpini* Fitch.

* It was one of Glover's boasts that he never described a species: yet on account of the marked colorational characters of this insect, he has unwittingly given, in two or three words, a recognizable description of it with figures. (Agricultural Report for 1876, p. 33, published in 1877.) The name conflicts with Fr. Löw's *Calophya* (*Psylla*) *rhois*, also published in 1877, (Abh. K. K. zool. bot. Ges. Wien, 1877, p. 148.) Without attempting to decide which of the two names has priority, but to avoid confusion, I would substitute for our North American species the name of *nigripennis*, under which Fitch described the species in his manuscript notes. Löw's description is a very careful one, while that of Glover is accidental and unintentional, the name being used under the impression that the species had already been described.

† This is described from Albany River, Hudson's Bay, (List of Homoptera, Brit. Mus., part 4, p. 931,) as an Aphalara. It is unknown to me, but Mr. Jno. Scott, (Trans. Ent. Soc. London, 1882, p. 459,) who has examined the types, declares it to be a genuine Psylla.

9. *Psylla annulata* Fitch.
10. *Pachypsylla* (n. gen.) *venusta*, Osten-Sacken. (*Psylla venusta* O.-S.; *Ps. c.-grandis* Riley.)
11. *Pachypsylla celtidis-mamma*, Riley. (*Pyslla c.-mamma*, Riley.)

The sub-family Psyllinæ which is characterized by prominent eyes, short petiolus cubiti, and by the frontal cones (when present) being well separated from the vertex, seems to be well represented in our fauna, but a large portion of our species cannot be included in the European genera. Of the ten genera into which Löw has divided the Psyllinæ, I have only been able to recognize two in our fauna, viz: Calophya Fr. Löw, and Psylla, as restricted by Löw. The former genus includes our two Sumac Psyllids, and a third of unknown habits, but presumably also living on Rhus. Of Pyslla a moderate number of species are in my collection, indicating the occurrence of the genus on both slopes of our continent.

Of the four new genera which I have recognized in our fauna, the most interesting appears to be that which includes our Hackberry Psyllids, interesting not only because of the peculiar structural characters exhibited in the larva and imago states, but more especially because of the fact that they are true gall-makers. I have called this new genus Pachypsylla, and append descriptions of it and of the principal species which it embraces.

IV.—SUB-FAMILY TRIOZINÆ.

Next to the Liviinæ this is the best defined sub-family of Psyllidæ, and it is at once recognizable by the prominent eyes, the long dorsulum and the absence of the petiolus cubiti. It includes the following species described from our fauna:

12. *Trioza tripunctata*, Fitch. (*Psylla tripunctata* Fitch; synonym: *Psylla rubi* Walsh & Riley.)
13. *Trioza magnoliæ*, Ashm. (*Psylla magnoliæ* Ashm.)
14. *Trioza diospyri*, Ashm. (*Ps. diospyri* Ashm.)

Of the genera described, only one, Trioza, has thus far been found in North America, but this genus is represented by numerous species. The venation of the front wings offers good characters for groups, while specific characters are best expressed in the genital armature of the male. Two species from Florida exhibit very remarkable structural characters which justify the establishment of two new genera here characterized.

In the following descriptions I have used those orismological terms which seem least likely to confuse, chiefly following Fr. Löw and other continental authors. The width of the head includes the eyes, and length measurements are from vertex to tip of closed wing.

Sub-family PSYLLINÆ.

PACHYPSYLLA, new genus.

Body very robust, transversely and longitudinally convex; in some species glabrous, in others finely pruinose with exceedingly short and sparse pubescence. Head large, vertical, vertex rugoso-punctate, longer than usual, but slightly or not at all narrowed anteriorly; anterior marginal line well marked, straight; frontal cones not in the same plane as the vertex, more or less oval, pubescent, vertical, about half as long as the vertex; anterior ocellus not visible from above; discoidal impressions punctiform or foveiform (*c.-gemma*); antennæ as long as (or even shorter than) the width of the head, stout, intermediate joints sub-turbinate. Pronotum of usual length (short in *c.-gemma*), steeply ascending posteriorly, rugosely punctate, of equal width, lateral impressions well marked, front and hind margins gently curved; dorsulum less developed than in the true Psyllas, more than twice as broad as long; sculpture of dorsulum and mesonotum varying according to species, either nearly smooth (*c.-gemma*) or alutaceous (*c.-venusta*) or rugoso-punctulate (*c.-mamma* and the rest of the species). Front wings varying in length and form according to species, flat (less so in *c.-gemma*), sub-membranaceous, and not rugose in the majority of the species (more leathery and rugose in *c.-gemma*), pterostigma more or less distinct, tip of wing between radius and fourth furcal and nearer to the costal than to the inner margin; petiolus cubiti much shorter than the discoidal part of the subcosta; marginal cells unusually long, narrow (less so in *c.-gemma*), and of nearly equal size. Metasternal processes shorter than in Psylla. Genital plate of male broad, convex at the sides, slightly lobed posteriorly, forceps simple; genital plates of female simple, of varying length. Legs stouter than usual. Larva and pupa with spinous tip of abdomen and sides of body not acute.

The species, so far as known, are all gall-makers, and confined to the Hackberry (*Celtis*).

There is no genus, among those characterized by Dr. Fr. Löw, with which Pachypsylla can properly be compared. In the convexity of the body it greatly surpasses Psylla, from which it is at once distinguished by the vertical and rugoso-punctate head, the quadrate vertex, the short frontal cones, the less filiform and stout antennæ.

Pachypsylla venusta (OSTEN-SACKEN.)

Average length, 5.6 mm. General color, brownish-yellow, variegated with darker brown, often with a greenish tinge, thorax with brown markings of the usual shape, front wings whitish speckled with brown, legs variegated with black. Head with the eyes narrower than the widest part of the thorax, vertical, slightly emarginate behind, vertex about one-third wider than long, nearly flat, not narrowing anteriorly, with anterior marginal line straight, slightly elevated along the inner margin of the eyes, surface rugoso-punctate, discoidal impressions punctiform, very distinct, median line fine; frontal cones below the plane of the vertex, vertical, very little longer than wide at base, rounded at tip and sides, not half as long as the vertex, and together only half as wide as the vertex, moderately divergent, rugoso-punctate, sparsely pubescent, and in color often brighter yellow than the vertex; antennæ as long as the head is wide, joint 2 a little longer than 1, joint 3 twice as narrow as 2 and but little longer than 4, the succeeding joints gradually decreasing in length, the terminal three closely conjointed, very little thicker than the preceding joints; each of the intermediate joints at tip a little wider than the base of the following joint; color, pale yellow, tips of intermediate joints and the whole of the last two joints black; terminal bristles very short. Pronotum moderately short, of equal width, slightly emarginate behind, steeply ascending posteriorly, sculptured and colored as the head; lateral impressions well marked. Dorsulum well developed, thrice as long as the pronotum and about twice as wide as long; posterior lobe distinctly longer than the anterior; hind margin sinuate each side and truncate at middle; surface finely alutaceous; color, light brownish yellow, with a large brown apical spot divided by a yellow median line. Mesonotum convex, wider than the head, sculptured as the dorsulum, with four vittæ (longitudinal) of brown or greenish-brown color, the outer ones usually wider than the inner ones, all bordered and divided transversely by lines of brighter yellow. Front wings two and one-third times longer than their greatest breadth, widest at basal half, whitish, semi-transparent, marked with brown, as follows: an oblique and gradually-diminishing band running from the tip of radial cell to middle of first furcal vein, more or less interrupted between, but persistent on the veins; a series of four large quadrate marginal spots at tips of furcals, a spot at base of pterostigma; paler specimens have these marks well relieved on a uniformly semi-transparent wing, while darker specimens have them more or less suffused with brown atoms, which often obscure the apical half of the wing and gradually intensify towards the posterior margin, where they always leave four clear, whitish terminal spaces between the veins, the fourth least distinct and sometimes obsolete; costal margin much rounded at base, thence straight, tip very narrowly rounded, nearly angulated, inner margin at terminal third rounded. Venation moderately strong, discoidal part of subcosta elevated into a prominent callus, pterostigma distinct, moderately long; petiolus cubiti as long as the stem of the first fork and one-half as long as the discoidal part of subcosta, which is as long as, or a little longer than, the basal part; radius nearly parallel to the stem of second or outer fork and fourth furcal, slightly curved upward at tip, all furcals terminating very obliquely upon the margin, the first slightly shorter than the fourth, the second one-fourth longer than the first, which terminates at about the middle of the inner margin; stem of second fork as long as the third furcal; tip of wing distinctly between the radius and the fourth furcal; outer basal cell one-fourth shorter than radial cell; second marginal cell as long, but not quite as wide, as first marginal cell; margin of cubital cell as long as that of second marginal. Metasternal processes nearly twice as long as wide, constricted at base, apex not sharply pointed; legs yellowish gray, femora usually with the upper edge and a sub-apical spot blackish, claw-joint black. ♂: genital segment as long as the two preceding ventral segments together, wider than usual; color, yellowish brown, shining, with sparse, long pubescence; plate nearly as high as the length of the segment, wide, rounded and convex at the sides, provided with a distinct lateral lobe; anterior margin straight, posterior margin forming a nearly semi-circular line, greatest width at apical third; on its outer face the plate is convex and smooth anteriorly; the posterior lobe is rugose, and separated from the plate itself by a wide and shallow depression. Forceps two-thirds as high as the plate, front margin straight, hind margin slightly sinuate at basal half, tip rounded, outer face smooth and very shining.

♀: genital segment a little longer than the rest of the abdomen, opaque, brownish yellow with black markings, with moderately short and inconspicuous pubescence, upper plate gradually tapering apically and drawn out in a very sharp point, which is slightly turned upward; lower plate a little shorter than the upper, rapidly narrowing from the base and pointed at tip, but by no means as sharply as the upper plate.

Described from numerous specimens reared from a large woody gall formed on the petiole of the leaf of *Celtis*, a part of the base of the leaf being included, so as to form a groove on one side.

Pachypsylla celtidis-mamma (Riley.)

Average length, 4 mm. Color dirty yellowish-brown, frequently dark brown or brownish-yellow, upper side usually with a greenish tint; antennæ and legs yellowish, variegated with black; wings subhyaline and whitish, speckled with brown. Head and thorax more strongly rugoso-punctate than in *venusta*, opaque and with sparse, extremely short, but glistening pubescence. Vertex as in the preceding species, frontal cones more transverse; antennæ a little shorter than the width of the head, coloration and relative length of the joints as in *venusta*, intermediate joints more distinctly turbinate. Parts of thorax formed and colored as in *venusta*, a little less convex, and the brown color more predominant, with markings on dorsulum and mesothorax less clearly defined. Front wings narrower and, therefore, apparently longer than in *venusta*, very little wider at terminal third than at basal third; costal margin at base but slightly convex, at tip more broadly rounded; whitish, subhyaline, more or less densely covered with small, brownish, scale-like specks, as follows: an oblique and gradually narrowing band (extending from tip of pterostigma to near tip of radius), which runs across the wing to the tip of the first furcal, is usually freer from these dots than the rest of the wing, while its edges are usually more crowded with the dots, so as to bring the pale band into greater relief; quite frequently there is an intensified patch of brown about discoidal part of subcostal vein and at all vein furcations; also, the terminal space outside the pale oblique band is often uniformly dark, but with three marginal pale spots (one in each of the cubital, second marginal, and discoidal cells) always more or less distinctly relieved. This pale band is sometimes obsolete and the wing more or less evenly speckled; exceptionally, both inside and outside the oblique band, there is a border of variable extent, of a uniform dark brown color, not composed of small dots; pterostigma distinct, moderately wide and long; petiolus cubiti a little more than half as long as the stem of first fork, and fully three times shorter than the discoidal part of subcosta, which is distinctly longer than the basal portion; radius nearly parallel to stem of second fork and fourth furcal, hardly curved upward at terminus, furcals terminating very obliquely upon the margin, third and fourth nearly equal in length, second very little longer than third, and first very little shorter than third, and terminating at about the middle of the margin; stem of second fork as long as third furcal; tip of wing between radius and fourth furcal; outer basal cell one-third shorter than radial cell, marginal cells of equal length, the second a little wider than the first. Metasternal processes pale greenish, cylindrical, hardly narrowed toward the tip, which is obtuse, not pointed. Legs pale brownish-yellow, femora usually variegated with black, last tarsal joint blackish. Abdomen either entirely blackish or brown, or brownish-yellow, in fresh specimens, suffused in pink.

♂: genital segment a little longer than the preceding ventral segment, brown, shining; plate as high as the length of the segment, lateral lobe barely indicated, anterior margin straight, posterior margin very slightly oblique, *i. e.*, the plate gradually increases in width toward the tip, which is truncate and not arcuate, as in the preceding species. Forceps as in *venusta*.

♀: genital segment a little shorter than the three preceding ventral segments together, laterally more compressed than in *venusta;* upper plate a little longer than the lower one, gradually tapering toward tip, which is straight and not so sharply pointed as in *venusta;* lower plate also simple.

Described from numerous specimens bred from closed mamma-like galls on leaves of *Celtis*.

Pachypsylla (Blastophysa) c.-gemma, new species.

Average length 3.5 mm. Glossy. Dark brown or lighter, head and thorax dirty brownish-yellow or deep gamboge-yellow, with greenish and often reddish tint; front wings uniformly yellowish-brown (lighter or darker); abdomen nearly black, sutures of the segments reddish, often the whole abdomen brownish-yellow. Head vertically inclined, as in the other species, with the eyes a little narrower than the widest part of the thorax; vertex shining, rugoso-punctate, yellowish-gray, twice as wide as long, not narrowing anteriorly, very slightly emarginate posteriorly, anterior margin straight, discoidal impressions large, foveiform, but shallow and ill-defined; median line fine; frontal cones vertical, somewhat variable in form, but usually subtransverse, always rounded at tip, more or less strongly divergent, rugoso-punctate, slightly hairy; antennæ fully as long as the width of the head, less stout than in the other species of the genus, yellow, more or less variegated and tipped with black; joints subturbinate, joint 4 not quite one-half as long as 3, the succeeding joints a little shorter than 4, but not decreasing in length, 9 and 10 closely united and together shorter than the preceding joint; terminal bristles very short; pronotum very short, of equal width, slightly emarginate behind, shining, impunctate; dorsulum formed as in other species, usually shining, finely alutaceous, with sparse transverse aciculate lines, which are sometimes absent; mesonotum formed as in other species, shining, very finely alutaceous; color of dorsulum and mesonotum very variable, usually brownish-yellow with greenish tinge, or yellowish-green with more or less indistinct markings of light brown; sometimes the color is more decidedly yellow, or even orange yellow, or nearly wholly pale green. Wings glossy, decidedly shorter and more leathery than in the other species, decidedly sub-convex, at basal third very slightly wider than at terminal third, transversely rugose, uniformly immaculate, costal margin at base strongly arched, then nearly straight, tip of wingly broadly rounded, inner margin regularly curved; venation much less prominent than in the genuine Pachypsyllas; pterostigma very indistinct; petiolus cubiti about half as long as the discoidal part of the subcosta, which is as long as, or a little longer than, the basal portion; radius nearly straight, third and fourth furcals of nearly equal length, terminating very obliquely upon the margin, stem of second fork a little longer than third furcal, first furcal but little longer than the stem of the first fork and one-third shorter than the second furcal, which is but little longer than the fourth furcal; outer basal cell very large and nearly as long as the inner one; base of pterostigma nearer to the middle than to basal third of wing; first furcal terminating at about the middle; margin of first marginal cell as long as that of second; margin of cubital cell shorter. Abdomen in matured specimens dark gray, each segment bordered behind with roseate color, in immature specimens brown or brownish-yellow. Metasternal processes pale-green, elongate oval, obtusely rounded at tip. Femora usually brownish-yellow, sometimes blackish, with exception of the tip; tibiæ and tarsi black.

♂: genital segment somewhat longer than the preceding ventral segment; plate as high as the length of the segment, anterior margin straight, posterior lateral lobe very feebly indicated toward the tip, the plate, therefore, slightly wider at tip than at base, posterior edge slightly curved, tip truncate; the lobe is hairy, opaque, rugose, and divided from the main part of the plate by a longitudinal depression; forceps three-fourths as high as the plate, anterior edge slightly convex, posterior edge slightly concave, tip acute.

♀: genital segment somewhat longer in proportion to the rest of the abdomen than in *c.-mamma*, but otherwise not different.

Described from numerous specimens reared from a small, rounded, more or less irregular swelling of the bud of *Celtis*.

The species shows sufficient differences, as compared with the more typical Pachypsylla, to warrant separation into a sub-genus, which I would designate by the name of Blastophysa, and which in future, with increased material, will probably be accepted as a good genus.

The following dichotomic table gives the principal differences between the three species of Pachypsylla just described:

Head and dorsum opaque; front wings submembranaceous or subhyaline, not rugose; pterostigma distinct; both marginal cells very long, narrow, and of about equal size and length; anal style of full-grown larva and pupa long.

- Dorsulum and mesonotum alutaceous, glabrous; front wings narrowly rounded at tip, widest in basal half; genital segment of female longer than the rest of the abdomen; anal style of full-grown larva and pupa notched at top .... *venusta.*
- Dorsulum and mesonotum rugoso-punctate, with distinct but very short, sparse pubescence; front wings broadly rounded at tip, widest in terminal half; genital segment of female shorter than the rest of the abdomen; anal style of full-grown larva and pupa pointed at tip .... *c.-mamma.*

Head and dorsum shining, without pubescence; front wings somewhat convex, basal half not wider than terminal half, broadly rounded at tip, distinctly rugose; pterostigma indistinct; marginal cells less narrow, the first shorter and somewhat smaller than the second; genital segment of female shorter than the rest of the body; anal style of full-grown larva and pupa very short, nicked at tip .... *c.-gemma.*

Sub-family TRIOZINÆ.

CEROPSYLLA, new genus

Body moderately slender, slightly convex longitudinally, glabrous, impunctate, opaque. Head with the eyes slightly narrower than the widest part of the thorax; vertex nearly half as long as wide, convex anteriorly, slightly emarginate behind; discoidal impressions large and polished, but shallow and ill-defined; frontal cones well separated from, and much depressed below, the plane of the vertex, nearly vertical, a little longer than wide, about half as long as the vertex, not divergent, not narrowing anteriorly, obtusely rounded at tip, jet black, opaque, slightly pubescent; antennæ more than twice as long as the width of the head, thin, terminal joints distinctly broader, joint 3 as long as 4 and 5 together, the last two joints less connate than usual, terminal bristle short. Thorax with the pronotum very short, deeply emarginate behind, lower than the head, and almost covered at the middle by the overlapping dorsulum; dorsulum longer than wide, anterior lobe much more developed than the posterior, laterally convex, gently ascending posteriorly; mesonotum nearly as long as dorsulum, of usual form.

Wings flat, perfectly hyaline, not sculptured, two and one-half times longer than wide, widest beyond the middle, outer costa gradually and slightly arched at base, tip distinctly angulated; basal part of subcosta unusually long, as long as the branch of the second fork; the stems of the two forks not starting from the same point of the subcosta, that of the first fork starting alone from the subcosta, some distance before the usual separation point of the principal veins; discoidal part of the subcosta extremely short—in fact, hardly perceptible; thus the radius, the radial part of subcosta and the stem of the second fork start from nearly the same point; radial part of subcosta but little shorter than the stem of first fork; radius straight, unusually short—shorter than the basal part of the subcosta; stem of second fork running, at basal fourth, very close to the radius, then gradually diverging from it; tip of wing within second marginal cell, but very close to the fourth furcal, which is nearly equal in length to the first and distinctly longer than the third furcal; second furcal nearly twice as long as the third and about as long as stem of the second fork. Basal cells very long, the outer not quite attaining the middle of the wing, the inner reaching beyond the middle; radial cell much shorter than outer basal cell; first marginal cell much larger than the second, but of similar shape.

Ceropsylla sideroxyli, new species.

Average length, 4.2 mm. To the characters given above in the generic description but little remains to be added. The color is greenish-yellow on the upper side, abdomen and under side more decidedly green; dorsal marking of brownish-yellow faintly indicated; antennæ black, with the three basal joints pale yellow; legs yellowish-green or pale yellow. The wings are perfectly colorless and transparent, the veins very fine, blackish. The exceptional arrangement of the venation, especially the almost complete absence of the discoidal part of the subcosta, produces some curious results, viz., the basal part of the subcosta and the radius appear to form a single straight line, and the discoidal cell is triangular, with the angle towards the base of the wings narrowly produced. The radial part of the subcosta terminates nearly at the middle of outer costa, the radius terminating about half way between the end of the radial part of subcosta and the tip of the wing; the outer basal cell is about one-third longer than the radial cell and little shorter, but much narrower than the inner basal cell.

Described from fourteen specimens.

The secondary sexual parts in the specimens before me are not well preserved, owing to the immature condition of the specimens, and I prefer to leave them undescribed at present.

The form of the head and thorax, and, in fact, the general appearance of this genus, show no important or essential differences from the typical Triozas, but the wing-venation is without parallel in the family, and so remarkable that, with but a single specimen for examination, it might be considered a rather interesting monstrosity, such as can occasionally be observed in large series of specimens of other species. The specimens examined, however, show precisely the same venation, and this character, together with the singular form exhibited in the full-grown larva, necessitates the establishment of a new genus. The specimens before me were bred from the larva, and as they died shortly after acquiring wings, they are more or less immature.

Full-grown larvæ were found by Mr. Wittfeld at Georgiana, in Southern Florida, on the under side of the leaves of *Sideroxylon masticodendron*, imbedded in small scattered cup shaped excavations, which, on the upper side of the leaves, appear as rough, elevated pustules. A white, wax-like (not flocculent) excretion covers the dorsal surface of the larva, and has suggested the generic name.

RHINOPSYLLA, new genus.

Body moderately slender, very slightly convex dorsally, opaque, glabrous, impunctate. Head (including eyes) wider than the widest part of the thorax, obliquely prolonged and narrowing behind the large and convex eyes, which are thus widely distant from the pronotum; hind angles obtuse, hind margin nearly straight, and not quite half as wide as the widest part of the head. Vertex deeply and triangularly excised in the middle of the anterior margin, which is very oblique each side of the excision. The vertex thus appears to be separated anteriorly in two cones pointing obliquely forward, and this peculiar bi-rostrate appearance of the head is enhanced by the basal joints of the antennæ forming apparently the continuation of these cones; no trace of frontal cones; front margin of vertex within the incisure not acute, but very narrowly rounded; anterior ocellus at the bottom of the incisure only visible from the front, but not readily perceptible; discoidal impressions very conspicuous, long, lineiform, reaching the hind margin of the head. Antennæ more than twice as long as the greatest width of the head; joints 1 and 2 longer than usual, joint 3 longer than 4 and 5 together, and at middle distinctly wider than the succeeding joints, but narrower than joint 2. Thorax, with the pronotum moderately short, slightly ascending posteriorly; front and hind margins but slightly curved, the latter, however, narrowly notched at middle; lateral impressions deep and large, situated at the hind margin; dorsulum distinctly wider than long, anterior lobe sub-acuminate in middle of front to fit in the emargination of the pronotum; mesonotum of usual form, subdepressed on the disc, convex at the sides, nearly as long as the dorsulum; metasternal processes small, elongate, pointed at tip. Front wings very long and narrow, more than three times longer than wide, widest at middle, tip distinctly angulated, with the angle more acute than usual, colorless and perfectly transparent, venation fine; basal portion of subcosta nearly as long as the stem of first fork and a little longer than the discoidal and radial portions of subcosta combined; radius straight and not parallel with stem of second fork; stem of second fork nearly twice as long as that of the first; tip of wing distinctly within second marginal cell; outer basal cell as long as radial cell, which is as long as, or little longer than, the margin of the discoidal cell. Anterior legs longer than the others, and with the femora laterally much compressed and curved inwardly.

The form and venation of the wings do not offer any differences from the Triozinæ, and more particularly from certain typical Triozas, while the absence of frontal cones, together with the form of the third antennal joint, seem to point to an affinity with Bactericera, Puton (a genus which is unknown to me in nature). The remarkable formation of the head, however, removes Rhinopsylla not only from the other genera of this sub-family, but from all Psyllidæ hitherto described. The formation of the anterior legs is also a character not otherwise occurring in the whole family; but this might be a sexual character, as the female is still unknown.

Rhinopsylla schwarzii, new species.

Length, 3 mm. Head and thorax dull brick-red, the latter above indistinctly marked with pale yellow; upper surface opaque, not pubescent, and without other sculpture than the usual very fine alutation. Abdomen greenish, femora red, tibiæ and tarsi pale yellow, the former blackish at base. Oblique post-ocular prolongation of the head nearly as long as the anterior portion of the head; anterior median excision of the vertex forming an almost equilateral triangle; the two lobes of the vertex formed by the notch are also triangular, and not more porrect than the front margin of the eyes, which are semi-globular and very prominent; discoidal impressions forming each side a longitudinal line reaching to near the hind margin of the head, deeply impressed behind and becoming obsolete before reaching the anterior margin of vertex; basal joints of antennæ larger and wider than usual and reddish; joint 2 narrower and shorter than 1, joints 3–6 and the bases of 7 and 8 pale yellow, remaining joints black; joint 3, of the form described above, longer than joints 4 and 5 together; joints 6, 7, and 8 each a little longer than joint 4; 9 and 10 of usual shape, closely connate; terminal bristles long. Pronotum colored as the head, of nearly equal width, laterally less convex than usual, nearly horizontal longitudinally, moderately long, indentation at middle of hind margin acutely triangular; dorsulum with very faint traces of paler longitudinal markings, very little higher than the pronotum. Mesonotum nearly as long as the dorsulum, with two broad pale median bands, separated by a fine subimpressed dark-colored median line, sublateral yellow lines barely indicated. Front wings, of the form described above, colorless, except a slight brown shade alongside the marginal venules; veins fine, yellowish-brown; third furcal one-third shorter than the fourth, and nearly rectangular upon the margin, second furcal about one-third longer than the fourth, strongly arched, first furcal slightly shorter than the third, terminating obliquely upon the margin; outer basal cell much narrower than the inner and as long as the radial cell; inner basal cell attaining the middle of the margin, marginal cells unlike in form but about equal in size. The anterior legs, especially the femora, are much longer than the middle legs; the anterior femora are, moreover, much wider, flattened, and bent inwardly at middle, or rather sinuate at the inner broad side.* The hind legs are nearly as long as the anterior, but the femora are of normal form. Metasternal processes rather widely separated, conical, acuminate.

The genital armature of the male cannot properly be described from the two specimens before me.

Described from two ♂s, found March 11th, 1879, at Baldwin, Fla., by Mr. E. A. Schwarz, to whom I take pleasure in dedicating the species, on low plants in the cypress swamps, but the food-plant of the species still remains unknown.

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*This curving of the anterior femora is not equal in the two males before me, being very conspicuous in the one and less so in the other.

REMARKS ON THE BAG-WORM—THYRIDOPTERYX EPHEMERÆFORMIS.

By C. V. Riley.

(Read April 13, 1883.)

Having been asked by members of the Society quite frequently of late to explain the facts in relation to the common bag-worm, and as the facts are somewhat puzzling to the uninitiated, I have thought it of sufficient interest to state them.

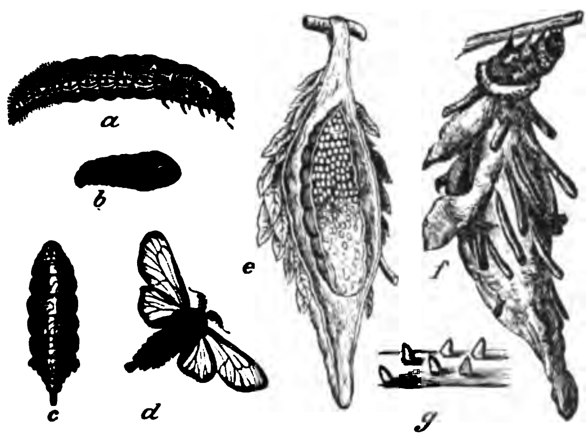

FIG. 1. THYRIDOPTERYX EPHEMERÆFORMIS: *a*, larva; *b*, male chrysalis; *c*, female moth; *d*, male moth; *e*, follicle and puparium cut open to show eggs; *f*, full grown larva with bag; *g*, young larvæ with their conical upright coverings; all natural size.

The bags, as they hang from the trees at the present time, and as illustrated by these specimens which I now exhibit, will be found to consist of very strong silk, and, while a large proportion of them contain little or nothing, many of them have within a brown shell, known as the puparium, and containing a large number of soft, yellowish eggs, interspersed with fulvous down. In a few days these eggs will hatch, the young worms from them will crawl out of the bags and disperse over the tree, covering themselves with little conical silken coats, to the outside of which they attach bits of leaves and twigs. These bags are at first held upright (Fig. 1, *g*), but, with increase in size, they are allowed to hang (Fig. 1, *f*). In the autumn, after attaining full growth, the worms appear as in Fig. 1, *a*. They now fasten the bags to the permanent parts of the tree, and transform to the pupa state. In due time, the male pupa (Fig. 1, *b*) pushes down toward the anal orifice, and a little, black, glassy-winged moth (Fig. 1, *d*), with strongly pectinate antennæ, escapes.

The female (Fig. 1, *c*) only partly issues from her pupa shell, receives the male, and retreats into the puparium, in which she deposits her eggs.

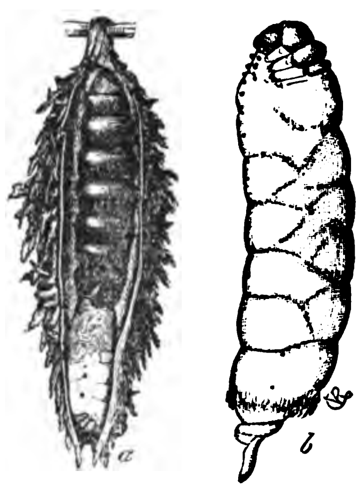

FIG. 2. THYRIDOPTERYX EPHEMERÆFORMIS: *a*, follicle cut open to show the manner in which the female works from her puparium and reaches the end of the bag, natural size; *b*, female extracted from her case, enlarged.

In reference to the act of coition, which has not been fully understood by entomologists, I quote from a former article of mine: *

"We have seen that, by means of the partial elongation of her puparium and her partial extraction therefrom, the female is able

* *Sci. Am.*, Suppl., April 3d, 1878.

to reach with her head to the extreme lower end of her follicle, causing, in doing so, the narrow elastic portion of the follicle to bulge, and the orifice to open more or less, as it repeatedly did while the larva was yet feeding, whenever the excrement had to be expelled. Fig. 2, *a*, shows a follicle cut open so as to exhibit the elongated puparium, and the female extended from it as she awaits the male; *b*, represents this degraded female more in detail. A cursory examination of the male shows the genital armature, which is always exposed, to consist of (1) a brown, horny, bilobed piece, broadening about the middle, narrowing to and notched at tip, concave, and furnished with a tuft of dark hairs at tip inside; (2,) a rigid brown sheath, upon which play (3) the genital hooks or clasps, which are also concave inside, strongly bifid at tip, the inner finger furnished with hairs, the outer produced to an obtuse angle near tip, and generally unarmed, (Fig. 3, *e*). In repose, this

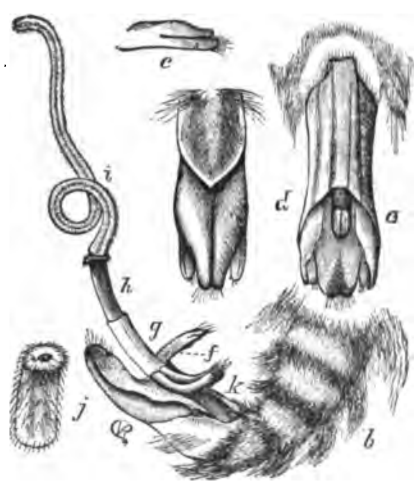

FIG. 3. THYRIDOPTERYX EPHEMERÆFORMIS: *b*, the end of male abdomen from the side, showing genitalia extended; *c*, genitalia in repose, ventral view; *d*, do., dorsal view; *e*, tip of bifid clasp; *j*, tip of penis; all enlarged.

armature appears as in Fig. 3, *c*, from beneath, and as at *d*, from above, and is well adapted to prying into the opening of the follicle. The male abdomen is telescopically extensile, while the tip easily bends or curves in any direction, but most naturally beneath, as at *b*, where it is represented enlarged about six times, and with all the genital parts expanded; *k*, the fixed outer sheath; *f*, the clasps; *g*, a pale membranous sheath, upon which the præputium (*h*) plays, as on the finger of a glove; *i*, the fleshy elastic penis, armed with retorse hairs, and capable of extending to nearly one-fourth of an inch; *j*, showing the end still more fully enlarged. With this exposition of details, not easily observed or generally understood, the act of fecundation is no longer a mystery.

"Experiments made in 1878 led me to conclude that parthenogenesis, although not improbable, seldom occurred in this species. In some sixty instances where I excluded the males, the females either worked out of their follicles and dropped to the ground without ovipositing, or else died and dried up in the ends of the same, likewise without laying. I have found the same to hold true in those exceptional cases (four have already come under my notice) where, in a state of nature out of doors, the larva had undergone its transformations head upward. In every instance the poor female had worked out of the puparium and butted against the closed end of the follicle, perishing finally without laying, because the male could not reach her.*

"The impregnated female that has laid her eggs always works out of her follicle when her task is completed, and drops to the ground exhausted; but she may at once be distinguished from those which perish without ovipositing by her shrunken, eggless body.

"The fawn-colored down, which the female intermingles with her eggs, is composed of the silky hair rubbed from her body. If examined while yet in the puparium, and just before she would naturally issue therefrom, each ring of the body of the female is seen to be more or less clothed with this silky material, while the eggs are perfectly free from it until they are laid. Under the microscope, this covering is seen to consist of the most delicate fibres, many times finer than ordinary silk, and it is so easily detached that most of it rubs off and remains in the puparium on the partial issuing therefrom of the female."

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* Since this was written more elaborate experiments have fully determined that parthenogenesis does occasionally occur in the species.

LIST OF PLANTS ADDED TO THE FLORA OF WASHINGTON FROM APRIL 1, 1882, TO APRIL 1, 1884.

By Lester F. Ward.

(Read November 24, 1882.)

[This list is supplemental to Ward's "Guide to the Flora of Washington and Vicinity" (Bulletin, U. S. National Museum). Unless otherwise stated, the species enumerated were found by the author.]

40*a*. **Argemone Mexicana**, L. Prickly Poppy.

Above Georgetown, near the ice house. Dr. E. Foreman, June 17, 1883.

89*a*. **Viola canina**, L., var. **sylvestris**, Regel. Dog Violet.

Left bank of Rock Creek below Pierce's Mill. First found and reported by Mr. Horace B. Patton, in April, 1883. Collected by myself May 5, 1883.

93*a*. **Viola tricolor**, L. Pansy. Heart's-ease.

Reform School region, escaped and much reduced in size. June 25, 1882.

124*a*. **Scleranthus annuus**, L. Knawel.

Easby's Point. Theo. F. Streets, May 18, 1883.

142*a*. **Hibiscus Syriacus**, L. Shrubby Althæa.

Escaped in many places.

142*b*. **Hibiscus esculentus**, L. Okra. Gumbo.

Pierce's Mill road, near Tenallytown, Oct. 22, 1882.

208*a*. **Desmodium ochroleucum**, M. A. Curtis.

Mount Hamilton,* Dr. E. Foreman, Sept. 24, 1882. Should be collected before the middle of September.

234*a*. **Phaseolus diversifolius**, Pers. Wild Bean.

Alexandria branch, B. & O. Railroad, above Uniontown, Sept. 10, 1882. Also by Dr. Foreman near Roache's Run, Va.

304*a*. **Callitriche Austini**, Eng.

North of Mount Hamilton. June 24, 1882.

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* The conspicuous hill opposite Mt. Olivet Cemetery, otherwise known as "Mulligan Hill" and "Munger's Hill," is thus designated on Boschke's "Topographical Map of the District of Columbia," 1880.

331*a*. **Conium maculatum**, L. POISON HEMLOCK.

Rhode Island avenue, on a vacant lot near 17th street. June 17, 1883.

333*a*. **Cicuta bulbifera**, L. WATER HEMLOCK.

Alexandria Canal, opposite the Arlington estate. Dr. E. Foreman, 1882.

391*a*. **Eupatorium altissimum**, L.

Between the canal and the river, a short distance below Chain Bridge. First reported by Dr. Vasey and Dr. Chas. Mohr at the end of September, 1882. Collected there by myself Oct. 5, 1882.

436*a*. **Aster ericoides**, L., var. **villosus**, Gray.

Woodley Park, Sept. 17, 1882.

457*a*. **Pluchea camphorata**, DC. SALT-MARSH FLEABANE.

Marshall Hall, Md. Collected by Mr. O. M. Bryan in 1883; specimens sent to Dr. Foreman, and by him shown to me.

497*a*. **Galinsoga parviflora**, Cav.

Fourteenth street near G, July 25, 1882. First seen by Dr. Chas. Mohr. Since observed by myself on Sixteenth street.

502*a*. **Leucanthemum Parthenium**, Godron. FEVERFEW.

Park near B and Sixth streets. July 10, 1884. Canal road above Georgetown, June 17, 1883.

504*a*. **Senecio vulgaris**, L. COMMON GROUNDSEL.

Alexandria branch, B. & O. Railroad, a short distance above Uniontown, May 27, 1883.

536*a*. **Tragopogon porrifolius**, L. COMMON SALSIFY. OYSTER-PLANT.

Nearly the same locality as the preceding. Dr. Foreman, May, 1883.

543*a*. **Campanula aparinoides**, Pursh. MARSH BELLFLOWER.

Rock Creek. Mr. M. S. Bebb, 1863.

In preparing the "Flora," several species were admitted, which, though not yet seen by the author or any of the recent collectors, were yet vouched for by perfectly competent authorities who had themselves found them in earlier years. In harmony with the rule thus adopted, I now add, without hesitation, this species which Mr. Bebb informs me, in a letter, that he was in the habit of collecting in whilom days. From his description of the locality, I infer that the spot on which the plant grew is now under cultivation.

628*a*. **Lycopsis arvensis**, L. SMALL BUGLOSS.

Near the Outlet Lock, Dr. Foreman, 1882. Collected there by myself June 17, 1883.

629*a*. **Heliotropium Europæum**, L. HELIOTROPE.

Georgetown, near the Aqueduct Bridge, Mr. M. S. Bebb, 1863.

The above remarks on *Campanula aparinoides* apply equally to this species.

640*a*. **Cuscuta compacta**, Juss. DODDER.

Specimen found in the herbarium of the Department of Agriculture, collected near Washington by Dr. Vasey.

661*a*. **Gratiola aurea**, Muhl.

Specimen in my herbarium (wrongly labeled) collected on the Eastern Branch marsh, in 1873.

732*a*. **Scutellaria parvula**, Michx. SCULLCAP.

This species was simply overlooked in the catalogue. I have specimens collected by Prof. Chickering near the Insane Asylum, May 26, 1875.

738*a*. **Lamium purpureum**, L. DEAD-NETTLE.

Soldiers' Home grounds. I have fine specimens of this species which I collected in this locality July 20, 1873, but had overlooked in preparing the catalogue. The omission was observed by Mr. Patton, who still found it there in 1882, and I again met with it widely spreading through the grounds on May 20, 1883.

746*a*. **Plantago pusilla**, Nutt.

Near the southwest corner of the Soldiers' Home grounds (outside), May 20, 1883.

773*a*. **Polygonum tenue**, Michx.

Mount Hamilton, Dr. E. Foreman, Sept. 24, 1882. Collected by myself on both sides of the hill, Oct. 1, 1882.

797*a*. **Euphorbia mercurialina**, Michx.

In a communication dated Dec. 6, 1882, the late Dr. George Engelmann informed me that this species was once sent to him labeled Washington, D. C., by Mr. F. Pech, who collected here extensively.

884*a*. **Zannichellia palustris**, L.

In the canal, above Foundry Run, June 17, 1883.

986*a*. **Eriocaulon septangulare**, With.

Eastern Branch (between tides) above Uniontown, Sept. 10, 1882. Abundant in the Potomac below Analostan Island, and near Custis Spring.

986*b*. **Cyperus flavescens**, L.

Specimen found in herb. Dep't Agriculture, collected in 1872 by Mr. Rudolph Oldberg, in the vicinity of Washington.

990*a*. **Cyperus inflexus**, Muhl.

Chain Bridge, Dr. Chas. Mohr, September, 1882.

996*a*. **Cyperus refractus**, Eng.

Collected near Washington by Dr. George Vasey.

1002*a*. **Eleocharis Engelmanni**, Steud.

Dried pond above Sandy Landing, June 24, 1883.

1019*a*. **Rhynchospora fusca**, Roem. & Schult.

Specimens in herb. Department of Agriculture, collected in the vicinity of Washington by Dr. George Vasey.

1031*a*. **Carex muricata**, L.

Established in and around the Agricultural Department grounds, *fide* Dr. Vasey and Mr. Conant.

1128*a*. **Glyceria pallida**, Trin.

North side of Four Mile Run pond, Dr. Vasey, 1883.

1160*a*. **Hordeum jubatum**, L. SQUIRREL-TAIL GRASS.

Park near B and 4½ streets, July 10, 1882.

1169*a*. **Arrhenatherum avenaceum**, Beauv. OAT GRASS.

Hillside above Boundary street and Conn. Ave., June 17, 1882.

1195*a*. **Setaria Italica**, Kunth. MILLET, BENGAL GRASS.

Agricultural Department grounds, July 22, 1882.

1253*a*. **Isoetes Engelmanni**, Al. Br., var. **valida**, Eng. QUILLWORT.

Pool among rocks above Sandy Landing, June 11, 1882.

CORRECTIONS.

The following names should be substituted for those standing in the Check-list opposite these numbers:

236. **Rhynchosia tomentosa**, Hook. & Arn., var. **erecta**, Torr. & Gray.

989. **Cyperus microdontus**, Torr.

991. **Cyperus vegetus**, Willd.

1055. **Carex glaucodea**, Tuckerm.

1129. **Clyceria Canadensis**, Trin.

DESCRIPTION OF A NEW GENUS AND SPECIES OF PEDICULATE FISHES (HALIEUTELLA LAPPA).

By G. Brown Goode and Tarleton H. Bean.

(Read March 8, 1884.)

HALIEUTELLA, new genus.

Body maltheiform, subcircular, depressed, its width equal to its length; covered with flaccid, inflatable skin. Spines feeble and less numerous than in *Halieutæa*. Head merged in body; forehead with a transverse bony ridge; no perceptible supraoral cavity; no tentacle. Mouth small, terminal; lower jaw slightly curved forward. Teeth in the jaws minute, cardiform; not discernible on palate, though possibly present. Carpus broad, slightly exserted. Pectoral fins remote from tail, obliquely placed, with membranes subvertical. Branchial aperture posterior to carpus, upon the disk, and not remote from its margin. Dorsal fin 5-rayed, inserted at junction of disk with caudal peduncle. Anal fin 4-rayed, originating at root of caudal peduncle.

Halieutella lappa, new species.

Disk subcircular, more than two-thirds as long as the body. Body covered with a loose, flaccid, inflatable skin, which so obscures its proportions that it is impossible to determine its exact height, but it is not nearly so much depressed as in the related genera. When the body is inflated the height and length of the disk are nearly equal.

Spines rather feeble; about ten between snout and dorsal fin. About six strong spines, with conical bases and stellular tips on the outer margin of the disk on each side, the anterior of them being opposite the eye. In front of these spines on the discal margin, and between them and the snout, are several small, simple spines, pointing backward. Belly armed with spines similar to those on the back, but weaker. A stellate spine upon the tip of the snout, with two weaker, simple spines on each side. Nasal openings midway between eye and tip of snout. Mouth small, upon the margin of the disk. The upper jaw is shorter than the diameter of the eye. Teeth as described in the generic diagnosis. Dorsal fin inserted at posterior limit of disk, with five simple, articulated rays, its longest ray one-fifth as long as the disk. Anal fin with four simple, articulated rays, inserted directly beneath the fourth ray of the dorsal; its second, and longest, ray one-fourth as long as the disk. Caudal twice as long as anal and slightly longer than caudal peduncle, with nine simple, articulated rays. Carpus inserted at a distance from the snout equal to twice the length of the longest pectoral ray, which is slightly greater than the distance of posterior margin of carpus, at its junction with disk, from vent. Number of pectoral rays, 15. Ventral inserted at a point equidistant from the snout and the origin of the anal; length of its longest ray (the fourth) equal to one-half the distance of the anal fin from the snout. Number of ventral rays, 5. D. 5; A. 4; C. 9; P. 15; V. 5.

A single specimen, 1¼ inches long, was dredged by the U. S. Fish Commission steamer Fish Hawk at station 1151, north latitude 39° 58′ 30″, west longitude 70° 37′, in a depth of 125 fathoms. Color, yellowish white.

DESCRIPTIONS OF SOME NEW NORTH AMERICAN BIRDS.

BY ROBERT RIDGWAY.

Read February 23, 1884, and published by permission of the Director of the U. S. National Museum.

1. Parus atricapillus turneri, new subspecies.

SUBSPECIFIC CHARACTERS.—Similar to *P atricapillus septentrionalis*, but still lighter in color, the gray of the upper parts very slightly, or not at all, tinged with brownish, the sides and flanks with little or no buff tinge.

♂: Wing, 2.70; tail, 2.65–2.90; tarsus, .65–.70. ♀: Wing, 2.55; tail, 2.55. *Hab.* Alaska.

Type, No. 70,826, (in collection, U. S. National Museum,) St. Michael's, Alaska, May 1, 1876; L. M. Turner.

2. Psaltriparus minimus californicus, new subspecies

SUBSPECIFIC CHARACTERS.—Differing from true *P. minimus* in much lighter colors, especially on the lower parts, which are very pale brownish gray, or soiled brownish white, only slightly tinged purplish brown on the flanks. *Hab.* California, except northern coast district.

