PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON.

PUBLISHED WITH THE CO-OPERATION OF THE SMITHSONIAN INSTITUTION.

VOLUME IV.

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1888.

PUBLICATION COMMITTEE.

C. HART MERRIAM, *Chairman.*

FREDERIC A. LUCAS, R. E. C. STEARNS,

RICHARD RATHBUN, FRANK H. KNOWLTON.

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OF THE

BIOLOGICAL SOCIETY OF WASHINGTON.

ELECTED JANUARY 8, 1887.

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STANDING COMMITTEES—1887.

Committee on Communications.

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Committee on Publications.

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* Ex-Presidents of the Society.

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ELECTED JANUARY 14, 1888.

OFFICERS.

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RICHARD RATHBUN.

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JOINT COMMISSION.

A temporary joint committee, appointed for the purpose of considering the advisability of forming a permanent joint committee, submitted the following report to each of the five societies concerned:—

WHEREAS, There now exist in Washington several scientific societies, organized with similar aims, working by similar methods, composed largely of the same members, and meeting in the same place; and

Whereas, Matters of common interest are numerous and constantly increasing: therefore it