In "Birds of North America," (page 397), Professor Baird remarks that "there is quite an appreciable difference between specimens of this species from Washington Territory and California; the latter are smaller, the under parts paler." He did not separate them, however, the scant material at his command evidently not warranting such a procedure. With numerous additional specimens, the differences are none the less striking, and, in my opinion, fully sufficient to justify their separation as well-defined geographical races.

It may be remarked that specimens from Marin County, just north of the Bay of San Francisco, are dark colored above like typical

P. minimus, but are light colored beneath as in *californicus*, being thus, as should be expected, intermediate; further north, along the humid, densely wooded coast, specimens probably approximate more closely to the typical form.

Types, Nos. 91,643, ♂ ad., Baird, Shasta Co., California, May 27, 1883, Chas. W. Townsend; 71,935, ♀ ad., Ft. Tejon, Cal., Aug. 7, 1875, H. W. Henshaw; 71,924, Walker's Basin, Cal., fall; 71,918, ♀ ad., same locality and collector, Nov. 10, 1875; 91,890, juv., Baird, Shasta Co., California, June 26, 1883, Chas. W. Townsend.

3. Colaptes mexicanus saturatior, new subspecies.

SUBSPECIFIC CHARACTERS.—Similar to *C. mexicanus*, but much darker colored. Back, etc., rich, dark umber-brown, throat deep plumbeous-gray, and lower parts deep vinaceous-pink. *Hab.* Northwest coast, from the Columbia River to Sitka.

Types, Nos. 40,063, ♂ ad., Neah Bay, Washington Territory, J. G. Swan; 13,516, ♀ ad., Simiahmoo, Washington Territory, Dr. C. B. Kennerly.

4. Myiarchus mexicanus magister, new subspecies.

SUBSPECIFIC CHARACTERS.—Differing from typical *M. mexicanus* in much larger size, with proportionally longer and stronger bill. Wing, 4.05–4.40; tail, 4.10–4.60; culmen, 1.10–1.27; bill from nostril, .60–.82 (average about .70); tarsus, .88–.95 (average about .92). *Hab.* Western Mexico, north to southern Arizona.

Types, Nos. 86,005, ♂ ad., Camp Lowell, Arizona, and 57.640, ♀ ad., Tehuantepec, Mexico.

In order to determine positively, if possible, the relationship of the larger Mexican *Myiarchi*, I sent recently to Dr. Sclater a series of specimens, asking him to compare them with Kaup's types of his *Tyrannula mexicana* and *T. cooperi*, which were supposed to be in the British Museum. His reply has just been received, and is, in substance, as follows:

"The original of Kaup's description [of *T. mexicana*] is not in the British Museum, ... but in that of Darmstadt, whence I obtained the loan of it in 1871. I cannot do this again, but I have a specimen in my own collection which, on that occasion, I compared with Kaup's type and found to be similar, except as regards the abraded plumage of my specimen. This specimen certainly agrees best with the smaller or eastern race, ... that is with *M. cooperi* of Baird, ... but is smaller in dimensions than Baird's type, and, therefore, much smaller than the large western form of the same species. . . . . What *Tyrannula cooperi* of Kaup was, it is now, as I believe, impossible to ascertain; because, if the specimen so described is in the British Museum, as Kaup affirms, it is not marked, and is, consequently, unrecognizable."

It will thus be seen that the large western race is unnamed, which is my excuse for providing it with a name as above.

5. Myiarchus lawrencei olivascens, new subspecies.

SUBSPECIFIC CHARACTERS.—Differing from true *M. lawrencei* of Eastern Mexico, in very much paler colors: Pileum light hair-brown, instead of dark sooty brown; back light grayish olive, instead of dark brownish olive; remiges and rectrices edged with dull ochraceous-rufous, instead of rusty rufous. Wing, 2.90–3.25; tail, 3.00–3.25; culmen, .65–.70; width of bill at base, .30–.35; tarsus, .70–.75. *Hab.* Western Mexico, north to southern Arizona; in winter, western and southern Mexico, and Yucatan.

Type, No. 57,655, ♂ ad., Sta. Efigenia, Tehuantepec, Dec. 25, 1868; F. Sumichrast.

I have carefully examined the type of *Musicapa lawrencii* Giraud, and find that it corresponds exactly with specimens from eastern Mexico, which are, without exception, (so far as the National Museum series are concerned,) much darker colored than those from western Mexico.

In Hist. N. Am. B. (ii, p. 333), *M. lawrencei olivascens* was erroneously considered to be the true *M. lawrencei*, the dark eastern race (true *M. lawrencei*) being referred to *M. nigricapillus* Caban. The latter is similar, but still darker, having the pileum nearly black, (whence the name). It reaches its extreme development in Costa Rica, but extends northward to Guatemala, whence northward it gradually passes into *M. lawrencei.* I have not seen Arizona examples, but would have no hesitation in referring them to *olivascens* on geographical grounds alone. That I am correct in doing so is strongly indicated by the following quotation from Mr. Brewster's remarks upon nine specimens obtained in the Santa Rita Mountains, in southern Arizona, by Mr. F. Stephens. (*Cf.* Bull. Nutt. Orn. Club, vii, Oct., 1882, p. 205): "These show little variation in color or markings, but the females are slightly smaller than the males. The characters which separate *M. lawrencii* from its respective allies, *M. tristis*, of Jamaica, and *M. nigricapillus*, of Central America, are well maintained in this series." [*Cf.* Hist. N. Am. B., ii, p. 333.]

In this connection it may be well to give a brief review of the Mexican *Myiarchi*, from the writer's standpoint, a special study of the subject, based upon the extensive series in the National Museum collection, (including many types,) enabling him to feel pretty sure as to the limits of the respective species.

In the National Museum we have the following:

1. *M. crinitus* (LINN.) CAB., as a migrant through eastern Mexico.

2. *M. mexicanus* (KAUP) LAWR.: *a. mexicanus*, from eastern Mexico, north to the lower Rio Grande Valley, in Texas; *b. magister*, NOBIS, from western and southwestern Mexico, and north to southern Arizona.

3. *M. nuttingi* RIDGW., from southwestern Mexico. (*Cf.* Proc. U. S. Nat. Mus., vol. 5, pp. 394, 395.)

4. *M. yucatanensis* LAWR. from Merida, Yucatan. (This seems to me to be most nearly related to the Antillean species (*M. stolidus*, etc). I have carefully examined the type, which is in the National Museum collection, and cannot at all agree to its reference to *M. mexicanus.*)

5. *M. lawrencei* (GIRAUD) BAIRD: *a. lawrencei*, from eastern

Mexico (north to southern Texas?); *b. olivascens*, NOBIS, from western Mexico, (southern Mexico, and even Yucatan in winter,) and north to southern Arizona.

6. *M. flammulatus* LAWR., from southwestern Mexico (Tehuantepec to Mazatlan). Several examples of this widely distinct species are in the National Museum collection.

6. **Pediœcetes phasianellus campestris**, new subspecies.

PRAIRIE SHARP-TAILED GROUSE.

SUBSPECIFIC CHARACTERS.—Differing from *P. phasianellus columbianus* in rather lighter and much more ochraceous coloration above, with the black bars narrower and less regular, and in having the V-shaped markings of the lower parts much less distinct (never deep black).

Types, Nos. 76,743, ♂ ad., Illinois, and 19,173, ♀ ad., Rosebud Creek, Montana Terr.

In the Bulletin of the Nuttall Ornithological Club for October, 1882, p. 233, Mr. Brewster alludes to differences between specimens of the Sharp-tailed Grouse from Fort Walla Walla, Washington Terr., and others from eastern localities, but concludes that the differences noted "probably have only a local significance." This was formerly my opinion also; but many additional specimens subsequently received at the National Museum show conclusively that two very different styles of this bird inhabit the regions west and east of the Rocky Mountains, respectively. *P. phasianellus columbianus* is represented in the collection by specimens from Washington Territory, Oregon, Northern California, and Nevada, and *P. phasianellus campestris* by examples from Montana (east of the mountains), Eastern Wyoming and Colorado, Nebraska, Dakota, and Illinois.

P phasianellus campestris is the form described and figured by Audubon, (B. Am., v, p. 112, pl. 298,) under the name *Tetrao phasianellus*.

7. **Lophortyx californicus brunnescens**, new subspecies.

BROWN-BACKED VALLEY QUAIL.

SUBSPECIFIC CHARACTERS.—Differing from true *L. californicus* in much darker coloration, the upper parts being deep olive-brown (almost clove-brown) instead of grayish olive, the stripes along inner edge of tertial deep ochraceous instead of pale buff, and the elongated feathers of the sides deep olive-brown instead of grayish olive. *Hab.* Pacific coast, from San Francisco Bay north to Washington Territory.

South of San Francisco, this strongly-marked race appears to be replaced by the typical *L californicus;* at least, specimens in the National Museum collection from San José and Sta. Barbara are of the paler form. It is true that Audubon describes and figures the dark race, and says that the male, from which his description and figure of that sex are taken, was "procured on the 6th of March, 1837, near Santa Barbara," but it is well known that the localities ascribed to Townsend's specimens were, in many cases, erroneous; and, since he made collections near the mouth of the Columbia River, it is very likely that the specimen in question came from the latter locality.

It is possible that this race may have already been named, since there are some points in the *Ortyx douglassi* Vigors, (Zool. Jour., iv, 1829, 354; Zool. Voy. Blossom, 1839, 27, pl. 11,) which strongly suggest the female or full-grown young. There are, however, so many features, both in the description and figure, which cannot be reconciled with the present bird that their actual identity is, to say the least, very doubtful.

Types, Nos. 2,829, ♂, "Santa Barbara, California," and 2,830, ♀, locality unknown; both types of Audubon's description and plate of "*Ortix californica.*"

8. **Phalacrocorax dilophus albociliatus**, new subspecies.

LESSER WHITE-CRESTED CORMORANT.

Phalacrocorax dilophus albociliatus RIDGW., Cat. Aquat. and Fish-eating Birds, 1883, p. 27; no description.

SUBSPECIFIC CHARACTERS.—Similar to *P. dilophus floridanus*, but with the nuptial plumes pure white, instead of black. Similar in coloration to *P. dilophus cincinnatus*, but much smaller. *Hab.* Pacific coast of United States, from California (Farallone Islands) to Cape St. Lucas; Revillegigedo Islands, Western Mexico.

This is the small southern form of *cincinnatus*, being, like the latter, distinguished by its white nuptial tufts, but differs in its much smaller size, in which respect it agrees closely with *floridanus*. *P. dilophus* thus may be separated into four races, the two southern ones (*floridanus* and *albociliatus*) distinguished from their northern representatives (*dilophus* and *cincinnatus*) by smaller size alone, while the western forms (*cincinnatus* and *albociliatus*) appear to differ from the eastern ones only in the color of the nuptial tufts, which seem to be always white or much mixed with white, instead of black with little or no admixture of white.

DESCRIPTION OF A NEW AMERICAN KINGFISHER.

BY ROBERT RIDGWAY.

Read February 23, 1884, and published by permission of the Director of the U. S. National Museum.

Ceryle superciliosa stictoptera, new subspecies.

? *Chloroceryle superciliosa* SCL., P. Z. S., 1864, 176, (City of Mexico.)

Ceryle superciliosa LAWR., Ann. Lyc., N. Y., ix, 1869, 204, (Sisal, Yucatan).—(?) Id., Bull. U. S. Nat. Mus. No. 4, 1876, 3, (Isth. Tehuantepec).—(?) SUMICH., Mem. Bost. Soc., i, 1869, 560, (hot reg. of Vera Cruz).—(?) BOUC., Liste Ois. réc. Guat. (in Ann. Soc. Linn. Lyon), 1878, 26.

HABITAT.—Yucatan; also, presumably, other parts of Southern Mexico and Guatemala. (NOTE.—The references given above, which are preceded by a mark of interrogation, are so designated for the reason that specimens from the localities indicated have not been examined.)

SUBSPECIFIC CHARACTERS.—Similar to *C. superciliosa*, but outer webs of secondaries conspicuously spotted with white (in three transverse rows), and with the white on the rectrices much more extended.

Of *C. superciliosa* (*vera*), the Museum possesses specimens from Demerara, Trinidad, Isthmus of Panama, and Costa Rica. These all have the outer webs of the secondaries either entirely immaculate, or else marked with very minute specks of dull fulvous. These markings are wanting in the two Demerara examples, are barely indicated in two from the isthmus, and are rather distinct (though still deep fulvous in color) in the one from Costa Rica—rendering it, therefore, probable that specimens from intermediate points might complete the transition from one to the other. It should be remarked, however, that the Costa Rican example (No. 64,666) is much more like South American skins than those from Yucatan, upon which the new race (possibly species) is based.

Types, Nos. 39,297, ♂, and 39,206, ♀, Sisal, Yucatan, May, 1865; Dr. A. Schott.

NOTE ON PSALTRIPARUS GRINDÆ, BELDING.

By Robert Ridgway.

(Read February 23, 1884.)

In my description of this species, on p. 155, vol. 6, of the Proceedings of the United States National Museum, I inadvertently made an erroneous comparison between this species and *P. melanotis*, as follows: "From the latter [*P. plumbeus*] it differs in much whiter throat and decidedly clearer, more bluish, shade of the upper parts, in both of which respects there is a close resemblance to *P. melanotis*." I wrote from memory, not having a specimen of *P. melanotis* before me at the time. Upon actual comparison I now find that while the statement is essentially correct so far as the coloration of the lower parts is concerned, I was greatly in error regarding the coloration of the upper parts. The difference is very great, *P. melanotis* having the pileum and nape fine light plumbeous-gray, exactly like the back of *P. grindæ*, while the back, etc., are bright brownish drab, much like the pileum and nape of *P. grindæ*, only more olivaceous. The relative position of the two colors is, in fact, exactly reversed in the two species.

NOTE ON THE GENERIC NAME CALODROMAS.

By Robert Ridgway.

(Read February 23, 1884.)

In 1873 ("Nomenclator Avium Neotropicalium," p. 156), Messrs. Sclater and Salvin proposed the name *Calodromas* for *Eudromia elegans*, Lafr. & D'Orb. This name, however, is preoccupied, having been given to a genus of Coleoptera by Goudot, in 1832 (Rev. et Mag. de Zool.) I therefore propose as a substitute *Calopezus* (καλός = *pulcher*, πεζός = *pedestris*.)

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DIAGNOSES OF NEW SPECIES OF BIRDS FROM KAMTSCHATKA AND THE COMMANDER ISLANDS.

By Leonhard Stejneger.

Read February 23, 1884, and published by permission of the Director of the U. S. National Museum.

1. **Pica camtschatica**, new species.

Diagnosis.—Larger than *P. caudata* and with longer bill; inner webs of the longest primaries white to the extreme tip; feathers of the throat black to the base.

♂ ♂: Total length, 525 mm.; wing, 218 mm.; tail f., 279 mm.; expos. culmen, 35 mm.

Hab.—Kamtschatka.

Types.—Nos. 89,144; 92,695, and 92,698, U. S. Nat. Mus.

2. **Corvus grebnitskii**, new species.

Diagnosis.—Nearly allied to *Corvus corax*, from which it differs in having the fourth and fifth primaries longest, and the latter decidedly longer than the second.

♂: Total length, 715 mm.; wing, 460 mm.; tail f., 255 mm.

♀: Total length. 660 mm.; wing, 426 mm.; tail f., 235 mm.

Hab.—Commander Islands, Bering Sea.

Types.—Nos. 92,759 and 92,760, U. S. Nat. Mus.

3. Alauda blakistoni, new species.

DIAGNOSIS.—Like *Alauda japonica* in the rusty tinge and the dark blackish brown scapulars and interscapulars, but differing in being larger and having a stronger and larger bill. The hind neck rusty colored, only dotted with small dark spots, forming a light collar between the strongly marked pileum and the dark color of the upper back.

♂ ♂: Total length, 187 mm.; wing, 116 mm.; tail f., 72 mm.; exp. culm., 13 mm.

♀ ♀: Total length, 186 mm.; wing, 109 mm.; tail f., 70 mm.; exp. culm., 12 mm.

HAB.—Kamtschatka and Bering Island.

TYPES.—Nos. 92,658 and 92,660, U. S. Nat. Mus.

4. Dendrocopos immaculatus, new species.

DIAGNOSIS.—Similar to *D. pipra*, but with unspotted white under tail-coverts, and the outer rectrices pure white, without dark cross-bars, or only with trace of a single bar; white bars on the wing broader; malar stripe narrow, broken, dusky, but not black.

♂: Total length, 167 mm.; wing, 97 mm.; tail f., 61 mm.; exp. culm., 18 mm.

HAB.—Kamtschatka.

TYPE.—No. 92,700, U. S. Nat. Mus.

REMARKS.—This is *Picus kamtschatkensis* of TACZANOWSKI (1882), but not of BONAPARTE (1854), whose type specimen came from Okotsk, *and not from Kamtschatka* BONAPARTE's bird is, in every respect, a typical *D. pipra* and the name *P. kamtschatkensis* consequently an unconditional synonym of the Siberian form.

5. Lagopus ridgwayi, new species.

DIAGNOSIS: ♂ ♂, in summer-plumage, above brownish black with dark ferruginous brown cross-bars and mottlings, but without any trace of white, whitish, and grayish edgings or barrings; first summer-plumage with blackish jugulum as in *L. muta*; bill longer and stouter than in the latter form; abdomen blackish in the perfect summer-plumage.

♂ ♂: Total length, 382–411; wing, 187–201; tail f., 102–112; bill from nostr., 10–12 mm.

♀ ♀: Total length, 357–384; wing, 179–189; tail f., 89–110; bill from nostr., 9.3–10.5 mm.

HAB.—Commander Islands.

TYPES.—U. S. Nat. Mus., Nos. 89,059; 89,062; 92,716; 92,709; 89,957; 92,712.

DIAGNOSES OF THREE NEW SPECIES OF FISHES FROM THE GULF OF MEXICO.

BY TARLETON H. BEAN, M. D., and H. G. DRESEL, Ensign, U. S. N.

Read February 23, 1884, and published by permission of the Director of the U. S. National Museum.

The writers are preparing descriptions of all the fishes of the Gulf of Mexico represented in the collections of the United States National Museum, to form a bulletin of the Museum. As considerable time must elapse before the material can be ready for the press, they present here brief diagnoses of some of the new species in advance of the complete publication.

Siphostoma crinigerum, new species.

The types of this species are two males, No. 33,173, taken at Pensacola, by Jordan and Stearns. The species is closely related to *S. crinitus* (Jenyns), a species inhabiting the coast of Northern Patagonia.

The snout is very short, less than ⅓ length of head. Eye, 5 times in length of head. Head nearly 11 times in total length to caudal base. Height of body, half length of head. Length of marsupium is 4 times in the total to caudal base. Dorsal of 16 or 17 rays. Body rings 15; caudal rings 38 or 39. Dorsal fin above the first 3½ to 4 caudal rings. The marsupium occupies 17 caudal rings. Minute filaments above the eyes, and apparently along the sides of the body.

Phycis floridanus, new species.

The type of the species is No. 32,762, taken by Silas Stearns at Pensacola. It is about 7¼ inches long. In general appearance it resembles *P. regius*, differing from this in its smaller scales, and more numerous dorsal rays. The greatest height is one-fifth of the total length to caudal base, and equals four-fifths of the length of head. Head 4 times in length to caudal base. Eye slightly less than snout, 5 times in length of head. Maxilla slightly less than mandible, one-half length of head. First dorsal not produced. Ventral about five-fourths length of head. Pectoral equal to head in length. Dorsal XIII, 57; Anal 49. Scales between first dorsal and lateral line in nine or ten rows; about 120 scales in the lateral line.

Ophichthys guttifer, new species.

The type of the species numbered 32,647 in the National Museum register is 22½ inches in length. It resembles *O. ocellatus* (Le Sueur) very closely, but the differences from that species are so important that we cannot consider them sexual.

The greatest height of body equals the distance from the angle of the mouth to the tip of the snout. The dorsal fin begins at a distance behind the vertical from tip of pectoral equal to length of the snout. The length of the pectoral is nearly 3½ times in length of the head. The head is ⅛ of the total length, ⅜ of the trunk. Eye 1½ times in length of snout, 9 times in that of head. Twenty-one or twenty-two small white spots along the median line.

A REVIEW OF THE AMERICAN CROSSBILLS (LOXIA) OF THE L. CURVIROSTRA TYPE.

By ROBERT RIDGWAY.

Read March 8, 1884, and published by permission of the Director of the U. S. National Museum.

Having long suspected the existence of two forms of the Red Crossbill in the United States, besides the Mexican race (*L. mexicana* Strickl.) which occurs just within our borders in Southern Arizona (and perhaps also in New Mexico), I was not surprised to find this conviction fully confirmed by a fine series of specimens presented to the National Museum by Captain Chas. E. Bendire, U. S. A., and obtained by him at Fort Klamath, Oregon, during the winter of 1882–83. The form under consideration being unquestionably distinct from both *L. americana* and *L. mexicana*, as well as from the several Palæarctic races, and being, so far as I am able to discover, unnamed, I take great pleasure in dedicating it to Captain Bendire as a slight recognition of his very valuable services to North American ornithology.

I am at present inclined to consider all the Red Crossbills that I have seen, from whatever country, as races of *Loxia curvirostra* Linn.; and therefore must prefer for the bird under consideration a trinomial designation, as follows:

Loxia curvirostra bendirei.

BENDIRE'S CROSSBILL.

Loxia americana (part) BAIRD, B. N. Am., 1858, 426.

Curvirostra americana (part) COOPER, Orn. Cal., i, 1870, 148.

Loxia curvirostra var. *americana* HENSH., Rep. Orn. Wheeler's Exp. 1873 (1874), 79 (Ft. Garland, Colorado).—(?) BENDIRE, Proc. Bost. Soc. N. H., xix, 1877, 116 (Camp Harney, Oregon, in winter).

Loxia curvirostra var. *mexicana* RIDGW., Bull. Essex Inst., v, Nov., 1873, 181, 189 (Colorado).

Loxia curvirostra mexicana MINOT, Bull. Nutt. Orn. Club, v, 1880, 229 (Colorado).

Loxia curvirostra bendirei RIDGW., MS.

HABITAT.—Chiefly the western mountain regions of the United States, from Colorado to Oregon and California; in winter, not uncommon in Eastern United States (Massachusetts, Maryland, etc).

SUBSPECIFIC CHARACTERS.—Differing from *L. curvirostra americana* in decidedly larger size. ♂: wing, 3.55–3.80 (average, 3.68); tail, 2.20–2.45 (2.34); culmen, .65–.78 (.71); depth of bill, .40–.45 (.42); gonys, .42–.50 (.47); tarsus, .62–.72 (.67); middle toe, .50–.60 (.57). ♀: wing, 3.40–3.60 (3.50); tail, 2.20–2.30 (2.23); culmen, .65–.70 (.67); depth of bill, .35–.40 (.39); gonys, .40–.55 (.46); tarsus, .60–.69 (.66); middle toe, .55–.58 (.56).

This race is about as much smaller than *L. curvirostra mexicana* as it is larger than *americana*. In fact, it may be considered as being about intermediate, so far as size is concerned. Compared with the *L. curvirostra*, it is found to differ in the following respects: (1) much brighter coloration; (2) shorter wing and tail; (3) shorter culmen combined with longer gonys, the mandible being proportionally stronger; and (4) more slender bill. *L. curvirostra mexicana* has the mandible still stouter, compared with the maxilla, and is, besides, much larger in all its measurements.

There is so little uniformity in coloration in the various races of this species that color alone is of little value as a race character. In the series of the present form, upon which these remarks are based, there are specimens which agree minutely in colors with examples of both *mexicana* and *americana*. In fact, it seems that *full-plumaged* specimens of the three American races are constantly much brighter than the two European forms (*L. curvirostra* and *L. curvirostra pityopsittacus*), although it should be stated that, with one exception, the males of the latter which have been examined are mounted museum specimens, and possibly much faded. However this may be, they certainly do not approach in richness of plumage American specimens of average intensity of coloration. There are two specimens, however, in the series before me which differ considerably from others in the tint of the red, which, on the lower parts, is of a purplish cast, much like a dilute tint of "Ruben's madder," the middle of the belly and the anal region fading into white. These specimens are Nos. 94,877 and 94,887, from Fort Klamath, Oregon, December 11, 1882, (Capt. Bendire, coll.), and resemble so closely two adult males from northern Japan (Nos. 91,432 and 91,433, Tate-Yama, P. L. Jouy, coll.), as to be distinguished only with great difficulty. Taking, however, No. 94,877, in which the resemblance to the Japanese birds is closest, and comparing with both the latter, the following differences are observable: The upper parts are decidedly darker, the pileum in the Japanese specimens being of the same pale purplish red as the color of the breast, while the brighter color of the rump corresponds closely to that of the flanks. In the Fort Klamath specimen, on the other hand, the pileum is much darker than the breast (being nearly the same color as the back), while the red of the rump is very much more intense than that on the flanks.

Three females from Japan are, however, practically indistinguishable from as many of the same sex from eastern Oregon (Fort Klamath, December, 1882, Capt. Bendire). In fact, were it not for the difference of habitat, these female Japanese Crossbills might well be regarded as identical with the larger North American form.*

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* The Japanese Crossbill has been referred to *L. albiventris* Swinhoe, but the description (Proc. Zoöl. Soc. Lond., 1870, p. 437) indicates a bird "like in color to *L. curvirostra*, but differing from all the known species in having the abdomen and under tail-coverts white, the latter with large central arrow-head brown spots. Under quills, whitish. Length 6 inches; wing 3⅝; tail 2; tip of wing to end of tail, 6. Iris brown; bill brown, light horn-color along the tomia. Legs, toes, and claws blackish brown, washed with pink on the soles." Habitat, south-eastern China. Should the phrase "like in color to *L. curvirostra*" be correct, the Crossbill of middle Japan certainly is not identical with that of China, for the Japanese specimens, both male and female, which I have examined are far more like *L. curvirostra bendirei* than *L. curvirostra* (*vera*). At any rate, even should they prove on comparison to be the same, the name *L. albiventris* is pre-occupied, having been bestowed in 1804 by Hermann (Obs. Zool., p. 205) upon a species of *Munia*. Regarding the Japanese birds as distinct from *L. curvirostra* proper (and leaving the question of their relationship to the Chinese bird in abeyance), it becomes necessary to give them a new name. I therefore propose to call them—

Loxia curvirostra japonica NOBIS. SUBSPECIFIC CHARACTERS.—Differing

In connection with the present subject, some remarks upon the other races of *L. curvirostra* (or supposed to be referable to that species) may not be unacceptable, the observations in question being based chiefly on specimens contained in the National Museum collection.

L. curvirostra pityopsittacus.—There are before me two adult males and one adult female of this robust species or race. These resemble most nearly, among the American forms, *L. mexicana*, but are decidedly larger in all their measurements, the bill especially being much higher; the mandible is broader at the base, though proportionally much shorter. The colors are similar but not so bright. The measurements of this form, as compared with *L. mexicana* and *L. curvirostra*, its nearest allies, are given in a table at the end of this article.

In Yarrell's "History of British Birds," fourth ed., part xi, page 210, the comparative measurements of *L. pityopsittacus* and *L. curvirostra*, apparently quoted from Dresser's "Birds of Europe," are given, in substance, as follows:

	Total length.	Wing.	Tail.	Tarsus.	Culmen.	Height of bill at base.	Width of mandible.
L. pityopsittacus	6.30–7.00	4.00–4.30	2.70–2.80	.75	.90	.60	.50
L. curvirostra	5.70–6.00	3.70–3.90	2.50–2.70	.60–.65	.75–.85	.50	.37–.40

from *L. curvirostra* (*vera*) in having the red of a fine rosy or madder-lake tint, the dimensions somewhat smaller. Female much grayer than that of *curvirostra*. *Dimensions.*—♂: wing 3.60–380 (3.70); tail 2.30–2.40 (2.35); culmen .70; depth of bill .45–.48 (.46); gonys .45–.48 (.46); tarsus .65–.70 (.67); middle toe .60. ♀: wing 3.60–3.70 (3.66); tail 2.20–2.35 (2.28); culmen .68–.70 (.69); depth of bill .42–.45 (.44); gonys .45–.49 (.46); tarsus .65–.70 (.68); middle toe .57–.58.

NOTE.—Since the above was written, specimens of a red crossbill have been received at the National Museum from Hakodadi (Nos. 91,386, ♂ ad., Feb., and 91,387, ♀ ad., Feb.), which are in every respect similar to European examples of *L. curvirostra*. It would therefore appear that while the form inhabiting the middle or main island of Japan is a distinct local race, that found in the northern island is identical with the European race.

L. curvirostra (*vera*).—Of this species or race I have for comparison only three adult males and two adult females. There is not the slightest difficulty in distinguishing any of these examples from *L. pityopsittacus*, or from any of the numerous American specimens. As to the latter, the resemblance of *L. curvirostra* is far nearest to *L. mexicana;* but the latter has a much more intensely red coloration, has the wing and tail (on the average) decidedly longer, and the mandible decidedly longer and stouter, both absolutely and in proportion to the upper mandible.

L. curvirostra americana.—When Wilson characterized his "*Curvirostra americana,*" he thus separated a North American Crossbill differing from the common European species (*L. curvirostra*), among other characters, in "being nearly one-third less." This statement of the difference in size is certainly not exaggerated. Of this form—which is the prevailing one in northern and eastern North America—I have examined in this connection twenty-four males, and twenty-three females. The characters presented by this series are very uniform, scarcely a single specimen being sufficiently larger than the average to render its position doubtful.

Compared with the provokingly small series of *L. pityopsittacus* and *L. curvirostra* which is available for the purpose, all the full-plumaged males of *L. americana* are decidedly brighter in coloration.* There is, however, much individual variation in color.

The brightest colored examples are Nos. 83,368, District of Columbia (spring of 1864; C. Drexler), and 78,186, Santa Cruz, California (W. A. Cooper), which are much alike, except that the former has the centre of the abdomen, hinder flanks, and anal region a rather deep, dull, grayish brown tinged with red, whereas in the latter these parts are dull grayish white. Both have the red of a deep "dragon's-blood" tint above, deepening on the head into a tint intermediate between "Indian-red" and crimson (but

* It is true that this is directly contrary to the experience of Messrs. Sharpe and Dresser, who state (Birds of Europe, pt. xiv) that "the adult male is generally duller than *L. curvirostra*, the red approaching to dirty orange;" but their observation was evidently based upon specimens not in perfect plumage.

much nearer the former), the rump much brighter, and inclining to clear, dull vermilion. The lower parts are bright "dragon's-blood-red," with a tinge of crimson. The wings are dark sepia-brown, the feathers very indistinctly edged with dull reddish-brown.

No. 83,366, from Utica, New York (winter of 1869; J. Davis), is very similar, but the red is somewhat lighter, inclining more to a dull vermilion shade. The centre of the abdomen adjoining the anal region is dull grayish white.

The darkest colored example is No. 86,893, Garrison's, New York (Dec. 30, 1874; T. Roosevelt), in which the red is of a dark madder-brown cast, the rump more brilliant, or of a dark brownish vermilion tint. The wings and tail are uniform dark sepia, without reddish edgings; the scapulars uniform dark sepia, and the back similar, but strongly tinged with dark red.

No. 93,630, from Arizona, has the red very brilliant, the whole pileum and nape, rump and lower parts being dull scarlet.

There is, in fact, so much individual variation in color that scarcely two specimens are closely alike.

The following measurements represent the averages of all the adult specimens of the several races which I have been able to examine. The males and females are given separately; and it will be noticed that *pityopsittacus* and *americana* represent the extremes of size, the others being intermediate in the order given. *L. himalayana* HODGS. is said to be smaller than *americana*, but I have seen no specimens.

Males.

	Wing.	Tail.	Culmen.	Gonys.	Depth of bill.	Tarsus.	Mid. toe.	Number of specimens.
L. pityopsittacus	4.10	2.60	.92	.60	.60	.75	------	2
" mexicana	3.99	2.54	.78	.53	.49	.70	.63	8
" curvirostra	3.88	2.48	.79	.46	.48	.68	.55	3
" japonica	3.70	2.35	.70	.46	.46	.67	.60	2
" bendirei	3.68	2.34	.71	.47	.42	.67	.57	21
" americana	3.38	2.12	.60	.41	.35	.62	.53	24

Females.

L. pityopsittacus	3.90	2.60	.75	.50	.58	------	------	1
" mexicana	------	------	------	------	------	------	------	(None.)
" curvirostra	3.75	2.35	.71	.49	.45	.70	------	2
" japonica	3.66	2.28	.68	.46	.44	.68	.57	3
" bendirei	3.50	2.23	.67	.46	.39	.66	.56	11
" americana	3.31	2.08	.59	.44	.37	.63	.52	23

NOTE.—Since the above was written, Mr. Wm. Palmer has kindly loaned me for examination three adult males and two females, obtained at Escanaba, Michigan, in June, 1883. These all belong to *americana*, and doubtless represent the form which breeds in that region.

NOTE ON THE ANAS HYPERBOREUS, PALL., AND ANSER ALBATUS, CASS.

BY ROBERT RIDGWAY.

(Read March 8, 1884.)

While there can be no doubt that Mr. Cassin did right in separating the smaller North American Snow Geese from the larger ones, it is very evident that he committed an error in giving the smaller form a new name. Pallas's *Anas hyperboreus* was based upon the birds of this species occurring in eastern Siberia; and on referring to his description it is perfectly clear that the Siberian specimens are identical with those from Alaska and other western portions of North America, which represent the so-called "*A. albatus*" of Cassin. This smaller form of the Snow Goose is not only the typical race, but has by far the most extensive distribution, so far, at least, as the United States are concerned, and is decidedly the more common one in most collections.* The larger race is the *Anas nivalis* of Forster (Philos. Trans., lxii, 1772, p. 413), and may therefore be called *Chen* (or *Anser*) *hyperboreus nivalis* (FORST). The habitat of this large race is the region about Hudson's Bay (the breeding grounds unknown, however), and southward in winter chiefly along the Atlantic coast of the United

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* The National Museum possesses only three specimens of the larger form, but has received at least ten times that number of the smaller race.

States. The smaller form, or true *hyperboreus*, breeds along the arctic coast, from northern Alaska eastward for an undetermined distance, but at least to the mouth of the McKenzie river; and throughout this extent of coast-line, and thence southward over the whole western portion of the continent, entirely replaces the larger bird.

As to the distinctive characters of the two races, I would remark that, while the length of the wing is by no means decisive (the maximum of *hyperboreus* being about 17.50 inches, and the minimum of *nivalis* 17.00!), *nivalis* always has a much larger bill, the culmen in adults of this form measuring from 2.50 to 2.65, and the length of the bill from tip to point of the basal angles, 3.00 to 3.12, the corresponding measurements of *hyperboreus* being only 1.95 to 2.28 and 2.50, or less, to 2.75.

REMARKS ON THE TYPE SPECIMENS OF MUSCICAPA FULVIFRONS, GIRAUD, AND MITREPHORUS PALLESCENS, COUES.

By Robert Ridgway.

(Read March 8, 1884.)

In the "Nomenclature of North American Birds" (p. 32, Nos. 329 and 329*a*), I have included, as two races of one species, an "*Empidonax fulvifrons* (Giraud) Scl.," and an *E. fulvifrons pallescens* Coues." This I did under the impression, based upon previous examination of the type specimens, that they were in reality sufficiently distinct to justify subspecific separation. Having recently had the matter brought to mind in another connection, I have re-examined the types in question, together with other material, and have thereby come to the following conclusions: (1) that *E. pallescens* is a decidedly smaller, lighter, or grayer colored western race, restricted to the western side of the Rocky Mountains, in Arizona and New Mexico, and probably portions of western Mexico also, although I have not seen specimens from south of the United States boundary; (2) that *E. fulvifrons* proper belongs to the country on the eastern side of the Rocky Mountains, the National Museum possessing the original type specimen, stated by Giraud to have come from Texas; (3) that in southern Mexico a third race exists, which agrees with *pallescens* in smaller size, but differs in decidedly deeper, richer coloration. The latter is the *Empidonax rubicundus* CAB. (Mus. Hein., ii, p. 70), but, being unquestionably conspecific with *E. fulvifrons*, should, in accordance with more modern usage, be called *E. fulvifrons rubicundus* (Cab.). We have, therefore, three geographical races of this species: the typical *fulvifrons* (Gir.) of "Texas" (and probably northeastern Mexico also), the *E. fulvifrons rubicundus* (Cab.) of southern Mexico, and *E. fulvifrons pallescens* (Coues) of southern Arizona and western New Mexico, and, probably, western Mexico.

I subjoin measurements of the adult specimens now before me, including two (from El Moro, New Mexico) which have the plumage much abraded.

a. E. fulvifrons (Giraud).

			Wing.	Tail.	Culmen.	Tarsus.	Mid. toe.
47691	—ad.	"Texas"	2.70	2.45	.35	.21	.60*

* Type of the species.

b. E. fulvifrons pallescens (Coues).

40601	♂ ad.	Ft. Whipple, Ariz.	2.20	1.95	.35	.20	.52*
40602	♀ "	" "	2.25	2.00	.37	.22	.51†
------	♂ "	Apache, Ariz.	2.40	2.10	.37	.20	.55
68603	♀ "	El Moro, New Mex.	2.45	2.10	.38	.20	.60
68604	♂ "	" "	2.40	2.15	.35	.21	.55

* Type of *Mitrephorus pallescens* Coues.

† *Ibid.*

c. E. fulvifrons rubicundus (Cab).

32914	♂ad.	"Mexique"	2.35	1.90	.37	.20	.52

It may be seen from the above measurements that there is much variation in dimensions in *E. fulvifrons pallescens*, from which we may reasonably infer that the same would be the case in the other races were an equal number of specimens measured. The coloration, however, is very uniform, none of the specimens of *pallescens* (and there are several young birds which are not measured) showing any approach to either *fulvifrons* or *rubicundus.**

True *E. fulvifrons* is of a peculiar shade of dull ochraceous-buff beneath, the throat and belly slightly paler, but not at all inclining to white; the upper parts are light dull brown, very slightly darker and duller on the pileum and lighter on the rump. *E. pallescens* is light yellowish ochraceous on the breast and sides, with the throat and belly inclining to yellowish white, and the upper parts are decidedly grayer than in *fulvifrons*. *E. rubicundus* is bright ochraceous beneath, the belly light creamy yellow, the throat buffy whitish, and the upper parts decidedly fulvous-brown.

NOTE REGARDING THE EARLIEST NAME FOR CARPODACUS HÆMORRHOUS (WAGLER).

By Robert Ridgway.

(Read March 8, 1884.)

A reference to plate 386 of Buffon's "Planches Enluminures" shows that figure 1 depicted thereon is intended to represent an adult male of the Mexican House Finch in abnormal plumage, or having the usual red color replaced by yellow—a variation not

* An additional series from New Mexico and Arizona, which, through the courtesy of Mr. H. W. Henshaw, I have recently been permitted to examine, fully confirms the validity of *pallescens*, none of the twelve specimens showing a nearer approach to *fulvifrons* than is exhibited by the specimens previously inspected.

uncommon among caged birds of this and allied species, and sometimes seen in wild specimens. This figure is the basis of *Fringilla mexicana* Müller (Syst. Nat. Suppl., 1776, p. 165), and also of *Emberiza mexicana* Bodd. (Tabl. P. E., 1783, p. 23). This bird must, therefore, be called *Carpodacus mexicanus* (Müll.), or, should intergradation with *C. frontalis* be proven, *C. frontalis mexicanus* (Müll.).

ON SOME HYDROCORALLINÆ FROM ALASKA AND CALIFORNIA.

By W. H. Dall.

(Read March 22, 1884.)

The descriptions herewith, with one exception, are of species from an area from which none have hitherto been described.* They are closely allied to species found in the Oregonian and Californian province described by Prof. Verrill, but have been, by his kind assistance, compared with his types, and appear to him and to myself to be distinct species, differing not only in habit and form, as well as relative size of the calyces, but especially in the sculpture and texture of the surface of the corallum. It is quite probable that the other species may hereafter be found in southeastern Alaska, in which case the fauna would comprise—

Allopora venusta Verrill; *Allopora Verrillii* Dall; *Allopora californica* Verrill; *Allopora Moseleyi* Dall; *Allopora papillosa* Dall.

To complete the list of Alaskan coralloid animals, *Calligorgia compressa* of Verrill may be added, as found in the Aleutian Islands, the only representative of the sea-fans yet known from the region, which is, however, extremely rich in Sertularian hydroids.

Allopora Verrillii, n. s.

Cœnosteum thin, reptate, whitish to pale rose pink, solid, encrusting; with a smoothish irregularly lumpy surface pretty regu-

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*A *Stylaster rosso-americanus* Brandt has been mentioned (Z. Wiss. Zool., xxii, 292), but has never been described or figured. It may be an additional species.

larly dotted with sporadic calyces, composed of circular gastropores, each surrounded by a circle of five to nine dactylopores, with occasional sac-shaped ampullæ, which are most abundant on the most elevated projections of the surface, and almost entirely absent from depressed parts. Diameter of the dactyloporic circle about 1.0^{mm}.; of the central gastropore about 0.37^{mm}.; the distance from center to center of the calyces varies from 1.5 to 2.5^{mm}.

Gastropores, cup-shaped, shallow ($0.25–0.50^{mm}$.), smooth inside, with the tip of a white spiculose nipple-shaped, or roundly conical style in the bottom of each, projecting about its own diameter or less into the cup through the aperture of a long nearly vertical conical tube which it occupies and closely fills. The length of this style, which resembles a fox's brush, is nearly equal to the thickness of the cœnosteum. The margin of the cup in fully developed gastropores is simple and entire, and depressed slightly below (or in no case elevated above) the general surface. In immature calyces there is frequently a shallow groove running from the innermost point of each dactylopore toward or into the gastropore.

Dactylopores variable in number, eight seeming to be the normal, but seven the most common number, never sporadic, in well-developed calyces entirely separated from the cavity of the gastropore throughout their extent; in immature ones joined to it by a shallow superficial groove. Transverse section a little ovoid, the wider arch away from the gastropore, and marked by a vertical, narrow, spongy lamina forming the style. The exterior margin simple, not elevated above the general surface, but rather slightly depressed below it. Neither sort of pore shows tabulæ. Ampullæ, simple sac-shaped cavities as large as, or larger than, the calyces, not protruding above the general surface, but more numerous on the prominences of the crust.

General surface between the above-described openings impervious, nearly smooth, with the vermicular fine reticulations of the cœnosteum structure showing through the translucent substance, and giving the surface a granular look, a vertical section of the crust looking much the same. Soft parts unknown. Crust growing several inches in diameter, and rarely more than three-eighths of an inch in thickness, generally found on dead shells of Modiola or pieces of nullipore from deep water. Habitat: thrown up on beach of Chika Islands, Akutan Pass, Aleutian Islands, near Unalashka—five specimens collected May, 1872, by W. H. Dall. Catalogue number, U. S. Nat. Museum, 4193.

Allopora Moseleyi, n. s.

Cœnosteum thick, nodulous or indistinctly branched, rosy pink, solid, with an irregular vesicular surface with sporadically distributed protuberant calyces, consisting of subcircular gastropores deeply vertically grooved near their margins by seven to twelve dactylopores whose cavities are continuous with the cavity of the gastropore. Ampullæ not observed. Diameter of the dactyloporic circle about 1.5^{mm}.; of the gastropore proper 0.75^{mm}. Gastropores rather deeply (0.50–0.75^{mm}.) cup-shaped, with the inner surface spiculose; style as in the preceding; margin of the pore deeply indented by the dactylopores, which are usually nine in number, but appear to be normally twelve; the whole calyx projecting, nipple-like, about 0.5–$0\ 6^{mm}$. from the general surface; recalling, in form, a small contracted *Zoanthus*. A spiculose lamellar style appears in the depth of each dactyloporic groove on careful search. The grooves appear to remain always open.

General surface impervious, covered between the raised calyces by small irregular sparse vesicular projections of the cœnosteum, otherwise in appearance and compactness much as in the previously mentioned form. Soft parts unknown. Habitat: Kyska Harbor, Kyska Island, in the western Aleutians, one specimen on the beach growing in a cavity between the layers of a mass of nullipore, collected July, 1873, by W. H. Dall. Museum number, 6851.

Allopora papillosa, n. s.

Cœnosteum very thin, encrusting, livid madder-pink or brown, with a regularly papillose surface, with close set sporadic calyces composed of deep cylindrical gastropores vertically grooved for three to six dactylopores, which are wholly continuous with the cavity of the gastropore. Ampullæ not noticed. Diameter of the calyx about 0.5^{mm}., of the gastropore proper about 0.35^{mm}.; average distance between the calyces, $0.7–1.3^{mm}$.

Gastropores deep, cylindrical, with a short, hardly perceptible style, which comes into the bottom of the gastropore, but, as a vertical section shows, not vertically but obliquely from one side. Inner surface nearly smooth, a narrow elevated ridge bounding the margin of the combined gastropores and dactylopores.

Dactyloporic grooves rather shallow, long, each with an evanescent trace of a style on the outer wall; six seems to be the normal number to each calyx.

General surface spiculose or finely granulated with small, pointed granules, with regularly-shaped, elevated, uniform papillæ standing in the spaces between the pore margins, and rising to about the same height, but absent on the immature growing margin of the colony.

Cœnosteum less vesicular than in the previously-described forms. Soft parts unknown. Habitat: on the outside of a living *Mytilus californianus*, from six fathoms, Coal Harbor, Unga Island, Shumagin Islands; collected October, 1874, by W. H. Dall. Museum number, 6852.

Errina Pourtalesii, n. s.

Cœnosteum of a saccharine structure, rising in stout, subcylindrical, rather round-pointed, occasionally branching stems ten to fifty millimeters high (possibly much larger at times), and eight or more in diameter; color, when fresh, deep rose-red, bleaching to white or gray in dead specimens; surface loosely granular, becoming lighter colored and more compact inward toward the central axis; gastropores disposed in irregular lines, which, in the specimen in hand, have a tendency to run from the base spirally to the left, around the column, but are so crowded that little of the surface is free from the nariform hoods of the attendant dactylopores; the gastropores average 0.25^{mm}. apart, but are rather irregular and occasionally sporadic, a rounded, rather smooth-topped style fills the pore nearly to the brim; the dactylopores are arranged alternately on opposite sides of the row of gastropores opposite the intervals between the latter, though sometimes crowded out of regularity; they are furnished with subtubular projections, squarely truncated at the top and open toward the gastropores, rising above the general surface to about 0.5^{mm}. or more; when perfect the styles rise nearly to the summit of the enclosing hood, slender, pointed, and rather feathery; two-thirds of their length, in general, is above the surface, and the depth of the gastropores is seldom greater (as a rule less) than that of the submerged portion of the others. Ampullæ on the surface, barely covered by a net-work of cœnosteal granules, which are often broken away, leaving shallow open cups between the projecting hoods; there are no scales, and the circular margin of the gastropores is smooth and simple.

Soft parts unknown.

Habitat: in 50–100 fathoms about the Farallones Islands, off the coast of California, on stones which are frequently brought up on the fishermen's hooks entangled in the corals. A large stone with several specimens upon it was obtained by Count Pourtalès in 1873, and is now in the Museum of Comparative Zoölogy, at Cambridge, from which the specimen described was selected; other specimens are in the collection of the California Academy of Sciences. This coral, as well as *Allopora venusta* and *A. californica* Verrill, meet with a ready sale in San Francisco, owing to their beautiful color, which, however, is not lasting if the specimens be much exposed to the light. The present species seems to do a good deal toward bridging the gap between *Errina* and *Distichopora*, as defined by Moseley. Museum number, 6853.

I may add, in conclusion, that through the kind co-operation of Prof. G. O. Sars and Miss Birgithe Esmark, I have been enabled to compare the Alaskan and Norwegian Alloporas, which, however, do not present any very marked points of resemblance outside of the generic characters.

SOME RESULTS BY MASSAGE ET CONTRE-COUP.

By W. S. Barnard, Ph. D.

Abstract of a communication made December 28th, 1883.

The application of jarring, somewhat stunning, blows in exceedingly rapid succession through a cushioned or elastic medium, to the head in particular directions at certain points of the cranium and face have been found in my experimentation to be simple means of producing local effects on the brain for the treatment of impaired circulation causing headache, &c.; also touches of what I denominate mechanical anæsthesia, and mechanical ataxy of local and transient character were similarly obtained. By making the blows very rapidly and through the deadening medium, they need not be so hard as would be the force of a single blow strong enough to cause a stunning effect, and the continuance of the effect is gained by the repetition of strokes in rapid succession. The fleshy portion of the hand was used for applying the strokes, and any elastic pounder answers. The speaker has been stunned by a single blow from a rubber ball, and quickly regained his senses without any noteworthy suffering, and has witnessed like cases of stunning with little pain from single strokes by boxing gloves. Similar examples, not uncommon, sustain the reality of mechanical anæsthesia and mechanical ataxy. By applying the rapid blows to parts of the head, temporary locomotor ataxy was experimentally generated while walking. The blows repeated as rapidly as possible are made harder and harder until with sufficient force shown by the effects instantly resulting as follows, but the blows must be hard enough to overcome voluntary effort; their application in a crosswise direction against the side of the chin caused turning and falling toward the blows, but similarly applied on the same side against the cranium at a region far backward but upward from the ear caused falling and turning in a contrary manner toward the opposite side. The blows against the chin on one side yielded the same effect as if against the occiput on the other side. The transmission of violence from one side of the chin to the opposite side of the upper back portion of the brain was named and explained as rotary transmission and delivery, viewing the head mechanically as a two-armed hollow lever and as an irregular wheel on the vertebral axis, the chin terminating one lever arm while the brain is contained in the other arm, the seat of locomotor control being in that part of the brain which is in the lever end farthest from the chin, as indicated in sketches shown. The effect there on one side of the brain inhibiited the use of the leg of the opposite side, &c. Some contre-coup injuries were similarly explained. The importance of the study of these and certain related principles, their application, and the practice of jarring to produce deep effects in the treatment of head maladies was urged.

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Dec. 9. 1886

PROCEEDINGS

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HONORARY MEMBER.

	Date of Election.
BAIRD, SPENCER FULLERTON, M. D., LL. D., M. N. A. S., Secretary of the Smithsonian Institution and Director of the U. S. National Museum; U. S. Commissioner of Fish and Fisheries; Foreign Member of the Zoological and Linnean Societies of London. *Smithsonian Institution, and 1445 Massachusetts Avenue N. W.*	1881, Jan. 14.

CORRESPONDING MEMBERS.

AGASSIZ, ALEXANDER, A. B., S. B., M. N. A. S., Curator of the Museum of Comparative Zoology, Cambridge; Foreign Member of the Zoological and Linnean Societies of London. *Cambridge, Massachusetts.*	1882, Mar. 31.
AGUILERA, JOSÉ G., Naturalista de la Comision Geografico Exploradora. *City of Puebla, Mexico.*	1886, Jan. 9.
ALLEN, HARRISON, M. D. *117 South Twentieth Street, Philadelphia, Pennsylvania.*	1882, Dec. 22.
ALLEN, JOEL ASAPH, M. N. A. S., C. M. Z. S., Curator of Ornithology and Mammalogy, American Museum of Natural History; President of the American Ornithologists' Union; Editor of "The Auk." *New York City.*	1882, April 8.
BARCENA, MARIANO, Profesor de Geologia en la Escuela Preparatoria. *City of Mexico, Mexico.*	1886, Jan. 9.
BREWER, WILLIAM HENRY, Ph. D., M. N. A. S., Professor of Agriculture in the Sheffield Scientific School, Yale College, New Haven. *New Haven, Connecticut.*	1882, April 28.

CORRESPONDING MEMBERS—Continued.	Date of Election.
BREWSTER, WILLIAM, Assistant in the Museum of Comparative Zoology, Cambridge. *61 Sparks Street, Cambridge, Massachusetts.*	1881, Feb. 25.
BROOKS, WILLIAM KEITH, Ph. D., Associate Professor of Biology and Director of the Marine Laboratory of Johns Hopkins University, Baltimore. *Baltimore, Maryland.*	1881, Feb. 25.
COLLETT, ROBERT, C. M. Z. S., Conservator of the Zoological Museum of the University of Christiania. *Christiania, Norway.*	1882, Jan. 6.
COPE, EDWARD DRINKER, M. A., M. N. A. S., C. M. Z. S., Editor of "The American Naturalist." *2100 Pine Street, Philadelphia, Pennsylvania.*	1882, Dec. 22.
DERBY, ORVILLE ADELBERT, M. S., Curator of the Geological Section of the National Museum of Brazil. *Rio de Janeiro, Brazil.*	1881, April 14.
DOBSON, GEORGE EDWARD, M. A., M. B., F. R. S., F. Z. S., Surgeon Major R. N. *Exeter, Devonshire, England.*	1884, Nov. 15.
FARLOW, WILLIAM GILSON, A. M., M. D., M. N. A. S., Professor of Cryptogamic Botany in Harvard University. *Cambridge, Massachusetts.*	1882, Jan. 6.
FLOWER, WILLIAM HENRY, LL. D., F. R. S., Pres. Z. S., F. L. S.; Director of the Natural History Departments of the British Museum. *South Kensington, London, S. W., England.*	1884, Feb. 8.
GIGLIOLI, ENRICO HILLYER, D. Sc., C. M. Z. S., Director of the Royal Zoological Museum of Vertebrates, and Professor of Vertebrate Zoology in the Royal Institute, Florence. *R. Istituto di Studi Superiori, Florence, Italy.*	1881, Mar. 11.
GRAY, ASA, M. D., LL. D., M. N. A. S., Fisher Professor of Natural History in Harvard University; Foreign Member of the Royal Society of London, and of the Institute of France. *Botanic Garden, Cambridge, Massachusetts.*	1882, Jan. 6.
HORN, GEORGE HENRY, M. D., Pres. American Entomological Society. *874 North Fourth Street, Philadelphia, Pennsylvania.*	1884, Feb. 8.

CORRESPONDING MEMBERS—Continued.	Date of Election.
HUBRECHT, A. A. W., C. M. Z. S., &c., Professor of Natural History in the University of Utrecht. *Utrecht, Holland.*	1884, Jan. 11.
HYATT, ALPHEUS, S. B., M. N. A. S., Professor of Zoology and Palæontology in the Massachusetts Institute of Technology; Custodian of the Boston Society of Natural History; President of the Society of Naturalists of the Eastern United States. *Cambridge, Massachusetts.*	1882, Jan. 6.
JORDAN, DAVID STARR, M. S., M. D., Ph. D., President of the Indiana University. *Bloomington, Indiana.*	1883, Jan. 5.
LAWRENCE, GEORGE N., C. M. Z. S. *45 East 21st St., New York City.*	1881, April 8.
LEIDY, JOSEPH, M. D., LL. D., M. N. A. S., F. M. Z. S. L.; Professor of Anatomy in the University of Pennsylvania; President of the Academy of Natural Sciences of Philadelphia. *Philadelphia, Penn.*	1884, Dec. 27.
LYMAN, HON. THEODORE, A. M., M. N. A. S. *Brookline, Mass.*	1883, Dec. 14.
MARK, EDWARD LAURENS, Ph. D., Hersey Professor of Anatomy, Harvard University, and Assistant in the Museum of Comparative Zoology, Cambridge, Mass. *Cambridge, Massachusetts.*	1884, Nov. 15.
MARSH, OTHNIEL CHARLES, M. A., Pres. N. A. S., Professor of Palæontology in Yale College, and Palæontologist to the U. S. Geological Survey. *New Haven, Connecticut.*	1884, Feb. 8.
MARTIN, HENRY NEWELL, A. M., M. D., D. Sc., Professor of Biology in Johns Hopkins University. *Baltimore, Maryland.*	1882, Dec. 22.
MORSE, EDWARD S., Ph. D., M. N. A. S., Director of the Peabody Academy of Science, Salem. *Salem, Mass.*	1882, Mar. 31.
MOSELEY, HENRY NOTTIDGE, A. M., F. R. S., F. L. S., F. Z. S., &c., Linacre Professor of Human and Comparative Anatomy in the University of Oxford. *14 St. Giles, Oxford, England.*	1883, Nov. 30.
PACKARD, ALPHEUS SPRING, Jr., A. M., M. D., M. N. A. S., Professor of Zoology and Geology in Brown University, Providence; Editor of "The American Naturalist." *Providence, Rhode Island.*	1882, Mar. 31.

CORRESPONDING MEMBERS—Continued.	Date of Election.
PEREZ, FERNANDO FERRARI, President of the University of Puebla; Naturalista de la Comision Geografico Exploradora. *City of Puebla, Mexico.*	1886, Jan. 9.
SCLATER, PHILIP LUTLEY, M. A., Ph. D., F. R. S., Secretary of the Zoological Society of London. *3 Hanover Square, London, W., England.*	1884, Nov. 15.
SCUDDER, SAMUEL HUBBARD, A. M., M. N. A. S., President of the Boston Society of Natural History. *Cambridge, Massachusetts.*	1882, Dec. 22.
SMITH, SIDNEY IRVING, Ph. B., Professor of Comparative Anatomy in Yale College, New Haven. *New Haven, Connecticut.*	1882, Mar. 3.
VELIE, JOHN W., M. D., Secretary and Curator of the Chicago Academy of Sciences. *263 Wabash Avenue, Chicago, Illinois.*	1881, Feb. 25.
VERRILL, ADDISON EMORY, A. M., S. B., M. N. A. S., Professor of Zoology, and Curator of the Zoological Collections in Yale College, New Haven. *New Haven, Connecticut.*	1882, Mar. 31.
WATSON, SERENO, Ph. D., M. N. A. S., Curator of the Herbarium of Harvard University. *Botanic Gardens, Cambridge, Massachusetts.*	1882, April 28.
WHITMAN, CHARLES OTIS, M. A., Ph. D., Embryologist, Museum of Comparative Zoology. *Cambridge, Massachusetts.*	1884, Nov. 15.
WILSON, EDMUND BEECHER, Ph. D., Professor of Natural History in Bryn Mawr College. *Bryn Mawr, Pennsylvania.*	1882, Mar. 3.

ACTIVE MEMBERS.*

ACKER, GEORGE N., M. D. *1403 New York Avenue, N. W.*	1883, Jan. 19.
AMES DELANO. *1600 13th Street, N. W.*	1883, Jan. 19.
ASHFORD, FRANCIS ASBURY, M. D. (*Deceased.*)	Orig. Member.
BAKER, FRANK, M. D. *Office of Light-House Board, and 326 C Street, N. W.*	1881, Jan. 14.

* Unless otherwise stated, all addresses are in Washington. By the words "Original Member" are designated those who attended the meetings for organization, November 26 and December 3, 1880.

ACTIVE MEMBERS—Continued.	Date of Election.
BALDWIN, ALBERTUS HUTCHINSON. *Smithsonian Institution.*	1884, Nov. 29.
BARKER, JOHN SHEPARD. *715 H Street, N. W.*	1882, Mar. 3.
BARNARD, WILLIAM STEBBINS. *917 New York Avenue.*	1881, Nov. 11.
BATES, HENRY HOBART. *U. S. Patent Office, and "The Portland."*	1884, April 19.
BEAN, TARLETON HOFFMAN, M. D. *Smithsonian Institution, and Summit Avenue, Lanier Heights.*	Orig. Member.
BENEDICT, JAMES EVERARD. *Smithsonian Institution, and 140 B Street, N.E.*	1883, Jan. 5.
BESSELS, EMIL. *The Cosmos Club.*	1881, Mar. 25.
BEYER, HENRY G., M. D., U. S. N. *Smithsonian Institution, and 1205 Connecticut Avenue, N. W.*	1881, Nov. 11.
BIGELOW, HORATIO RIPLEY, M. D. *(Absent.)*	1884, Jan. 11.
BIGELOW, ROBERT PAYNE. *(Absent.)*	1883, Mar. 2.
BIRNEY, HERMAN HOFFMAN. *(Absent.) 1901 Harewood Avenue, Le Droit Park.*	1881, Jan. 14.
BIRNEY, Gen. WILLIAM. *1901 Harewood Avenue, Le Droit Park.*	1882, Jan. 20.
BLACKBURN, ISAAC WRIGHT, M. D. *Government Hospital for the Insane.*	1885, Nov. 14.
BRITTON, WILEY. *Quartermaster General's Office.*	1882, Nov. 24.
BROMWELL, JOSIAH ROBSON, M. D. *1138 Connecticut Avenue, N. W.*	1883, Dec. 14.
BROWN, JAMES TEMPLEMAN. *(Deceased.)*	Orig. Member.
BROWNE, JOHN MILLS, M. D., U. S. N. *Bureau of Medicine and Surgery, U. S. Navy, and "The Portland."*	1882, Nov. 24.
BRUNER, LAWRENCE. *(Absent.) West Point, Neb.*	1882, Dec. 22.
BRYAN, JOSEPH H., M. D., U. S. N. *1534 I Street, N. W.*	1883, Dec. 28.
BURGESS, EDWARD SANDFORD. *High School, and 810 12th Street, N. W.*	1883, Jan. 5.
BURNETT, SWAN MOSES, M. D. *1215 I Street, N. W.*	1882, Mar. 17.

ACTIVE MEMBERS—Continued.	Date of Election.
BUSEY, SAMUEL CLAGETT, M. D. *901 16th St., N. W.*	Orig. Member.
CHAMBERS, PAUL, M. D. *1001 11th Street, N. W.*	1885, April 4.
CHAPPEL, JOHN WILLIAM, M. D. *Tennallytown, D. C.*	1883, Jan. 19.
CHASE, HENRY SANDERS, Ensign, U. S. N. (*Absent.*) *Navy Department.*	1882, Feb. 17.
CHESTER, COLBY M., Commander, U. S. N. (*Absent.*) *Navy Department.*	1883, April 27.
CHICKERING, Prof. JOHN WHITE, Jr. *National Deaf-Mute College, Kendall Green, N.E.*	Orig. Member.
CHICKERING, JOHN JAMESON. *Kendall Green, N.E.*	1881, May 20.
CHRISTIE, ALEXANDER SMYTH. *U. S. Coast Survey Office, and 507 Sixth Street, N. W.*	1882, Mar. 17.
CLARK, ALONZO HOWARD. *U. S. National Museum, and 1527 S Street, N. W.*	1881, Jan. 28.
COLLINS, JOSEPH WILLIAM. (*Absent.*) *Gloucester, Mass.*	1881, Feb. 23.
COMSTOCK, Prof. JOHN HENRY. (*Absent.*) *Cornell University, Ithaca, N. Y.*	Orig. Member.
CONANT, WOODBURY PAGE. (*Absent.*)	1881, Dec. 23.
COUES, ELLIOTT, M. D. *Smithsonian Institution, and 1726 N Street, N. W.*	Orig. Member.
COX, WILLIAM VAN ZANDT. *U. S. National Museum, and "Belmont," corner 14th Street and Boundary, N. W.*	1881, Nov. 11.
CURET, ALBERT. *U. S. National Museum, and 934 E Street, N. W.*	1884, Nov. 29.
CURTICE, COOPER. *Smithsonian Institution.*	1884, Dec. 27.
DALL, WILLIAM HEALEY. *Smithsonian Institution, and 1119 12th Street, N. W.*	1881, Jan. 28.
DEWEY, FREDERIC PERKINS. *U. S. National Museum, and Lanier Heights.*	1881, Nov. 11.
DOSH, FRANK BOWMAN. (*Deceased.*)	1882, Jan. 20.
DRESEL, HERMAN GEORGE, Ensign, U. S. N. (*Absent.*) *Navy Department.*	1882, Dec. 22.
DRURY, GEORGE A., M. D. *1105 C Street, N.E.*	1885, April 4.

ACTIVE MEMBERS—Continued.	Date of Election.
EARLL, ROBERT EDWARD. *Smithsonian Institution, and 1336 T Street, N. W.*	1881, Jan. 28.
EGGLESTON, Rev. NATHANIEL HILLYER. *U. S. Department of Agriculture.*	1884, May 17.
ELLIOTT, HENRY WOOD. *Smithsonian Institution, and Cleveland, Ohio.*	1881, Feb. 25.
ELLZEY, MASON GRAHAM, M. D. *1012 I Street, N. W.*	1881, Nov. 25.
ENTHOFFER, JOSEPH. *U. S. Coast Survey Office, and 68 I Street, N. W.*	1882, Oct. 27.
FERGUSON, THOMAS BARKER. "*The Richmond.*"	1881, Jan. 28.
FISHER, ALBERT KENRICK, M. D. *U. S. Department of Agriculture, and Sing Sing, N. Y.*	1885, Dec. 12.
FLETCHER, ROBERT, M. D. *Surgeon General's Office, and "The Portland."*	1881, Mar. 25.
FLINT, JAMES MILTON, M. D., U. S. N. *U. S. Fish Commission Steamer Albatross.*	1881, Feb. 11.
FOREMAN, EDWARD, M. D. (*Deceased.*)	1881, Dec. 9.
FOSTER, RICHARD. *Howard University.*	1883, April 13.
FOX, WILLIAM HENRY. (*Absent.*) *Rockwood, Roane Co., Tenn.*	1883, April 27.
FRANZONI, CHARLES WILLIAM, M. D. *810 H Street, N. W.*	1883, Dec. 14.
FRISTOE, Prof. EDWARD T. *Columbian University, and 1434 N Street, N. W.*	1883, Jan. 5.
GANNETT, HENRY. *U. S. Geological Survey, and 1881 Harewood Avenue, LeDroit Park.*	1881, Mar. 25.
GARRETT, LEROY MASON, Ensign, U. S. N. (*Absent.*) *Navy Department.*	1882, Feb. 17.
GEARE, RANDOLPH ILTYD. *U. S. National Museum.*	1884, May 3.
GEDNEY, CHARLES DE FOREST. *U. S. Coast Survey Office, and 115 F Street, N.E.*	Orig. Member.
GIHON, ALBERT LEARY, M. D., U. S. N. *U. S. Naval Hospital.*	1881, Mar. 11.
GILBERT, GROVE KARL. *U. S. Geological Survey, and 1424 Corcoran Street, N. W.*	1882, April 28.

ACTIVE MEMBERS—Continued.	Date of Election.
GILL, THEODORE NICHOLAS, M. D. *The Cosmos Club, and 321 Four-and-a-half Street, N. W.*	Orig. Member.
GILPIN, GEORGE E., M. D. *Tennallytown, D. C.*	1883, Mar. 30.
GODWIN, HARRY P. *Office of "The Evening Star."*	1882, Nov. 24.
GOODE, GEORGE BROWN. *Smithsonian Institution, and Summit Avenue, Lanier Heights.*	Orig. Member.
GOODRICH, JOSEPH KING. (*Absent.*)	1882, Oct. 27.
GORE, Prof. JAMES HOWARD. *Columbian University, and 1305 Q Street, N. W.*	Orig. Member.
GRAY, WILLIAM M., M. D. *Army Medical Museum.*	1885, Dec. 12.
GURLEY, REVERE RANDOLPH, M. D. *3055 Q Street, N. W.*	1882, Nov. 24.
HAMILTON, JOHN B., M. D. *9 B Street, N. W.*	1882, Nov. 24.
HASSLER, FERDINAND AUGUSTUS, M. D. (*Absent.*) *Santa Aña, Los Angeles Co., Cal.*	Orig. Member.
HAWES, GEORGE WESSON. (*Deceased.*)	1881, Feb. 25.
HAWKES, WILLIAM HIMES, M. D. *1330 New York Avenue, N. W.*	1882, Feb. 3.
HAYDEN, EDWARD EVERETT. *U. S. Geological Survey, and 1601 S Street, N. W.*	1882, Feb. 17.
HEIDEMANN, OTTO. *U. S. Department of Agriculture.*	1885, April 4.
HENSHAW, HENRY WETHERBEE. *Bureau of Ethnology, Smithsonian Institution, and 13 Iowa Circle.*	1882, Mar. 31.
HESSEL, RUDOLPH. *514 Tenth Street, N. W.*	1881, Jan. 14.
HILL, ROBERT THOMAS. *Smithsonian Institution.*	1886, Jan. 23.
HITCHCOCK, ROMYN. *Smithsonian Institution.*	1883, Nov. 16.
HOADLY, FREDERICK H., M. D. (*Absent.*)	1882, Dec. 22.
HOFFMAN, WALTER JAMES, M. D. *Bureau of Ethnology, and 222 E Street, N. W.*	Orig. Member.
HORNADAY, WILLIAM TELL. *U. S. National Museum, and 404 Spruce Street, LeDroit Park.*	1882, April 14.
HOUGH, FRANKLIN BENJAMIN. (*Deceased.*)	1882, May 26.

ACTIVE MEMBERS—Continued.	Date of Election.
HOUGH, MYRON BEACH WARNER. (*Deceased.*)	1882, April 27.
HOWARD, LELAND O. *U. S. Department of Agriculture, and Oakland Avenue, Washington Heights.*	Orig. Member.
HOWE, FRANK T. *Office of "The National Republican," and 1438 Corcoran Street, N. W.*	1883, Feb. 6.
HOWLAND, EDWIN PERRY, M. D. *211 Four-and-a-half Street, N. W.*	1881, Feb. 25.
INGERSOLL, ERNEST. (*Absent.*) *New Haven, Conn.*	Orig. Member.
ISRAEL, GEORGE ROBERT. *High School.*	1882, Dec. 22.
JENKINS, THORNTON A., Rear Admiral, U. S. N. *2115 Pennsylvania Avenue, N. W.*	1885, Feb. 22.
JOHNSON, ARNOLD BURGES. *Office U. S. Light-House Board, and 501 Maple Avenue, LeDroit Park.*	1882, Mar. 3.
JOHNSON, BLANCHARD FREEMAN. (*Deceased.*)	1882, Jan. 20.
JOHNSON, JOSEPH TABER, M. D. *926 17th Street, N. W.*	1882, Feb. 3.
JOHNSON, WILLARD DRAKE. (*Absent.*)	1884, Feb. 23.
JOHNSTON, WILLIAM WARING, M. D. *1603 K Street, N. W.*	1882, Nov. 24.
JOUY, PIERRE LOUIS. (*Absent.*)	Orig. Member.
KIDDER, JEROME HENRY, M. D. *Smithsonian Institution, and 1816 N Street, N. W.*	Orig. Member.
KING, ALBERT FREEMAN AFRICANUS, M. D. *726 13th Street, N. W.*	Orig. Member.
KNOWLTON, FRANK HALL. *U. S. National Museum, and 202 5th Street, S. E.*	1884, Nov. 29.
KOEBELE, ALBERT. (*Absent.*) *Alameda, Cal.*	1881, Nov. 25.
LAMASURE, GEORGE MORTON. *216 12th Street, S. W.*	1885, May 30.
LEE, THOMAS. *Smithsonian Institution.*	1884, Dec. 27.
LEE, WILLIAM, M. D. *2111 Pennsylvania Avenue, N. W.*	Orig. Member.
LEHNERT, Rev. ERNEST. *320 Four-and-a-half Street, S. W.*	1882, Jan. 20.
LUCAS, FREDERIC AUGUSTUS. *U. S. National Museum.*	1882, Oct. 27.
LUGGER, OTTO. *U. S. Department of Agriculture, and 429 N. Carey Street, Baltimore, Md.*	1885, Nov. 14.

ACTIVE MEMBERS—Continued.	Date of Election.
McArdle, Thomas Eugene, M. D. *707 12th Street, N. W.*	1882, Dec. 22.
McClain, Charles Sumner, Ensign, U. S. N. (*Absent.*) *Navy Department.*	1883, Dec. 28.
McConnell, James Culbertson, M. D. (*Absent.*)	1883, April 27.
McDonald, Marshall. *Office U. S. Fish Commission.*	1881, Jan. 28.
McElhone, James Francis. *1318 Vermont Ave., N. W.*	1883, April 13.
McGee, W. J. *U. S. Geological Survey, and 1424 Corcoran Street, N. W.*	1883, Dec. 14.
McMurtrie, Prof. William. (*Absent.*) *Illinois Industrial University, Champaign, Ill.*	1881, May 20.
Mann, Benjamin Pickman. *U. S. Department of Agriculture, and 924 19th Street, N. W.*	1881, Nov. 11.
Marcou, John Belknap. *U. S. Geological Survey.*	1883, Nov. 3.
Marsh, Charles Carrolton, Ensign, U. S. N. (*Absent.*) *Navy Department.*	1882, Feb. 17.
Marx, George, M. D. *U. S. Department of Agriculture, and 924 Mass. Ave., N. W.*	Orig. Member.
Mason, Otis Tufton. *U. S. National Museum, and 1305 Q Street, N. W.*	Orig. Member.
Merriam, Clinton Hart, M. D. *Smithsonian Institution.*	1885, Nov. 14.
Miller, Benjamin. *1516 31st Street, N. W.*	1881, June 3.
Miner, Randolph Huntington, Ensign, U. S. N. (*Absent.*) *Navy Department.*	1882, Feb. 17.
Moser, Jefferson Franklin, Lieut., U. S. N. *Office U. S. Coast Survey.*	1884, April 5.
Murdoch, John. *U. S. National Museum, and 1441 Chapin Street, College Hill.*	1883, Nov. 30.
Murrell, Edward H., M. D. *Lynchburg, Va.*	1885, Nov. 14.
Nelson, Edward W. (*Absent.*)	1881, Dec. 9.
Nelson, Henry Clay, M. D., U. S. N. *Westminster, Md.*	1883, Feb. 2.
Niblack, Albert Parker, Ensign, U. S. N. (*Absent.*) *Navy Department.*	1883, Jan. 19.

ACTIVE MEMBERS—Continued.	Date of Election.
NICHOLS, HENRY E., Lieut.-Comdr., U. S. N. (*Absent*). *Navy Department.*	1884, April 19.
NORRIS, BASIL, M. D., U. S. A. (*Absent.*) *Vancouver, Clarke County, Washington Territory.*	Orig. Member.
PARKER, PETER, JR. *Smithsonian Institution, and 2 Lafayette Square, N. W.*	1882, Dec. 22.
PATTON, HORACE B. (*Absent.*)	1882, Dec. 22.
PATTON, WILLIAM HAMPTON. (*Absent.*)	Orig. Member.
PERGANDE, THEODORE. *U. S. Department of Agriculture, and 614 7th Street, S. W.*	Orig. Member.
PERSONS, REMUS CHARLES, M. D., U. S. N. (*Absent.*) *Navy Department.*	1883, Feb. 16.
PHILLIPS, LOUIS E. *1428 New York Avenue, N. W.*	1883, Nov. 16.
PORTER, JOHN HAMPDEN, M. D. *2720 M Street, N. W.*	Orig. Member.
POWELL, Major JOHN WESLEY. *U. S. Geological Survey, and 910 M Street, N. W.*	1881, Feb. 11.
PRENTISS, DANIEL WEBSTER, M. D. *1224 9th Street, N. W.*	Orig. Member.
RATHBUN, RICHARD. *Smithsonian Institution, and 1622 Massachusetts Avenue, N. W.*	Orig. Member.
RAU, CHARLES. *Smithsonian Institution.*	1881, May 20.
REYBURN, ROBERT, M. D. *2129 F Street, N. W.*	1881, Dec. 9.
RHEES, WILLIAM JONES. *Smithsonian Institution.*	1882, Oct. 27.
RICHEY, STEPHEN OLIN, M. D. *1426 New York Avenue, N. W.*	1882, Mar. 17.
RIDGWAY, ROBERT. *Smithsonian Institution, and 1214 Virginia Avenue, S. W.*	Orig. Member.
RILEY, CHARLES VALENTINE. *U. S. Department of Agriculture, and 1700 13th Street, N. W.*	Orig. Member.
RUSSELL, ISRAEL COOK. *U. S. Geological Survey, and 1424 Corcoran Street, N. W.*	1882, April 28.
RYDER, JOHN ADAM. *Smithsonian Institution.*	1882, Mar. 31.
SAFFORD, WILLIAM EDWIN, Ensign, U. S. N. (*Absent.*) *Navy Department.*	1882, Nov. 24.

ACTIVE MEMBERS—Continued.	Date of Election.
SALMON, Dr. DANIEL ELMER. *U. S. Department of Agriculture.*	1883, May 25.
SAYLES, IRA. *U. S. Geological Survey.*	1884, May 3.
SCHÆFFER, EDWARD MARTIN, M. D. *1321 F Street, N. W.*	Orig. Member.
SCHÖNBORN, HENRY. *213 7th Street, N. W.*	1882, Jan. 20.
SCHUERMANN, CARL WILHELM. *Smithsonian Institution, and 916 D Street, S. W.*	1882, Mar. 11.
SCHWARZ, EUGENE AMANDUS. *U. S. Department of Agriculture, and 600 M Street, N. W.*	Orig. Member.
SCRIBNER, FRANK LAMSON. *U. S. Department of Agriculture.*	1885, Dec. 26.
SCUDDER, CHARLES WILLIS. *Office U. S. Fish Commission, and 1115 S Street, N. W.*	1881, Jan. 14.
SCUDDER, NEWTON PRATT. *Smithsonian Institution.*	Orig. Member.
SEAMAN, WILLIAM HENRY. *1424 11th Street, N. W.*	Orig. Member.
SEATON, CHARLES W. *(Deceased.)*	1882, May 26.
SHUFELDT, ROBERT WILSON, M. D., U. S. A. *(Absent.) Box 144, Smithsonian Institution.*	1881, Nov. 11.
SHUTE, DANIEL KERFOOT, M. D. *916 12th Street, N. W.*	1882, Feb. 17.
SMILEY, CHARLES WESLEY. *Office U. S. Fish Commission, and 943 Mass. Avenue, N. W.*	Orig. Member.
SMILLIE, THOMAS WILLIAM. *U. S. National Museum.*	1883, Mar. 2.
SMITH, DEXTER A. *816 14th Street, N. W.*	1885, April 4.
SMITH, JOHN B. *U. S. National Museum.*	1885, Nov. 14.
SMITH, THEOBALD, M. D. *U. S. Department of Agriculture.*	1884, Feb. 8.
SMITH, THOMAS CROGGON, M. D. *1133 12th Street, N. W.*	1883, Feb. 16.
SMITH, WILLIAM ROBERT. *U. S. Botanical Garden.*	1881, Nov. 11.
SNELL, Hon. WILLIAM B. *941 K Street, N. W.*	1885, May 16.
STEARNS, ROBERT EDWARDS CARTER. *Smithsonian Institution, and 1635 13th Street, N. W.*	1884, Nov. 29.
STEJNEGER, LEONHARD. *Smithsonian Institution.*	1881, Nov. 11.

ACTIVE MEMBERS—Continued.	Date of Election.
STERNBERG, GEORGE MILLER, M. D., U. S. A. (*Absent.*)	1881, Mar. 25.
STEVENSON, JAMES. *U. S. Geological Survey, and 1913 N Street, N. W.*	1882, Mar. 17.
STEWART, ALONZO HOPKINS. *204 4th Street, S.E.*	1883, Dec. 14.
STIMPSON, WILLIAM GORDON. *U. S. National Museum.*	1881, Feb. 25.
STREETS, THOMAS HALE, M. D., U. S. N. (*Absent.*) *Navy Department.*	1882, Feb. 17.
TARR, RALPH STOCKMAN. (*Absent.*)	1882, Nov. 24.
TAYLOR, JAMES HEMPHILL. *482 Louisiana Avenue, N. W.*	1882, Dec. 22.
TAYLOR, THOMAS, M. D. *U. S. Department of Agriculture, and 238 Massachusetts Avenue, N.E.*	Orig. Member.
TAYLOR, WILLIAM BOWER. *Smithsonian Institution, and 306 C Street, N. W.*	1882, Oct. 27.
THOMAS, CYRUS. *Bureau of Ethnology, Smithsonian Institution.*	1883, Jan. 5.
THOMPSON, JOHN FORD, M. D. *904 14th Street, N. W.*	1881, Dec. 9.
TODD, Prof. JAMES EDWARD. (*Absent.*) *Tabor College, Tabor, Iowa.*	1881, Jan. 28.
TONER, JOSEPH MEREDITH, M. D. *615 Louisiana Avenue, N. W.*	Orig. Member.
TRUE, FREDERICK WILLIAM. *U. S. National Museum, and 1335 N Street, N. W.*	Orig. Member.
TUPPER, JAMES BRAINERD TAYLOR. *Internal Revenue Bureau, Treasury Department, and 510 I Street, N. W.*	1883, Nov. 30.
TURNER, HENRY W. (*Absent.*)	1882, Oct. 27.
TURNER, LUCIEN M. *Smithsonian Institution.*	1881, Dec. 23.
ULKE, HENRY. *411 15th Street, N. W.*	Orig. Member.
UPHAM, EDWIN PORTER. *Smithsonian Institution.*	1881, Mar. 25.
VASEY, Dr. GEORGE. *U. S. Department of Agriculture, and 2012 14th Street, N. W.*	Orig. Member.
WALCOTT, CHARLES DOOLITTLE. *U. S. National Museum.*	1883, Nov. 3.

ACTIVE MEMBERS—Continued.	Date of Election.
WARD, LESTER FRANK. *U. S. National Museum, and 1464 Rhode Island Avenue, N. W.*	Orig. Member.
WEST, HENRY LITCHFIELD. *Office of the "Washington Post," and 111 E Street, N. W.*	1882, Dec. 22.
WHITE, CHARLES ABIATHAR. *U. S. National Museum, and 312 Maple Avenue, LeDroit Park.*	Orig. Member.
WHITE, CHARLES HENRY, M. D., U. S. N. *Museum of Hygiene, and 1744 G Street, N. W.*	1883, Dec. 14.
WHITE, MAURICE PUTNAM. (*Absent.*)	1881, May 20.
WILLCOX, JOSEPH. (*Absent.*) *Media, Penn.*	1884, Dec. 27.
WILLIAMS, ALFRED. *Department of State, and 232 North Capitol Street.*	1881, Jan. 28.
WILSON, JOSEPH MCMINN. *1108 Maryland Avenue, S. W.*	Orig. Member.
WILSON, Hon. WILLIAM LYNE, M. C. *1008 N Street, N. W.*	1884, Mar. 22.
WINSLOW, FRANCIS, Lieut., U. S. N. (*Absent.*) *Navy Department.*	1881, Dec. 9.
WORTMAN, JACOB L. *Army Medical Museum.*	1884, April 19.
YARROW, HENRY CRÉCY, M. D. *Surgeon-General's Office, and 814 17th Street, N. W.*	Orig. Member.
YEATES, WILLIAM SMITH. *U. S. National Museum, and 1403 6th Street, N. W.*	1881, Feb. 25.
ZUMBROCK, ANTON. *455 C Street, N. W.*	1882, Jan. 6.

THE BIOLOGICAL SOCIETY OF WASHINGTON.

CONSTITUTION.

Adopted December 3, 1880.

ARTICLE I.

Name.

The name of this Society shall be "THE BIOLOGICAL SOCIETY OF WASHINGTON."

ARTICLE II.

Objects.

Its objects shall be to encourage the study of the Biological Sciences, and to hold meetings at which papers shall be read and discussed.

ARTICLE III.

[As amended January 10, 1885.]

Members.

The Society shall consist of active, corresponding, foreign, and honorary members. Candidates for membership shall be proposed to the Council, in writing, by at least three members, and, upon recommendation of the majority of the Council present at its regular meeting, shall be balloted for at the earliest ensuing meeting. A majority vote of the members present when the ballot is taken shall be necessary to election.

ARTICLE IV.

[As amended January 10, 1885.]

Officers.

The officers shall be a President, four Vice-Presidents, two Secretaries, and a Treasurer. There shall be a Council, consisting of the officers of the Society and five members, to be elected by the Society. A quorum of the Council shall consist of seven members. Its duties shall be to act on nominations for membership, have the direction of the finances, audit the accounts of the Treasurer, and provide a programme for each meeting of the Society.

The officers shall be elected by ballot at each annual meeting, and shall serve one year, or until their successors are elected.

Presidents of the Society shall be members of the Council after the expiration of their term as President, without election thereto, in addition to the members of the Council otherwise provided for by the Constitution.

Article V.

President and Vice-Presidents.

The President, or, in his absence, one of the Vice-Presidents, shall preside at meetings of the Society and Council. The presiding officer shall appoint all committees in the Council and in the Society, unless otherwise ordered. It shall be the duty of the retiring President to deliver an address at the second meeting in January.

Article VI.

Secretaries.

The Secretaries shall take and preserve correct minutes of the proceedings of the Society and Council and a record of the members, shall conduct its correspondence, give due notice of all meetings, and inspect and count all ballots.

Article VII.

Treasurer.

The Treasurer shall have charge of all money and other property of the Society, and shall make disbursements under the direction of the Council. He shall collect all fees and assessments, and notify members who may be in arrears.

Article VIII.

Sections.

Sections for special work in any department of Biology may be formed upon the recommendation of the Council.

Article IX.

Meetings.

Stated meetings shall, unless otherwise ordered, be held on Friday of each alternate week, at eight o'clock P. M. The annual meeting for the election of officers shall be the first meeting in January. Special and field meetings may be called by the Council.

Article X.

[As amended February 2, 1883.]

Fees.

The initiation fee shall be one dollar; the annual fee two dollars. Members in arrears for one year shall, after due notification by the Treasurer, be dropped from the rolls, except in the case of those absent from the city for a year or more, who may be retained on the list as non-resident members during their absence. No member in arrears shall be entitled to vote at the annual meeting for the election of officers.

Article XI.

Amendments to the Constitution.

The Constitution of the Society may be amended by a two-thirds vote of the members present at any regular meeting, after at least four weeks' notice.

Article XII.

Order of Business.

The order of business at each regular meeting, unless otherwise provided by the Council, shall be as follows:

I. Reading of minutes.
II. Reports of Committees
III. Balloting for members.
IV. Nominations for membership.
V. Miscellaneous business.
VI. Reading of papers, discussions, and exhibition of specimens.

Article XII may be suspended at any time by a two-thirds vote of the members present.

PROCEEDINGS.

SIXTY-SIXTH MEETING, November 1, 1884.

The President occupied the chair, and thirty-five members were present.

The President announced the death during the summer intermission of Mr. Blanchard F. Johnson and Mr. M. B. W. Hough, active members of the Society.

He also gave notice that those present were invited to partake, at the close of the meeting, of a collation that had been spread in an adjoining room. It was explained that a number of members were desirous of introducing this new feature at the meetings of the Society, in order to promote social, as well as scientific, intercourse between the members, and that a committee had been appointed to report upon the subject.

Mr. William H. Dall made a communication upon the ZOOLOGICAL POSITION OF TURBINELLA,* stating as his conclusions that *Turbinella* proper, as typified by *T. pyrum*, was closely related to the group typified by *Cynodonta cornigera*; and that the investigation of the soft parts, hitherto unknown, corroborated previous conclusions from the shell.

Dr. T. H. Bean exhibited specimens of A CHIMÆRID FISH NEW TO THE WESTERN ATLANTIC, obtained from deep water during the summer of 1884 by the Fish Commission Steamer Albatross, and explained its relations to described species.

Mr. John A. Ryder, in a paper entitled THE DEVELOPMENT OF THE SUNFISH, MOLA,† stated his belief that *Molacanthus* was merely a stage in the development of *Mola*.

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* 1885. DALL, W. H. *On Turbinella pyrum, Lamarck, and its dentition.* <Proc. U. S. Nat. Mus., viii, pp. 345–348, pl. xix.

† Chapter viii of a paper entitled *On the Origin of Heterocercy and the Evolution of the Fins and Fin-rays of Fishes.* (In press).

Sixty-Seventh Meeting, November 15, 1884.

The President occupied the chair, and forty members were present.

Mr. A. B. Johnson exhibited a collection of plants obtained by Sergeant Connell, a member of the Greely Expedition, at Fort Conger, lat. 81° 44′ N., long. 64° 45′ W. Dr. Vasey offered provisional identifications of the seven species as follows: *Ranunculus* (perhaps *R. Nelsoni*), *Potentilla*, sp., *Vesicaria* (perhaps *V. arctica*), *Calandrina*, sp.. a species of the family Portulacaceæ, a fern, and a moss (perhaps *Bryum*, sp.).

Prof. Theodore Gill made a communication upon The Classification of the Monotremata,* sketching the history of opinion concerning their affinities, and calling attention to the fact that their oviparity had been recorded as early as 1822, by Fleming.

Prof. C. V. Riley read a paper on The Phytophagic Habit in Isosoma,† giving a historical and critical review of past opinion, and claiming to have finally demonstrated the life history of the Isosoma and its allies.

Mr. F. W. True spoke of his recent studies of The Habits of the Bottle-nose Dolphin,‡ and of the porpoise fisheries of Cape May and Cape Hatteras, which he had visited.

Sixty-Eighth Meeting, November 29, 1884.

The President occupied the chair, and forty-four members were present.

A communication was received from the Secretary of the Philosophical Society of Washington, inviting the members of the Biological Society to be present on the occasion of an address

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* 1884. Gill, Theodore. *The Eggs of Ornithorhynchus.* <Science, iv, pp. 452–453.

† 1885. Riley, C. V. *The Larger Wheat-straw Isosoma, Isosoma grande, Riley.* <Rept. [U. S.] Commiss. Agric. for 1884 (1885). (Riley, C. V. Report of the Entomologist, [Jan.] 1885), pp. 357, 358 [73–74], pl. 7, fig. 2, 3; pl. 8, fig. 3, 4.

‡ 1885. Science, v, p. 338, 1 fig.

by the president, Dr. J. C. Welling, at the annual meeting of that Society. The invitation was accepted.

Dr. W. K. Brooks, of Johns Hopkins University, made a communication upon THE ORIGIN OF ALTERNATION OF GENERATION IN THE HYDRO-MEDUSÆ.*

Mr. Sanderson Smith, of New York, read a paper entitled THE RECENT EXPLORATIONS OF THE STEAMER ALBATROSS, WITH SPECIAL REFERENCE TO THEIR GEOLOGICAL TEACHINGS.

SIXTY-NINTH MEETING, December 13, 1884.

The President occupied the chair, and thirty-six members were present.

The following communications were made:

Mr. Leonhard Stejneger, THE SHEDDING OF THE BILL IN AUKS.†

Dr. George Vasey, THE GRASSES OF THE ARID PLAINS, an account of observations during a recent trip to the western part of the United States.

Mr. C. D. Walcott, THE OLDEST KNOWN FAUNA ON THE AMERICAN CONTINENT,‡ a description of the characteristic fossils of the Primordial Group, of St. John, New Brunswick.

Prof. L. F. Ward, THE OCCURRENCE OF THE SEVENTEEN-YEAR LOCUST IN VIRGINIA, IN OCTOBER, 1884,§ and ADDITIONS TO THE FLORA OF WASHINGTON DURING 1884.‖ In his second

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* Abstract of a memoir entitled *The Life History of the Hydro-Medusæ; a Discussion of the Origin of the Medusæ, and of the Significance of Metagenesis*, now in course of publication by the Boston Society of Natural History.

† 1885. <Results of Ornithological Explorations in the Commander Islands and Kamtschatka, by Leonhard Stejneger. Bulletin of the U. S. National Museum, No. 29, Washington, 1885, pages 25–62, pls. i–v.

‡ 1884. WALCOTT, CHARLES D. On the Cambrian Faunas of North America. Preliminary Studies. Review of the Fauna of the Saint John Formation contained in the Hartt Collection at Cornell University. Bull. U. S. Geological Survey, No. 10; Washington, 8vo., pp. 56, pls. i–x.

§ 1885. WARD, LESTER F. *Premature Appearance of the Periodical Cicada.* <Science, v, June 12, p. 476.

‖ 1886. Proc. Biol. Soc. Washington, viii, p. 106.

communication, Prof. Ward announced that the names of 18 plants had been added to the Flora Columbiana during the past year, some of these having been new discoveries, and others based upon earlier observations, to which his attention had first been called during 1884.

SEVENTIETH MEETING, December 27, 1884.

The President occupied the chair, and thirty members were present.

Dr. Charles Sedgwick Minot, Secretary of the Society of Naturalists of the Eastern United States, made a statement concerning the annual meeting of that Society, to be held in Washington, on Monday and Tuesday of the following week.

Prof. R. E. C. Stearns, Dr. H. G. Beyer, and Mr. Benjamin Miller were appointed a committee to audit the accounts of the Treasurer, on account of his expected absence from the city after January 1.

Mr. F. W. True read a paper respecting A NEW SPECIES OF PORPOISE, PHOCÆNA DALLI, FROM ALASKA.*

Mr. John A. Ryder made a communication upon THE DEVELOPMENT OF THE FIN-RAYS IN FISHES.†

Mr. John Murdoch exhibited A COLLECTION OF MARINE INVERTEBRATES OBTAINED BY LIEUT. A. W. GREELY, AT CAMP CLAY, CAPE SABINE, SMITH SOUND,‡ all of which were well known Arctic forms.

Mr. G. Brown Goode spoke upon THE NATURAL HISTORY FEATURES AT THE WORLD'S EXPOSITION AT NEW ORLEANS.

SEVENTY-FIRST MEETING, January 10, 1885.

(Fifth Annual Meeting).

The President occupied the chair, and thirty-nine members were present.

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* 1885. TRUE, FREDERICK W. *On a New Species of Porpoise, Phocæna Dalli, from Alaska.* <Proc. U. S. Nat. Mus., viii, pp. 95–98, pls. ii–v.

† 1885. RYDER, JOHN A. *The Development of the Rays of Osseous Fishes.* <Am. Naturalist, Feb., pp. 200–204.

‡ Abstract in The Pastime, Washington, vol. iii, No. 7, p. 11, 1885.

The following amendments to the Constitution were unanimously adopted:

Article III, of members; the first sentence to be altered by the addition of the word "foreign," and to read as follows: The Society shall consist of active, corresponding, foreign, and honorary members.

Article IV, of officers; to insert the following sentence: Presidents of the Society shall be members of the Council after the expiration of their term as President, without election thereto, in addition to the members of the Council otherwise provided for by the Constitution.

The Society then proceeded to ballot for officers for the ensuing year, with the following results:

President—Mr. G. Brown Goode.

Vice-Presidents—Prof. Charles V. Riley, Prof. Lester F. Ward, Mr. William H. Dall, Prof. Otis T. Mason.

Secretaries—Mr. Richard Rathbun, Dr. Frank Baker.

Treasurer—Mr. Frederick W. True.

Additional Members of the Council—Dr. J. H. Kidder, Mr. C. D. Walcott, Mr. Romyn Hitchcock, Dr. George Vasey, Mr. J. L. Wortman.

SEVENTY-SECOND MEETING, January 24, 1885.

The fifth anniversary meeting was held in the lecture-room of the National Museum, the President, Mr. Goode, in the chair, and about one hundred persons present.

The retiring President, Dr. White, delivered an address upon THE RELATION OF BIOLOGY TO GEOLOGICAL HISTORY,* at the close of which, on motion of Mr. Dall, seconded by Prof. Mason and Prof. Ward, a vote of thanks was tendered him for his excellent communication, and for the very acceptable manner in which he had conducted the affairs of the Society during the past two years.

SEVENTY-THIRD MEETING, February 7, 1885.

The President occupied the chair, and twenty-five members were present.

* 1885. Proc. Biol. Soc., iii, pp. 1–20.

Mr. True announced that at the next meeting he would move to reconsider the day of meeting of the Society.

Mr. John A. Ryder made a communication upon THE PROBABLE ORIGIN AND HOMOLOGIES OF THE FLUKES OF CETACEANS AND SIRENIANS.*

SATURDAY LECTURES, 1885.

The fourth course of Saturday Lectures, under the auspices of the Biological Society and the Anthropological Society, was begun February 7, 1885. The lectures were delivered in the lecture room of the National Museum, and the following programme was carried out:

February 7: Prof. JOHN FISKE. Results in England of the Surrender of Cornwallis.

February 14: Dr. GEORGE M. STERNBERG, U. S. A. Germs and Germicides.

February 28: Hon. EUGENE SCHUYLER. The Machinery of our Foreign Service.

March 7: Mr. WILLIAM T. HORNADAY. Natural History and People of Borneo.

March 14: Mr. CHARLES D. WALCOTT. Searching for the First Forms of Life.

March 21: President E. M. GALLAUDET. The Language of Signs and the Combined Method of Instructing Deaf-Mutes.

March 28: President JAMES C. WELLING. Oldest History in the Light of Newest Science.

April 4: Mr. FREDERICK W. TRUE. Ornithorhynchus; a Mammal that Lays Eggs.

April 11: Dr. A. L. GIHON, U. S. N. Sanitary Ignorance among High and Low.

April 18: Mr. J. S. DILLER. A Trip to Mt. Shasta, California.

April 25: Dr. D. E. SALMON. Our Invisible Enemies, the Plagues of Animal Life.

May 2: Prof. T. C. MENDENHALL. Weighing the Earth.

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* 1885. Amer. Naturalist, vol. xix (May), pp. 515–519. (Abstract).

Seventy-Fourth Meeting, February 21, 1885.

The President in the chair, and ten members present.

Dr. H. G. Beyer, U. S. N., read a paper upon The Genital Apparatus of Lingula.*

Mr. J. L. Wortman described A Method of Exhibiting the Relationship of the Bones of the Skull, the plan consisting in painting the bones with different colors.

Mr. F. W. True made some remarks on The Recent Capture of Right Whales on Long Island.

Seventy-Fifth Meeting, March 7, 1885.

Professor Ward, Vice-President, in the chair, and twenty-five members present.

Dr. C. A. White described The Use of Gutta Percha in making Casts of Fossils.

Dr. H. G. Beyer, U. S. N., read a paper entitled Report on Intracellular Digestion and its Relations to Pathology.†

An informal ballot was taken to ascertain the sentiment of the members present with respect to the proposed change in the day of meeting, two-thirds of the members voting against the change. The Secretary was instructed to communicate with all the members of the Society in regard to this matter, and to report the result at a subsequent meeting.

Seventy-Sixth Meeting, March 21, 1885.

Mr. Dall, Vice-President, occupied the chair, and twenty-eight members were present.

The following paper, by Mr. Robert Ridgway, submitted for publication in the Proceedings, was read by title: Descriptions

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* 1886. Beyer, H. G. *A Study of the Structure of Lingula (Glottidia) pyramidata Stim. (Dall.)* <Studies from the Biol. Lab. Johns Hopkins Univ., Baltimore, iii, No. 5, March, pp. 227–265, pls. xiii–xvii.

† 1885. Beyer, H. G., Surg., U. S. N. *Abstract from an Article on Intracellular Digestion by Dr. Elias Metschnikoff.* <Monthly Jour. of Microscopy, vi, pp. 61–65.

OF SOME NEW SPECIES OF BIRDS FROM COZUMEL ISLAND, YUCATAN.[*]

Mr. W. H. Dall made a communication ON THE MARSUPIUM OF MILNERIA MINIMA,[†] a small Californian bivalve shell belonging to the family Carditidæ.

Prof. J. W. Chickering, Jr., exhibited a series of drawings and paintings of the flowering plants of the Shenandoah Valley, made by Mr. William T. Allen, a farmer of Gaylord, Clark Co., Virginia.

Dr. T. H. Bean spoke of SOME FEATURES OF COLLECTING AT COZUMEL ISLAND, YUCATAN,[‡] which he had recently visited, with the Fish Commission Steamer Albatross.

Mr. J. A. Ryder made a communication upon THE DEVELOPMENT OF THE MAMMARY GLANDS IN CETACEA,[§] based upon recent studies of sections of a female embryo of the black fish (*Globiocephalus melas*), two inches long.

Prof. L. F. Ward described the PHYLLOTAXY OF PAULOWNIA IMPERIALIS, and made some remarks on the general subject of leaf arrangement.

SEVENTY-SEVENTH MEETING, April 4, 1885.

Prof. Ward, Vice-President, occupied the chair, and twenty members were present.

The chair announced that 107 replies had been received in response to the circulars sent out by the Secretary, asking expressions of opinion respecting the proposed change of meeting-day. The greater number indicated a preference for Friday and Saturday, the same number of votes (thirty-four) having been received in favor of each of those days. On motion of Mr. A. B. Johnson, action upon this question was indefinitely postponed.

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* 1885. Proc. Biological Society, iii, pp. 21–24.

† 1885. ORCUTT, CHARLES R. *Notes on the Mollusks of the vicinity of San Diego, Cal., and Todos Santos Bay, Lower California, with comments by W. H. Dall.* <Proc. U. S. Nat. Mus., viii, pp. 534–552, pl. xxiv.

‡ New York Times, May 3, 1885.

§ 1885. RYDER, JOHN A. *On the Development of the Mammary Glands of Cetacea.* <Am. Nat., xix (June), pp. 616–618. *On the Development of the Mammary Glands and Genitalia of the Cetacea.* <Bull. U. S. Fish Com., v, pp. 135-142, one figure in text.

The following communications were made:

Mr. Frank H. Knowlton, ON SOME ALASKAN WILLOWS AND BIRCHES COLLECTED BY MR. C. L. McKAY, AT NUSHAGAK, IN 1881.*

Dr. Frank Baker, MUSCULAR EQUILIBRATION.

Dr. C. A. White, SOME REMARKS ON VEGETABLE CELLS.

Prof. W. H. Seaman stated that he had recently noticed in the Washington markets what is to this region a new species of tropical plant, known in New Orleans as the Japanese plum. The supplies had been received from Georgia. The fruit is indigenous to China and Japan, and in the former country is known as *Loo-Chee*.

SEVENTY-EIGHTH MEETING, April 18, 1885.

The President occupied the chair, and twenty-five members were present.

The President announced the recent death of Dr. Edward Foreman, a member of the Society, and appointed Messrs. White, Seaman, and Ward, a committee to prepare a report upon his services to science.

Dr. Theobald Smith read a paper, detailing KOCH'S METHOD OF ISOLATING AND CULTIVATING BACTERIA, as used in the laboratory of the Bureau of Animal Industry.†

Mr. A. B. Johnson presented a communication upon THE SHIP-WORM, TEREDO NAVALIS, AND THE SHEEPSHEAD, ARCHOSARGUS PROBATOCEPHALUS. He exhibited sections of the piles of wharves, which had been gnawed by the sheepshead, in order to feed upon the teredos, thus aiding in the work of destruction which is sufficiently rapid when left to the latter species alone.

After adjournment, Mr. Romyn Hitchcock exhibited, under the microscope, a series of preparations showing the comma bacillus of cholera, according to Koch.

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* 1885. KNOWLTON, FRANK H. *List of Plants collected by Mr. Charles L. McKay, at Nushagak, Alaska, in 1881, for the United States National Museum.* <Proc. U. S. Nat. Mus., viii, pp. 213–221.

† 1885. SALMON, D. E., and SMITH, THEOBALD, Drs. *Koch's Method of Isolating and Cultivating Bacteria, as used in the Laboratory of the Bureau of Animal Industry, Dept. Agriculture.* <Am. Monthly Micro. Jour., vi, p. 81. (Abstract).

SEVENTY-NINTH MEETING, May 2, 1885.

The President occupied the chair, and twenty-eight members were present.

Dr. Thomas Taylor made a communication on THE WHITE RUST OF CABBAGES, CYSTOPUS CANDIDUS.

Mr. H. W. Henshaw read a paper entitled HYBRID QUAIL,* the case of hybridism presented being between the California Valley quail (*Lophortyx californicus*), and Gambel's quail (*Lophortyx Gambeli*).

Mr. W. H. Dall spoke of OBSERVATIONS MADE DURING A RECENT JOURNEY IN FLORIDA.

EIGHTIETH MEETING, May 16, 1885.

The President in the chair, and twenty-five members present.

Mr. F. W. True exhibited A SPECIMEN OF THE ADULT MALE GUEREZA MONKEY, COLOBUS GUEREZA, recently purchased by the National Museum, and made some remarks upon the coloration, geographical distribution, and habits of the species.

Dr. T. H. Bean exhibited specimens of A NEW GENUS AND SPECIES OF FISH FROM FLORIDA, RELATED TO MURÆNOIDES,† a genus known to occur only in temperate and Arctic regions.

Mr. J. L. Wortman presented a communication on THE REDUCTION OF THE MOLAR TEETH OF THE CARNIVORA.

Prof. O. T. Mason read a paper ON POST-MORTEM TREPANNING,‡ describing especially a specimen recently sent from Peru, by Dr. W. H. Jones, U. S. N., and considered by Prof. Mason to be the most remarkable example yet brought to light.

EIGHTY-FIRST MEETING, May 30, 1885.

The President in the chair, and thirty-two members present.

Prof. L. F. Ward, in a communication entitled RECENT FLOW-

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*1885. HENSHAW, H. W. *Hybrid Quail (Lophortyx Gambeli x L. californicus).* <The Auk, vol. ii, No. 3, July, pp. 247–249.

†1885. BEAN, TARLETON H. *On Stathmonotus, a new genus of fishes related to Murænoides, from Florida.* <Proc. U. S. Nat. Mus., viii, pp. 191–192, pl. xiii.

‡1885. MASON, OTIS T. *The Chaclacayo Trephined Skull.* <Proc. U. S. National Museum, viii, pp. 410–412, pl. xxii.

ERING OF THE GINKGO TREE IN WASHINGTON,* stated that two trees of *Ginkgo biloba*, L., a male and a female, had flowered for the first time in the Botanical Garden, and the artificial pollinization of the female tree had been successfully effected.

Dr. H. G. Beyer, U. S. N., read a paper on THE PHYSIOLOGICAL EFFECTS OF COCAINE.†

Prof. C. V. Riley presented a paper entitled NOTES ON THE PERIODICAL CICADA,‡ in which he described the two extensive broods of this year, and discussed the specific value of the different forms.

Dr. Thomas Taylor made a communication on HOW TO DISTINGUISH BETWEEN ANIMAL AND VEGETABLE FATS,§ giving an account of his recent experiments on the subject.

EIGHTY-SECOND MEETING, October 31, 1885.

The President occupied the chair, and thirty members were present.

Col. Marshall McDonald made a communication entitled FISH CULTURE A NECESSITY FOR THE MAINTENANCE OF THE SHAD FISHERY,‖ illustrating his arguments by a comparison of the statistics for 1880 and 1885.

Mr. Wm. H. Dall read a paper on DEEP-SEA MOLLUSKS AND THE LAWS ILLUSTRATED IN THEIR DEVELOPMENT, exhibiting specimens collected by the Coast Survey Steamer "Blake" and the Fish Commission Steamer "Albatross."

Prof. O. T. Mason exhibited a series of casts taken from the

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* 1885. WARD, LESTER F. *The Ginkgo Tree.* <Science, v, June 19, pp. 495-497, 10 figs.

† 1885. BEYER, H. G. *The Influence of Atropine, Cocaine, and Caffeine on the Heart and Blood Vessels.* <Am. Jour. of the Medical Sciences, Phila., July, pp. 1-31, 2 pls.

‡ 1885. RILEY. C. V. *The Periodical Cicada.* <Science, v, June 26, pp. 518-521.

§ Proc. Am. Assoc. Advancement of Science, 1885; Proc. Am. Soc. of Microscopists, 1885; Ann. Rept. U. S. Dept. of Agriculture, 1885.

‖ 1885. *The Results of Shad Propagation on the Atlantic Coast.* <Science, vi, No. 145, suppl., pp. 433-434. (Abstract). Abstracts also printed in the American Angler, Forest and Stream, and other papers.

surfaces of a set of Haidi gambling sticks, the carvings on which were illustrative of Haidi mythology.

EIGHTY-THIRD MEETING, November 14, 1885.

The President occupied the chair, and twenty-six members were present.

Mr. Richard Rathbun read a paper entitled REMARKS ON THE WOOD'S HOLL STATION OF THE U. S. FISH COMMISSION, in which he described the quarters recently constructed for the purposes of fish culture and investigation.

Dr. W. S. Barnard exhibited A NEW STYLE OF METAL CASE FOR MOUNTING NATURAL HISTORY SPECIMENS.

The cases are of different shapes and sizes, and without sharp angles to give greater strength. They are intended for both dry and fluid preparations, and may have a glass face on one side. They are so constructed as to receive a tablet on which the specimens may be mounted. The lid has a groove with soft packing, to prevent evaporation or the entrance of museum pests.

Mr. John A. Ryder described A NEW AND PRACTICAL SYSTEM OF RAISING SEED OYSTERS.*

Mr. F. W. True made a communication ON A SPOTTED DOLPHIN APPARENTLY IDENTICAL WITH PRODELPHINUS DORIS, GRAY,† basing his remarks upon a specimen recently taken off Cape Hatteras by the Fish Commission Steamer Albatross.

EIGHTY-FOURTH MEETING, November 28, 1885.

The President occupied the chair, and thirty-six members were present.

Letters were read from the Secretaries of the Philosophical Society and the Chemical Society, inviting the members of the Biological Society to attend the next meetings of those Societies, at which presidential addresses would be delivered.

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* 1885. Forest and Stream, xxv, No. 13, Oct. 22, pp. 249–250. Science, Nov. 28.

† TRUE, FREDERICK W. *On a Spotted Dolphin Apparently Identical with the Prodelphinus doris of Gray.* <Rept. U. S. National Museum for 1884, pp. 317–324.

Dr. Theobald Smith exhibited A SIMPLE DEVICE FOR STORING COVER-GLASSES ILLUSTRATIVE OF BACTERIAL DISEASE.

Dr. W. S. Barnard explained A NEW METHOD OF MOUNTING GLASS SPECIMEN TUBES. Punched wads of some material that is proof against insects and fluids were recommended as stoppers for specimen tubes, being both economical and efficient. The tubes are mounted on tablets or labels by means of sheet-metal end clips which also serve to hold in the stopper; several different styles were exhibited.

Dr. C. Hart Merriam read a paper on THE WORK OF THE U. S. DEPARTMENT OF AGRICULTURE IN ECONOMIC ORNITHOLOGY.

Mr. C. D. Walcott made a communication upon EVIDENCE OF THE LOSS OF VITAL FORCE IN CERTAIN TRILOBITES ON APPROACHING EXTINCTION.

Mr. F. W. True presented A NEW STUDY OF THE AMERICAN POCKET RATS, GENUS DIPODOMYS.

EIGHTY-FIFTH MEETING, December 12, 1885.

The President occupied the chair.

Dr. J. M. Flint, U. S. N., read a paper entitled THE COLLECTION AND METHOD OF STUDYING FORAMINIFERA, exhibiting representative specimens from the dredgings of the U. S. Fish Commission Steamer Albatross.

Mr. Romyn Hitchcock made a communication upon THE RED SNOW,* showing specimens derived from several sources.

Dr. W. S. Barnard spoke upon ENVIRONMENTAL DIGESTION.

Prof. C. V. Riley presented a paper entitled THE MILDEWS OF THE GRAPE VINE.†

EIGHTY-SIXTH MEETING, December 26, 1885.

The President occupied the chair, and twenty-five members were present.

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* 1885. *The Red Snow.* <Am. Monthly Micr. Jour., vi, pp. 221–224.

† RILEY, C. V. *The Mildews of the Grape Vine. An effectual remedy for the Peronospora.* <Rural New Yorker, Feb. 6, 1886, illustrated. (Also separate reprint).

The following communications were made:

Dr. C. Hart Merriam, Description of a new Species of Striped Squirrel, Tamias macrorhabdotes, from California;* and Description of a new Sub-Species of the Common Eastern Chipmunk, Tamias striatus lysteri.†

Mr. F. H. Knowlton, The Multiplication in the Gynoecium of Datura Stramonium.

Prof. O. T. Mason, Mutilations of the Human Body, Considered Ethnically.

Eighty-Seventh Meeting, January 9, 1886.

The President occupied the chair, and twelve members were present.

This meeting was called as the annual meeting for the election of officers, but, on account of the small number of members present, due to very inclement weather, it was voted to defer the election to the next regular meeting-day.

Eighty-Eighth Meeting, January 23, 1886.

(Sixth Annual Meeting).

The President occupied the chair, and twenty-eight members were present.

The following board of officers was elected for the ensuing year:

President—Mr. G. Brown Goode.

Vice-Presidents—Mr. William H. Dall, Prof. Charles V. Riley, Prof. Lester F. Ward, Dr. Frank Baker.

Secretaries—Mr. Richard Rathbun, Dr. C. Hart Merriam.

Treasurer—Mr. Frederick W. True.

Additional Members of the Council—Mr. Romyn Hitchcock, Mr. Charles D. Walcott, Dr. Tarleton H. Bean, Prof. Otis T. Mason, Dr. George Vasey.

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* 1886. Proc. Biological Society, iii, pp. 25-28.

† 1886. Merriam, C. Hart, M. D. *Description of a New Subspecies of the Common Eastern Chipmunk.* <Am. Nat., xx, pp. 236–242.

EIGHTY-NINTH MEETING, February 6, 1886.

The Sixth Anniversary Meeting of the Society was held this evening in the Lecture Hall of the National Museum, Mr. William H. Dall, Vice-President, presiding. The President, Mr. Goode, delivered the annual address, his subject being THE BEGINNINGS OF NATURAL HISTORY IN AMERICA.*

Many members of the other scientific societies of the city were present by invitation.

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* 1886. Proc. Biological Society, iii, pp. 35–105.

ADDRESSES AND COMMUNICATIONS.

THE APPLICATION OF BIOLOGY TO GEOLOGICAL HISTORY.*

BY CHARLES A. WHITE.

I have chosen the subject which has just been announced by the Chairman, because I have been so long identified with the geological and paleontological work of our country that I think you will naturally expect my retiring address to have reference to some subject connected with the biological history of the earlier ages of the earth. It has become customary upon occasions like the present for the speaker to select some subject relating to his own special lines of research; and it is often the case that such addresses are real contributions to science and records of its advancement, as indeed it is well that they should be; but after much hesitation I have decided that my remarks upon this occasion shall be of a somewhat opposite character. That is, I shall endeavor to show that certain prevalent ideas are erroneous, and, incidentally, how they have retarded rather than aided philosophical inquiry.

It is much pleasanter for one to record and announce the triumphs of long and patient research, and to show the evidence of a steady increase of knowledge in the branch of study to which he is devoted, than to point out the existence of errors in unexpected quarters. But it is well that we should pause occasionally in our labors and question the truth of every proposition upon

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*Annual presidential address delivered at the Fifth Anniversary Meeting of the Society, January 24, 1885, in the lecture-room of the U. S. National Museum.

which we have been wont to act, and to inquire whether they will bear the light of rapidly increasing knowledge. I propose to-night not only to point out the insufficiency of the evidence which is relied upon to support some of the assumptions of paleontology, but to challenge the truth of some of the propositions which its leading men have been in the habit of treating as fixed laws of unquestionable and universal application, and to show that they are not in harmony with the facts of philosophical biology. I comprehend the danger that those who are not familiar with the leading principles of paleontology, hearing only a statement of the misconceptions which its votaries have fallen into, will be inclined to underestimate its fundamental truths, which are really unassailable. I wish to say, therefore, that I have no intention of treating my subject wantonly; and I shall be sorry to weaken the faith of any one in the general truths of a science which has done more than any other to broaden the minds of men as to the problems of animal and vegetable life; and which has a future before it, the brilliance of which is in no danger of being obscured.

The remarks which I am about to make refer mainly to certain errors, not yet entirely eliminated, which early obtained a foothold in paleontology, as a natural consequence of the biological opinions then prevailing, and which were inseparable from its stage of transition and growth. Modern paleontology, like the other sciences, has been a matter of growth; and errors once introduced have been found difficult to eradicate, even after an increase of knowledge has shown them to be such; and it is an unpleasant fact that our science, as it is now taught and practised, even by some of the best authors, is marred by some of its early defects.

The first and principal question which I propose to discuss relates to the chronological order of succession of animal and vegetable types, and their geographical distribution during their existence.

As aids to the correlation of the geological formations, fossils began early to be used. At first they were treated merely as tokens of the formations in which they occurred, without any reference to their character as representatives of formerly existing life; but it was soon perceived that by their use a systematic classification of the stratified rocks could be made. We now know that without their use we could not have obtained any adequate conception of geological history; and the present recognized scheme of the formations, or the geological scale, as it is sometimes called, could have never been devised. It is true that the order of succession of the few formations which may be favorably exposed in limited districts might have been made out by means of the lithological character of the strata alone; but the correlation of such limited groups of strata with those of other and distant districts would have been by such means impossible.

After the order of succession of the different groups of strata had been made out for certain regions and correlated with those of other regions, it began to appear that certain types of animal and vegetable remains characterized certain portions of the geological scale which was devised as a result of that correlation. That scale, which is the foundation of the one now in general use, was necessarily at first more or less defective and artificial. It has from time to time been much improved, and, although it is still imperfect, it is a marvellous monument of the results of inductive reasoning. Geology and biology have each come to the other's aid until not only has the foundation been substantially laid, but the structure itself is approaching completion in a perfect form.

In Europe, where geological science was first studied, and where it has ever since been prosecuted with remarkable energy, it was found that the chronological range of the types of fossils which characterize the respective formations is well defined. And when researches were extended into the adjacent parts of

Asia and Africa, the European standards were still found sufficiently exact for at least general conclusions. Even in Eastern North America the order of the formations and the types of the fossils which characterize them are closely like those of Western Europe, and in many cases the species are regarded as identical.

It was natural, then, that the conditions which were found to have formerly prevailed in those regions where geology was first studied should be held to have been the normal conditions for the whole earth. Such were the opinions formed by the earlier European geologists; and their successors still hold the European standard to be applicable to every region, and to every condition of climate which the earth has known. The leading idea which is embodied in this chronological scheme would, I think, be fairly illustrated by a diagram which may be constructed by taking such a section of the geological formations as is usually given in the text-books of geology, that of Dana's Manual for example, and projecting a series of circular lines from the boundary lines of each of its divisions and subdivisions. Let this series of circles represent approximately the time-equivalent of the geological column of formations and the assumed universal definition of each of its subdivisions.

It will of course be understood that such a diagram could not be intended to illustrate the time ratios of the different epochs, periods, and ages into which historic geology has been divided. It has been suggested only to illustrate the rigid character of the paleontological time-standard which European geologists have erected for themselves, and which they seek, with the consent of most of the geologists of other countries, to apply to the whole earth, even in minute detail.

It was formerly held that not only have all species of animals and plants been specially created, but that a majority of them became extinct during or at the close of each epoch; and that each period was closed with a universal catastrophe, by which every living thing upon the earth was destroyed. Furthermore, that the whole earth, at the beginning of each successive period, was stocked anew by special creation, with all its forms of life; and that these forms were everywhere impressed with the type-characters peculiar to the respective epochs. Even after it became known that in numerous instances species and genera continued their existence from one period to another, it was still held that these were extra-limitary forms, and that their existence did not affect the exclusive character of the types of those animals and plants which were ordained to bear the chronological impress.

Accepting such a scheme of creation as this, it was natural to suppose that the types of animal and vegetable life which characterized each of the geological periods should be universal in its distribution, and strictly confined to the period for which it was specially created.

Although the doctrine of evolution is now accepted by every working naturalist, this idea of a successive series of narrow chronological horizons of universal extent, each characterized by its own peculiar types of organic forms, which are everywhere the same, and none of which exist in any other horizon, prevails to almost as great an extent as before. The later naturalists, it is true, based their views of this assumed constancy, not upon the idea of special creation and universal distribution in each period, as their predecessors did, but upon that of a progressive evolution, by distinct and world-wide steps, from pre-existing forms. The views which were held by the older naturalists were the result of a rational deduction from their own premises; but that similar views should be held by the naturalists of to-day is certainly unphilosophical. In accordance with the old views little opportunity was given for the variation of types, because, as they believed, all the species in which those types were expressed were sure to be extinguished at the close of each period, and they were to be succeeded by a newly-created series.

To the modern naturalist, a belief in the universal distribution, and narrow and rigidly restricted chronological range of organic types which characterize each successive epoch, implies that evolution has occurred in all instances in exactly the same mathematical ratio; for animal as well as vegetable forms; for aqueous as well as for terrestrial life; for the life of fresh waters as well as that of the seas; and under every environing condition of climate and of geological change. It implies the existence of some unknown and unexplainable law which, at the close of each epoch, required the utter and speedy extinction of exactly such types as had specially characterized those epochs, even if the physical conditions under which they had formerly existed had continued the same. That such ideas do prevail among paleontologists at the present time one has abundant proof in their published writings.

In Europe it was found that during the successive geological epochs certain types of plants and vertebrate and invertebrate animals all lived simultaneously; and the actual and relative rate of progress of evolution of the types in each of these great biological divisions, seeming to be a natural one, was regarded as under the influence of some cosmical law which necessarily made that rate uniform for the whole earth. When, therefore, even a single type, whether of plants or vertebrate or invertebrate animals, such as is known to characterize any European group of strata, has been found in any other part of the earth, it has been customary to hold that the animal or plant, as the case might be, which is represented by that type, existed simultaneously with its European congeners. Although the folly of relying upon such slender evidence has again and again been shown, it is not uncommon to see it presented in important paleontological publications with all the force that such words as "certainly," "undoubtedly," "unquestionably," &c., can give it.

I have made the foregoing statements, first, to call attention to the existence of the erroneous views which I have indicated; and, secondly, that they may serve as a suggestion of the reason why they have obtained a foothold. I am confident that if the geological scheme had yet to be devised upon the basis of the advanced knowledge which naturalists have now acquired, it would be free from the defects which I have mentioned. In fact, it seems that these defects are due to the erroneous biological views which naturalists formerly entertained; and that they have remained solely because it is so difficult for men to free their minds from impressions which have once become firmly fixed, even after their fallacy has become apparent.

These errors have by no means escaped the attention of leading naturalists; and several years ago Prof. Huxley proposed the term "homotaxis" to express the existence of close biological relationship between formations in different parts of the world respectively, which might not, or could not, have been contemporaneously deposited. In using this term instead of "equivalent," "synchronous," &c., as has usually been done in relation to formations in separate regions which contain closely similar faunas or floras, one does not thus commit himself to any opinion as to the actual geological age of such formations, but only to the fact that the forms of life were similar when and where those formations were respectively deposited. Professor Huxley's idea may be represented graphically by superimposing upon the diagram which I have suggested a complementary series of lines, much as isothermal lines are superimposed upon a map with its lines of latitude. But to express the present state of our knowledge, these complementary or isotaxial lines must be sadly broken and fragmentary.

This idea of homotaxy necessarily has reference to some acknowledged standard of the order in which the geological formations have been deposited; and in using the term I shall of course have reference to that which is in general use, which is practically the European standard.

Various authors have shown, not only that many formations have been found in different parts of the world to be homotaxially related to each other by their respective faunas and floras which certainly were not contemporaneously deposited, but also that many foreign formations contain faunas which respectively embrace homotaxial representatives of two or more European formations. After I had selected the subject, and written out the greater part of these remarks, the address of Mr. W. T. Blanford and the article of Mr. J. Starkie Gardner, read before the British Association for the Advancement of Science, at Montreal, reached my hands. I find from a perusal of them that both of those gentlemen have so far anticipated much which I intended to say that I cordially recommend my hearers to read those productions. Both of them, especially that of Mr. Blanford, record some startling exceptions to the generally received rule that formations homotaxially related were of contemporaneous origin. I shall have occasion to refer to some of the cases of this character which they have mentioned, and I shall also cite other instances which have come under my own observation. First, I shall mention instances where there is apparent reversion of the chronological order of the formations, and afterward those in which a commingling in one formation of the characteristic types of two or more epochs occur.

Mr. Blanford, in his address, cites a considerable number of instances where the order of occurrence of faunal and floral types, according to the accepted chronological scale, is reversed. One of these instances occurs at the famous Pikermi beds, near the ancient city of Athens. These beds contain a rich mammalian fauna which is so characteristically Miocene that the French committee of the International Congress of Geologists specially mention it as of that age. Some of the species of the Grecian locality referred to are identical with those of some of the fully recognized Miocene strata of other parts of Europe. Now, Professor Gaudry found in the lowest of these Grecian beds which bear Miocene vertebrates several species of well-known Pliocene mollusca, and he also found that this bed in turn rests upon a "marine bed of undoubted Pliocene age."

A similar condition of things occurs among the Tertiary deposits along the southern base of the Himalayas in India, in what are known as the Siwalik beds. These beds contain a mammalian fauna which European paleontologists have unhesitatingly referred to the Miocene; but the geologists of the Indian survey have shown that they have many thousand feet of Miocene strata beneath them; and upon other grounds, also, they show that they cannot be of earlier age than the Pliocene.

Perhaps one of the most remarkable instances of the apparent reversion of the chronological order of the formations, as it is known in Europe, occurs in the great series of strata in India which is known as the Gondwána System. Mr. Blanford, in his address, gives an account of this remarkable case in detail. Certain of the beds of this system of formations contain a fauna which paleontologists agree in classifying as Triassic. These Triassic beds are found overlying beds which contain a Rhætic flora, or one which has its homotaxial representative in Europe between the Jurassic and Triassic; and these Rhætic beds are found to overlie those which contain a flora that paleobotanists refer with confidence to the Jurassic period. In the other cases mentioned, there is a reversion of two homotaxial epochs; but in this Gondwána System the reversion embraces three of them. That is, the order of all the three is reversed, so that the ascending order in India is the same as the descending order in Europe.

Again, it has been shown by experienced geologists that in Australia there are beds which bear a flora that paleobotanists declare to be typically Jurassic, and which are interstratified with marine beds that bear an abundance of characteristic Lower Carboniferous molluscan species. And, furthermore, that these beds are overlaid by a fresh-water formation which has been referred with confidence to the Permian period.

Coming to our own country, the most remarkable case of the reversion of the order in which the faunal and floral types are found to characterize the European formations is found in the Cretaceous series of the valley of the Upper Missouri river. Here we have a series of strata which has been held to represent the European Cretaceous series from the Gault to the Upper Chalk, inclusive. In the lower division of this American series there has long been known to exist a flora which, when it was first discovered, was referred by the best authority to the age of the Eocene Tertiary. Even so late as the past year, Mr. J. Starkie Gardner has expressed the opinion that these plants are more likely to be of Eocene age than earlier. Now the strata containing this assumed Tertiary flora are overlaid by a series, several thousand feet in thickness, which contains an abundance of marine types that correspond with those of the Cretaceous of Europe. Indeed, several of the species are regarded as identical; and the types embrace reptiles, fishes, and cœlenterata, as well as all the classes of mollusca. Then, resting upon this series, and its Atlantic border equivalent, we find the whole Tertiary series, at least up to the close of the Miocene. Furthermore, a considerable number of these American Tertiary forms are usually regarded as identical with European Tertiary species. It would thus seem that both the stratigraphical and concurrent paleontological evidence are decidedly against the Tertiary age of that flora, and in favor of its Cretaceous age, notwithstanding its homotaxial relationship to the Tertiary flora of Europe.

The commingling of types in one formation which, in Europe, respectively characterize two or more separate formations, is a matter of not uncommon occurrence in America and other parts of the world. These cases occur where the order of the formations seems to agree well with that of the accepted European standard; and they apparently merely show that the types referred to began their existence earlier, or continued it later, as the case may be, than they were known to have done in Europe. In the other cases the discrepancies are seen to occur as between marine faunas on the one hand, and land faunas and floras on the other; and those discrepancies amount to an actual reversion of the usual order. In the cases which I shall now mention, however, the discrepancies consist in either the actual or relative earlier introduction, or later continuation, of certain types among both marine and continental faunas and land floras, than is required by the European standards. In these latter cases there is of course a confusion of homotaxial relationship, of the formations which contain the commingled types, with other formations; but there is not necessarily any reversion of the order of occurrence of the types, as there is in the cases already mentioned.

I ought not in this connection to omit mention of the so-called colonies of Barrande, in Bohemia, which, as he contended, bear a marine Silurian fauna, alternating with strata which bear a Primordial one. But as the truth of Barrande's position has been seriously questioned, I need not discuss it in these remarks.

Even after what we have seen of the history of the received opinions concerning the synchronism of formations, it is still a somewhat remarkable fact that, although the blending of the faunas of certain formations into each other by the commingling of types, which are regarded as characteristic of each respectively, has been so long known and so often demonstrated, that the idea of universal restriction of types to narrow time-horizons should be so persistently held. Indeed, the fact that such a commingling of types as I have referred to has been so well recognized that it has made its impress upon the terminology of geology. Thus the term Permo-Carboniferous has long been used in America to designate strata which partake of both Coal-Measure and Permian characteristics; and the same term has been applied by Dr. Toula to strata which bear a similar fauna on the island of Spitzbergen.

The terms Cretaceo-Jurassic and Cretaceo-Tertiary have been respectively applied to New Zealand strata for obvious reasons. The former term has also been applied to Chilian strata by Darwin; and the latter, (but erroneously, I think,) to the Laramie Group of our own country. Mr. Gardner would even extend the application of this latter term so as to embrace all that series of strata from the Dakota Cretaceous to the Laramie Group, inclusive. These terms, and the instances I have given of their application, are quite sufficient to show the existence of the facts to which I have called your attention. But the following instances of the early introduction and late continuance of certain important types are of especial interest in this connection.

From strata in Northwestern Punjab, India, which are by all geologists admitted to be of Carboniferous age, a remarkable collection of fossils was made which contained specimens of a species of Ammonites. Upon the announcement of this fact its truth was not only questioned by European paleontologists, but some went so far as to deny the possibility of the association of that genus with a Carboniferous fauna. Afterward the well-known paleontologist Waagen visited the locality and himself collected there specimens of *Ammonites*, *Ceratites*, and *Goniatites*, all associated together in the same layers with characteristic Carboniferous forms.

That *Goniatites* should be found in Carboniferous strata was to have been expected; but if the *Ceratites* and *Ammonites* had been found separately and unassociated with any other fossils, no European paleontologist would have hesitated to refer the one to the Triassic, and the other to the Cretaceous. In fact, Dr. Waagen has placed the Ammonite referred to under a generic group which is an especially characteristic one among Cretaceous faunas. This instance of the commingling of types which are characteristic of different periods is a remarkable one in all respects, and especially as showing the very early differentiation of even subgeneric forms, which are generally believed not to have existed until a much later period. Confirmatory of the fact of this introduction before the close of the Paleozoic age, of types which are especially characteristic of the Mesozoic, Professor Heilprin has announced the discovery of an Ammonitic form among a characteristic Carboniferous fauna from Texas.

The commingling in New Zealand strata of types which are usually found to characterize separate formations has already been referred to, but in this connection I also wish to mention the reported discovery in those islands of *Belemnites*, *Belemnitella*, and *Plesiosaurus* in strata which have usually been classed as Tertiary. There seems to be little reason to doubt that this is an instance of a natural transition from the Cretaceous to the Tertiary, so gradually accomplished that it cannot be said where the one ends and the other begins.

A similar survival of Mesozoic types into an epoch, the strata of which bear otherwise the fullest evidence of homotaxial relationship to the Eocene Tertiary, occurs in California. Here there is found a species of Ammonite associated with numerous genera which all paleontologists have agreed in regarding as characteristic of the Tertiary. The series of strata which contains this belated Ammonite is some ten thousand feet in thickness, the lower part of which is homotaxially related to the Cretaceous, and the upper part is similarly related to the Tertiary, with the exception just mentioned. Still, this series of strata has every appearance of having been produced by continuous sedimentation, and of presenting an intercommingling of Cretaceous and Tertiary types through the greater part, if not the whole, vertical range of the series.

In the cases which have just been mentioned, the continuation of ancient types among those of later origin, or of more modern characteristics, the comparison was made between the different members of one and the same fauna for the different portions of its existence; but in the case now to be considered, the comparison is to be made between continental faunas and floras. The case referred to is that of the Laramie Group. It will be remembered that in my address before this society last year I made some extended remarks upon this group, showing that it was deposited in a great inland sea of brackish and fresh waters. Comparison, therefore, is to be made between the aqueous fauna of such a sea, and the land fauna and flora which existed upon its borders. I have upon several occasions called attention to the fact that brackish and fresh-water faunas have undergone far less differentiation during the lapse of geological epochs than marine faunas have. I cannot now contrast the aqueous fauna of the Laramie Group with any open-sea fauna, but, together with its contemporaneous flora and land molluscan fauna, it contrasts strangely with its contemporaneous land vertebrate fauna.

The aqueous fauna of the Laramie Group is mainly molluscan; and while the brackish-water forms show their relationship to the preceding Cretaceous marine fauna, the fresh-water and land mollusca are largely of types that now exist. The flora is also of a very modern character; but the vertebrate land fauna is largely Dinosaurian. I need not tell a paleontologist that here is a most remarkable mixture of types. The extraordinary biological character of this group will be still more conspicuously seen when I mention that I have collected the characteristic mollusca of this group where they were associated with Dinosaurian remains; and in the same series of layers I have also obtained numerous species of plants, several of which have by competent authority been identified with European Miocene species, and two of them with species now living in the United States. That is, we have evidence that a large molluscan fauna, and a luxuriant dicotyledonous flora, both containing species that we can with difficulty, if at all, distinguish from living forms, existed contemporaneously with great Dinosaurian reptiles such as have always been regarded as peculiar to the Mesozoic age.

The instances which I have presented demonstrate that in different parts of the world there are many and material departures from the European paleontological standard; but in no case have we seen that departure to be so great when marine formations are compared with each other as they are when formations containing a marine fauna are compared with those containing a continental fauna or flora. I therefore quite agree with those who regard the marine faunas as much the most reliable indices of geological age.

During geological time the open sea has certainly afforded far greater uniformity of conditions for the existence and evolution of the different forms of life which it has contained than the land and fresh waters have done. Therefore, it is reasonable to conclude that, as a rule, the progress and ratio of the differentiation, evolution, and decadence among marine forms have been more uniform throughout geological time, and over greater areas, than has been the case with continental life. While, as we have seen, the ratio of evolution and decadence of marine types among themselves has not been so uniform as it has been assumed to have been by the European paleontological standard, such a ratio for the continental forms of life has often not only an extraordinary want of uniformity among themselves, but it is often at great variance with that of marine life.

Now it seems to me that the absence of a uniform ratio of evolution and decadence between marine, fresh-water, and land faunas and land floras, respectively, is just what we ought to expect when we consider the great variety of character of the various forms of life involved, and the great diversity of physical conditions under which they have existed. All that we yet know of ancient continental life points to the conclusion that the evolution of its various forms has been subject to frequent accelerations and retardations; and that, as a rule, they have been more subject to abrupt extinction than marine forms have. It is true, however, that some of the types among the continental faunas and floras which are now living have come down to us from very ancient times. It is also evident that a uniform rate of evolution of similar forms of continental life did not obtain in all parts of the world during the respective geological periods. An illustration of my meaning in this respect is afforded by our Cretaceous dicotyledonous flora already referred to. In America that flora had reached the European Tertiary stage long before the close of the Cretaceous period.

The instances which I have mentioned, besides many others which might be referred to, show that the confidence with which many paleontologists have decided upon the question of the synchronism of formations in widely separated portions of the earth, some of which are at most only one or two hundred feet in thickness, is quite unjustifiable.

I would gladly end here my arraignment of the unwarrantable positions which paleontologists have hitherto assumed, but I have yet to refer to others, especially to the custom of deciding upon the homotaxial relationship, or so-called equivalency, of formations upon insufficient evidence. Before the student of living animals and plants is prepared to decide in a satisfactory manner upon the forms which he is investigating, he requires not only a series of perfect specimens of his species, but also all that can be known of its anatomy and physiology, its habits and habitat, its associated forms, and its specific and generic relations. On the contrary, the paleontologist, as is well known, is confined to the study of such of the hard or skeletal parts of animals as may have escaped destruction by decomposition or other means; and the imprints or fragments of plants, mainly leaves.

One cannot cease to wonder at and admire the large amount of real knowledge which has been gained by the study of even such imperfect material as this. In fact, all that we know of the ancient life of the earth has been derived from this source; and by means of comparisons with related living forms we are often able, by the aid of a perfectly legitimate use of the imagination, to restore to a large extent the faunas and floras of long past geological periods. Encouraged by this success, and urged by the necessities of geology, paleontologists have assumed not only to decide upon the specific and generic identity of the forms represented by such imperfect material, but also to base upon it generalizations of the greatest importance in both geology and biology.

Every investigator knows how small a clue will sometimes lead to the unravelling of obscure problems in scientific research, and no one has more frequent occasion to give earnest attention to such clues than the working paleontologist. Indeed, some of his best results would often have escaped him if such clues had been disregarded. Such a use of even the most insignificant facts is perfectly legitimate; but I wish to refer especially to the practice which has prevailed of publishing what are ostensibly conclusions which have been reached from legitimate investigation, when in reality they are at best little more than mere surmises. I will give a couple of instances of this kind to illustrate my meaning.

In California and Western Nevada, where the country is mountainous and the rocks are much displaced and more or less altered, several isolated and limited exposures of strata have been found which contained a few fossil shells. At some of the localities half a dozen species are represented, but at some only one or two species. Most of these specimens are too imperfect to serve as the basis of even a satisfactory specific description; and none of the types presumably represented by them are of such a character as to give reasonable assurance of even homotaxial relationship with those of any European formation.

The most that can be said of this meagre fauna is that it is probably of Mesozoic age. And yet the equivalency of these rocks with the Jurassic of Europe has been confidently asserted, and broad generalizations have been based upon that assumption as to the age of mountain uplifts and other great geological events.

Again, there is in the western portion of the United States domain a formation which all geologists and paleontologists have agreed in referring to the Jurassic period. It is true that its invertebrate fauna is not full enough to afford entirely satisfactory evidence on this point, but the rich vertebrate fauna which

Professor Marsh has published from that formation has been accepted as conclusive. Furthermore, the position of the formation in relation to those which underlie and overlie it is confirmatory of the received opinion as to its Jurassic age. Notwithstanding this weight of evidence in the direction indicated, the paleontologist of the Canadian Geological Survey has, upon what I believe to be the mistaken identification of a comparatively small collection of imperfect and uncharacteristic fossil shells, referred the formation bodily to the Middle Cretaceous. When such a circumstance as this is possible it is certainly time we should examine well the grounds of our conclusions before we publish them to the world or base other results of our labors upon them.

While belief in the general applicability to all parts of the world of the chronological scale now in common use will probably never be seriously shaken, it is plain that we must abandon the idea that formations in widely separated parts of the world were necessarily synchronous in their origin because certain portions of their faunas or floras are similar. The custom has been to recognize a complete chronological scheme of the formations, of universal application, as already established, and to prosecute the geology of every part of the earth with the express view of making it conform to that scheme. But I submit that the geology of each of the large divisions of the earth ought to be studied independently, and untrammelled by preconceived notions of necessary conformity to a foreign standard. In my opinion, the time has not yet come for the construction of a complete and detailed chronological scale for the whole earth, and that it will not have fully arrived until the whole earth shall have been carefully studied.

If geology were studied in the different divisions of the earth with the ideas in view which I have indicated, its prosecution would be relieved of much useless labor, as well as freed from a large proportion of the now prevailing liability to error. I do not wish to be understood as trying to discourage comparisons of the geology of different parts of the earth with each other. On the contrary, this ought constantly to be done; but what I wish to insist upon is that the study of each separate division of the earth should not be trammelled by a standard erected for another.

I have shown that the study of geology and paleontology has always been interdependent; but among certain geologists and paleontologists, respectively, there has been manifested a disposition to pursue the study of each branch separately, if not independently. A large part of the paleontological work which has been published has been done by men who have made no systematic study of field geology, or none in connection with their paleontological work. Much of their work has evidently been done in the belief that the paleontologist can sit in his study and fix with precision the geological horizons and the order of succession of the formations from which every collection submitted to him may come. If a difference of opinion in this respect has arisen between the field geologist and the paleontologist, each has contended for the truth of his own position, and each has often been shown to be in error.

It is therefore evident that the field geologist and paleontologist must work in concert. Indeed, the field geologist who ignores the use of fossils, as some have affected to do, is sure to burthen science with the results of worthless work; and the paleontologist who does not go to the field and study there the formations from which his fossils have been obtained is sure to produce results of work which will be worthy of the condemnation of both geologists and biologists.

But I am confident that there is a better day near at hand for the science to which so many able men have devoted their lives; and that the evils to which I have called your attention are already passing away, and will soon be entirely of the past. When we remember what rapid strides have been made in all the branches of natural science within the memory of even the youngest workers, we have reason to anticipate a future for all those branches which will equal our most extravagant desires.

DESCRIPTION OF SOME NEW SPECIES OF BIRDS FROM COZUMEL ISLAND, YUCATAN.

By Robert Ridgway.

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A collection of birds made by Mr. J. E. Benedict, Naturalist of the U. S. Fish Commission Steamer "Albatross," assisted by Dr. T. H. Bean and Mr. Thomas Lee, on the Island of Cozumel, in January, 1885, contains the following new species. A full report upon the collection is in course of preparation and will soon be published in the Proceedings of the U. S. National Museum.

1. Harporhynchus guttatus, sp. nov.

Specific Characters.—Similar to *H. longirostris* (Lafr.), but smaller, darker in color, the bill wholly deep black, and all the markings more sharply defined. Type, No. 102,454, ♂, U. S. Nat. Mus.; Cozumel, Jan. 23.

2. Troglodytes beani, sp. nov.

Specific Characters.—Above plain brown, more castaneous on rump and tail, the latter indistinctly barred with darker, the remiges more distinctly barred. Lower parts, pure white; the sides, flanks, and crissum, light cinnamon-brown; the under tail-coverts barred or spotted with dusky. Wing, 2.20; tail, 1.90; culmen, .81; bill from nostril, .50; tarsus, .80; middle toe, .50. Type, No. 102,473, ♂, U. S. Nat. Mus.; Cozumel, Jan. 28.

3. Dendroica petechia rufivertex, subsp. nov.

Subspecific Characters.—Similar to *D. petechia ruficapilla* (Gmel.), of St. Thomas, and other Lesser Antilles, but with shorter wings and tail, and more intense coloration. Wing, 2.40; tail, 2.05. Type, No. 102,508, ♂, U. S. Nat. Mus.; Cozumel, Jan. 28.

4. Vireosylvia cinerea, sp. nov.

SPECIFIC CHARACTERS.—Agreeing with *V. magister* Baird, in absence of dusky sub-malar streak and streak on side of crown, but plumage ashy, instead of olive-brown. Wing, 3 00; tail, 2 30. Type, No. 105,656, U. S. Nat. Mus.; Cozumel, Jan. 29.

5. Vireo bairdi, sp. nov.

SPECIFIC CHARACTERS.—Above deep olive-brown, the wings with two broad bands of yellowish-white. Lores and median lower parts, pure white; the lateral lower parts, from cheeks to flanks, inclusive, deep cinnamon-ochre, in strong and abrupt contrast with the white. Type, No. 102,635, U. S. Nat. Mus.; Cozumel, Jan. 25.

6. Cyclorhis insularis, sp. nov.

SPECIFIC CHARACTERS.—Similar to *C. flaviventris* Lafr., but agreeing with *C. ochrocephala*, Tschudi, in coloration of the lower parts. Type, No. 102,659, ♀, U. S. Nat. Mus.; Cozumel, Jan. 28.

7. Spindalis benedicti, sp. nov.

SPECIFIC CHARACTERS.—Most like *S. zena* (Linn.), of the Bahamas, but much larger, the bill altogether heavier, the back and scapulars dark olive-brown instead of black, the lesser wing-coverts chestnut, and the yellow throat stripe entirely confluent with the chestnut of the jugulum. Wing (♂), 3.40; tail, 2.90. Type No. 102,675, ♂, U. S. Nat. Mus.; Cozumel, Jan. 29.

8. Euetheia olivacea intermedia, subsp. nov.

SUBSPECIFIC CHARACTERS.—Intermediate between and connecting *E. olivacea* (Gm.) and *E. olivacea pusilla* (Sw.), having the grayer cheeks of the former and greater extension of black on the breast of the latter. Type, No. 102,710, ♂, U. S. Nat. Mus.; Cozumel, Jan. 28.

9. Centurus leei, sp. nov.

SPECIFIC CHARACTERS.—Similar to *C. dubius* (Cabot), but lower rump and upper tail-coverts barred with black, and lower parts darker. Type, No. 102,777, U. S. Nat. Mus.; Cozumel, Jan. 28.

10. Attila cozumelæ, sp. nov.

SPECIFIC CHARACTERS.—Most like *A. citreopygia* (Bonap.), but lower parts grayish white, the throat and jugulum very indistinctly streaked with darker. Type, No. 102,767, U. S. Nat. Mus.; Cozumel, Jan. 29.

11. Lampornis thalassinus, sp. nov.

SPECIFIC CHARACTERS.—Most like *L. prevosti* (Less.), but upper parts less bronzy or more of a grass-green, the black on the throat much more extended, and the breast greenish-blue. Type, No. 102,796, ♂, U. S. Nat. Mus.; Cozumel, Jan. 24.

12. Chlorostilbon forficatus, sp. nov.

SPECIFIC CHARACTERS.—Most like *C. caniveti* (Less.), but tail much longer (1.90 inches, forked for 1.15). Type, No. 102,812, ♂, U. S. Nat. Mus.; Cozumel, Jan. 23.

13. Empidonax gracilis, sp. nov.

SPECIFIC CHARACTERS.—Above ash-gray, more brownish, but still decidedly gray, on lower back, rump, and upper tail-coverts; a distinct orbital ring, two broad wing-bands, and broad edges to tertials, grayish-white; sides of head, light ash-gray, fading to grayish-white on throat; jugulum and sides of breast, light brownish-gray; rest of lower parts, white. Wing, 2.50; tail, 2.20; culmen, .55; bill, from nostril, .25; width of bill at base, .23; tarsus, .60; middle toe, .30. Type, No. 102,737, ♀ (?), U. S. Nat. Mus; Cozumel, Jan. 22.

14. Myiarchus platyrhynchus, sp. nov.

SPECIFIC CHARACTERS.—Above dull brown, without olive tinge, darker on pileum; upper tail-coverts and edges of rectrices, remiges, and greater wing-coverts, rusty. Chin, throat, and jugulum, pale ash-gray; rest of lower parts, very pale sulphur yellow. Wing, 3.00; tail, 2.00; culmen, .85; bill, from nostril, .50; width at base, .33; tarsus, .80; middle toe, .42. Type, No. 102,738, ♀ (?), U. S. Nat. Mus.; Cozumel, Jan. 22.

15. Cardinalis saturatus, sp. nov.

SPECIFIC CHARACTERS.—Similar to *C. virginianus coccineus*. Ridgw., but still more deeply colored, the bill shorter and relatively much thicker. Female, with the capistrum dark slaty and very conspicuous. Type, No. 102,720, ♂, U .S. Nat. Mus.; Cozumel, Jan. 24.

DESCRIPTION OF A NEW SPECIES OF CHIPMUNK FROM CALIFORNIA (*Tamias macrorhabdotes* sp. nov.).

By Dr. C. Hart Merriam.

(Read December 26, 1885.)

I have recently secured, from the Sierra Nevada mountains of central California, a series of Chipmunks or Ground Squirrels which differ markedly from any known species. In size they closely approach typical examples of *Tamias asiaticus townsendi*; and in coloration they are in some respects intermediate between vars. *townsendi* and *borealis*, while in other respects they are peculiar. They may be distinguished at a glance from all other described forms by the great length of the ear, the clearness and sharpness of definition of the light stripe which occupies its posterior half, and by the large size and whiteness of the spot behind its base.

Tamias macrorhabdotes* sp. nov. LONG-EARED CHIPMUNK.

Diagnosis.—Ears exceedingly long, measuring from 16 to 17 mm. in height from the occiput (average of ten, 16.20 mm.). Crown grizzled grayish-brown, more or less mixed with rusty; convex surface of ears sharply bicolor vertically, anterior half sooty-brown, with a slight admixture of rusty near the anterior margin, posterior half ashy-white in striking contrast; a large white spot (nearly as large as the ear itself) on each side of the neck just behind the ear and continuous with its ashy-white posterior half and with the white cheek-stripe under the eye, and almost continuous posteriorly with the external lateral white

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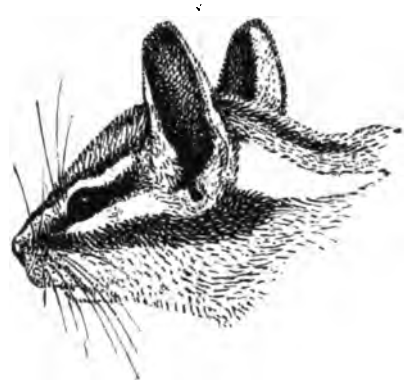
*Macro-rhabd-ótes: μακρός, long; ῥάβδος, stripe; οὖς, ὠτός, ear,—in allusion to the long, striped ear, which is diagnostic of the species.

stripe; five dark dorsal stripes (outer often indistinct), rusty umber to sepia brown; the two outer of each side separated by a grayish-white stripe which is almost continuous anteriorly with the white blotch behind the ear; the median and inner of each side separated by a grayish stripe more or less obscured with rusty; rump grizzled gray sometimes tinged with brownish; sides pale fulvous to deep rusty fulvous, the color extending well



TAMIAS MACRORHABDOTES.

up on the neck, but never back over the hips; under parts white or soiled white; tail above sub-terete, almost black, with hoary tips to the hairs and with more or less hazel showing through; tail below distichous, mesially bright hazel, heavily bordered with black and edged with hoary. The facial stripes are highly developed and are five in number, three rusty umber and two white, as follows: A narrow white stripe runs from the tip of the nose to the anterior base of the ear, passing over the eye; it is bordered above by a stripe of rusty umber (which is broadest and darkest from the eye to the ear), and below by another of the same color which passes through the eye and terminates at the meatus; below this is a second white stripe, broader than the first, which runs just below the eye and thence backward under the root of the ear, where it bends upward and backward, becoming continuous with the white spot behind the ear; below this still is another rusty umber stripe which ends against the white just back of the ear.

MEASUREMENTS.—The twelve specimens before me are all skins, but they are well prepared and afford measurements which may be regarded as approximately correct. The length of head and body varies from 125 to 140 mm. and the tail with hairs from 105 to 130 mm. The hind foot with claw averages between 34 and 35 mm.

CRANIAL CHARACTERS.—The nasal bones are both relatively and absolutely longer in *macrorhabdotes* than in its nearest ally, *townsendi*, notwithstanding the fact that the latter is the larger animal. The longest nasal in the four skulls of *townsendi* before me measures 11.00 mm., while the smallest of five adult *macrorhabdotes* measures 12.60 mm. and the largest 13.20 mm. The nasals usually project backward in *macrorhabdotes* beyond the line of the fronto-premaxillary suture, while in *townsendi* they generally end flush with the suture. Their ratio to the basilar length in *townsendi* is 35.73 mm. (average of two), against 44.54 in *macrorhabdotes* (average of five fairly adult specimens). In addition to their shortness, the nasal bones in *townsendi* average a little broader, particularly behind; thus the average width (at the fronto-premaxillary suture) of four specimens of *townsendi* is 3.27 mm., while the average of eight specimens of *macrorhabdotes* is 2.85 mm. Hence the average of the ratios of the posterior breadth of the nasal bones to their length in nine skulls of *macrorhabdotes* is 22.97, while in four skulls of *townsendi* it is 30.75.

Interorbitally, the frontal bone averages somewhat broader in *macrorhabdotes* than in *townsendi*. The palate is longer in the latter. The average ratio of the length of the palate to the basilar length in eight specimens of *macrorhabdotes* is 53.96, while in two specimens of *townsendi* it is 56.80.

The parietal and supra-occipital bones co-ossify so early in life that in the adults it is generally impossible to detect the suture between them; hence they are here measured together. They are very much shorter in *macrorhabdotes* than in *townsendi*, measuring from 10.60 to 11.00 mm. (four-tenths of a millimetre covering the limits of variation in nine specimens); while in *townsendi* two specimens measure respectively 13.50 and 13.00 mm. The average of the ratios of the length of the parietals and supra-occipital, thus united, to the basilar length in eight skulls of *macrorhabdotes* is 37.87; in two of *townsendi* it is 45.77.

The first upper premolar is decidedly smaller in *macrorhabdotes* than in *townsendi*; it has evidently ceased to be functional and is fast becoming obsolete—one of many characters pointing to the higher differentiation of the new species.

The pretty little Striped Squirrel which forms the subject of the present paper is one of peculiar interest. It is surprising that an animal of its size and diurnal habits, and one which differs so markedly from even its nearest relative, should have escaped so long the notice of the many naturalists and collectors who have traversed the region. The most natural explanation is that the Long-Eared Chipmunk is an exceedingly local species, restricted in its range by certain physiographical conditions of which we are at present ignorant—conditions which were influential, doubtless, in bringing about the modifications which distinguish it from its congeners and mark it as one of the most highly specialized of the genus *Tamias*. That this genus is peculiarly susceptible to environmental influences is amply attested by the number and perplexing characteristics of the incipient species already known from the United States.

The specimens of this new species were collected by C. A. Allen, of Nicasio, California, and the accompanying figure was drawn by Ernest E. T. Seton.

ON A NEW METHOD OF PRODUCING IMMUNITY FROM CONTAGIOUS DISEASES.

By D. E. Salmon, D. V. M., and Theobald Smith, M. D.

(Read February 20, 1886.)

More than four years ago * one of us, in the study of the subject of insusceptibility to contagious diseases, reached the conclusion that, in those diseases in which one attack protects from the effects of the contagion in the future, the germs of such maladies were only able to multiply in the body of the individual attacked because of a poisonous principle or substance which was produced during the multiplication of those germs. And also that, after being exposed for a certain time to the influence of this poison, the animal bioplasm was no longer sufficiently affected by it to produce that profound depression and modification of the vital activity which alone allowed the growth of the pathogenic germs and the consequent development of the processes of disease. After several series of experiments, made at that time with only negative results, it became necessary to suspend these investigations until points connected with them, and which were then obscure, should be cleared up, and until it should become possible to repeat the experiments under more favorable conditions. Our expectations in regard to this important subject have at last been realized by the results of experiments recently made in the laboratory of the Bureau of Animal Industry.

The bacterium, which we have lately discovered and which we believe to be the cause of swine plague, is killed in liquid cultures by an exposure to 58° C. for about ten minutes.

This method of destroying the bacterium in liquid cultures was resorted to in studying the effects on pigeons of the chemical

* Department of Agriculture, Annual Report, 1881–2, pp. 290-295.

products (ptomaines?) formed by the bacteria in their vegetative state, and which are probably dissolved in the culture liquid. The heated cultures used in these experiments were always tested by inoculating fresh tubes therefrom, and, if no growth followed this inoculation, the death of the microbes was considered established.

It had been previously determined that the subcutaneous injection of .75 cc. ($\frac{3}{16}$ dram) of a liquid culture of the swine plague bacterium containing 1% of peptone was invariably fatal, in the majority of pigeons within 24 hours. One half of this dose was fatal to a few only.

As a preliminary experiment, four pigeons were inoculated December 24, 1885, with a liquid culture that had been heated for 2 hours at 58°–60° C. Three of these (Nos. 10, 8, 9) received subcutaneously .4, .8, and 1.5 cc. of the heated culture, respectively. The fourth (No. 7) received 1.5 cc. of the pure culture liquid, into which no microbes had been introduced. No. 9, the one which had received the largest dose, was evidently sick the next day, but slowly recovered. The others did not show any symptoms of illness.

January 11, the one which had received a hypodermic injection of the simple culture liquid (No. 7), and the one which had received the largest dose of heated virus (No. 9), received subcutaneously about .75 cc. each of a liquid culture five days old, which had been prepared from a potato culture 15 days old. It is probable that this virus was not so strong, therefore, as a more recent culture from the pig would have been. Both pigeons were sick on the following day. No. 7 died seven days after inoculation. The bacterium of swine plague was found abundantly in the pectoral muscle, in the spleen, kidneys, and liver in moderate numbers.* The other pigeon (No. 9) slowly recovered, but had

*In this animal the major part of both pectoral muscles appeared as if they had been boiled; they were whitish, bloodless; the fibres could be easily broken and crushed with the forceps. The muscular tissue surrounding the dead portion was very dark, gorged with blood. The liver was dark in patches; spleen and kidney pale.

lost the use of its legs. It seemed perfectly well when killed, 15 days after inoculation. It was quite fat, the crop filled with food. In the pectorals were found imbedded two elongated masses of dead tissue or sequestra about 2 cm. long and 1 cm. in diameter, entirely separated from the surrounding tissue by a dense, smooth membrane. In this animal the multiplication of the pathogenic bacteria was purely local, the resistance of the tissues being sufficiently powerful to confine, and finally destroy, the bacteria. The sequestra were made up of dead muscular fibre, which was pale and parboiled in appearance. Each was enveloped by a more or less hyaline homogeneous layer. A liquid culture, inoculated with blood from the heart, remained sterile.

This experiment pointed evidently to an immunity obtained from the chemical products of the bacterium of swine plague. To confirm this view another experiment was made.

January 21, three pigeons (Nos. 11, 12, 13) received hypodermically 1.5 cc. of heated culture liquid in which the bacterium of swine plague had multiplied for two weeks, and was then destroyed by exposure to 58°–60° C. for several hours. A fourth pigeon (No. 14) was kept as a check. No. 10, which had received .4 cc. of heated virus Dec. 24, now received a second dose, this time of 1.5 cc. For the following three or four days all were somewhat ill, and remained rather quiet, with feathers slightly ruffled.

January 29, when all seemed well, three of the four (Nos. 10, 11, and 12) received hypodermically another dose of 1.5 cc. of heated culture liquid. The other (No. 13) had been fiercely attacked by its fellows, and its head was so injured that it was thought best not to give it an injection at this time, and it was placed in a spacious coop alone. None of the birds seemed much affected by this dose.

February 6, a final injection was practised upon the four, No. 13 having recovered from the effects of its injuries. The dose was, as before, 1.5 cc. All seemed well a few days later.

February 13, one week after the last injection, these birds were inoculated with strong virus, the quantity injected being .75 cc., which had hitherto proved invariably fatal, with the single exception of the bird that had been previously treated with heated virus. Those inoculated were Nos. 10, 11, 12, 13, which had received the heated virus, also No. 14, the check pigeon, which had not been touched, and No. 8, which had received a small quantity, .8 cc. of heated virus, December 24, over 50 days before.

On the following day the check pigeon (No. 14) was found dead; the one which had received the smaller dose (No. 8) was very ill and died before the next day. The other pigeons were perfectly well. The effect of this dose of strong virus, so remarkable on the unprotected pigeons, was even more evanescent than that of the heated virus in which all life had been destroyed.

There can be no doubt, therefore, from this very positive result, that the pigeons had acquired an immunity through the effect upon the tissues of the chemical products formed by the bacterium in the culture liquid.

A table giving the dates of the injections and the quantity introduced into each animal is given below:

Pigeons.	1885.	1886.				Total of Heated Virus.	Remarks.
	Dec. 24.	Jan. 21.	Jan. 29.	Feb. 6.	Feb. 13.		
	Heated Virus.	Heated Virus.	Heated Virus.	Heated Virus.	Strong Virus.		
	cc.	cc.	cc.	cc.	cc.	cc.	
No. 8......	.8	....	....	....	.75	.8	Died in 48 hours after injection of strong virus.
" 10......	.4	1.5	1.5	1.5	.75	4.9	Well Feb. 20.
" 11......	....	1.5	1.5	1.5	.75	4.5	Same.
" 12......	....	1.5	1.5	1.5	.75	4.5	Same.
" 13......	....	1.5	....	1.5	.75	3.0	Same.
" 14......	....	....	....	....	.75	....	Died in 24 hours after injection of strong virus.

In the birds that died, (Nos. 8 and 14), the pectoral muscles at the place of injection were pale and friable. Necrosis was already at hand. The internal organs were not macroscopically altered, excepting the spleen of No. 8, which was enlarged and dark. The presence of the bacterium of swine plague in the blood from the heart was demonstrated by liquid cultures, which, inoculated with a minimum quantity of blood, were turbid with this specific microbe on the following day.

The conclusions to be drawn from this experiment we believe are of superlative importance to a correct understanding of the phenomena of contagious diseases, and the methods by which these diseases are to be combated. They probably apply to all bacterial plagues of men and animals in which one attack confers immunity from the effects of that particular virus in the future. These conclusions are:

1. Immunity is the result of the exposure of the bioplasm of the animal body to the chemical products of the growth of the specific microbes which constitute the virus of contagious fevers.

2. These particular chemical products are produced by the growth of the microbes in suitable culture liquids in the laboratory, as well as in the liquids and tissues of the body.

3. Immunity may be produced by introducing into the animal body such chemical products that have been produced in the laboratory.

THE BEGINNINGS OF NATURAL HISTORY IN AMERICA.*

BY G. BROWN GOODE.

Is not Science a growth? Has not Science its embryology? And must not a neglect of its embryology lead to a misunderstanding of the principles of its evolution and of its existing organization?

—SPENCER: *The Genesis of Science.*

ANALYSIS.

I.

Three centuries ago the only English settlement in America was the little colony of one hundred and eight men which Raleigh had planted, five months before, upon Roanoke Island, in North Carolina.

The 17th of August, 1885, was the anniversary of one of the most noteworthy events in the history of America, for it marked the three hundredth return of the date when Sir Richard Gren-

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* Annual presidential address delivered at the Sixth Anniversary Meeting of the Society, February 6, 1886, in the Lecture Room of the U. S. National Museum.

ville brought to its shores this sturdy company of pioneers, who, by their sojourn on this side of the Atlantic, prepared the way for the great armies of immigrants who were to follow.

It was also the anniversary of an important event in the history of science, for among the colonists was THOMAS HARRIOTT —the first English man of science who crossed the Atlantic. His name is familiar to few, save those who love the time-browned pages and quaint narrations of Hakluyt, Purchas, and Pinkerton; yet Harriott was foremost among the scholars of his time—the Huxley or the Stokes of his day—a man of wide culture, a skillful astronomer, a profound mathematician, the author of a standard treatise upon algebra, and a botanist, zoologist, and anthropologist withal. "He had been the mathematical instructor of Raleigh, and in obeying this summons to go forth upon the present expedition, gave to it," says Anderson, "the most valuable aid which could be derived from human strength." *

This eminent man deserves more than a passing notice on this occasion, and I have taken pains to bring together all that is known about him. He was born at Oxford in 1560, or as old Anthony Wood quaintly expresses it, "he tumbled out of his mother's womb into the lap of the Oxonian muses," and, at an early age, was entered as a scholar in St. Mary's Hall, receiving his bachelor's degree in 1579. He was soon received into Raleigh's family as his instructor in mathematics, and, at the age of twenty-five, made his voyage to America.

After his return he was introduced by Raleigh to Henry Percy, Earl of Northumberland, one of the most munificent patrons of science of that day, who allowed him a pension of £120 a year. "About the same time," we are told, "Hues, well known by his 'Treatise upon the Globes,'† and Walter Warner, who is said to have given Harvey the first hint concerning the circulation of the blood, being both of them mathematicians, received

* ANDERSON: *History of the Church of England in the Colonies*, p. 86.
† *Tractatus de Globis*, etc., 1611.

from him (Northumberland) pensions of less value; so that in 1606, when the Earl was committed to the Tower for life, Harriott, Hues, and Warner were his constant companions, and were usually called the Earl of Northumberland's Magi." *

One thing, at least, have three centuries accomplished for science. Its greatest workers are not now, as they were at the beginning of the seventeenth century, dependent upon the liberality and caprice of wealthy men, classed as their "pensioners" and "servants," and assigned places at their tables which they must needs accept or famish.

Harriott appears to have passed the latter years of his life at Sion College, in Oxford, where he died in 1621. He was buried in St. Christopher's Church, and the following eulogy was embodied in his epitaph:

QUI OMNES SCIENTIAS CALLUIT AC IN OMNIBUS EXCELLUIT
MATHEMATICIS, PHILOSOPHICIS, THEOLOGICIS.
VERITATIS, INDAGATOR STUDIOSISSIMUS,
DEI TRINIUNIUS PIISSIMUS.

He was especially eminent in the field of Mathematics. "Harriott," says Hallam, "was destined to make the last great discovery in the pure science of algebra. * * * Harriott arrived at a complete theory of the genesis of equations, which Cardan and Vieta had but partially conceived." †

His improvements in algebra were adopted, we are told, by Descartes, and for a considerable time imposed upon the French as his own invention, but the theft was at last detected and ex-

* Harriott was also a friend and companion of Raleigh during his imprisonment in the Tower (1603–16), and was his collaborator in the preparation of the "History of the World." His fidelity was rewarded by that distinguished authority, Chief-Justice Popham, who denounced him from the bench as "a devil."

† HALLAM: *Introduction to the Literature of Europe*, 4th ed., 1854; i, pp. 454, 456; ii, p. 223; iii, p. 181. See also MONTUCLA: *Histoire des Mathematiques*, and ERSCH AND GRUBER: *Algemeine Encyklopædie*.

posed by Dr. Wallis in his "Treatise of Algebra, both Theoretical and Practical," London, 1685.*

"Oldys, in his Life of Sir Walter Raleigh, has shown," says Stith, "that the famous French philosopher, Descartes, borrowed much of his light from this excellent mathematician, and that the learned Dr. Wallis gave the preference to Harriot's improvements before Descartes', altho' he had the advantage of coming after and being assisted by him." †

Harriott's papers were left after his death in the possession of the Percy family at "Petworth," where they were examined in 1787 by Dr. Zach, and later by Prof. Rigaud, of Oxford, who, in 1833, published in his supplement to the works of James Bradley, "An Account of Thomas Harriot's Astronomical Papers." His observations on Halley's comet in 1607 are still referred to as being of great importance. Zach pronounced him an eminent astronomer, both theoretical and practical. "He was the first observer of the solar spots, on which he made a hundred and ninety-nine observations; he also made many excellent observations on the satellites of Jupiter, and indeed, it is probable that he discovered them as early if not earlier than Galileo." ‡

A posthumous work, "Artes Analyticæ Praxis ad Æquationes algebraicas nova, expedita et generali Methodo resolvendas, e posthumis Thomas Harriot," was published in 1631 by his friend and associate, Walter Warner, and there is in the library of Sion College a manuscript work of his entitled "Ephemeris Chyrometrica."

Wood says that, "notwithstanding his great skill in mathematics, he had strange thoughts of the scriptures, always under-

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* It would appear, however, that Wallis may have been too enthusiastic in his admiration of the English mathematician. Hallam states that he ascribed to Harriott a long list of discoveries which have since been reclaimed for Cardan and Vieta.

† STITH: *History of Virginia*, 1747, p. 20.

‡ GOOD AND GREGORY: *Pantologia*, vol. v.

valued the old story of the creation of the world, and would never believe that trite proposition, 'Ex nihilo nihil fit.'"

Stith, the historian of Virginia, protests, however, against the charge that Harriott had led his pupil Raleigh into atheism. "As to this groundless Aspersion," he remarked, "the Truth of it, perhaps, was that Sir Walter and Mr. Harriott were the first who ventured to depart from the beaten Tract of the Schools, and to throw off and combat some hoary Follies and traditionary Errors which had been riveted by age, and rendered sacred and inviolable in the eyes of weak and prejudiced Persons. Sir Walter is said to have been first led to this by the manifest Detection, from his own Experience, of their erroneous Opinions concerning the Torrid Zone, and he intended to have proceeded farther in the Search after more Solid and important Truths 'till he was chid and restrained by the Queen, into whom some Persons had infused a Notion that such Doctrine was against God."*

The erroneous opinions concerning the torrid zone which were called in question by Harriott and Raleigh were based upon a statement of Aristotle, in those days accepted as an article of faith, that the equatorial zone of the earth was so scorched and dried by the sun's heat as to be uninhabitable. Even the experience of explorers was for many years overpowered by the weight of this time-worn dogma. The Jesuit, Acosta, was accused of atheism on the same grounds, by his Spanish contemporaries, but he rejoiced that he had seen for himself, and that the climate under the equator was so different from what he had expected that "he could but laugh at Aristotle's meteors and his philosophy."

Harriott's "Brief and True Report of the New Found Land of Virginia," a thin volume in quarto, printed at Frankfort-on-the-Main in 1590,† is now one of the rarest and most precious

* STITH: *History of Virginia*, p 20.

† 1590. HARIOT (or Harriott), THOMAS. A briefe and true report | of the new found land of Virginia | of the commodities and of the nature and man | ners of the naturall inhabitants. Discouered by the English Col-

works relating to America,* and is full of interest to the naturalist. Harriott's description of the Indians and their customs and beliefs, though strongly tinctured with prepossessed ideas concerning them, is thorough and scholarly, and one of the fullest and most reliable of the early treatises upon the inhabitants of North America.

The chief man of the Roanoke colony, Sir Ralph Lane, usually spoken of as the first governor of Virginia, was a man of great energy and enterprise, † and with the help of Harriott planned and conducted expeditions in every direction; southward eighty leagues to Secotan, "an Indian town lying between the rivers Pampticoe and Neus," to the northwest up the Albemarle Sound and Chowan River, to the forks of the Meherrin and Nottaway; and north one hundred and thirty miles to the Elizabeth River, on the south side of Chesapeake Bay.

Besides his description of the Indians, Harriott wrote "a particular narrative of all the beasts, birds, fishes, fowls, fruits, and roots, and how they may be useful." A systematic report could hardly

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ony there seated by Sir Richard | Greinuile Knight In the yeere 1585. Which rema | ined Vnder the gouernment of twelue monethes, | At the special charge and direction of the Honou- | rable SIR WALTER RALEIGH Knight lord Warden | of the stanneries Who therein hath beene fauoured | and authorised by her MAIESTIE | : and her letters patents: | This fore booke Is made in English | By Thomas Hariot, seruant to the above named | Sir WALTER, a member of the Colony and there | imployed in discouering | CUM GRATIA ET PRIVILEGIO CAES. MATI. SPECIALI | Francoforti ad Mœnum | Typis Ioannis Wecheli, sumtibus vero Theodori | DeBry Anno CIƆ IC XC, | venales reperuunter in officina Sigismundi Feirabendii. | 4°. pp. 1–33 (1). *Title page with ornamental border of architectural design.*

* There are now only six or seven perfect copies in existence. These, we are told by Sabine, are in the British Museum and Bodleian libraries, and in the private collections of Messrs. Lennox, Brown, Christie-Miller, and Mann, besides an imperfect copy in the library of Harvard College and one in the possession of Sir Thomas Phillipps. At a sale in London in 1883 a copy sold for 300 pounds. A reproduction in photo-lithographic fac-simile was issued by Sabine in New York in 1875.

† See Life of Sir Ralph Lane, by Edward Everett Hale. *Archæologia Americana*, iv, pp. 317–347.

be expected from one who lived a century and a half before Linnæus, but if we keep in mind the condition of zoology at that day we can but be pleased with the fullness of his narrative.

He collected the names of twenty-eight species of mammals, twelve of these, including the black bear, the gray squirrel, the cony or hare, the otter, and the possum and raccoon, (*Saquenúckot* and *Maquówoc*), he saw, beside the civet cat or skunk, which he observed by means of another sense. He was the first to distinguish the American from the European deer, stating that the former have longer tails, and the snags of their horns look backward—a brief diagnosis, but one which was not replaced by a better one for nearly two centuries.

Of birds he collected the names of eighty-six "in the countrie language," and had pictures drawn of twenty-five. He mentions turkeys, stockdoves, partridges, crows, herons, and in winter, great store of swans and geese.

With aquatic animals he seems to have been well acquainted. He refers to some by English names, and to many others which had no names "but in the countrey language." In the plates accompanying the first edition of his book are figured several familiar forms, then for the first time made known in Europe, among them the gar pike (*Lepidosteus*),* and the horse shoe or king crab (*Limulus*),† "*Seekanauk*, a kinde of crustie shell fishe which is good meate, about a foot in breadth, having a crustie tayle, many legges like a crabbe, and her eyes in her back."

* Subsequently referred to by Champlain in 1613, and Sagard in 1636, under the name *chaousarou*, and figured by Champlain on his map of *Nouvelle France*. Creuxin in his *History of Canada*, 1664, also mentions it.

† It has been generally supposed that Champlain was the first to notice this characteristic American animal, and Slafter, in his notes upon Champlain's works, [*Publications of the Prince Society, Champlain's Voyages*, vol. ii, p 87,] makes a statement to that effect, and is followed by Higginson in his History of the United States. Actually, the French explorer did not observe it until twenty years after Harriott, and his account of it was not printed until 1613.

Harriott also alludes to various kinds of trees and shrubs, usually by their Indian names. Among them may easily be recognized the pitch-pine, sassafras, shoemake, chestnut, walnut, hickory, persimmon, prickly pear, Nelumbium, Liriodendron, holly, beech, ash, and so on, beside the maize and tobacco cultivated by the natives.

A companion of Harriott's, whose labors are deserving of notice, was John With or White, the first delineator of plants and animals who visited this continent. Concerning him and the ultimate utilization of his work, Stith discourses as follows:

> UPON this Voyage, Sir *Walter Ralegh*, by the Queen's Advice and Directions, sent, at no small Expence, Mr. John With, a skilful and ingenious Painter, to take the Situation of the Country, and to paint, from the Life, the Figures and Habits of the Natives, their Way of Living, and their several Fashions, Modes and Superstitions, which he did with great Beauty and Exactness. There was one *Theodore De Bry*, who afterwards published the beautiful *Latin* Edition of Voyages in six Volumes, *Folio*, a most curious and valuable Work. He being in England, soon after, by the Means of the Rev. Mr. *Richard Hackluyt*, then of *Christ's-Church*, in Oxford, obtained from Mr. *With* a Sight of these Pieces, with Permission to take them off in Copper Plates. These, being very lively and well done, he carried to *Frankfort* on the *Maine*, where he published a noble Edition of them, with Latin Explanations, out of *John Wechelius's* Press, in the Year 1590. And there are the Originals from which Mr. *Beverley's* and the Cuts of many of our late Writers and Travellers have been chiefly imitated.*

With's drawings are still in the British Museum,† where they were examined in 1860 by Dr. E. E. Hale, who reported upon their condition to the American Antiquarian Society.‡

This collection, he says, consists of 112 drawings in water-color, very carefully preserved. They are very well drawn, colored with skill, and even in the present state of art would be considered anywhere valuable and creditable representations of

* STITH: *History of Virginia*, p. 16.
† Sloane & Additional MSS., 5270.
‡ See *Archæologia Americana*, iv, pp. 21–24.

the plants, birds, beasts, and men of a new country. Mr. Hale gives a list of these drawings as identified by Sloane and others. Among these were the bald eagle, the red-headed, hairy, and golden-winged woodpeckers, the bluebird, red-wing blackbird, towhee, red-bird, blue jay, and fox-colored thrush, the crow blackbird, and apparently the mocking bird—"*Artamockes*, the linguist; a bird that imitateth and useth the sounds and tones of almost all birds in the Countrie." Among the fish we recognize the mullet (*Tetszo*), the menhaden or old-wife (*Masunnehockeo*), and the sturgeon (*Coppauleo*), and perhaps the squeteague or chigwit (*Chigwusso*).

The science of North America, then, began with Thomas Harriott. Let us review together to-night its progress for a period of two centuries—a period coinciding almost exactly with the colonial portion of the history of the United States.

"The present generation," says Whewell, "finds itself the heir of a vast patrimony of science, and it must needs concern us to know the steps by which these possessions were acquired and the documents by which they are secured to us and our heirs forever. Our species from the time of its creation has been travelling onwards in pursuit of truth; and now that we have reached a lofty and commanding position, with the broad light of day around us, it must be grateful to look back on the line of our past progress; to review the journey begun in early twilight amid primeval wilds; for a long time continued with slow advance and obscure prospects; and gradually and in later days followed along more open and lightsome paths, in a wide and fertile region. The historian of science, from early periods to the present time, may hope for favor on the score of the mere subject of his narrative, and in virtue of the curiosity which the men of the present day may naturally feel respecting the events and persons of his story."

II.

Although Harriott was the first who described the natural characteristics of North America, it would not be proper to ignore the fact that the first scientific exploration of the western continent was accomplished by Spaniards and Frenchmen.

Gonzalo Fernandez de Oviedo y Valdes, the first historian of the New World, [b. 1478, d. 1557], was an Asturian of noble birth, who began life as a page in the palace of Ferdinand and Isabella. He saw Columbus at Burgos on his second return from America in 1496. He came over in 1514 to Santo Domingo, having been appointed inspector of gold-smelting, and was subsequently governor of that island and royal historiographer of the Indies. In 1525 he transmitted to Charles V. his "Sumario de la Natural Historia de las Indias," printed at Toledo two years later, and in 1535 began the publication of his "Historia General y Natural de las Indias," a task which was finally completed only thirty years ago by the Spanish Royal Academy of History.

Las Casas said that Oviedo's books were "as full of lies almost as pages," but whatever may have been his methods in the discussion of history and politics, he seems, in his descriptions, to have been both minute and accurate. Among the American animals which he was first to mention was the tapir or *dant*—"of the bignesse of a meane mule, without hornes, ash-coloured," and the *churchia*, evidently a species of *Didelphys*, allied to our possum. This was the first notice of any member of the great group of marsupial mammals. I quote a portion of the description in Oviedo's "Sumario," employing the quaint phraseology of Purchas's translation:

"The *Churchia* is as bigge as a small *Conie*, tawnie, sharpe-snowted, dog-toothed, long-tayled and eared like a *Rat*. They do great harm to Hennes, killing sometimes twenty or more at once to sucke their bloude: And if they then have young shee carrieth them with her in a bagge of skin under her belly, running alongst the same like a Satchell, which shee opens and shuts at pleasure to let them in and out."*

He characterized and described at length many other animals, among them the manatee, the iguana (*Iuanna*), the armadillos (*Bardati*), the ant-eaters, the sloth, the pelican, the ivory-billed woodpecker, and the humming birds.

"There are found in the foune land," he wrote, "certaine birds, so little that the whole body of one of them is no bigger than the top of the biggest finger of a man's hand, and yet is the bare body, without the feathers, not half so bigge. This Bird, besides her littlenesse, is of such velocitie and swiftness in flying that who so seeth her flying in the aire cannot see her flap or beat her wings after any other sort than doe the Humble Bees or Beetles. And I know not whereunto I may better liken them then to the little birds which the lymners of books are accustomed to paint on the Margent of Church Bookes and other Bookes of Divine Service. Their feathers are of manie faire colours, golden, yellow and greene."

That the spirit of Oviedo's work was scientific and critical, and not credulous and marvel-seeking, like that of many of his contemporaries, is everywhere manifest. His materials are classified in systematically arranged chapters. His methods may be illustrated by referring to his chapter "On Tigers."

"In Terra Firma," he begins, "are found many terrible beasts which the first Spaniards called tigers—which thing, nevertheless, I dare not affirm." He then reviews concisely and critically what is known of tigers elsewhere, and goes on to describe the supposed American tiger at length, and in such terms that it is at once evident that the mammal under discussion is one of the spotted cats, doubtless the jaguar (*Felis onca*).†

The second in order of time to publish a book upon American natural history was Jean de Lery, [b. 1535, d. 1611], a Calvinistic minister, who was a member of the Huguenot colony founded by the Chevalier de Villegagnon in 1555, on the small island

* *Sumario*, Cap. xxvii. PURCHAS: *his pilgrimes*, iii, p. 995.
† *Sumario*, Cap. xi.

in the bay of Rio de Janeiro, which still bears his name. He remained in Brazil less than five years, and in 1578 published at Rouen a work entitled "Voyage en Amerique, avec la description des Animaux et Plantes de ce Pays."

José d' Acosta was another Spanish explorer who preceded Harriott, and was a man of much the same school and temper of mind. Born in the province of Leon about the year 1539, he entered the society of Jesuits at the age of fourteen, and in 1571 went to Peru, where he travelled as a missionary for seventeen years. After his return to Spain he filled several important ecclesiastical offices and died February 15, 1600, rector of the University of Salamanca. His first book, "De Natura Novi Orbis Libri Duo," was published in 1589. His "Historia Natural y Moral de las Indias" appeared in 1590, and is one of the best known and most useful of the early Spanish works on America, having passed through numerous editions in many languages.

Acosta was, perhaps, the most learned of the early writers upon America, and his writings, though modeled after those of the mediæval schoolmen, were full of suggestive observations, "touching the naturall historie of the heavens, ayre, water and earth at the West Indies, also of their beasts, fishes, fowles, plants, and other remarkable varieties of nature." He discoursed "of the fashion and form of heaven at the new-found world," "of the ayre and the winds," of ocean-physics, of volcanoes and earthquakes, as well as of metals, pearls, emeralds, trees, beasts and fowls.

He discussed the appearance and habits of the manatee and the crocodile, and described the Indian methods of whaling and pearl-fishing. He dwelt at length upon the condition of the domestic animals, sheep, kine, goats, horses, asses, dogs and cats which the Spaniards had introduced into the New World and which were already thoroughly acclimated. It seems strange to learn from his pages that in the year 1587, 99,794 hides of domestic cattle were exported from St. Domingo and New Spain to Seville. Lynceus has suggested that some of these skins were from the bison-herds, believed at that time to have been abundant in the north of Mexico.

He gives a formidable catalogue of the animals of Central and South America, in which occur the familiar names of armadillo, iguana, chinchilla, viscacha, vicugna, paco, and guanaco, and describes many of them at length, especially the peccary (*Saino*), the tapirs, the sloths, and the vicugna. He speaks of the cochineal insect, which had already become of importance in the arts.

He was the first to call attention to the existence in South America of immense fossil bones; these he supposed to be the remains of gigantic individuals of the human species.

His description of the Flora is very full, and he dwells at length upon the useful applications of the cacao-bean and its product, the drink which they call chocolate—"whereof they make great account in that Country, foolishly and without reason,"—the plantain, the yucca, the cassava, the maguey, the tunall or cactus, and very many more.

It is, however, as a scientific theorist that Acosta has the highest claim to our attention. He appears to have been the first to discuss America from the standpoint of the zoögeographer.

In considering the question, "How it should be possible that at the Indies there should be any sorts of beasts, whereof the like are nowhere else," he owns that he is quite unable to determine whether they were special creations, or whether they came out of the ark. He evidently prefers the first alternative, although so trammelled by the prevalent opinions of his day and sect that he is unable to bring himself quite to its avowal. He approaches so close to the limits of heterodoxy, however, that Purchas, in his Pilgrimes, feels obliged to print a foot-note pronouncing it "unchristian to say that America was not drowned with the flood."

Acosta thoroughly appreciated the peculiar character of the American fauna and remarked that "if the kinds of beasts are to be judged by their properties, it would be as reasonable to call an egg a chestnut as to seeke to reduce to the known kinds of Europe the divers kinds of the Indies." He was even willing to admit that it may not be necessary to say that the creation of the world was finished in six days, and that beasts of a more perfect character may have been made subsequently; and in his anxiety to escape the alternative of a Noah's ark almost committed himself to a theory of evolution. "We may consider well upon this subject," he wrote, "whether these beasts differ in kinde and essentially from all others, or if this difference be accidentall, which might grow by divers accidents, as we see in the Images of men, some are white, others black, some Giants, others Dwarfes; and in Apes, some have no taile, others have; and in Sheepe, some are bare, others have fleeces, some great and strong with a long necke as those of Peru, others weake and little, having a short necke, as those of Castile. But to speak directly who so would preserve the propagation of beasts at the Indies, and reduce them to those of Europe, hee shall undertake a charge he will hardly discharge with his honour."

Francesco Hernandez, a representative physician and man of science, was sent by Philip II. of Spain to Mexico, with unlimited facilities for exploration, and remained in that country from 1593 to 1600. His notes and collections seem to have been very extensive, and it is said that over 1,200 drawings of plants and animals were prepared under his direction. Editions of his works were published in Mexico in 1604 and 1615. I am assured by Mexican naturalists that his work was careful and valuable, the only defect being that he trusted too implicitly in what he was told by the native Mexicans.

Among the animals not met with in previous writings are the coyote (Aztec, *Coyotl*), the buffalo, the axolotl, the porcupine (*Hoitztlacuatzin*), the prong-buck (*Mazame*), the horned lizard (*Tapayaxin*), the bison, the peccary (*Quapizotl*), and the Toucan.

Among those of which figures are for the first time published are the ocelot (*Ocelotl*), the rattlesnake (*Teuhtlacot zanhqui*), the manatee (*Manati*), the alligator (*Aquetzpalin*), the armadillo (*Ayotochtli*), the pelican (*Ayototl*).

The figures of plants are numerous, and in most instances, I should judge, recognizable.

Many other Spaniards published their observations upon America in the sixteenth and seventeenth centuries, but it is perhaps not necessary to refer to them even by name. They were, as a rule, travellers, not explorers. Purchas assures us that "Acosta and Oviedo have best deserved of the studious of Nature—that is, of the knowledge of God in his workes."

III.

A personage who must on no account be overlooked in the consideration of these early days is Garcilasso de la Vega. Born in Peru in 1530, his father the Spanish governor of Cuzco, his mother a princess of the Inca blood, he boasted of a lineage traced through the line of ancient Peruvian monarchs back to Manco Capac and the Sun. He served as a soldier in Europe and died in Spain about the year 1615. His "Royal Commentaries of Peru," constitutes a magnificent contribution to the history of pre-Columbian America, and was said by some authorities to have been first written in the Peruvian language.*

Be this as it may, De la Vega's commentaries, though more valuable to the civil than to the natural historian, will always possess a peculiar interest, not only because the author was the first native of America who wrote concerning its animals and plants, but for the reason that it represents to us the historic and scientific lore of the aboriginal inhabitants of this continent.

* A Paris edition of 1633 had the following title: Commentaire Royal ou l'Histoire des Yncas, Roys de Peru, &c. Ensemble une description particulière des Animaux, des Fruits, des Mineraux, des Plantes, &c., Ecrité en langue Peruvienne et traduit sur la version Espagnole, par Baudouin, Paris, 1633. Amsterdam, 1704 and 1715. See Artedi, Bibliotheca Ichthyologica, 1788, p. 65.

De la Vega describes in an intelligible manner the condor (*Cuntur*) of South America, of which, as he tells us, there was a famous Indian painting in the temple at Cacha, the mountain cats or ocelots (Inca *Ozcollo*, Aztec *Ocelotl*), the puma, the viscacha, the tapir, and the three-toed ostrich. He was one of the first to notice the skunk (*Mephitis*, sp.), " which the Indians call Annas, the Spanish *Zorinnas*." " It is well," he remarks, " that these creatures are not in great numbers, for if they were, they were able to poison and stench up a whole Countrey." He devotes a chapter to " the tame cattel which God hath given to the Indians of Peru "—the llama and the huanaco—and speaks also of the paco and the vicuna, clearly distinguishing and describing the appearance and habits of the four species of Tylopoda which occur on the west coast of South America, although European naturalists a century later knew but two of them. He describes the annual vicuna hunts which were conducted by the Inca kings in person, assisted by twenty or thirty thousand Indians.

The fauna of Peru, as catalogued by him, included nearly fifty species, and the minuteness of his observations and the accuracy of his descriptions are very surprising. He discusses at length the plants of Peru, especially the maguey, the pineapple, the tobacco, and " the pretious leaf called *Cuca*," whose virtues pharmacologists now hold in such high esteem, and devotes chapters to " The Emeralds, Turquoises and Pearls of that Countrey;" to gold and silver, and to quicksilver.

De la Vega refers to a certain place in the city of Cuzco, where lions and other fierce creatures were kept in captivity. The taste for menageries and gardens seems to have been less pronounced in Peru, however, than in Mexico.

Much has been written concerning the wonderful collections of animals and plants which the Spanish conquestadors found in Montezuma's capital city. Carus, in his " Geschichte der Zoölogie " declares that at the time of the discovery of Mexico, Europe had no menageries and botanical gardens which could be compared with those of Chapoltepec and Huaxtepec, a statement which is quite within the bounds of truth, for the earliest botanical garden in the old world was that founded at Pisa in 1543.* Our fellow-member, Dr. Charles Rau, has also described the zoölogical gardens of Mexico in glowing terms,† and Prof. E. B. Tylor states that in the palace gardens of Mexico all kinds of birds and beasts were kept in well appointed zoölogical gardens where there were homes even for alligators and snakes, and declares that this testifies to a cultivation of natural history which was really beyond the European level of the time.

Is it not to be regretted that the capital of the United States in 1885 is still unprovided with a means of public instruction which was to be found in the capital of Mexico four hundred years ago?

I have examined the historians of Mexico with care and must express my conviction that the truth is more nearly touched in the bluff, soldier-like narrative of Cortez himself, than in the flowery and redundant paraphrases of Prescott. We may probably safely accept the story as told by Bernal Diaz del Castillo, one of the companions of Cortez, to whom Torquemada, Robertson, Lockhart, Rau and others give high praise as a truthful narrator.

Diaz presents a most vivid word-painting of the city of Mexico, and was particularly impressed by the royal aviaries:

"We saw here every kind of eagle, from the king's eagle‡ to the smallest kind included, and every species of bird from the largest known to the little colibris§ in their full splendor of plumage. Here also were to be seen those birds from which the Mexicans take the green colored feathers of which they manufacture their beautiful feathered stuffs; these last-mentioned birds very

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* Whewell: *History of the Inductive Sciences*, iii, p. 325.

† Carl Rau: *Thiergärten*. < New Yorker Staats-Zeitung, April 26, 1863.

‡ The golden eagle, says Aguilera.

§ Humming-birds.

much resemble our Spanish jays and are called by the Indians *quezales*.*

"The species of sparrows † were very curious, having five distinct colors in their plumage—green, red, white, yellow, blue.

"There were such vast numbers of parrots and such a variety of kinds that I cannot remember all their names; and geese of the richest plumage and other large birds.

"These were at stated periods stripped of their feathers, that new ones might grow in their place. All these birds had appropriate places to breed in and were under the care of several Indians of both sexes, who had to keep their nests clean, give to each kind its proper food, and set the birds for breeding."

In another place, near a temple were kept all manner of beautiful animals, the names of which were not noted by Diaz, nor their peculiarities described.

"In the building where human sacrifices were perpetrated there were dens in which were kept poisonous serpents and among them 'a species at the end of whose tail there was a kind of rattle.' This last-mentioned serpent, which is the most dangerous, was kept in a cabin in which a quantity of feathers had been strewed: here it laid its eggs, and it was fed with the flesh of dogs and of human beings which had been sacrificed. * * * When all the tigers and lions ‡ roared together with the howlings of the jackals § and foxes and hissing of the serpents, it was quite fearful, and you could not suppose otherwise than that you were in hell."

This is the first record of the rattlesnake, and brings to mind the captive snakes of the Mokis, their annual snake dance, and their use of feathers in the same connection.‖

I am not yet prepared to believe in the marvellous aquaria described by Prescott, although fish ponds there doubtless were.

I am assured by our fellow member, Senor Aguilera, that the locations of the gardens of Montezuma are well identified and that the Mexican Indians still possess a marvellous knowledge of the medicinal virtues of plants, which is handed down by tradition

* Trogons, known as *quetzales* by the Mexican Indians of to-day. Excellent examples of their pictorial use of trogon feathers may be seen in the U. S. National Museum.

† *Cyanospiza versicolor*.

‡ Ocelots, jaguars, pumas, eyras, jaguarundis.

§ The coyote (*coyotl*), *Canis latrans*.

‖ See Bourke: *The Snake Dance of the Moquis of Arizona*, New York, 1884.

from generation to generation. From this he infers that in the days of Aztec glory, the knowledge of the uses of plants must have been very comprehensive.

Who shall say that the spirit of true science did not inspire the Inca Pachacutec, when many centuries ago he handed down to his descendants maxims such as this:

"A herbalist who knows the names but is ignorant of the virtues and qualities of herbs, or he who knows few but is ignorant of most, is a mere quack and mountebank, and deserves not the name and repute of a physician until he is skilful as well in the noxious as in the salutiferous qualities of herbs."

Impressed with the extent of the knowledge of nature among the aborigines of America, I asked one of the most learned of our anthropologists for his opinion in regard to its character, and received the following statement:

WASHINGTON, *January* 5, 1886.

MY DEAR MR. GOODE:

We make a very grave mistake if we think there was no study of nature before the science of natural history. In all branches of study whatever there was lore before there was science. Before the weather bureau was weather lore, a kind of rough induction which the ancient people made, and which was very far from erroneous. Dr. Washington Matthews read a paper before the Washington Philosophical Society more than a year ago* to draw attention to the marvellous intimacy of the Navajo Indians with the plant kingdom around them, and their vocabulary which contained names for many species constructed so as to connote qualities well known to them. You are familiar with the stories concerning the respect in which certain animals are held by the Eskimo, and the minute acquaintance of all our aborigines of both continents with the life histories of many animals. The Eskimo as well as the Indian tribes carve and depict forms so well that the naturalist can frequently determine the species. Mr. Lucien Turner collected carvings in ivory of fœtal forms.

Very truly yours,

O. T. MASON.

Professor Mason also called attention to a long paper upon

* WASHINGTON MATTHEWS: *Natural Naturalists.* < Bull. Phil. Soc. Washington, vii, 1885, p. 73, (abs.)

"Tame Animals Among the Red Men of America," by Dr. E. F. im Thurn,* in which it is stated that the Indian of South America finds means to tame almost every wild bird and beast of his country, so that these domesticated animals are ever among the most prominent members of his household, not because of any affection for them, but because he enjoys their bright colors, makes use of them in various ways, and employs them as a medium of exchange. They even know how to change the colors of a living bird from green to yellow. In one settlement he counted twenty-one kinds of monkeys. Nearly all of the thirty or more species of Guiana parrots are tamed, two species of deer, two of peccaries, two of coati-mundis, jaguars, pacas, capybaras, agoutis, hawks, owls, herons, plovers, toucans, troupials, rupicolas, and iguanas were also observed in captivity. The mere fact that these animals are kept in captivity is not in itself especially significant, but it renders it possible to understand how the splendor-loving rulers of Mexico succeeded in building up their great menageries.

Bearing in mind the animal myths which Major Powell has found so prevalent among the Indians of Arizona and New Mexico, and has so charmingly translated, and those which Schoolcraft and others recorded in the north long ago, and which Longfellow has arranged in metric form, we cannot but be impressed with the idea that the red man of old, living close to nature as he did, knew many of her secrets which we should be glad to share with him at the present day.

Garcilasso de la Vega was not the only descendant of the aboriginal Americans who has written upon their history. Among the authors of works upon Mexican archæology published in the seventeenth and eighteenth centuries were Taddeo de Niza and Gabriel d'Ayala, "noble Indians" of Tlazcala and Tezcuco, the

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*Timehri, being the Journal of the Royal Agricultural and Commercial Society of British Guiana. Demerara, vol. 1, 1882, pp. 25–43.

three named Ixtlilxochitl, and ten or twelve more. Gongora, a native Mexican, professor of mathematics in the University of Mexico, was one of the earliest American astronomers, the author of the "Mexican Cyclography," printed two centuries ago. Herrera, Martinez, Garcia, Torquemada, Castillejo, De Betancourt, De Solis, Del Pulgar, and Beneducci have done what they could to preserve a portion of this ancient American lore, and it seems almost incredible that, some time in the future when American archæology shall have gained a firmer footing, some of the treasures of fact which these men garnered up are not to have an important function in elucidating anthropological problems which are as yet entirely unsolved.

IV.

The colony on Roanoke Island having been abandoned by the English, twenty years elapsed before their next effort toward peopling America. Then came the adventurers to Jamestown in 1606, and with them that picturesque personage, Captain John Smith, who, though unversed in the mathematics and astronomy which made up to a great extent the science of the day, was a keen observer, and an enterprising explorer. His contributions to geography were important, and his descriptions of the animals and plants of Virginia and New England supplement well those of his predecessor, Harriott.

Captain Smith was the first to describe the raccoon, the musquash, and the flying squirrel:

"There is a beast they call *Aroughcun* (raccoon), much like a badger, but useth to live on trees, as Squirrels doe. Their Squirrels some are neare as great as our smallest sort of wilde Rabbets, some blackish, or blacke and white, but most are gray. A small beast they have they call *Assapanick*, but we call them flying Squirrels, because, spreading their legs, and so stretching the largenesse of their skins that they have been seene to fly 30 or 40 yards. An *Opossum* hath a head like a Swine, and a taile like a Rat, and is of the bignesse of a Cat. Vnder her belly she hath a bagge, wherein she lodgeth, carrieth, and suckleth her young. A

Mussascus (musquash) is a beast of the forme and nature of our water Rats, but many of them smell exceedingly strongly of Muske."

And in the same strain he goes on to mention a score of mammals, identifying them with those of Europe with surprising accuracy.

His "*Utchun quoyes*, which is like a Wild Cat," is evidently the bay lynx. With the birds he was less familiar, but he mentions a number which resemble those of Europe, and states that many of them were unfamiliar. He was the first to refer to the red-wing blackbird (*Agelæus phœniceus*).

He catalogues 25 kinds of fish and shell-fish, using the names by which many of them are known to this day.

He gives also a very judicious account of the useful trees of Virginia, referring, among novel things, to the Chechinquamin, (chinkapin), and another which no one can fail to recognize.

"Plums," he says, "are of three sorts. * * * That which they call *Putchamins* grow as high as a *Palmeta;* the fruit is like a Medler; it is first greene, then yellow, and red when it is ripe; if it be not ripe it will draw a man's mouth awry with much torment."*

In his description of New England, Smith mentions twelve species of mammals, including the "moos," now spoken of for the first time,† 16 of birds, and 27 "fishes." His descriptions of the abundance of fishes are often quoted.‡

Smith's first work upon Virginia was printed in 1612 and his General History in 1624. In the interim, Raphe Hamor, the younger, secretary of the Colony, issued his "True Discourse of the Present Estate of Virginia," published in London in 1615.§

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* *Generall Historie*, 1624, p. 27.

† From the Indian word *Moosoa*. Slafter, in his notes on Champlain's Voyages, i, p. 265, supposes the *Orignac* referred to by this explorer in his De Sauvages, etc., Paris, 1607, to have been the Moose, and his *Cerf* to have been the Caribou.

‡ *Generall Historie*, pp. 216–17.

§ A copy of this rare work was sold in London, 1883, for 69 pounds. A

Hamor was not a naturalist, but his name is usually referred to by zoölogical bibliographers, since he mentions by name over sixty native animals. He was the first to describe the great flocks of wild pigeons, of which he remarks: "In winter, beyond number or imagination, myselfe hath seene three or foure houres together flockes in the aire so thicke that even they have shadowed the skie from us."* He gives an amusing description of the "opossume," and also speaks of the introduction and successful acclimation of the Chinese silk-worm.

In 1620, the Plymouth Colony was planted, and its members also began to record their impressions of the birds and the beasts and the plants which they found, for the instruction of their kinsfolk at home.

Bradford and Winslow's Journal, printed in London in 1622, contains various passing allusions to the animals and plants observed by the Pilgrims, as does also Bradford's History, which, however, was not printed until long after its completion. They added nothing, however, to what had already been said by Smith.

Edward Winslow's "News from New England," printed in London in 1624, contains one of the earliest descriptions of the Indians of the Northeast.

William Wood's "New England's Prospect," which was issued in London in 1634, and Morton's "New English Canaan," printed three years later in Amsterdam, were the first formal treatises upon New England and its animals and plants. The two authors were very unlike, and their books even more so—yet complementing each other very satisfactorily. Morton was the best educated man, brightest, and most observant; Wood, the most conscientious and the most laborious in recording minute details.

"Thomas Morton, of Clifford's Inn, Gent.," was by no means

reprint was issued by Joel Munsell at Albany in 1860, but this privately printed edition consisted of only 200 copies and it is already scarce.

* P. 21.

a representative man in the Puritan community in which he lived. His habits were those of an English man of fashion, and his Rabelaisian humor, when directed against his fellow-colonists and their institutions, was no recommendation to their favor. We cannot wonder that he was hunted from settlement to settlement and even cast into prison, to endure, without bedding or fire, the rigor of a New England winter.

As a naturalist, Morton appears to have been the most accurate of the two of this time. In those parts of his book which describe animals and plants he manifests a definite scientific purpose. He discriminates between species, and frequently points out characters by which American and European forms may be distinguished. He was the first to banish the lion from the catalogue of the mammals of eastern North America. Even Wood, though he admitted that he could not say that he ever saw one with his own eye, evidently believed that lions inhabited the woods of Massachusetts. Morton was a skeptic because, as he said, "it is contrary to the Nature of the beast to frequent places accustomed to snow; being like the Catt, that will hazard the burning of her tayle, rather than abide from the fire." His brief biographies, especially those of mammals, indicate that he was an observer of no slight acuteness.

Twenty species of mammals, thirty-two of birds, twenty of fishes, eight of marine invertebrates, and twenty-seven of plants are mentioned, usually in such definite terms that they may readily be identified.

A thorough pagan himself, he seems to have commanded the confidence of the Indians more than others, to have lived in their society, and learned to comprehend the meaning of their customs. His first book, "The Originall of the Natives, their manners and customs," seems to have been the careful record of rather critical observations.

Wood's book is no less deserving of praise. The climate and the soil are judiciously discussed, and the herbs, fruits, woods, waters, and minerals, then "the beasts that live on land," "beasts living in the water," "birds and fowls both of land and water," and fish, after which follows a topographical description of the colony. His catalogues of species are in verse, and his adjectives are so descriptive and pictorial that his subsequent remarks in prose are often superfluous. I quote his catalogue of the trees of New England, an imitation in manner and metre of Spenser's famous catalogue in The Faerie Queene:

> Trees both in hills and plaines in plenty be
> The long liv'd Oake, and mourneful Cypris tree
> Skie towring pines, and Chestnuts coated rough,
> The lasting Cedar and the Walnut tough;
> The rozin dropping Firre for masts in use.
> The boatmen seeke for Oares light neeate growne sprewse,
> The brittle Ash, the ever trembling Aspes,
> The broad-spread Elme, whose concave harbours waspes
> The water-springie Alder, good for nought
> Small Elderes by the Indian Fletchers sought
> The knottie Maple, pallid Birtch, Hawthornes,
> The Horne bound tree that to be cloven scornes;
> Which from the tender Vine oft takes his spouse,
> Who twinds embracing armes about his boughes.
> Within this Indian Orchard fruites be some
> The ruddie Cherrie, and the jettie Plumbe
> Snake murthering Hazell, with sweet Saxaphrage
> Whose steemes in beere allays hot fever's rage.
> The Diar's Shumach, with more trees there be
> That are both good to use and rare to see.

Thus he describes the "Animals of New England:"

> The Kingly Lyon and the strong arm'd Beare
> The large limbed Mooses, with the tripping Deare.
> Quill darting Porcupines, and Rackcoones bee
> Castelld in the hollow of an aged Tree
> The skipping Squirrel, Rabbet, purblinde Hare
> Immured in the selfe same Castle are
> Least red-eyed Ferrets, wily Foxes should
> Them undermine if ramperd but with mould.
> The grim fac't Ounce, and ravenous howling Woolfe
> Whose meagre Paunch suckes like a swallowing Gulfe,
> Black glistening Otters and rich coated Beaver
> The Civet scented Musquash, smelling ever.

His subsequent remarks upon the mammals are expanded from his rhyme, and extended by tales which he has heard from hunters. One of the animals whose name would not lend itself to poesy is the "squuncke," which he classified among the "beasts of offence." This seems to be the first use of the name.

In the second part of Wood's book the Indians are discussed, and a very creditable vocabulary is given.

Most admirable work was now being done among the Indians by some of the colonial clergymen. Chief among them was the Rev. John Eliot, [b. 1604, d. 1690], who, during a residence of more than half a century at Roxbury, mastered the language of the Massachusetts branch of the great Algonquin tribe, and published his grammars and translations. He was a graduate of Jesus College, Cambridge, and came to Massachusetts in 1631. The Rev. Abraham Peirson, one of the founders of the colony at Newark, during his residence in New England made valuable investigations upon the language of the Quiripi or Quinnipiac Indians of the New Haven Colony. The extensive bibliography of which Mr. Pilling has recently published advance sheets gives an excellent idea of the attention which American linguistics have since received.

That very eminent colonial statesman, John Winthrop, the younger, the first Governor of Connecticut, [b. 1587, d. 1649], stood high in the esteem of English men of science, and was invited by the newly founded Royal Society, of which he was a fellow, "to take upon himself the charge of being the chief correspondent in the West, as Sir Philiberto Vernatti was in the East Indies." The Secretary of the Royal Society said of him: "His name, had he put it to his writings, would have been as universally known as the Boyles, the Wilkins's, and the Oldenburghs, and been handed down to us with similar applause." *

Governor Winthrop's name occurs from time to time in the Philosophical Transactions, and it was to him that science was indebted for its first knowledge of the genus *Astrophyton*.

John Winthrop, F. R. S., [b. 1606, d. 1676], son of the last,

* Dr. Cromwell Mortimer in the Dedication of vol. xl, Philosophical Transactions.

and also Governor of Connecticut in 1662, is said to have been "famous for his philosophical knowledge." He was a founder of the Royal Society, being at the time of its origin in England as agent of the colony. And the second Governor's grandson, John Winthrop, F. R. S., [b. 1681, d. 1747), who passed the latter part of his life in England, was declared to have increased the Royal Society's repository "with more than six hundred curious specimens, chiefly in the mineral kingdom," and since the founder of the museum of the Royal Society, "the benefactor who has given the most numerous collections."*

The Rev. John Clayton, rector of Crofton, at Wakefield, in Yorkshire, made a journey to Virginia in 1685, and in 1688 communicated to the Royal Society "An account of several observables in Virginia and in his voyage thither."† Clayton seems to have been a man of scientific culture, and to have been the author, in company with Dr. Moulin, of a treatise upon Comparative Anatomy. He was of the same school with Harriott and Wood, though more philosophical. His essay was, however, the most important which had yet been published upon the natural history of the South, and his annotated catalogue of mammals, birds and reptiles is creditably full.

Thomas Glover also published about this time "An Account of Virginia,"‡ in which he discussed the natural history of the colony after the manner of Wood and Morton. The Rev. Hugh Jones also published a similar but shorter paper upon "Several Observables in Maryland," § in which, however, no new facts are mentioned. He collected insects and plants for Petiver.

Benjamin Bullivant, of Boston, was another of the men who, to use the language of the day, was "curious" in matters of nat-

* Tuckerman, *op. cit.*, pp. 123-4. See also *The Winthrop Papers.* < Mass. Hist. Soc. Coll., Fifth Series, vol. viii.

† Phil. Trans, xvii, pp. 781-795, 978-999; xviii, pp. 121-135, and in *Miscellanea Curiosa*, vol. iii; also reprinted in Force's Historical Tracts, vol. iii.

‡ Phil. Trans., ix, p. 633.

§ Phil. Trans., xxi, p. 436.

ural history. One of his letters was published in the Philosophical Transactions,* and his notes on the "hum-bird" are sometimes referred to.

Bullivant was not a naturalist; he is less worthy of our consideration than Harriott, although a century later. A fit companion for Bullivant was John Josselyn.

Josselyn's famous work entitled "New England's Rarities Discovered in Birds, Beasts, Fishes, Serpents, and Plants of that Country," was printed in London in 1672; his "Account of two voyages to New England" in 1675, ("Second Addition"). No writer of his period is more frequently quoted than Josselyn, whose quaint language and picturesque style are very attractive. Although no more in sympathy with his Puritan associations than the author of "New England's Prospect," he was evidently more justly entitled to subscribe himself as "Gentleman," and his books are not disfigured by personalities and political aspersions.

Josselyn does not seem to me to be the peer, as a naturalist, of many of those who preceded him. He was a bright, though superficial man, and a ready compiler. He evidently had some botanical work in his possession, possibly as Tuckerman has suggested, a recently published edition of Gerard's "Herbal," and this he used with such skill as to give him a certain standing in botanical literature. In his zoölogical chapters I find little which had not been recorded before, while the author's fondness for startling anecdotes greatly mars the semblance of accuracy in his work. His catalogue of fishes is a strange olla-podrida of names and scraps of information, compiled, collected and invented. His method of arrangement is not more scientific than his spirit, and it is questionable whether he is entitled to a place among naturalists.

Here is an example of his style:

"The Basse," writes he, "is a salt-water fish too; one writes

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*Phil. Trans., xx, p. 168.

that the fat in the bone of a Basses head is his braines, which is a lye."

To this period belongs, also, Lawson, the author of a "History of North Carolina" and "A New Voyage to North Carolina," made in 1700 and the following years, while acting as surveyor general of the colony. Lawson was burnt at the stake in 1709 by the Indians, who resented his encroachments upon their territory. His lists of the animals and plants of the region are very full and his observations accurate. Coues's "Lawsonian period" in the history of American ornithology is hardly justifiable. Lawson belonged to the school of Harriott and the first Clayton.

Edward Bohun and Job Lord, of Carolina, appear to have been interested in natural history at this time and to have been collecting specimens for Petiver in London, while William Vernon was engaged in similar occupations in Maryland.

In those early days all Europe was anxious to hear of the wonders of America, and still more eager to see the strange objects which explorers might be able to preserve and bring back with them. Public museums were as yet unknown, but the reigning princes sought eagerly to secure novelties in the shape of animals and plants.

Columbus was charged by Queen Isabella to collect birds, and it is recorded that he took back to Spain various skins of beasts. Even to this day may be seen, in Siena, hanging over the walls of the old collegiate church, a votive offering, placed there nearly four centuries ago by the discoverer of America, then in the prime of his glory. It consists of the helmet and armor worn by him when he first stepped upon the soil of the New World, and the rostrum of a swordfish killed on the American coast.

The State papers of Great Britain contain many entries of interest to naturalists. King James I. was an enthusiastic collector. December 15, 1609, Lord Southampton wrote to

Lord Salisbury that he had told the King of the Virginia squirrels brought into England, which were said to fly. The King very earnestly asked if none were provided for him—whether Salisbury had none for him—and said he was sure Salisbury would get him one. The writer apologizes for troubling Lord Salisbury, "but," he continues, "you know so well how he (the King) is affected to such toys."

Charles I. appears to have been equally curious in such matters. In 1637 he sent John Tradescant, the younger, to Virginia "to gather all rarities of flowers, plants, and shells."

In 1625 we find Tradescant writing to one Nicholas that it is the Duke of Buckingham's pleasure that he should deal with all merchants from all places, but especially from Virginia, Bermudas, Newfoundland, Guinea, the Amazons, and the East Indies for all manner of rare beasts, fowls and birds, shells and shining stones, et cetera.*

In the Domestic Correspondence of Charles I. in another place,† July, 1625, is a "Note of things desired from Guinea, for which letters are to be written to the merchants of the Guinea company." Among other items referred to are "an elephant's head, with the teeth very large; a river-horse's head; strange sorts of fowls: birds' and fishes' skins; great flying and sucking fishes; all sorts of serpents; dried fruits, shining stones, etc." Still further on is a note of one Jeremy Blackman's charge—in all, £20—for transporting four deer from Virginia, including corn and a place made of wood for them to lie in.‡

Not only did the kings make collections, but the keepers of public houses made museums then, as they do now, for the pleasure of their patrons.

At the middle of the last century there appear to have been several collections of curiosities.

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* *Calendar of Colonial Papers*, 1625, p. 75.

† Vol. iv, Nos. 155–6. Cal., p. 77.

‡ *Calendar of Colonial Papers*, p. 285.

In Artedi's ichthyological works there are numerous references to places where he had seen American fishes, especially at Spring-garden,* and at "the Naggshead," and the "White-bear," and the Green Dragon in Stepney, in those days a famous hostelry in London. He speaks also of collections at the houses of Mr. Lillia and Master Saltero's † in Chelsey and at Stratford, and also in the collection of Seba, in Amsterdam, and in that of Hans Sloane.

With the exception of "*the monk* or *Angel-fish*, *Anglis*, aliis *Mermaid-fish*," probably a species of *Squatina*, which he saw at the Nag's Head, all the fishes in these London collections belonged to the order Plectognathi.

Josselyn, after telling us how a Piscataway colonist had the fortune to kill a Pilhannaw—the king of the birds of prey—continues, "How he disposed of her I know not, but had he taken her alive and sent her over into England, neither Bartholomew or Sturbridge Fair could have produced such another sight." ‡

Shakespeare's mirror strongly reflects the spirit of the day. When Trinculo, cast ashore upon a lonesome island, catches a glimpse of Caliban he exclaims:

> "What have we here? A man or a fish? Dead or alive? A fish: he smells like a fish; a very ancient and fish-like smell. * * * A strange fish! Were I in England now, as once I was, and had but this fish painted, not a holiday fool there but would give a piece of silver; there would this monster make a man; any strange beast there makes a man; when they will not give a doit to relieve a lame beggar, they will lay out ten to see a dead Indian."§

The compilers of the great encyclopædia-like works on natural history were quick to pick up the names and descriptions of the American animals which had found their way to Europe, and

* Later known as Vauxhall Gardens, a famous place of resort.

† The barber-virtuoso, described in Bulwer's "Devereux."

‡ JOSSELYN: *Two Voyages to New England* (1638–1673).

§ *A Winter's Tale.*

many such are mentioned in the writings of Gesner, Clusius and Aldrovandus, Lister, Laet and Willughby.*

Creatures of remarkable appearance, which could be preserved with ease were the first to become known. Among fishes, for instance, those with a hard, inflexible integument, such as the trunk-fishes. Every species of the family *Ostraciontidæ* was known in Europe as early as 1685; most of them probably a century before. We know that Columbus caught a trunk-fish and described it in his "Voyages."

Professor Tuckerman has traced in a most instructive manner the beginnings of European acquaintance with American plants, finding traces of the knowledge of a few at a very early period:

> "Dalechamp, Clusius, Lobel, and Alpinus—all authors of the sixteenth century—must be cited occasionally in any complete synonomy of our *Flora*. The Indian corn, the side-saddle flower (*Sarracenia purpurea* and *S. flava*), the columbine, the common milk-weed (*Asclepias cornuti*), the everlasting (*Antennaria margaritacea*) and the *Arbor vitæ*, were known to the just mentioned botanists before 1600. *Sarracenia flava* was sent, either from Virginia, or possibly from some Spanish monk in Florida. Clusius's figure of our well-known northern *S. purpurea* was derived from a specimen furnished to him by one Mr. Claude Gonier, apothecary at Paris, who himself had it from Lisbon, whither we may suppose it was carried by some fisherman from the Newfoundland coast. The evening primrose, *Oenothera biennis*, was known in Europe, according to Linnæus, as early as 1614. *Polygonum sagittatum* and *arafolium* (tear thumb) were figured by DeLaet, probably from New York specimens, in his *Novus Orbis*, 1633. Johnson's edition of Gerard's "Herbal," 1636, contains some dozen North American species, furnished often from the garden of Mr. John Tradescant and John Parkinson, whose "Theatrum Botanicum" (1640) is declared by Tournefort to embrace a larger number of species than any work which had gone before. It describes a still larger number.†

* In Nehemiah Grew's "Catalogue and description of the natural and artificial Rarities, belonging to the Royal Society and preserved at Gresham College, Whereunto is subjoined the comparative Anatomy of Stomachs and Guts," London, 1681, are descriptions and figures of many American animals.

† *Archæologia Americana*, iv, pp. 116–117.

All the early voyagers were striving for the discovery of a western passage to India, and the West Indies, so-called, were considered simply a stage on the journey towards the East Indies. It is not strange, therefore, that writers should often have failed to distinguish the faunal relations of the animals which they described. Many curious paradoxes in nomenclature have thus arisen—*Cassis madagascariensis*, for instance; a very misleading name for a common West Indian mollusk.

V.

The seventeenth century bears upon its roll the names of many explorers besides those of English origin who have already been named. Within fifty years of the time of Harriott and of the planting of the colony at Roanoke, the number and extent of the European settlements in America had become very considerable. Virginia and the New England plantations were growing populous and Maryland was fairly established. Insular colonies were thriving at Newfoundland and Bermuda and on Barbados, and elsewhere in the West Indies.

New Spain and Florida marked the northern limits of the domain of the Spaniards, who had already overrun almost all of South America.

New France bounded New England on the north, and the French were pushing their military posts and missionary stations down into the Mississippi valley.

The Dutch were established on Manhattan Island and elsewhere in the surrounding country, and the Dutch West India Company had already a foothold in Brazil and Guiana. A colony of Scandinavians had been planted by the Swedish West India Company near the present site of Philadelphia, and the forsaken Danish colonies of Greenland were soon to be re-established. The Portuguese had flourishing settlements in Brazil, for the possession of which they were contending with the Dutch.

Every European nation was represented in the great struggle for territory save Italy and Germany, Switzerland and Russia; but the Italians and Germans, the Swiss and the Russians were to hold their own in the more generous emulation of scientific exploration which was to follow.

During the 17th and 18th centuries numerous explorations were made both in North and South America by Spanish, French, Dutch, German, and Scandinavian explorers. Although these men have been studied in the preparation of this address, I do not intend to speak of them at any length, but to confine my attention in the main to the growth of scientific opinions and institutions in the English colonies.

The number of volumes of reports and narratives, often sumptuously printed and expensively illustrated, which were published during the seventeenth and eighteenth centuries, impresses upon one most powerfully the idea of the earnestness, diligence, and intelligence of their writers.

The Spaniards.—Even as early as the beginning of the century, Spanish influence was less prominent in the affairs of the New World; in no respect more strikingly so than in explorations. The political supremacy of Spain was gone, her intellectual activity was waning, and the mighty storm of energy, by which her domain in America had been so suddenly and widely established, seemed to have completely exhausted the energy of her people, depleted as it had been by wars without and religious persecution within.

From this time forward the record of Spanish achievements in the fields of science and discovery is very meagre. Between the day of Hernandez and that of Azara and Mutis, who explored South America in the latter part of the eighteenth century, I find but two names worthy of mention, and these seem properly to belong with the naturalists who lived a hundred years before them. I refer to José Gumilla who published, in 1741, a work on the natural history of the Orinoco Region, and Miguel Venegas, whose "Noticia de la California" appeared in 1757.

The French.—One of the first French explorers who left a record of his observations was Samuel de Champlain, who made a voyage to the West Indies and Mexico, 1599–1602, and began his travels in New France in 1603. He was the founder of Quebec, where he died in 1635, and his geographical explorations and maps are of great value. His observations upon the animals and plants are disappointing. He describes the gar-pike and the king-crab, already described and figured by Harriott many years before, and refers in unmistakable terms to the shearwater, the caribou, the wild turkey, and the scarlet tanager. His lists of animals which occur now and again in the course of his narrative are too vague to be of value.*

Much higher in the esteem of naturalists was Gabriel Sagard Theodat, a Franciscan friar, whose "Grand Voyage Du Pays Des Hurons," printed in 1632, was the most scholarly work upon America which had yet appeared, and whose History of Canada and of the journeys made by the Franciscans for the conversion of the infidels also contains most valuable records.

The first work on the plants of North America was that of Cornuti—"Canadensium Plantarum, aliarumque nondum editarum Historia"—printed in Paris in 1635, which described thirty-seven species, thirty-six of these being illustrated by elaborate engravings upon copper. The botanical part of this treatise is usually ascribed to Vespasian Robin, and Tuckerman supposes that the local notes, as well as the specimens described, were probably the result of the labors of the worthy Franciscan missionary, Sagard.†

A few years later, Pierre Francois Xavier de Charlevoix, [b. 1682, d. 1761], a Jesuit priest, having by royal command travelled through the northern part of North America, published his "Histoire et Description Générale de la Nouvelle France,"

* Publications of Prince Society, Boston, 1878. Hakluyt Society, vol. xxiv, 1850.

† *Archæologia Americana*, iv, p. 119.

Paris, 1744, which was full of important biological and ethnological observations, the accuracy of which is not questioned.

He subsequently travelled in South America, and published in 1760, a work full of statements concerning the animals, plants, and fruits of that country, and also particularly interesting from the account which it gives of the singular Jesuit establishment in Paraguay.

Other French missionaries, Brebœuf, Du Poisson, Jaques, Joliet, La Chaise, Lallemand, Marquette, Senat, and Souel followed Charlevoix in the exploration of these regions. Their works contain many valuable notes upon animals and plants.

Jean Baptiste du Tertre, in his "Histoire Générale des Antilles, habitées par les Francois," published in Paris in 1654, [ed. 1654–1667], described and illustrated many of the New World animals.

In 1672 Nicolas Denyse published in Paris two comprehensive works upon America, viz: "Histoire Naturelle des Peuples, des Animaux, des Arbres et des Plantes de l'Amérique,"* and "Description Geographique des costes de l'Amérique Septentrionale, avec l'Histoire Naturelle du Pays."†

F. Froger, a companion of De Gennes in his voyage made in 1695–97 to the coast of Africa, the Straits of Magellan, Brazil, Cayenne and the Antilles, published a report in 1698.‡ The book has been overlooked by recent bibliographers, but, judging from Artedi's remarks upon its ichthyological portion, it was fully equal to similar works of its day.

Baron de la Hontan, Lord Lieutenant of the French Colony at Placentia, printed at the Hague in 1703 his "Voyages dans l'Amérique," which is sometimes referred to by zoölogists.

Louis Feuillée, who travelled by royal commission from 1707–12 in Central and South America, published four volumes of physical mathematics and botanical observations, 1714–25, in Paris.

* Paris, 1672, 8°. † 1672, 12°, 2 vol.

‡ Paris, 1698; Amsterdam, 1699; London (translation), 1698.

The Père Jean Baptiste Labat, visited the West Indies as a missionary early in the eighteenth century, and "Nouveau Voyage aux Isles de l'Amérique," printed in Paris, 1722, is very full of interesting and copious details of natural history.

The Père Laval, visited Louisiana, and published in Paris, 1728, his "Voyage de la Louisiane."

M. LePage DuPratz followed, in 1758, with his "Histoire de la Louisiane,"* full of geographical, biological, and anthropological observations upon the lower valley of the Mississippi, and Captain Bossu, of the French Marines, also published a book upon the same region,† translated into English in 1771 by John Rembold Forster, whose notes gave to the work its only value. These men are all catalogued with the seventeenth century naturalists because they were of the old school of general observers and only indirectly contributed to the progress of systematic zoölogy.

Charles Plumier [b. 1646, d. 1704] was sent thrice by the King of France to the Antilles during the latter years of the seventeenth century. He published three magnificently illustrated works upon the plants of America,‡ and left an extensive collection of notes and drawings of animals and plants, many of which have proved of value to naturalists of recent years. His colored drawings of fishes were of great service to Cuvier in the preparation of his great work upon ichthyology, and in some instances species were founded upon them.

The Dutch.—There were few lovers of nature among the colonists of Manhattan, and with the exception of certain names which have clung to well-known animals, such as the mossbunker and weakfish, naturalists have little to remind them of the days of Van Twiller and Stuyvesant. Van Der Donck, in 1659, de-

* Paris, 1758.

† *Nouveaux Voyages aux Indes Occidentales*, etc., Paris: 1768.

‡ 1693. *Nova Plantarum Americanarum Genera*, 1703. Traité de Fougéres d'Amérique, 1705.

scribed the fauna, and Jakob Steendam's poem, "In Praise of the Netherlands," catalogued many of the animals.

The achievements of Prince Maurice of Nassau, [b. 1604, d. 1679], the conqueror of Brazil, during his residence in that country from 1636 to 1644, were far more important than those of any one man in the seventeenth century, and entitled the Netherlands to a leading place in the early history of American scientific explorations. The notes and figures which were collected by him and his scientific assistants, Marcgrave, Piso, and Cralitz, were published in part under the editorship of Golius, and Laet, and have been frequently used by naturalists of the present century. An atlas of colored drawings from the hand of Prince Maurice is still preserved in the Royal Library in Berlin. Here are depicted 34 species of mammals, 100 of birds, 55 of reptiles, 69 of fishes, and 77 of insects, besides many of plants.

Marcgrave's "Historia Rerum Naturalium Brasiliæ" was printed in Amsterdam in 1648, four years after his untimely death while exploring the coast of Guinea.

Piso's "Medicina Braziliensis," 1648, and his Natural History and Medicine of both Indies, 1658, were also results of Prince Maurice's expedition.

Among other contributions made by the Netherlands to the natural history of America were the "Relation du Voyage de Isle Tobago," Paris, 1606, and the "Histoire Naturelle et Morale des Isles Antilles," Rotterdam, 1658,* written by N. Rochefort, a Protestant missionary to the West Indies, and Jan Nieuhof's "See und Landreize benessens een bondege Beschreyving von gantsch Nederland Brazil so van Landschappen Steden, Deren Gewaffen," &c., printed in 1682.

Jan Jacob Hartsinck, a Dutch traveller in Guiana, printed a book of scientific travels at Amsterdam in 1770.

Philippe Fermin, a Dutch naturalist, resident for many years

* First edition without name of author; others, Paris, 1665; Lyons, 1667; Amsterdam, 1716.

in Surinam, published in Amsterdam two important works upon the natural history of that region, in 1765 his "Histoire Naturelle de la Hollande Equinoxiale," and in 1769 his "Description de Surinam." I refer to these works as important, not because they are of great value to zoölogical writers of to-day, but because they, in their day, marked distinct advances in knowledge.

The Scandinavians.—Danish enterprise at an early day sent explorers to the western continent, and the scholarly tendencies of the Scandinavian mind were soon manifest in a literature of geographical and scientific observations.

Hans Egede, a missionary who went to Greenland at least as early as 1715, published in 1741 his comprehensive work upon Greenland, of which so many editions have been published.

Otho Fabricius, [b. 1744, d. 1822], another missionary, long resident in Greenland, published in 1780 his "Fauna Grœnlandica," a work which in scientific accuracy has never been excelled—a most important contribution to systematic zoölogy. David Crantz's "History of Greenland," published in 1770, is another important scientific work from the hand of a missionary, and Zorgdrager's notices of the Greenland fisheries deserve a passing notice.

The travels of Kalm, a Swede and a pupil of Linnæus, are noticed elsewhere. Peter Loefling, another pupil of Linnæus, visited Spanish America, and in his "Iter Hispanicum," printed in Stockholm, 1758, described many animals and plants observed by him.

Olaf Swartz, a Swede, discovered and described 850 new species of West Indian plants from 1785–89. He spent a year in the southern United States before going to the West Indies.*

The Germans.—Germany, too, soon began to send its students across the Atlantic. Johann Anderson, a Burgomaster of Hamburg, published in 1746 his "Tidings from Iceland, Greenland,

* Brendel.

and Davis Straits, for the benefit of Science and Commerce." Hans Just Winkelmann published in Oldenburg in 1664 "Der Amerikanischen neuen Welt Bescreibung," &c., with descriptions and figures of animals and plants.

Christian Bullen, in 1667, made a voyage to Greenland and Spitzbergen, an account of which, including interesting observations on whales and the whale fishery, was printed at Bremen in 1668.

Marcgrave, Krieg, the two Forsters, and Schoepf are referred to elsewhere. Steller, Pallas and Chamisso are mentioned in connection with Russian explorations.

Madame Maria Sibilla Merian, [b. 1647, d. 1717], who was a native of Frankfort, was an enthusiastic entomologist who travelled in Surinam from 1699–1701. Her paintings of tropical insects were reproduced in a magnificent folio volume, printed 1705–9, which was one of the wonders of her day, and which, together with her other writings upon insects, have secured her a prominent place in the early history of science.

VI.

The seventeenth century was not, upon the whole, a period favorable to the promotion of science, for all Europe was agitated by war and political strife, and men had neither opportunity nor inclination for intellectual pursuits. During its latter half, however, and with the return of peace and tranquillity, science grew in favor as it had never done before. The restoration of the Stuarts to the English throne was quickly followed by the establishment of the Royal Society. Louis XIV. made the period of his accession memorable by founding the Royal Academy of Sciences, and by building an observatory.

This was the period of intellectual activity which followed the revival of letters in Europe. Carus, in his History of Zoölogy, calls it the period of encyclopædia-making, (*Periode der encyklopädische Darstellungen*), filling the interspace between

"The Zoölogy of the Middle Ages" and "the period of Systematic Classification." Students of science had ceased to compile endless commentaries on the works of Aristotle and had begun to record their own observations and thoughts, to gather new facts and materials, which were to serve as a basis for the systematic work for their successors.

The greatest names of the day among naturalists were those of Ray, Tournefort, Lister, Jonston, Goedart, Redi, Willughby, Swammerdam, Sloane, Jung, and Morrison; names not often referred to at the present day, but worthy of our recollection and veneration, for they were men of a new era—the pioneers in systematic zoölogy and botany.

Among the earliest representatives of the new school in North America were Banister, Clayton, Mitchell, and Garden. John Banister, a clergyman of the Church of England, emigrated to Virginia before 1668, and in addition to his clerical duties applied himself assiduously to the study of natural history. He was a disciple and also, no doubt, a pupil of the great English naturalist, John Ray, who called him, in his Historia Plantarum, "erudissimus vir et consummatissimus Botanicus," and corresponded also with Lister, and Compton, Bishop of London. He was the first to observe intelligently the mollusks and insects of North America. In a paper communicated to the Royal Society in 1693 he refers to drawings of ten or twelve kinds of land snails and six of fresh-water mussels. The drawings were not published, nor were the notes, except those in reference to the circulation of a species of snail.*

He sent to Petiver, in 1680, a collection of 52 species of insects, his observations upon which, with notes by Petiver, were a few years later communicated to the Royal Society.†

* Phil. Trans., xvii, 1693, pp. 671–672. See also Trans. Linnæan Soc., vii, p. 227.

† *Some Observations concerning Insects made by Mr. John Banister in Virginia, A. D. 1680, with Remarks on them by Mr. James Petiver*, &c. Phil. Trans., xxii, 1701, pp. 807–814.

Among them many familiar forms are recognizable—the mud-wasp, seventeen-year locust, cimex, cock-roach, firefly, the spring beetle (*Elater*), and the tobacco-moth. He appears to have drawn and described several phases of the life history of the ichneumon-fly. He had in his possession in 1686, and exhibited to an English traveller, large bones and teeth of fossil mammals from the interior of Virginia, the first of which we have any record in North America.*

It was as a botanist, however, that he was best known. He made drawings of the rarer species, and transmitted these with his notes and dried specimens to Compton and Ray. Banister's "Catalogus Plantarum in Virginia observatarum," printed in 1686,† was the first systematic paper upon natural history which emanated from America. In one of his botanical excursions, about the year 1692, he visited the falls of the Roanoke, and, slipping among the rocks, was killed.‡

Lawson, the historian of North Carolina, writing at the beginning of the next century, remarked: "Had not the ingenious Mr. Banister (the greatest virtuoso we ever had on this continent) been unfortunately taken out of this world, he would have given the best account of the plants of America of any that ever yet made such an attempt in these parts."§ The memory of John Banister is still cherished in Virginia, where his descendants are numerous.‖

John Clayton was also an excellent representative of the new school, and should not be confounded with the Rev. John Clayton who visited America in 1685. John Clayton, the naturalist, as

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* Perhaps the *Megalonyx Jeffersonii*, subsequently discovered.

† In RAY'S *Historia Plantarum*.

‡ His papers and collections were sent to the Bishop of London. The plants are said to have passed into the hands of Sloane, and to be still preserved in the British Museum. It would be interesting to know what has become of his manuscripts.

§ LAWSON: *History of North Carolina*, Raleigh Ed., p. 134.

‖ See *The Bland Papers* and SLAUGHTER'S *History of Bristol Parish*, 1st and 2d editions.

he is styled in Virginian history, appears to have been born in Fulham, a suburb of London, in 1686, and to have accompanied his father, John Clayton, subsequently Attorney-General of Virginia, when he came to this country in 1705. He was clerk of Gloucester County, Virginia, for fifty-one years, and died December 15, 1773. "He passed a long life," says Thacher, "in exploring and describing the plants of this country, and is supposed to have enlarged the botanical catalogue as much as any man who ever lived." He was a correspondent of Linnæus, Gronovius, and Collinson, and the latter wrote of him in 1764 as "my friend John Clayton, the greatest botanist of America."

Clayton's "Flora Virginica," which was edited by Gronovius, assisted by the young Linnæus, who was just entering upon his career of success, and was then resident in Leyden, began to appear in 1739, subsequent portions being published in 1743 and 1762. It seems to be the opinion of botanists that Gronovius deserves less credit for his share in this work than has usually been allowed him, and that Clayton's descriptions were those of a thorough master of botanical science as then understood. He communicated to the Royal Society various botanical papers, including one upon the culture of the different kinds of tobacco. At his death he left two volumes of manuscripts, and an herbarium, with marginal notes and references for the engraver who should prepare the plates for his proposed work. These were in the possession of his son when the revolutionary war commenced, and were placed in the office of the clerk of New Kent county for security from the invading enemy. The building was burned down by incendiaries, and thus perished not only the records of the county but probably one of the most important works on American botany written before the days of Gray and Torrey.

Jefferson declares that Clayton was a native Virginian, and such is the confusion in the records that it is quite possible that such may be the fact.*

* See *Spotswood Letters*, i, pp. 1, 8; ii, pp. 44, 58, 355.

Still another pioneer was Dr. John Mitchell, born in England about 1680 and settled, early in the last century, at Urbanna, Virginia, where he remained nearly fifty years practising medicine and promoting science. He appears to have been a man of genius and broad culture, and was one of the earliest chemists and physicists in America. His political and botanical writings were well received, and his map of North America is still an authority in boundary matters. He was a correspondent of Linnæus, and in 1740 sent Collinson a paper in which thirty new genera of Virginia plants were proposed.* His Dissertation upon the Elements of Botany and Zoology† was dated Virginia, 1738, and was thus almost contemporary with the first edition of the *Systema Naturæ* of Linnæus, though it was not printed until ten years after it was written. This was the first work upon the principles of science ever written in America. In 1743 he communicated to the Royal Society an "Essay on the Causes of the Different Colours of People in Different Climates,"‡ writing from the standpoint of an evolutionist. He also communicated an "Essay on the Properties and Uses of the Different Kinds of Potash," § and a "Letter concerning the Force of Electrical Cohesion." ‖ His fame rests chiefly, however, upon his investigations into the yellow fever epidemic of 1737–42, published after his death.¶ In 1743 he appears to have been engaged in physiological researches upon the opossum, which, however, were never published. In 1746 Dr. Mitchell returned to England, and upon the voyage was captured by French or Spanish pirates, and his collections, and apparently his manuscripts, destroyed. He became a Fellow of the Royal Society,

* DARLINGTON, p. 21.

† *Dissertatio brevis de Principiis Botanicorum et Zoologorum, deque novo stabiliendo naturæ rerum Systemati congruo, cum Appendice aliquot generum plantarum recens conditorum et in Virginia observatum.* Nuremburg, 1748.

‡ Phil. Trans., xliii, 1744.

§ Phil. Trans., xlv.

‖ Phil. Trans., l.

¶ Amer. Med. & Phil. Reg., iv.

and in 1748 was writing a work upon the natural and medical history of North America.* He died at an advanced age, about 1772. His name is perpetuated in that of our beautiful little partridgeberry, *Mitchella repens*. "Mitchell and Clayton together," says Tuckerman, "gave to the botany of Virginia a distinguished lustre."

Dr. John Tennent, of Port Royal, Va., seems to have been a man of botanical tastes. He it was who brought into view the virtues of the Seneca snake root, publishing at Williamsburgh, in 1736, an essay on pleurisy, in which he treats of the Seneca as an efficient remedy in the cure of this disease.† He also wrote other botanical treatises.‡ Dr. Greham, of Dumfries, Va., was a man of similar tastes, and it is said by Mr. Jefferson that we are indebted to him for the introduction into America of the tomato.

David Krieg, F. R. S., a German botanist, collected insects for Petiver in Maryland, and gathered also hundreds of species of plants. He seems to have returned to England very early in the century, for his name appears in the Philosophical Transactions in 1701.

Col. William Byrd, of "Westover," Va., [b. 1674, d. 1744], was a man of European education, the owner of a magnificent library, in which Stith wrote his history of Virginia, founder of the city of Richmond, colonial agent in London, and President of the King's council. He was a Fellow of the Royal Society, to which he communicated a paper "concerning a negro boy dappled with white spots,"§ and was a correspondent of Collinson, Bartram, and other naturalists. His "History of the Dividing Line" and his "Journey to the Land of Eden," in 1733, contain many inter-

* SMITH : *Correspondence of Linnæus*, ii, pp. 442–451.

† THACHER : *Medical Biography*, i, p. 73.

‡ Mitchell writing to Linnæus, in 1748, remarks : "I can now only send you * * * some dissertations of Mr. Tennant upon the *Polygala*, two of which only have come out among his latest publications. His former ones, of inferior merit, are not now to be had."

§ Phil. Trans., 1697.

esting observations upon Indians and general natural history. He it was who, in 1694, carried to England a female opossum, which furnished the materials for the first dissertation upon the anatomy of the marsupiates.*

One of the most eminent of our colonial naturalists was Dr. Alexander Garden, born in Scotland about 1728 [d. 1791]. He emigrated to America about 1750, and practised medicine in Charleston, S. C., until after the close of the revolutionary war, when he returned to England and became very prominent in scientific and literary circles, and vice-president of the Royal Society in 1783. He was an excellent botanist, but did his best work upon fishes and reptiles. He sent large collections of fishes to Linnæus, which were so well prepared that when I examined the fishes in the Linnæan collection in London, in 1883, I found nearly every specimen referred to by him in his letters in excellent condition, though few collected by others were identifiable. Garden was the discoverer of *Amphiuma means*, and was instrumental in first sending the electrical eel to Europe. His letters to Linnæus and to Ellis are voluminous and abound in valuable information. In 1764 he published a description of *Spigelia marilandica*, with an account of its medicinal properties.

James Logan, [b. 1664, d. 1751], a native of Ireland and member of the Society of Friends, accompanied William Penn to this country in 1682 in the capacity of secretary, and became a public man of prominence, serving for two years as governor of the colony of Pennsylvania. He was a man of broad culture and was the author of a translation of Cicero's "De Senectute," printed by Benjamin Franklin in 1744. To Logan belongs the honor of having carried on the first American investigations in physiological botany, the results of which were published in Leyden, in 1739, in an essay entitled "Experimenta et Meletemata de Plantarum Generationis." This essay, which related to

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*EDWARD TYSON: *Carigueya seu Marsupialis, or the Anatomy of an Opossum*, &c., &c. < Phil. Trans., xx, 1698, p. 105.

the fructification of the Indian corn, was accepted in its day as a valuable contribution to knowledge.

Cadwallader Colden [b. 1688, d. 1776] was also a statesman and a naturalist. A native of Scotland, he came to America in 1708, and, after a short residence in Pennsylvania, settled in New York, where he held the office of surveyor-general and member of the King's council, and in later life was for many years lieutenant-governor, and frequently acting-governor of the province. His intellectual activity manifested itself in various directions, and his "History of the Five Indian Nations of Canada," New York, 1727, was one of the earliest ethnological works printed in America. He also was interested in meteorology and astronomy, and as a correspondent of Linnæus and Collinson did much to advance the study of American Botany. His daughter, Miss Jane Colden, was the first lady in America to become proficient in the study of plants. She was the author of a Flora of New York which was never published.* Governor Colden's "Plantae Coldenhamiae," the first part of a catalogue of the plants growing in the neighborhood of his country residence, "Coldenham," near Newburgh, was the first treatise on the flora of New York. It was published in 1744 in the Acts of the Royal Society of Upsala.† A most interesting collection from the scientific correspondence of Colden was published many years ago by Dr. Asa Gray.‡

Hans Sloane, a young Irish physician, [b. 1660, d. 1753], who had been a pupil of Tournefort and Magnol, visited the West Indies in 1684, and after his return printed a Catalogue of Jamaica Plants in 1696, and, later, a sumptuously illustrated work on the natural history of Jamaica (1707–25). After his return he became an eminent physician, and in 1727 succeeded Isaac Newton as President of the Royal Society. The collection of animals and plants made by Sir Hans Sloane in America was greatly increased by him during his long and active life, and, having been be-

* BRENDEL in Amer. Nat., Dec., 1879. † TORREY: *Flora of New York.*
‡ Amer. Journ. Science, xiv.

queathed by him to the nation, became, upon his death in 1753, the nucleus of the British Museum.

Another naturalist of the same general character was Mark Catesby, [b. 1679, d. 1749], who lived in Virginia, 1712 to 1721, collecting and making paintings of birds and plants; in the Carolinas, 1722 to 1725, and a year also in the Bahamas. His magnificent, illustrated work upon the Natural History of Carolina, Florida, and the Bahamas,* is still of great value to students of natural history.

The name of John Bartram, the Quaker naturalist of Philadelphia, is possibly better remembered than those of his contemporaries. This is no doubt due to the fact that he left behind him a lasting monument in his botanic garden on the banks of the Schuylkill. He was the earliest native American to prosecute studies in systematic botany, unless Jefferson's statement concerning Clayton proves to be true. Linnæus is said to have called him "the greatest natural botanist in the world," and George III. honored him in 1765 with the title of "Botanist to his Majesty for the Floridas," and a pension of fifty pounds a year. Bartram was a most picturesque and interesting personage, and a true lover of nature. He did great service to botany by supplying plants and seeds to Linnæus, Dillenius, Collinson, and other European botanists. He was a collector, however, rather than an investigator, and his successes seem to have been due, in the main, to the patient promptings and advice of his friend Collinson in London. Garden, whom he visited at Charleston, in 1765, after his appointment as King's Botanist, wrote of him to Ellis:

"I have been several times into the country with him and have told him the classes, genera, and species of all the plants that occurred which I knew. I did this in order to facilitate his enquiries, as I find that he knows nothing of the generic characters of plants and can neither class nor describe them, but I see that,

* London, 1754-71.

from great natural strength of mind and long practice, he has much acquaintance with the specific characters; though his knowledge is rude, inaccurate, indistinct, and confused, seldom determining well between species and varieties. He is, however, alert, active, industrious, and indefatigable in his pursuits."*

Fothergill says in his Memoir of Collinson "that the eminent naturalist, John Bartram, may almost be said to have been created by my friend's assistance."

The foregoing remarks concerning the elder Bartram are simply for the purpose of calling attention to his proper position among the American naturalists of his day. It is not that I esteem Bartram the less, but that I esteem Garden, Clayton, Mitchell and Colden more. The name of Bartram brings up at once that of his friend and patron, Peter Collinson, just as that of Garden reminds us of John Ellis.

Collinson and Ellis were never in America, yet if any men deserve to be called the fathers of American natural history it is they. For a period of thirty years or more, that period during which Linnæus was bringing about those reforms which have associated his name forever with the history of the classificatory sciences, these enlightened and science-loving London merchants seem to have held the welfare of American science in their keeping and to have faithfully performed their trust. I know few books which are more delightful than Darlington's "Memoir of Bartram" and Smith's "Correspondence of Linnæus," made up as they are largely of the letters which passed between Collinson and Ellis and their correspondents in America, and with Linnæus, to whom they were constantly transmitting American notes and specimens.†

Humphrey Marshall [b. 1722, d. 1801] was a farmer-botanist of the Bartram type, and the author of "The American Grove," a treatise upon the forest trees and shrubs of the United States,

* SMITH: *Correspondence of Linnæus*, i, p. 537.

† DARLINGTON: *Memoirs of Bartram and Marshall.*

the first botanical work which was entirely American. Darlington's "Memorials of Bartram and Marshall" is a worthy tribute to this useful man.

Moses Bartram, a nephew of John, was also a botanist, and William, his son, [b. 1739, d. 1823], was a much more prominent figure in American science. His "Travels through North and South Carolina," published in 1791, was, in the opinion of Coues, the starting-point of a distinctively American school of ornithology.

Collinson was a correspondent of Benjamin Franklin, and is said not only to have procured and sent to him the first electrical machine which came to America, but to have made known to him in 1743 the results of the first experiments in electricity, the continuation of which gave to Franklin his European reputation as a man of science. Collinson was instrumental in introducing grape culture in Virginia, and in acclimating here many foreign ornamental shrubs.

Ellis was a more eminent man of science, and his name is associated with the beginnings of modern marine zoölogy. Linnæus wrote to him in 1769: "Your discoveries may be said to vie with those of Columbus. He found out America, or a new India, in the West; you have laid open hitherto unknown Indies in the depths of the ocean." He was royal agent for West Florida, and had extraordinary facilities for obtaining specimens from the colonies.

His nephew, Henry Ellis, F. R. S., [b. 1720, d. 1805], was the author of "A Voyage to Hudson's Bay in 1746 and 1747 for discovering a Northwest Passage," which contains some valuable notes upon zoölogy. He was in 1756 appointed governor of the colony of Georgia, and in 1758 published in the Philosophical Transactions an essay on "The Heat of the Weather in Georgia." In 1760 he made a voyage for the discovery of a new passage to the Pacific, and later was governor of Nova Scotia, where we can but believe he continued his observations and his correspondence with the savans of Europe. "Finally," says Jones, "having attained a venerable age, and to the last intent upon the prosecution of some favorite physical researches, he fell in sleep, as did Pliny the Elder, within sight of Vesuvius, and upon the shores of the beautiful Bay of Naples."*

Jones, in his "History of Georgia," [I, p. 444], refers to the Rev. Stephen Hales—"equally renowned as a naturalist and a divine"—who lived for a time in Georgia during the last century. Can this have been the famous author of "Vegetable Statics?" I have been unable to find any allusion to a sojourn in America, in the published notices of the English Hales, and equally unable to discover a second Hales in the annals of science.

The central figure among eighteenth-century naturalists was of course Linnæus. His Systema Naturæ was an epoch-making work, and with the publication of its first edition at Leyden in 1735 the study of the biological sciences received an impress which was soon felt in America.

In 1738, while in Leyden, he assisted Gronovius in editing the notes sent by Clayton from Virginia, and it is evident that Linnæus was already, at the age of thirty, recognized by European botanists as an authority upon the plants of America. It was in this year that he visited Paris. He at once made his way to the Garden of Plants, and entered the lecture-room of Bernard de Jussieu, who was describing some exotics to his pupils in Latin. There was one which the demonstrator had not yet determined, and which seemed to puzzle him. The Swede looked on in silence at first, but observing the hesitation of the learned Professor, cried out: "Haec plantam faciem Americanam habet." Jussieu turned about quickly with the exclamation, "You are Linnæus."

It is interesting to notice how strongly the Linnæan reforms took root in American soil, and how soon. Collinson wrote to

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* *History of Georgia.*

Bartram in 1737: "The Systema Naturæ is a curious performance for a young man, but his coining a new set of names for plants tends but to embarrass and perplex the study of Botany. As to his system, * * * botanists are not agreed about it. Very few like it. Be that as it will, he is certainly a very ingenious man, and a great naturalist."* Six years later he wrote to Linnæus himself:

"Your system I can tell you obtains much in America. Mr. Clayton and Dr. Colden at Albany are complete professors, as is Dr. Mitchell at Urbana, in Virginia."†

This may not seem a very numerous following, but twelve years after this (1755), only seven English botanists were mentioned by Collinson in response to a request from Linnæus to know what botanical people in London were skilled in his plan.‡

It is a fact not often referred to that during his period of poverty and struggles, Linnæus received, through the influence of his patron, Boerhaave, an appointment in the colony of Surinam. His prospects for a successful career in Europe had, however, brightened, and he decided not to come to America.

His interest in American natural history was always very great, and his descriptions of New World forms seem to have been drawn up with especial care. Garden, Colden, Bartram, Mitchell, Clayton and Ellis were all, as we have seen, active in supplying him with materials, and his pupils, Kalm, Alstroem, Loefling, Kuhn and Rolander (who collected for many years in Surinam) sent him many notes and specimens.

The progress of systematic zoölogy in the interval between Ray and Linnæus may perhaps best be illustrated by some brief statistical references. The former, in 1690, made an estimate of the number of animals and plants known at that time.

The number of beasts, including serpents, he placed at 150, ad-

* DARLINGTON, p. 106. † SMITH, i, p. 9.
‡ SMITH, i, p. 33.

ding that according to his belief not many that are of any considerable bigness in the known regions of the world have escaped the cognizance of the curious.

Linnæus in his 12th edition (1766) described 210 species of beasts or mammals, and 124 of reptiles so called. Of the mammals known to Linnæus, 78, or more than one-third, were American, and 88 of the reptiles were attributed to this continent.

"The number of birds," said Ray, "may be near 500." Linnæus catalogued 790, of which about one-third were American.

Although at this time the Middle and Southern States were the most active in the prosecution of scientific researches, there were in New England at least two diligent students of nature. Paul Dudley, F. R. S., [b. 1675], chief-justice of the colony of Massachusetts, was the author of several papers in the Philosophical Transactions. Among these were "A Description of the Moose Deer in America,"* "An Account of a Method Lately Found Out in New England for Discovering Where the Bees Hive in the Woods,"** "An Account of the Rattlesnake,"† and "An Essay Upon the Natural History of Whales, with a Particular Account of the Ambergris Found in the Spermaceti Whale,"‡ which is often quoted.

Others were an "Account of the Poison Wood Tree in New England,"§ and "Observations on Some Plants of New England, with Remarkable Instances of the Nature and Power of Vegetation."‖ He also appears to have sent to Collinson a treatise upon the evergreens of New England.¶

The Rev. Jared Eliot, [b. 1685, d. 1763], minister at Killingworth, in Connecticut, and one of the earliest graduates of Yale College, described by his contemporaries as "the first physician of his day," and as "the first botanist in New England," appears

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*Phil. Trans., xxxi, 1721.

**Phil. Trans., xxxi, 1721, p. 148–50.

†Phil. Trans., xxxii, p. 292–5.

‡Phil. Trans., xxxiii, 1725, pp. 256–69.

§Phil. Trans., xxi, p. 135.

‖Phil. Trans., xxxiii, p. 129.

¶See Tuckerman in *Archæologia Americana*, iv, pp. 125–6.

to have been a correspondent of Franklin, and a scientific agriculturist.

In 1781 appeared Jefferson's "Notes on Virginia." This was the first comprehensive treatise upon the topography, natural history, and natural resources of one of the United States, and was the precursor of the great library of scientific reports which have since been issued by the state and federal governments.

The book, although hastily prepared to meet a special need, and not put forth as a formal essay upon a scientific topic, was, if measured by its influence, the most important scientific work as yet published in America. The personal history and the public career of Thomas Jefferson are so familiar to all that it would be an idle task to repeat them here. Had he not been a master in statecraft, he would have been a master of science. It is probable that no two men have done so much for science in America as Jefferson and Agassiz—not so much by their direct contributions to knowledge as by the immense weight which they gave to scientific interests by their advocacy.

Many pages of Jefferson's "Notes on Virginia" are devoted to the discussion of Buffon's statements: (1) that the animals common to both continents are smaller in the New World; (2) that those which are peculiar to the New are on a smaller scale; (3) that those which have been domesticated in both have degenerated in America, and (4) that, on the whole, America exhibits fewer species. He successfully overthrows the specious and superficial arguments of the eloquent French naturalist, who, it must be remembered, was at this time considered the highest authority living in such matters. Not content with this, when Minister Plenipotentiary to Europe a few years later, he forced Buffon himself to admit his error.

The circumstance shall be related in the words of Daniel Webster, who was very fond of relating the anecdote:

"It was a dispute in relation to the moose, and in one of the circles of the *beaux-esprits* in Paris, Mr. Jefferson contended for some characteristics in the formation of the animal which Buffon stoutly denied. Whereupon Mr. Jefferson wrote from Paris to General John Sullivan, then residing in Durham, New Hampshire, to procure and send him the whole frame of a moose. The General was no little astonished at a request he deemed so extraordinary, but well acquainted with Mr. Jefferson, he knew he must have sufficient reason for it; so he made a hunting party of his neighbors and took the field. They captured a moose of unusual proportions, stripped it to the bone, and sent the skeleton to Mr. Jefferson at a cost of fifty pounds sterling. On its arrival, Mr. Jefferson invited Buffon and some other *savants* to a supper at his house and exhibited his dear bought specimen. Buffon immediately acknowledged his error. 'I should have consulted you, Monsieur,' he said, 'before publishing my book on Natural History, and then I should have been sure of my facts.'"

In still another matter in which he was at variance with Buffon he was manifestly in the right. In a letter to President Madison, of William and Mary College, he wrote:

"Speaking one day with M. de Buffon on the present ardor of chemical inquiry, he affected to consider chemistry but as cookery, and to place the toils of the laboratory on a footing with those of the kitchen. *I* think it, on the contrary, among the most useful of sciences and *big* with future discoveries for the utility and safety of the human race."

It was the scientific foresight of Jefferson, so manifest in such letters, which led him to advocate so vigorously the idea that science must be the corner-stone of our Republic.

In 1789 he wrote from Paris to Dr. Willard, president of Harvard College:

To Dr. WILLARD:

What a field have we at our doors to signalize ourselves in. The botany of America is far from being exhausted, its mineralogy is untouched, and its Natural History or zoölogy totally mistaken and misrepresented. * * * It is for such institutions as that over which you preside so worthily, sir, to do justice to our country, its productions, and its genius. It is the work to which the young men you are forming should lay their hands. We have spent the prime of our lives in procuring them the precious blessing of liberty. Let them spend theirs in showing that it is the great parent of *science* and of virtue, and that a nation will be great in both always in proportion as it is free.

THOMAS JEFFERSON.

To Jefferson's interest was due the organization of the first government exploring expedition. As early as 1780 we find him anxious to promote an expedition to the upper portion of the Mississippi Valley, and offering to raise 1000 guineas for the purpose from private sources, and while he was President he dispatched Lewis and Clarke upon their famous expedition into the northwest—the precursor of all the similar enterprises carried on by the general Government, which have culminated in our magnificent Geological Survey.

Jefferson's personal influence in favor of science was of incalculable value. Transferred from the presidency of the principal American scientific society to the presidency of the nation, he carried with him to the Executive Mansion the tastes and habits of a scientific investigator. Mr. Luther, in his recent essay upon "Jefferson as a Naturalist,"* has shown that during his residence in Paris he kept the four principal colleges—Harvard, Yale, William and Mary, and the College of Philadelphia—informed of all that happened in the scientific circles in Europe.

He wrote to one correspondent: "Nature intended me for the tranquil pursuits of science by rendering them my supreme delight." To another he said: "Your first gives me information in the line of natural history, and the second promises political news. The first is my passion, the last my duty, and therefore both desirable."

When Jefferson went to Philadelphia to be inaugurated Vice-President he carried with him a collection of fossil bones which he had obtained in Green Brier county, Virginia, together with a paper, in which were formulated the results of his studies upon them. This was published in the Transactions of the American Philosophical Society, and the species is still known as *Megalonyx Jeffersoni*.

"The spectacle," remarks Luther, "of an American states-

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* Magazine of American History, April, 1885.

man coming to take part as a central figure in the greatest political ceremony of our country, and bringing with him an original contribution to science, is certainly one we shall not soon see repeated." *

When Jefferson became President, his scientific tastes were the subject of much ridicule as well as of bitter opposition among the people in whose eyes, even in that day, science was considered synonymous with atheism. William Cullen Bryant, then a lad of thirteen, wrote a satirical poem, "The Embargo," since suppressed, in which the popular feeling seems to have been voiced:

> "Go, wretch, resign the Presidential chair;
> Disclose thy secret measures, foul or fair.
> Go search with curious eyes for horned frogs
> Mid the wild wastes of Louisianian bogs,
> Or, where the Ohio rolls his turbid stream,
> Dig for huge bones, thy glory and thy theme."

A prominent personage in the history of this period was Peter Kalm, a pupil of Linnæus and Professor in the University of Aobo, who was sent to America by the Swedish government, and travelled through Canada, New York, New Jersey, and Pennsylvania from 1748–51. Although the ostensible object of his mission was to find a species of mulberry suitable for acclimatization in Sweden, with a view to the introduction of silk-culture, it is very evident that he and his master were very willing to make of applied science a beast of burden, upon whose back they could heap up a heavy burthen of investigations in pure science. Kalm's botanical collections were of great importance and are still preserved in the Linnæan herbarium in London. His "Travels into North America" are full of interesting observations upon animals and men, as well as upon plants, and give us an insight into the life of the naturalists at that time resident in America. After his return to Sweden he published several papers relating to his discoveries in America.

* *op. cit.*

Another traveller who deserves our attention, Johann David Schœpf, [b. 1752, d., in Baireuth, 1800], the author of one of the earliest monographs of the Testudinata, was a surgeon of mercenary troops under the Marcgrave of Anspach, and was one of the hated "Hessian" auxiliaries during the revolutionary war (1776-83). While stationed at New York he wrote a paper upon the Fishes of New York, which was published in Berlin in 1787. This was the first special ichthyological paper ever written in America or concerning American species. Immediately after the treaty of peace in 1783, Schœpf made an extensive tour through the United States, proceeding from New York south to Florida and the Bahamas. He was accompanied in his more southern excursions by Prof. Marter and Dr. Stupicz, who with several assistants had been sent to America from Vienna to make botanical explorations. Schœpf's "Nord Amerikanische Reisen" is full of interesting notes upon natural history, and describes nearly all the scientific men at that time resident in the United States. His "Materia Medica Americana," published in 1787 at Erlangen, was a standard in its day.*

One of the most prominent names in American natural history is that of Johann Reinhold Forster, [b. 1729, d. 1798], who was a leader in zoölogical studies in England during the last century. He was a native of Germany, and at the time of his death Professor of Botany at Halle. He spent many years in England, and was the naturalist of Cooke's second voyage around the world (1772–75). In 1771 he published in London, in an appendix to his translation of Kalm's Travels, "A Catalogue of the Animals of North America, compiled from the writings of Linnæus, Pennant, Brisson, Edwards and Catesby, and in the same year a similar nominal catalogue of the plants of North America. His account of the birds sent from Hudson's Bay, published in 1772, was a valuable contribution to American ornithology,

* Erlangen, 1788, 2 vols., 8°.

"notable," says Coues, "as the first formal treatise exclusively devoted to a collection of North American birds sent abroad." Fifty-eight species were described, among which were several new to science. Other papers of equal value were published upon the quadrupeds and fishes of the same region. Forster was one of the earliest students of the geographical distribution of animals, and his "Enchiridion of Natural History" was in its day a standard. His son, John George Forster, who was his companion in the voyage of circumnavigation, owes his fame to his literary rather than to his scientific labors. He published a paper on the Patella or Trumpet Fish found at Bermuda.*

The annals of Russian explorations upon the west coast of North America have been so exhaustively recorded by Dall in his "Alaska and its Resources," that only passing mention need be made of the two German naturalists, Steller and Chamisso, whose names are identified with the natural history work of the Russian explorer.

Among the other naturalists whose names are associated with America during this period may be mentioned Sonnini de Manoncourt, an eminent French zoölogist, who travelled in Surinam from 1771 to 1775 and made important contributions to its ornithology. Don Felix de Azara, [b. 1746, d. after 1806], who carried on researches in Spanish America from 1781 to 1801; Don Antonio Parra, who published a useful treatise on the natural history of Cuba in Havana, in 1787; Don Jose C. Mutis, a learned Spanish ecclesiastic and physician, professor of natural history in the University of Santa Fe de Bogota, in Grenada, who carried on a voluminous correspondence with Linnæus and his son from 1763 to 1778,† and Joseph Jussieu, botanist to the King of France, who went to the west coast of South America in 1734 as a member of the commission sent by the Royal Academy of Sciences to make observations to determine more accurately the shape and magni-

*Phil. Trans., l, p. 859.

† SMITH: *Correspondence of Linnæus*, ii, pp. 507–550.

tude of the earth. "His curiosity," says Flourens, "held him captive for many years in these regions, so rich and unexplored, where he often joined the labors of the engineer with those of the botanist. To him Europe owes several new plants, the heliotrope, the marvel of Peru, &c., with many curious and then unknown species." Here, also, should be mentioned the eminent French ornithologist, Francois Levaillant, [b. 1753, d. 1824], who was a native of America, and the two Mexican naturalists, also native born, Jose A. Alzate, [b. in Ozumba, 1729, d. in Mexico, Feb. 2, 1790], a learned botanist, and Francisco Javier Clavigero.

Francisco Javier Clavigero, the historian of Mexico, was one of the earliest of American archæologists. Born in Vera Cruz Sept. 9, 1731, the son of a Spanish scholar, he was educated at the college of Puebla, entered the Society of Jesuits, and was sent out as a missionary among the Indians, with whom he spent thirty-six years. He learned their language, collected their traditions, and examined all their historical records and monuments for the purpose of correcting the misrepresentations of early Spanish writers. When the Society of Jesus was suppressed by Spain, in 1767, Clavigero went to Italy, where he wrote his "Storia Antica del Messico," printed in 1780–81.

Clavigero was a man who, in his spirit, was fully abreast of the science of his day, but whose methods of thought and argument were already antiquated.

His monastic training led him to write from the standpoint of a commentator rather than that of an original observer, and his observations upon the animals and plants of Mexico were subordinated in a very unfortunate manner to those of his predecessor, Hernandez. In the "Dissertations," which make up the fourth volume of his history, he throws aside, in the ardor of his dispute with Buffon and his followers, the trammels of tradition, and places upon record many facts concerning American natural history which had never before been referred to. He here presented a list of the quadrupeds of America, the first ever printed for the entire continent, including 143 species; not systematically arranged, it is true, but perhaps as scientific in its construction as was possible at that time, even had its author been trained in the school of Linnæus.

Clavigero's dissertations are well worthy of the attention of naturalists even of the present day. His essay upon the manner in which the continent of America was peopled with living forms, shows a remarkable appreciation of the difficulties in the way of the solution of this still unsolved problem. The position taken by its author is not unlike that held by zoögeographers of to-day, in considering it necessary to bridge with land the waters between Asia and Northwestern America, and Africa and South America.* In his first "Dissertation of the Animals of Mexico" he combats the prevailing European views as to the inferiority of the soil and climate of the New World and the degeneracy of its inhabitants, engaging in the same battle in which fought also Harriott, Acosta, and Jefferson.

Clavigero's contributions to archæology and ethnology are extensive and valuable, and we can but admit that at the time of the issue of his "Storia Antica" no work concerning America had been printed in English which was equally valuable.

Although in his formal discussion of the natural history of Mexico he follows closely the nomenclature and arrangement of Hernandez, there are many important original observations inserted. I will instance only the notes on the mechanism of the poison-gland and fang of the rattlesnake, the biographies of the possum, the coyote and the tapir, and the Tuza or pouched rat, the mocking-bird, the chegoe and the cochineal insect. Clavigero states that Father Inamma, a Jesuit missionary of California, has made many experiments upon snakes which serve to confirm those made by Mead upon vipers.

To the post-revolutionary period belongs Dr. Manasseh Cutler,

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*See similar speculation in George Scot's *Model of the Government of the Province of East New Jersey in America.* Edinburgh, 1685.

for fifty-one years minister of Ipswich Hamlet, Mass., [b. 1743, d. 1823], who in 1785 published "An Account of some of the Vegetable Productions naturally growing in this part of America, botanically arranged,"* in which he described about 370 species. Cutler was a correspondent of Muhlenberg in Pennsylvania, Swartz and Payshull in Sweden, and Withering and Stokes in England. He left unpublished manuscripts of great value. He was one of the founders of the settlement in Ohio, and at one time a member of Congress. After Cutler, says Tuckerman, there appeared in the Northeastern States nothing of importance until the new school of New England Botanists, a school characterized by the names of an Oakes, a Boott, and an Emerson, was founded in 1814, by the publication of Bigelow's "Florula Bostoniensis."

Thomas Walter [b. in Hampshire, 1740] published in London, in 1787, his "Flora Caroliniana," a scholarly work describing the plants of a region situate upon the Santee river.†

Dr. Hugh Williamson, of North Carolina, [b. 1735, d. 1819], was a prominent member of the American Philosophical Society. He was concerned in some of the earliest astronomical and mathematical work in America; published papers upon comets and climatology, which were favorably received, and secured his election to many foreign societies, and in 1775 printed in the Philosophical Transactions his "Experiments and Observations on the Gymnotus Electricus or Electric Eel."

Dr. Caspar Wistar [b. 1761, d. 1818] was one of the early professors of chemistry [1789] and anatomy [1793] in the College of Philadelphia. He was the discoverer of some important points in the structure of the ethmoid bone, a man of eminence as a teacher, and versed in all the sciences of his day.

Dr. James Woodhouse, of Philadelphia, [b. 1770, d. 1809], made investigations in chemistry, mineralogy, and vegetable physiology which were considered of importance.

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* Mem. Amer. Acad. Sci., 1785.

† See Brendel, American Naturalist, Dec., 1879, p. 759.

The story of the origin of American scientific societies has been so often told that it need not be repeated here. The only institutions of the kind which were in existence at the end of the period under consideration were the American Philosophical Society, an outgrowth primarily of the American Society for the Advancement of Natural Knowledge, founded in Philadelphia in 1743, and secondarily of Franklin's famous "Junto," whose origin dates back to 1727, and the American Academy of Arts and Sciences, founded in 1780.

The relations of the colonial naturalists to the scientific societies of England have not so often been referred to, and it does not seem to be generally known that the early history of the Royal Society of London was intimately connected with the foundation of New England, and that the first proposition for the establishment of a scientific society in America was under consideration early in the seventeenth century. "The great Mr. Boyle," writes Eliot, "Bishop Wilkins, and several other learned men, had proposed to leave England and establish a society for promoting natural knowledge in the new colony, of which Mr. Winthrop, their intimate friend and associate, was appointed governor. Such men were too valuable to lose from Great Britain; and Charles II. having taken them under his protection, the society was there established, and obtained the title of the Royal Society of London."*

For more than a hundred years the Royal Society was the chief resource of naturalists in North America. The three Winthrops, Mitchell, Clayton, Garden, Franklin, Byrd, Rittenhouse, and others were among its fellows, and the Philosophical Transactions contained many American papers.

As at an early date the Society of Arts in London began to offer prizes for various industrial successes in the colonies, for instance, for the production of potash and pearlash, for the culture of silk, and for the culture of hemp, the vine, safflower, olives,

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* ELIOT: *Biographical Dictionary.*

logwood, opium, scammony, burilla, aloes, sarsaparilla, cinnamon, myrtle wax, the production of saltpetre, cobalt, cochineal, the manufacture of wine, raisins, and olive oil, the collection of gum from the persimmon tree, and the acclimation of silk grass. A medal was given in 1761 to Dr. Jared Eliot, of Connecticut, for the extraction of iron from "black sand."* In 1757 we find their secretary endeavoring to establish branch societies in the colonial cities, especially in Charleston, Philadelphia and New York, and Garden seems to have tried to carry out the enterprise in Charleston. After two years he wrote that the society organized had become "a mere society of drawing, painting, and sculpture."

In a subsequent letter he utters a pitiful plaint. He has often wondered, he says, "that there should be a country abounding with almost every sort of plant, and almost every species of the animal kind, and yet that it should not have pleased God to raise up one botanist."†

The American Academy of Arts and Sciences was founded by the Legislature of Massachusetts in 1780 and its first volume of memoirs appeared in 1785.

In 1788 an effort was made by the Chevalier Quesnay de Beaurepaire to found in Richmond, Virginia, the "Academy of Arts and Sciences of the United States of America" upon the model of the French Academy. The plan was submitted to the Royal Academy of Sciences in Paris, and received its unqualified endorsement, signed, among others, by Lavoisier. A large subscription was made by the Virginians and a large building erected, but an academy of sciences needs members as well as a president, and the enterprise was soon abandoned.‡

In 1799 was organized the Connecticut Academy of Arts and Sciences, which, after publishing one volume of Transactions,

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* See Dossie: *Memoirs of Agriculture.* London, vol. i, 1768, pp. 24–6, *et seq.*, also Brock in Richmond Standard, April 26, 1879, p. 4.

† Smith: *op. cit.*, i, p. 477.

‡ See Mordecai: *Richmond in By-gone Days.* A copy of the original pamphlet of proposals is still preserved in the Virginia State Library.

went into a state of inactivity from which it did not arouse itself until 1866.

This sketch would not be complete without some reference also to the history of scientific instruction in America during the last century.

The first regular lectures upon a special natural history topic appear to have been upon comparative anatomy. A course upon this topic was delivered at Newport, Rhode Island, in 1754, by Dr. William Hunter, a native of Scotland, [b. about 1729], a kinsman of the famous English anatomists, William and John Hunter, and a pupil of Munro. His course upon comparative anatomy was given in connection with others upon human anatomy and the history of anatomy, the first medical lectures in America.*

The first instruction in botany was given in Philadelphia in 1768 by Kuhn, who began in May of that year a course of lectures upon that subject in connection with his professorship of Materia Medica and Botany in the College of Philadelphia. Adam Kuhn [b. in Germantown, Pa., 1741, d. 1817] was educated in Europe, and had been a favorite pupil of Linnæus. He did not, however, continue his devotion to natural history, though he became an eminent physician. William Bartram, son of John Bartram, was elected to the same professorship in 1782. In 1788 Prof. Waterhouse, of Harvard College, read lectures upon Natural History to his medical classes, and is said to have subsequently claimed that these were the first public lectures upon natural history given in the United States. This was doubtless an error, for we find that in 1785 a course upon the philosophy of Chemistry and Natural History was delivered in Philadelphia. "People of every description, men and women, flock to these lectures," writes a contemporary. "They are held at the University three evenings in a week."†

* One of the original tickets to these courses is in the Library of the Surgeon-General's office in Washington.

† DARLINGTON, p. 535.

The first professor of chemistry was Dr. Benjamin Rush, who lectured in the Philadelphia Medical School as early as 1769. Bishop Madison was professor of chemistry and natural philosophy at William and Mary College, from 1774 to 1777; Aaron Dexter, of chemistry and materia medica at Harvard, 1783 to 1816; John Maclean, at Princeton, 1795-1812, being the first to occupy a separate chair of chemistry. Before the days of chemical professorships, the professor of mathematics seems to have been the chief exponent of science in our institutions of learning.

John Winthrop, [b. 1714, d. 1779], for instance, who was Hollis Professor of Mathematics and Natural Philosophy at Harvard from 1738 to 1779, was a prominent Fellow of the Royal Society, to whose Transactions he communicated many important papers, chiefly astronomical. We read, however, that Count Rumford imbibed from his lectures his love for physical and chemical research, and from this it may be inferred that he taught as much of chemistry as was known in his day. William Small, professor of mathematics in William and Mary from 1758 to 1762, was a man of similar tastes, though less eminent. He was the intimate friend of Erasmus Darwin. President Jefferson was his pupil, attended his lectures on natural philosophy, and got from time to time his "first views of the expansion of science and of the system of things in which we are placed."

Dr. Samuel Latham Mitchill [b. 1764, d. 1831] was the first man to hold a professorship of natural history, lecturing upon that subject, together with chemistry, in Columbia College in 1792. Dr. Mitchill was eminent as a zoölogist, mineralogist, and chemist, and not only published many valuable papers but in 1798 established the first American scientific journal.

Harvard appears to have had the first separate professorship of natural history, which was filled by William Dandridge Peck, a zoölogist and botanist of prominence in his day.

A professorship of botany was established in Columbia College, N. Y., as early as 1795, at which time Dr. David Hosack [b. in

New York, 1769, d. 1835] was the incumbent. Dr. Hosack brought with him from Europe in 1790 the first cabinet of minerals ever seen in the United States. In its arrangement he was assisted by one of his pupils, Archibald Bruce, who became, in 1806, Professor of Mineralogy, and who, soon after, in 1810, established the American Journal of Mineralogy.

Dr. Hosack was the founder of the first public botanic garden—this was in New York in 1801; another was founded in Charleston in 1804. These had disappeared forty years ago, and the one at Cambridge, established in 1808, is the only one now in existence.

The first public museum was that founded in Philadelphia, in 1785, by Charles Wilson Peale; the bones of a mammoth and a stuffed paddle-fish forming its nucleus. This establishment had a useful career of nearly fifty years.

VII.

We have now rehearsed the story of the earliest investigators of American natural history, including two centuries of English endeavor, and nearly three if we take into consideration the earlier explorations of the naturalists of continental Europe.

We have seen how, in the course of many generations, the intellectual supremacy of the Western Continent went from the Spaniards and the French and the Dutch to the new people who were to be called Americans, and we have become acquainted with the men who were most thoroughly identified with the scientific endeavors of each successive period of activity.

The achievements of American science during the century which has elapsed since the time when Franklin, Jefferson, Rittenhouse, and Rumford were its chief exponents have been often the subject of presidential addresses like this, and the record is a proud one. During the last fifty years in England, and the last forty in America, discovery has followed discovery with such rapid succession that it is somewhat hard to realize that

American science in the colonial period, or even that of Europe at the same time, had any features which are worthy of consideration.

The naturalists whose names I have mentioned were the intellectual ancestors of the naturalists of to-day. Upon the foundations which they laid the superstructure of modern natural history is supported. Without the encyclopædists and explorers there could have been no Ray, no Klein, no Linnæus. Without the systematists of the latter part of the eighteenth century the school of comparative anatomists would never have arisen. Had Cuvier and his disciples never lived there would have been no place for the philosophic biologists of to-day.

The spirit of the early naturalists may be tested by passages in their writings which show how well aware they were of the imperfections of their work. Listen to what John Lawson, the Carolina naturalist, wrote in the year 1700:

"The reptiles or smaller insects are too numerous to relate here, this country affording innumerable quantities thereof; as the flying stags with horns, beetles, butterflies, grasshoppers, locust, and several hundreds of uncouth shapes, which in the summer season are discovered here in Carolina, the description of which requires a large volume, which is not my intent at present, besides, what the mountainous part of this land may hereafter open to our view, time and industry will discover, for we that have settled but a small share of this large province cannot imagine, but there will be a great number of discoveries made by those that shall come hereafter into the back part of this land, and make enquiries therein, when, at least, we consider that the westward of Carolina is quite different in soil, air, weather, growth of vegetables, and several animals, too, which we at present are wholly strangers to, and seek for. As to a right knowledge thereof, I say, when another age is come, the ingenious then in being may stand upon the shoulders of those that went before them, adding their own experiments to what was delivered down to them by their predecessors, and then there will be something towards a complete natural history, which, in these days, would be no easy undertaking to any author that writes truly and compendiously as he ought to do."

Herbert Spencer, in his essay on "The Genesis of Science," lays stress upon the fact that the most advanced sciences have attained to their present power by a slow process of improvement, extending through thousands of years, that science and the positive knowledge of the uncultured cannot be separated in nature, and that the one is but a perfected and extended form of the other. "Is not science a growth?" says he, "Has not science its embryology? And must not the neglect of its embryology lead to a misunderstanding of the principles of its evolution and its existing organization?"

It seems to me unfortunate, therefore, that we should allow the value of the labors of our predecessors to be depreciated, or to refer to the naturalists of the last century as belonging to the unscientific or to the archaic period. It has been frequently said by naturalists that there was no science in America until after the beginning of the present century. This is, in one sense, true, in another, very false. There were then, it is certain, many men equal in capacity, in culture, in enthusiasm, to the naturalists of to-day, who were giving careful attention to the study of precisely the same phenomena of nature. The misfortune of men of science in the year of 1785 was that they had three generations fewer of scientific predecessors than have we. Can it be doubted that the scientists of some period long distant will look back upon the work of our own time as archaic and crude, and catalogue our books among the "curiosities of scientific literature?"

Is it not incumbent upon workers in science to keep green the memory of those whose traditions they have inherited? That it is, I do most steadfastly believe, and with this purpose I have taken advantage of the tercentenary of American biology to read this review of the work of the men of old.

Monuments are not often erected to men of science. More enduring, however, than monuments are those living and self-perpetuating memorials, the plants and animals which bear the names of the masters who knew them and loved them. Well have the Agassizs remarked that "there is a world of meaning hidden under our zoölogical and botanical nomenclature known only to those who are intimately acquainted with the annals of scientific life in its social as well as its professional aspect."*

I hope I am not at this day entirely alone in my appreciation of the extreme appropriateness of this time-honored custom, although I know that many of our too matter-of-fact naturalists are disposed to abandon it, and that it is losing much of its former significance. In fact, in these days of unstable nomenclature, such tributes are often very evanescent. It seems fortunate that the names of some of the most honored of the early naturalists are perpetuated in well established generic and specific combinations.†

When I see the *Linnæa borealis*, I am always reminded of the sage of Upsala, as he is represented in the famous Amsterdam painting, clad in Lapland fur, and holding a spray of that graceful arctic plant. *Magnolia* and *Wistaria* call up the venerable professors of botany at Montpelier and Philadelphia. *Tradescantia virginica* reminds me of John Tradescant and the Ashmolean Museum, whose beginnings were gathered by him in Virginia. The cape jessamine (*Gardenia*), the spring beauty (*Claytonia*), the partridge berry (*Mitchella*), the iron weed (*Vernonia*), the *Quercus Bartramii* (=*Q. heterophylla*), the *Scarus Catesbyi*, *Tha-*

* *Seaside Studies in Natural History*, p. 25.

† The genus HARRIOTTA has been dedicated by Goode and Bean to the memory of *Thomas Harriott*. It is intended to embrace a long-rostrated chimæroid fish from deep water off the Atlantic coast of North America. The description is not yet published. "Heriot's Isle," named for Harriott by the early explorers, and shown upon Vaughan's map, in Smith's "Generall History of Virginia," has entirely disappeared. It was situate on the north side of Albemarle Sound, about midway between Roanoke Island and the mouth of Chowan river. Whether it has been swept away by the tides, or has become a part of the main-land, it is difficult to say. The latter supposition seems the most probable, and since it is in all likelihood "Reed's Point" which now occupies its former location, the propriety is suggested of calling this little cape, "Harriott's Point," in memory of the explorer.

lictrum and *Asclepias Cornuti*, *Macrurus Fabricii*, *Didelphys* and *Canis Azaræ*, *Chauliodus Sloanei*, *Alutera Schæpfii*, *Sterna*, *Forsteri*, *Stolephorus Mitchilli*, *Malacanthus Plumieri*, *Salix Cutleri* and *Pinus Banksiana*, the *Kalmia*, the *Jeffersonia*, the *Hernandia*, the *Comptonia*, the *Sarracenia*, the *Gaultheria*, the *Kuhnia*, the *Ellisia*, the *Coldenia*, the *Robinia*, the *Banisteria*, the *Plumieria*, the *Collinsonia*, the *Bartramia*, all bear the names of men associated with the beginnings of Natural History in America.

Yet, pleasant as it is to recall in such manner the achievements of the fathers of natural history, let us not do them the injustice to suppose that posthumous fame was the object for which they worked. Like Sir Thomas Browne, they believed that "the world was made to be inhabited by beasts, but to be studied by man." Let us emulate their works and let us share with them the admonitions of the "Religio Medici."

"The wisdom of God," says Browne, "receives small honor from those vulgar heads that rudely stray about, and with a gross rusticity admire his works; those highly magnify him whose judicious inquiry into his acts, and deliberate research into his creatures, return the duty of a devout and learned admiration. Therefore," he continues—

> "Search while thou wilt and let thy reason go
> To ransom truth, even to the abysse below,
> Rally the scattered causes, and that line
> Which nature twists be able to untwine.
> It is thy Maker's will, for unto none
> But unto reason can He e'er be known."

ADDITIONS TO THE FLORA OF WASHINGTON AND VICINITY, FROM APRIL 1, 1884, TO APRIL 1, 1886.

By F. H. KNOWLTON, B. S.

[The following notes are supplementary to Ward's "Guide to the Flora of Washington and Vicinity" (Bulletin No. 22, U. S. National Museum). The species added to the Flora between April 1, 1884, and April 1, 1885, wêre enumerated by Prof. Ward in a paper read before the Society Dec. 13, 1884; the additions and changes for 1885 were presented by the author in a paper read March 20, 1886. The first collector of each species is given due credit in the proper place.]

ANALYSIS.

I. LIST OF VASCULAR PLANTS ADDED TO THE FLORA OF WASHINGTON FROM APRIL 1, 1884, TO APRIL 1, 1886.

11*a*. **Trautvetteria palmata,** Fischer & Meyer.

Great Falls, Virginia side. Mr. J. S. Barker, June 22, 1884. Also found on the Mt. Vernon estate by Mr. William Hunter, June 21, 1885.

22*a*. **Caltha palustris,** L. MARSH MARIGOLD.

Rock Creek. Collected by Mr. Gerald McCarthy in 1884.

99*a*. **Polygala Curtissii,** Gray, var. **pycnostachya,** Gray.

Collected south of Arlington P. O., near Four Mile Run, June 29 and July 30, 1884, and on the Marlboro' road, August 3, 1884, by Prof. Ward. Specimens of this plant have been sent to Dr. Asa Gray, who states that he considers this form to be the type, and that the original specimens collected by Curtiss were abnormal. Until an authoritative revision of the genus is made, however, it must stand as above.

195*a*. **Trifolium hybridum**, Savi.

Alexander's Island, June 25, 1885, by Mr. J. A. Allen.

295*a*. **Ribes floridum**, L'Her. WILD BLACK CURRANT.

Blagden's Mill, at the head of the mill-race on the creek side, April 27, 1884. Prof. Ward.

297*a*. **Sedum Telephium**, L.

Found near Woodlawn (Mt. Vernon) July 25, 1885, by Mr. Wm. Hunter.

351*a*. **Aralia quinquefolia**, Decsne & Planch.

Collected by the late Dr. A. C. Schott in the vicinity of Rockville, Md., nearly twenty-five years ago. The specimens have, unfortunately, all been sent to Scotland and none since collected.

390*a*. **Eupatorium purpureum**, L., var. **amœnum**, Gray.

Rock Creek, Sept. 17, 1882. Mentioned as a form in the "Flora" by Prof. Ward.

391*a*. **Eupatorium hyssopifolium**, L., var. **laciniatum**, Gray.

Back of Mount Hamilton, Oct. 11, 1885. Prof. Ward and the author.

436*a*. **Aster ericoides**, L., var. **villosus**, Torr & Gray.

Near upper end of Lobelia Run, Sept. 17, 1882. Prof. Ward.

462*a*. **Inula Helenium**, L. ELECAMPANE.

Found on the Mount Vernon estate, one mile west of the Mansion, by Mr. William Hunter, who states that it has been established there for thirty years.

494*a*. **Bidens connata**, Muhl. SWAMP BEGGAR-TICKS.

Holmead Swamp, September 22, 1878. Placed in the herbarium under the name of ***Bidens cernua***, L., and only recently detected. Prof. Ward.

502*c*. **Artemisia vulgaris**, L. MUGWORT.

Collected at the mouth of Pope's Head Creek, near Clifton Station, Fairfax county, Va., October 9, 1884, by Prof. Ward.

563*a*. **Clethra alnifolia**, L. White Alder. Sweet Pepper Bush.
Left bank of Bladensburg mill-race below second foot bridge, 200 yards above sluice gate. In flower July 27, 1884, in fruit August 24, 1884. Prof. Ward.

585*a*. **Apocynum androsæmifolium**, L.
Collected near Woodlawn, Fairfax county, Va., August, 1885, by Mr. Wm. Hunter.

614*a*. **Hydrophyllum Canadense**, L. Waterleaf.
In a ravine containing a cataract which was christened "Hydrophyllum Run," nearly opposite Eads' Mill, Va., July 6, 1884, then a little past flowering time. Prof. Ward. Fine flowering specimens collected June 21, 1885.

620*a*. **Borago officinalis**, L.
Foundry Run, June 23, 1885. Mr. A. L. Schott.

675*a*. **Gerardia auriculata**, Michx.
Below Alexandria, Va., Sept. 9, 1885. Mr. Wm. Hunter.

825*a*. **Comptonia asplenifolia**, Ait. Sweet Fern.
Between the Reform School and Highlands, Md., on an abandoned earthwork, June 22, 1884, by Prof. Ward.

826*a*. **Betula lenta**, L. Cherry, Sweet, or Black Birch.
Found by Dr. G. W. Hill at the mouth of Difficult Run, Va., May 11, 1884. Dr. Hill states that he could find no full-grown trees, and none bearing fruit or flowers. Mr. Wm. Hunter reports this species from Clifton Station, Va., also as a mere shrub.

The following remarkable forms of *Quercus*, supposed to be of hybrid origin, are deserving of special mention in the catalogue. Most of them were described by Dr. George Vasey in an article published in the "Bulletin of the Torrey Botanical Club" for March, 1883, with figures (plates xxviii–xxx). Their principal peculiarities were further pointed out in a paper by Prof. Ward, read before this Society April 13, 1883.

The names given below are based on the assumption that they are hybrids, the one standing first being that of the species supposed to predominate in the hybridism.

831*a*. **Quercus alba × obtusiloba**.
Discovered by Dr. Vasey near Silver Spring, Maryland, September 20, 1882.

831*b*. **Quercus alba × Prinus.**

On the Rockville Road a few rods north of Woodley Park Road. Discovered October 22, 1882, by Prof. Ward. A large tree standing just inside the fence on the west side of the road.

832*a*. **Quercus obtusiloba × alba.**

Discovered by Dr. Vasey by the roadside near Piney Branch, September 20, 1882.

836*a*. **Quercus Prinus × alba.** SAUL'S OAK.

Pointed out to Dr. Vasey by Mr. John Saul in his nursery, just back of his residence, September 20, 1882.

890*a*. **Potamogeton crispus, L.**

Near mouth of Gravelly Run, Va., October 26, 1884. The specimens seen were all without fruit. Prof. Ward and the author.

924*a*. **Allium sativum, L.** ENGLISH GARLIC.

Georgetown College grounds, July 22, 1882. Prof. Ward. In addition to this locality he found it below the Insane Asylum, June, 1884.

1093*a*. **Carex utriculata, Boott.**

Eastern Branch Marsh, June 8, 1879. These specimens were confounded with those of *C. riparia* from the same locality, and under that name sent to Mr. Walter Deane, of Cambridge, who pointed out the error.

1101*a*. **Sporobolus vaginæflorus, Torr.**

Monument Grounds, Sept. 12, 1885. Prof. Ward.

1103*a*. **Agrostis canina, L.**

Vacant lots near B. & O. depot, July, 1885. Prof. F. Lampson Scribner.

1125*a*. **Eatonia obtusata. Gray.**

Collected by Dr. George Vasey, June, 1884.

1153*a*. **Bromus tectorum, L.**

Kendall Green, July, 1885. Prof. F. Lampson Scribner.

1172*a*. **Phalaris arundinacea, L.**

Collected on the Seventh street road by Dr. Geo. Vasey, June, 1884.

1205*a*. **Taxodium distichum**, Richard.

Marshall Hall, Md., Sept. 13, 1885. Collected by Mr. Wm. Palmer and Mr. O. N. Bryan. Mr. Bryan regards these trees as undoubtedly indigenous.

1225*a*. **Asplenium montanum**, Willd.

A short distance above Great Falls, Virginia side, Aug. 30, 1885. Mr. Wm. Palmer.

1233*a*. **Aspidium spinulosum**, Swz. SPINULOSE WOOD FERN.

In a ravine (Goldianum Run) on the Virginia side of the Potomac, opposite the Distributing Reservoir, July 6, 1884, by Prof. Ward.

1248*a*. **Lycopodium inundatum**, L.

Near the Sarracenia swamp; first detected May 10, 1885. Fruiting specimens collected Sept. 10, 1885. Also found near Woodlawn, Fairfax Co., Va., Oct. 1885, by Wm. Hunter.

1248*a*. **Lycopodium annotinum**, L.

Specimen in herb. Mr. Wm. Palmer, said to have been collected by Dr. E. Foreman in Holmead Swamp. Station long since obliterated.

1249*a*. **Lycopodium clavatum**, L.

Above Great Falls, Virginia side, Aug. 30, 1885, by Mr. Wm. Palmer. Also Silver Spring, Md., Jan. 2, 1886.

1382*a*. **Nitella megacarpa**, Allen.

Eastern Branch, above Benning's Bridge, Sept. 21, 1884. In fine fruiting condition. Identified by Dr. T. F. Allen, of New York.

II. A REVISION OF THE MUSCI AND HEPATICÆ OF WASHINGTON AND VICINITY, WITH NUMEROUS ADDITIONS.

By Rev. E. LEHNERT.

[It is with great pleasure that I am able to include in this communication the much-needed revision of our Mosses and Liverworts, which has been so kindly placed at my disposal by Mr. Lehnert. The list given in the "Flora," which was prepared by Mr. Rudolph Oldberg, enumerates 127 species. We are now able to augment that list by the addition of 111 species, of which 83 are Frondosi and 28 Hepaticæ, making a total of 238 species.

The nomenclature followed is, for the Frondosi, "The Mosses of North America," by Lesquereux and James, and for the Hepaticæ, the "Descriptive Catalog of Hepaticæ," by Underwood.]

A. MUSCI FRONDOSI.

ORD. 1. *SPHAGNACEÆ.*

Sphagnum cymbifolium, Ehrh.
" squarrosum, Pers.
" acutifolium, Ehrh.
" subsecundum, Nees.
" intermedium, Hoff.

ORD. 2. *ANDREÆACEÆ.*

Andreæa rupestris, Turn.

ORD. 3. *BRYACEÆ.*

a. Acrocarpi.

1. PHASCEÆ.

Ephemerum crassinervium, Hampe.
" stenophyllum, Schimp.
" cohærens, Muell.
" spinulosum, Br. & Sch.
Sphærangium triquetrum, Schimp.
Phascum cuspidatum, Schreb.
Pleuridium subulatum, Br. & Sch.
" alternifolium, Brid.
" Sullivantii, Aust.
Archidium Ravenelii, Aust.
Bruchia flexuosa, Muell.
" brevifolia, Sull.

2. WEISIEÆ.

Astomum nitidulum, Schimp.
" Sullivantii, Schimp.
Weisia viridula, Brid.
Trematodon longicollis, Michx.
Dicranella varia, Schimp.
" heteromalla, Schimp.
Dicranum scoparium, Hedw.
" majus, Turn.
" Drummondii, Muell.
" undulatum, Turn.

3. FISSIDENTEÆ.

Fissidens adiantoides, Hedw.
" taxifolius, Hedw.
" minutulus, Sull.
" osmundoides, Hedw.

4. LEUCOBRYEÆ.

Leucobryum vulgare, Hampe.
" minus, Sull.

5. CERATODONTEÆ.

Ceratodon purpureus, Brid.

6. POTTIEÆ.

Pottia truncata, Fuern.
Leptotrichum tortile, Muell.
" vaginans, Lesq. & James.
" pallidum, Hampe.
" glaucescens, Hampe.
Barbula unguiculata, Hedw.
" marginata, Br. & Sch.
" cæspitosa, Schwg.
" convoluta, Hedw.
" muralis, Timm.

7. GRIMMIEÆ.

Grimmia apocarpa, Hedw.
" Pennsylvanica, Schwg.
" Olneyi, Sull.
" conferta, Funck.
Racomitrium fasciculare, Brid.
Hedwigia ciliata, Ehrh.

8. ORTHOTRICHEÆ.

Ptychomitrium Drummondii, Sull.
" incurvum, Sull.
Drummondia clavellata, Hook.
Ulota crispa, Brid.
" crispula, Brid.
" Huthinsiæ, Schimp.
Orthotrichum canadense, Br. & Sch.
" obtusifolium, Schrad.
" exiguum, Sull.

Orthotrichum strangulatum, Beauv.
" **Ohioense**, Sull. & Lesq.
" **cupulatum**, Hoff.
" **psilocarpum**, James.

9. TETRAPHIDEÆ.

Tetraphis pellucida, Hedw.

10. PHYSCOMITRIEÆ.

Physcomitrium pyriforme, Brid.
" **Hookeri**, Hampe.
Funaria hygrometrica, Sibth.
" **flavicans**, Michx.
" **calvescens**, Schwg.

11. BARTRAMIEÆ.

Philonotis Muhlenbergii, Brid.
" **fontana**, Brid.
Bartramia pomiformis, Hedw.
" **radicalis**, Beauv.

12. BRYEÆ.

Leptobryum pyriforme, Schimp.
Webera albicans, Schimp.
Bryum argenteum, L.
" **cæspiticium**, L.
" **capillare**, L.
" **pseudotriquetrum**, Schwg.
Rhodobryum roseum, Schrb.
Mnium stellare, Reich.
" **hornum**, L.
" **Drummondii**, Br. & Sch.
" **punctatum**, Hedw.
" **cuspidatum**, Hedw.
" **affine**, Bland.

13. AULACOMNIEÆ.

Aulacomnium palustre, Schwgr.
" **heterostichum**, Br. & Sch.

14. POLYTRICHEÆ.

Atrichum angustatum, Beauv.
" **undulatum**, Beauv.
" **crispum**, James.

Pogonatum brevicaule, Brid.
" umigerum, Brid.
Polytrichum commune, L.
" juniperinum, Willd.
" perigoniale, Michx.
" formosum, Hedw.
" piliferum, Schreb.

15. BUXBAUMIEÆ.

Diphyscium foliosum, Mohr.
Buxbaumia aphylla, L.

b. Cladocarpi.

16. FONTINALEÆ.

Fontinalis biformis, Sull.
Dichelyma subulatum, Myrin.
" capillaceum, Br. & Sch.

c. Pleurocarpi.

17. NECKEREÆ.

Cryphæa glomerata, Br. & Sch.
Neckera pennata, Hedw.
Leptodon trichomitrion, Mohr.

18. LEUCODONTEÆ.

Leucodon julaceus, Sull.
" brachypus, Sull.
Clasmatodon parvulus, Sull.

19. LESKEÆ.

Thelia hirtella, Sull.
" asprella, Sull.
" Lescurii, Sull.
Leskea obscura, Hedw.
" polycarpa, Ehrh.
" denticulata, Sull.
" tristis, Cesat.
Anomodon rostratus, Schimp.
" attenuatus, Hüb.
" obtusifolius, Br. & Sch.

20. ORTHOTHECIEÆ.

Platygyrium repens, Br. & Sch.
Pylaisia intricata, Br. & Sch.
" velutina, Br. & Sch.

Homalothecium subcapillatum, Sull.
Cylindrothecium cladorrhizans, Schimp.
" **seductrix**, Sull.
" **Drummondii**, Br. & Sch.
" **compressum**, Br. & Sch.
Climacium Americanum, Brid.

21. HYPNEÆ.

Hypnum minutulum, Hedw.
" **scitum**, Beauv.
" **recognitum**, Hedw.
" **delicatulum**, Linn.
" **lætum**, Brid.
" **acuminatum**, Beauv.
" **salebrosum**, Hoff.
" **velutinum**, L.
" **rutabulum**, L.
" **Novæ-Angliæ**, Sull & Lesq.
" **rivulare**, Bruch.
" **populeum**, Hedw.
" **plumosum**, Swartz.
" **strigosum**, Hoff.
" **Boscii**, Schwgr.
" **Sullivantii**, Spruce.
" **hians**, Hedw.
" **piliferum**, Schreb.
" **demissum**, Wils.
" **Novæ-Cesareæ**, Aust.
" **recurvans**, Schwgr.
" **deplanatum**, Schimp.
" **serrulatum**, Hedw.
" **rusciforme**, Weis.
" **Alleghaniense**, Muell.
" **micrans**, Swartz, var. **fulvum**.
" **denticulatum**, L.
" **Sullivantiæ**, Schimp.
" **sylvaticum**, Huds.
" **minutissimum**, Sull. & Lesq.
" **serpens**, L.

Hypnum radicale, Beauv.
" orthocladon, Beauv.
" riparium, Hedw.
" vacillans, Sull.
" hispidulum, Brid.
" chrysophyllum, Brid.
" stellatum, Schreb.
" uncinatum, Hedw.
" fluitans, L.
" molluscum, Hedw.
" imponens, Hedw.
" cupressiforme, L.
" curvifolium, Hedw.
" arcuatum, Ldb.?
" pratense, Koch.
" stramineum, Dicks.
" Schreberi, Willd.
" splendens, Hedw.
" Oakesii, Sull.
" triquetrum, L.

B. MUSCI HEPATICI.

ORD. 1. *RICCIACEÆ.*

Riccia lutescens, Schwein.
" fluitans, L.
" natans, L.
" arvensis, Aust.

ORD. 2. *ANTHOCEROTACEÆ.*

Anthoceros punctatus, L.
" lævis, L.
Notothylas orbicularis, Sull.

ORD. 3. *MARCHANTIACEÆ.*

Marchantia polymorpha, L.
Conocephalus conicus, Dumort.
Asterella hemisphærica, Beauv.
Dumortiera hirsuta, Nees.
Fimbriaria tenella, Nees.
Lunularia cruciata, Dumort.

ORD. 4. *JUNGERMANIACEÆ.*

Aneura palmata, Nees.

Pellia epiphylla, Nees.

Blasia pusilla, L.

Steetzia Lyellii, Lehm.

Metzgeria pubescens, Raddi.

" **conjugata**, Lindb.

Frullania Grayana, Mont.

" **tamarisci**, Nees.

" **Virginica**, Gottsche.

" **brunnea**, Spreng.

" **Eboracensis**, Gottsche.

" **plana**, Sull.

Phragmicoma cucculata? Nees.

Lejeunia cyclostipa? Tayl.

" **calyculata**, Tayl.

" **minutissima**, Dumort.

Madotheca platyphylla, Dumort.

" **porella**, Nees.

Radula complanata, Dumort.

" **tenax**, Lindb.

" **obconica**, Sull.

Blepharostoma trichophylla, Dumort.

Blepharozia ciliaris, Dumort.

Trichocolea tomentella, Dumort.

Bazzania trilobata, B. Gr.

Lepidozia reptans, Dumort.

" **setacea**, Mitt.

Calypogeia trichomanis, Corda.

" **Sullivanti**, Aust.

Geocalyx graveolens, Nees.

Chiloscyphus polyanthos, Corda.

Lophocolea bidentata, Dumort.

" **heterophylla**, Nees.

" **minor**, Nees.

Odontoschisma sphagni, Dumort.

" **denudata**, Dumort.

Cephalozia curvifolia, Dumort.

" **multiflora**, Lindb.

Jungermania Schraderi, Mart.
Scapania albicans, Mitt.: var. taxifolia, Undw.
" nemorosa, Nees.
" compacta, Dumort; var. irigua, Undw.
Plagiocheila asplenioides, Nees & Mont.
" spinulosa, Nees & Mont.

III. A LIST OF THE LICHENS OF WASHINGTON AND VICINITY.

By Rev. E. Lehnert.

[This great desideratum, a list of our Lichens, is at last supplied, through the indefatigable labors of Mr. Lehnert, who has also placed it at my disposal.

In a prefatory note accompanying the list, Mr. Lehnert says: "So far as known, the Lichens of the District comprise 251 species, with 89 varieties, a total of 340 forms. In the main our species are not as showy as those from the North or South, but have, when compared with the same species from these localities, a dwarfed and depauperate aspect, caused, possibly, by the dryness of our climate, as we have very warm summers and cold winters"].

(According to Tuckerman's Genera Lichenum Emend).

A. GYMNOCARPI.

Trib. 1. Parmeliacei.

Fam. 1. USNEEI.

Ramalina rigida, Pers.
" calicaris, Fr.
" " var. fraxinea, Fr.
" " " farinacea, Schær.
" " " fastigiata, Fr.
" " " canaliculata, Fr.
Cetraria Fahlunensis, Schær.
" juniperina, Ach.
" aleurites, Fr.
" " var. placorodia, Tuck.
" Fendleri, Tuck.
" lacunosa, Ach.
" ciliaris, Ach.
" sæpincola, Ach.
" Oakesiana, Tuck.
Evernia furfuracea, Mann.

Usnea barbata, Fr.
" " var. **florida**, Fr.
" " " **hirta**, Fr.
" " " **rubiginia**, Michx.
" " " **dasypoga**, Fr.
" " " **ceratina**, Schær.
" **angulata**, Ach.
" **trichodea**, Ach.
Alectoria jubata, L.

Fam. 2. PARMELIEI.

Theloschistes chrysophthalmus, Norm.
" " var. **flavicans**, Wallr.
" **parietinus**, Norm.
" **polycarpus**, Ehrh.
" **lychneus**, Nyl.
" **concolor**, Dick.
" " var. **effuse**, Tuck.
Parmelia perforata, Ach.
" " var. **hypotropa**, Nyl.
" **crinita**, Ach.
" **saxatilis**, Fr.
" **physodes**, Ach.
" **Borreri**, Turn.
" " var. **rudecta**, Tuck.
" **lævigata**, Nyl.
" **tiliacea**, Floerke.
" " var. **sublævigata**, Nyl.
" " " **sulphurosa**, Tuck.
" **cetrata**, Ach.
" **colpodes**, Nyl.
" **olivacea**, Ach.
" **caperata**, Ach.
" **conspersa**, Ach.
" **ambigua**, Ach.
Physcia speciosa, Nyl.
" **hypoleuca**, Tuck.
" **comosa**, Nyl.
" **granulifera**, Tuck.

Physcia aquila, Nyl. var. detonsa, Tuck.
" pulverulenta, Nyl.
" stellaris, L.
" " var. aipolia, Nyl.
" astroidea, Ach.
" crispa, Nyl.
" tribacia, Tuck.
" cæsia, Nyl.
" obscura, Nyl.
" " var. endochrysea, Nyl.
" adglutinata, Nyl.
Pyxine sorediata, Fr.

Fam. 3. PELTIGEREI.

Sticta pulmonaria, Ach.
" amplissima, Mass.
" quercizans, Ach.
Nephroma lævigatum, Ach.
" Helveticum, Ach.
Peltigera scutata, Leightf.
" aphthosa, Hoff.
" polydactyla, Hoff.
" rufescens, Hoff.
" horizontalis, Hoff.
" canina, Hoff.
" " var. spongiosa, Tuck.
" " " sorediata, Sch.
" " " spuria, Ach.

Fam. 4. PANNARIEI.

Endocarpiscum Guepini, Nyl.
Physma luridum, Mont.
Pannaria lanuginosa, Koerb.
" leucosticta, Tuck.
" microphylla, Delis.
" tryptophylla, Mass.
" molybdæa, Tuck.
" nigra, Nyl.
" rubiginosa, Delis.

Fam. 5. COLLEMEI.

Pyrenopsis Schæreri, Nyl.

Omphalaria phyllisca, Tuck.
Collema myriococcum, Arn.
" **pycnocarpum**, Nyl.
" **cyrtaspis**, Tuck.
" **verruciforme**, Nyl.
" **leptaleum**, Tuck.
" **flaccidum**, Ach.
" **nigrescens**, Ach.
ryssoleum, Tuck.
" **pulposum**, Nyl.
" **limosum**, Ach.
" **pustulatum**, Ach.
Leptogium bolacinum, Stizenb.
" **minutissimum**, Mass.
" **lacerum**, Fr.
" **pulchellum**, Nyl.
" **Tremelloides**, Fr.
" **juniperinum**, Tuck.
" **chloromelum**, Nyl.
" **myochroum**, Tuck.
" " var. **saturnium**, Sch.
" " " **tomentosum**, Sch.

Fam. 6. LECANOREI.

Placodium cinnabarrinum, Anz.
" **vittelinum**, Ach.
" " var. **aurellam**, Ach.
" **cerinum**, Naeg. & Hepp.
" " var. **sideritis**, Tuck.
" " " **pyracea**, Nyl.
" **aurantiacum**, Naeg. & Hepp.
" **microphyllinum**, Tuck.
' **camptidium**, Tuck.
" **ferrugineum**, Hepp.
" " var. **pollinii**, Tuck.
" " " **discolor**, Willey.
Lecanora rubina, Ach.
" **muralis**, Schær.
" **pallida**, Schær.

Lecanora pallida, var. cancriformis, Tuck.
" " " angulosa, Hoff.
" miculata, Ach.
" subfusca, Ach.
" " var. allophana, Ach.
" " " distans, Ach.
" " " coilocarpa, Ach.
" " " argentata, Ach.
" Hageni, Ach.
" atra, Ach.
" varia, Nyl.
" " var. symmicta, Ach.
" " " sæpincola, Fr.
" Cupressi, Tuck.
" pallescens, Schær.
" " var. rosella, Tuck.
" tartarea, Ach.
" cinerea, Sommer.
" " var. lævata, Fr.
" lacustris, Nyl.
" fuscata, Th., Fr.
" privigna, Nyl.
" " var. pruinosa, Auctt.
" " " Clavus, Koerb.
Rinodina oreina, Mass.
" sophodes, Mass.
" " var. atrocinerea, Nyl.
" " " confragosa, Nyl.
" " " exigua, Fr.
" " " tephraspis, Tuck.
" constans, Tuck.
" milliaria, Tuck.
Pertusaria communis, DC.
" multipuncta, Nyl.
" velata, Nyl.
" pustulata, Nyl.
" Wulffenii, DC.
" leioplaca, Schær.

Pertusaria globularis, Ach.
Conotrema urceolatum, Tuck.
Gyalecta Pineti, Fr.
" **cupularis**, Schær.
" **geoica**, (?) Ach.
" **lutea**, Tuck.
Urceolaria scruposa, Snif.
" " var. **parasitica**, Sommerf.
" " " **gypsacea**, Nyl.
" **actinostoma**, Pers.
Myriangium Curtissii, M. & B.

Trib. I. Lecideacei.

Fam. 1. CLADONIEI.

Cladonia Papillaria, Hoff.
" **pyxidata**, Fr.
" " var. **Pocillum**, Ach.
" **alcicornis**, Floerke.
" **symphycarpa**, Fr.
" " var. **epiphylla**, Nyl.
" **Mitrula**, Tuck.
" **cariosa**, Spreng.
" **decorticata**, Floerke.
" **fimbriata**, Fr.
" " var. **tubæformis**, Fr.
" " " **radiata**, Fr.
" **gracilis**, Fr.
" " var. **verticillata**, Fr.
" " " **hybrida**, Schær.
" " " **cervicornis**, Floerke.
" **degenerans**, Floerke.
" **Santensis**, Tuck.
" **cæspiticia**, Fl.
" **furcata**, Fr.
" " var. **subulata**, Fl.
" " " **racemosa**, Fl.
" **rangiferina**, Hoff.
" " var. **sylvatica**, L.
" " " **alpestris**, L.
" **uncialis**, Fr.

Cladonia macilenta, Hoff.
" **Floerkiana**, Fr.
" **pulchella**, Schwein.
" **cristatella**, Tuck.
" **leporina**, Fr. (var.)
Cystocoleus rupestris, Rabh.

Fam. 2. LECIDEEI.

Bæomyces roseus, Pers.
Biatora rufo-nigra, Tuck.
" **coarctata**, Th. Fr.
" **decolorans**, Fr.
" **russula**, Mont.
" **sanguineo-atra**, Fr.
" **atro-rufa**, Ach
" **exigua**, Fr.
" **milliaria**. Fr.
" **anomala**, Fr.
" **mixta**, Fr.
" **rubella**, Fr.
" " var. **spadicea**, Ach.
" " " **suffusa**, Fr.
" " " **Schweinitzii**, Tuck.
" " " **incompta**, Nyl.
" " " **inundata**, Fr.
" " " **arceutina**, Ach.
" **umbrina**, Ach.
" **chlorosticta**, Tuck.
" **vernalis**, Fr.
" **uliginosa**, Fr.
" **hypnophila**, Turn.
" **campestris**, Fr.
" **resinæ**, Fr.
Heterothecium **sanguinarium**, Tuck.
" **leucoxanthum**, Spreng.
" **vulpinum**, Tuck.
Lecidea **contigua**, Fr
" **enteroleuca**, Fr.
" " var. **olivacea**, Fr.

Lecidea enteroleuca, var. **theioplaca**, Tuck.
" " " **arenaria**, Fl.
" **insularis**, Nyl.
" **albo-cœrulescens**, Fr.
Buellia lactea, Mass.
" **lepidastra**, Tuck.
" **atro-alba**, Fl.
" **parasema**, Krb.
" " var. **cæsio-pruinosa**, Nyl.
" " " **triphragmia**, Nyl.
" " " **microcarpa**, Nyl.
" **dialyta**, Nyl.
" **myriocarpa**, Dl.
" **Schæreri**, Dnot.
" **Elizæ**, Tuck.
" **petræa**, Tuck.
" " var. **Montagnei**, Fl.
" " " **Oederi**, Krb.; and others undefined.

Trib. III. Graphidacei.

Fam. 1. LECANACTIDEA.

Lecanactis chloroconia, Tuck.

Fam. 2. OPEGRAPHEI.

Opegrapha demissa, Tuck.
" **varia**, Fr.
" " var. **notha**, Fr.
" " " **pulicaris**, Fr.
" " " **diaphora**, Fr.
" " " **rimalis**, Fr.
" **atra**, Nyl.
" **vulgata**, Nyl.
Xylographa opegraphella, Nyl.
Graphis scripta, Ach.
" " var. **limitata**, Schær.
" " " **recta**, Schær.
" " " **serpentina**, Ach.
" " " **sophistica**, Nyl.
" " " **assimilis**, Nyl.
" **dentritica**, Ach.

Graphis dentritica, var. inusta, Ach.
" tricosa, Ach.
" nitidia (?), Nyl.

Fam. 3. ARTHONIEI.

Arthonia pyrrhula, Nyl.
" rubella, Nyl.
" cinereo-pruinosa, Schær.
" cinnabarina, Wallr.
Arthonia lecidella, Nyl.
" lurida, Ach.
" patellulata, Nyl.
" astroidea, Nyl.
" epipasta, Ach.
" macularis, Fr.
" obscura, Ach.
" punctiformis, Ach.
" polymorpha, Ach.
" tædiosa, Nyl.
" spectabilis, Fl.
" anastomosans, Ach.
Mycoporum pycnocarpum, Nyl.

Trib. IV. Caliciacei.

Acolium tigillare, Dnot.
Calicium trichiale, Ach.
" brunneolum, Ach.
" subtile, Fr.
" trachelinum, Ach.
" turbinatum, Pers.
" leucopodum, Nyl.
" albo-nigrum, Nyl.

B. ANGIOCARPI.

Trib. V. Verrucariacei.

Fam. 1. ENDOCARPEI.

Endocarpon miniatum, Schær.
" " var. complicatum, Schær.
" " " aquaticum, Schær.
" arboreum, Schwein.
" rufescens, Ach.
" pusillum. Hedw.

Fam. 2. VERRUCARIEI.

Staurothele difractella, Tuck.
" **Drummondii**, Tuck.
" **umbrina**, Tuck.
Trypethelium virens, Tuck.
Sagedia lactea, Kbr.
" **oxyspora**, Tuck.
" **cestrensis**, Tuck.
Verrucaria epigæa, Ach.
" **margacea**, Nyl.
" **nigrescens**, Pers.
" **rupestris**, Schrad.
" **muralis**, Ach.
Pyrenula thelena, Tuck.
" **micula**, Fl.
" **punctiformis**, Naeg.
" **fallax**, Nyl.
" **gemmata**, Naeg.
" **hyalospora**, Tuck.
" **glabrata**, Mass.
" **Santensis**, Nyl.
" **nitida**, Ach.
" **lactea**, Tuck.
" **subprostans**, Tuck.
" **falliciora**, Nyl.
" **leucoplaca**, Kbr.
" **thelomorpha**, Tuck.

IV. CHANGES IN NOMENCLATURE.

[The recent published works of Drs. Gray and Vasey have made necessary many changes in the nomenclature of our species. It has been suggested that these changes be deferred until the publication of a second edition of the "Flora," but this has seemed to be inadvisable, as it must be some years before a second edition can be brought out, if ever, and if we are constantly confronted by the old names we shall never become familiar with the new and correct ones.]

295. **Ribes rotundifolium**, Michx., = **Ribes oxycanthoides**, Linn.
Pointed out by Mr. Walter Deane, of Cambridge, who has carefully compared it at the Gray Herbarium.

395. **Eupatorium pubescens**, Muhl., = **Eupatorium rotundifolium**, L., var. **ovatum**, Torr.

412. **Solidago stricta**, Ait., = **Solidago neglecta**, Torr. & Gr.

414. **Solidago Virga-aurea**, L., var. **humilis**, Gray. = **Solidago humilis**, Pursh.

416. **Solidago elliptica**, Ait., = **Solidago Elliottii**, Torr. & Gray.

417. **Solidago arguta**, Ait., = **Solidago juncea**, Ait.

418. **Solidago altissima**, L., = **Solidago rugosa**, Mill.

439. **Aster miser**, L., (Ait. of Gray's "Manual"), = **Aster vimineus**, var. **foliolosus**, Gray. (?)

440. **Aster simplex**, Willd., = **Aster paniculatus**, Lam.

442. **Aster carneus**, Nees, = **Aster salicifolius**, (Lam.) Ait.

443. **Aster æstivus**, Ait.,= **Aster junceus**, Ait.

445. **Aster puniceus**, L., var. **vimineus**, Torr. & Gray, = **Aster puniceus**, L., var. **lucidulus**, Gray.

449. **Diplopappus linearifolius**, Hook., = **Aster linearifolius**, L.

450. **Diplopappus umbellatus**, Torr. & Gray, = **Aster umbellatus**, Mill.

451. **Diplopappus cornifolius**, Darl., = **Aster infirmus**, Michx.

473. **Eclipta procumbens**, Michx., = **Eclipta alba**, Hasskarl.

489. **Verbesina Siegesbeckia**, Michx. = **Verbesina occidentalis**, Walt.

510. **Lappa officinalis**, Allioni, = **Arctium Lappa**, L., var. (?)

512. **Cnicus discolor**, Gray, = **Cnicus altissimus**, Willd., var. **discolor**, Gray.

520. **Cynthia Dandelion**, DC., = **Krigia Dandelion**, Nutt.

523. **Hieracium venosus**, L., var. **subcaulescens**, Gray, = **Hieracium venosus**, Gray.

526 **Taraxacum Dens-leonis**, Desf., = **Taraxacum officinalis**, Weber.

529. **Lactuca Canadensis**, L., var. **integrifolia**, Gray, = **Lactuca integrifolia**, Bigel.

530. **Mulgedium acuminatum**, DC., = **Lactuca acuminata**, Gray.

531. **Mulgedium Floridanum**, DC., = **Lactuca Floridana**, Gærtn.

532. **Mulgedium leucophæum**, DC.,= **Lactuca leucophæa**, Gray.

533. **Nabalus albus**, Hook., = **Prenanthes alba**, L.

534. **Nabalus Fraseri**, DC., = **Prenanthes serpentaria**, Pursh.

644. **Physalis viscosa**, L., of Gray's Manual, = **Physalis Virginiana**, Mill. of Syn., Fl. of N. A. This change has been pointed out by Mr. Deane.

832. **Quercus stellata,** Wang., = **Quercus obtusiloba,** Michx., as adopted by Sargent in his "Forest Trees of N. A.," vol. ix, Tenth Census of United States.

837. **Quercus Muhlenbergii,** Engel, = **Quercus prinoides,** Willd., as adopted by Sargent.

1101. **Vilfa aspera,** Beauv. =**Sporobolus aspera,** Kth.

1105. **Agrostis alba,** L., = **Agrostis vulgaris,** var. **alba,** Vasey.

1114. **Calamagrostis Nuttalliana,** Steud., = **Deyeuxia Nuttalliana,** Vasey.

1124. **Tricuspis seslerioides,** Torr., = **Triodia seslerioides,** Vasey.

1129. **Glycera aquatica,** Smith, = **Glycera arundinacea,** Kth.

1140. **Eragrostis poæoides,** Beav., = **Eragrostis minor,** Host.

1141. **Eragrostis poæoides,** var. **megastachya,** Gray, = **Eragrostis major,** Host.

1165. **Gymnostichum Hystrix,** Schreb., = **Asperella Hystrix,** Willd.

1187. **Panicum pauciflorum,** Ell., = **Panicum scoparium,** Lam.

1198. **Erianthus alopecuroides,** Ell., = **Panicum saccharoides,** Michx.

1199. **Andropogon furcatus,** Muhl., = **Andropogon provincialis,** Lam.

1201. **Andropogon argenteus,** Ell., = **Andropogon argyræus,** Schultz.

1202. **Andropogon Virginicus,** L., = **Andropogon dissitiflorus,** Michx.

1204. **Sorghum nutans,** Gray, = **Chrysopogon nutans,** Benth.

V. NEW LOCALITIES FOR RARE SPECIES.

26. **Aconitum uncinatum,** L.
Near Clifton Station, Va., Sept. 20, 1885, by Prof. Ward.

78. **Thlaspi arvense,** L. **Field Pennycress.**
Below St. Elizabeth's, May 18, 1884, by Prof. Ward.

106. **Silene nivea,** DC.
Alexander's Island, June 25, 1885. Mr. J. A. Allen.

300. **Drosera rotundifolia,** L.
Sarracenia Swamp, May 10, 1885; also at Fort Ethan Allen, by Mr. William Palmer.

304. **Callitriche Austini,** Engelm.
Brightwood, May 16, 1885. Mr. J. A. Allen.

415. **Solidago rigida,** L.
Woodley Park, in fruit, Oct. 18, 1885. Prof. Ward and myself.

551. **Gaultheria procumbens**, L. **Wintergreen.**
Found on the Mt. Vernon estate, Va, in October, 1884, by Mr. William Hunter.

589. **Asclepias rubra**, L.
Vicinity of Falls Church, Va., Miss M. A. Hayes, July 11, 1885.

599. **Enslenia albida**, Nutt.
Alexander's Island, June 25, 1885. Mr. J. A. Allen. Below Chain Bridge, in fruit, Sept. 12, 1885. Prof. Ward and myself.

627. **Lithospermum canescens**, Lehm.
North side of Woodley Park Road, first bend above the bridge. Collected May 17 and 21, 1884. Prof. Ward.

629*a*. **Heliotropium Europæum**, L. **Heliotrope.**
Alexandria, Va., near the ship-yard, July 4, 1884. Prof. Ward.

672. **Buchnera Americana**, L.
Near Clifton Station, Va, Sept. 20, 1885. Prof. Ward.

732*a*. **Scutellaria parvula**, Mx. **Scullcap.**
Kengla's Woods, June 4, 1884. Prof. Ward.

741. **Plantago cordata**, Lam.
Poplar Point, on the Eastern Branch, October 26, 1884. Prof. Ward and myself. Important on account of its greater accessibility.

805. **Cacalia reniformis**, Muhl.
Alexander's Island, June 25, 1885. Mr. J. A. Allen.

835. **Quercus Michauxii**, Nutt.
Near "Owl Bridge," (Northwest Branch). A large fine tree, quite typical. Found by Mr. H. W. Henshaw and myself, September 11, 1885.

849. **Quercus heterophylla**, Mx.
A fine tree of this species was discovered near Convalescent Camp, Virginia, June 29, 1884, by Prof. Ward. In fine fruiting condition, October 5, 1884. "The affinities of this specimen with **Q. Phellos** are closer than in any of the forms hitherto found. The leaves resemble in almost every respect those which I collected from the tree now standing in the Bartram estate, Philadelphia, south of the mansion, and which is said to have grown from an acorn of the

original Bartram Oak planted by the discoverer." Prof. Ward.

874. **Arisæma Dracontium**, Schott.
Analostan Island, June 20, 1885. Titus Ulke.

918. **Corallorhiza odontorhiza**, Nutt. **Coral-root.**
Found by Mr. Benj. Miller in Kengla's Woods, near the Foundry Run, May 7, 1884, and therefore constituting a case of the vernal blooming of an autumnal species. "I visited this spot in company with Mr. Miller on June 4, 1884, and found the plant nearly extinct. It had died down and withered away without fruiting. On September 28, 1884. I found it in abundance along the Northwest Branch of the Potomac."—Prof. Ward.

919. **Corallorhiza multiflora**, Nutt.
A single specimen, the second ever seen here, was found on the Northwest Branch of the Potomac, Sept. 28, 1884.

946. **Smilacina stellata**, Desf.
High Island, May 11, 1885. Four or five fine specimens found. Hugh M. Smith.

951. **Erythronium albidum**, L.
Found at "Vis-a-vis" Landing, opposite Three Sisters, April 26, 1885. Mr. H. M. Smith.

1211. **Tsuga Canadensis**, Carrière.
Left bank of Pope's Head Creek, one-half mile below Clifton Station, Va., Sept. 20, 1885. Prof. Ward.

1216. **Pellæa atropurpurea**, Link.
Found June, 1885, by Mr. H. M. Smith, on the outer walls of the causeway connecting Analostan Island with the mainland. Plants numerous.

1223. **Asplenium augustifolium**, Michx.
Found at head of Asplenium Run, above Aqueduct Bridge, Sept. 19, 1885. Mr. H. W. Henshaw and myself.

1226. **Camptosorus rhizophyllus**, Link.
Near Burnt Mills, Md., July 1, 1885. Mr. H. W. Henshaw. Also High Island, April, 1885. Mr. J. A. Allen.

1220. **Woodwardia Virginica,** Smith.

Below the Reform School, Aug. 19, 1885. Mr. Wm. Palmer and myself.

VI. SPECIES EXCLUDED.

172 **Vitis vulpina,** L., = **Vitis riparia,** Michx.

The specimens mentioned in the "Flora" that were referred to this species, were collected in flower May 22, 1881, and in young fruit June 4, 1881, at Sandy Landing, Md. Specimens in mature fruit collected Sept. 12, 1885, on the rocks below Chain Bridge. From characters furnished by the seeds and the diaphrams separating the nodes of the stem, as pointed out by Dr. Engelmann, this is referred to the V. riparia, Michx.

220. **Lespedeza violacea,** Pers.,= **L. reticulata,** Pers.

This species has been compared at the Gray Herb. by Mr. Walter Deane, and referred as above.

973. **Juncus marginatus,** var. **bifloms,** Engl., = **Juncus marginatus,** Rostk.

Compared at the Gray Herbarium by Mr. Walter Deane who pronounces this to be the type and not the variety.

1251. **Lycopodium complanatum,** L., var. **sabinæfolium,** Spring., = **Lycopodium complanatum,** L.

The forms referred to this variety were collected two miles north of Bladensburg, in young fruit, July 20, 1879, and at Clifton Station, Va., Oct. 12, 1884, by Prof. Ward. These have been submitted to Prof. L. W. Underwood, of Syracuse University, and he pronounces them all to be *complanatum*. This variety, or, as it has been lately known, species, *sabinæfolium*, is distinguished by having the stems leafy to base of spikes, or nearly so, elongated, creeping, usually underground; branches erect, short, dichotomous; leaves 4-rowed, apparently terete.

In *complanatum* the stems are flattened, leaves of two forms, imbricated—oppressed in 4 ranks. These specimens are certainly anomalous in having the stems creeping underground, but otherwise they agree well with the type.

ALPHABETICAL INDEX.

N.

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R.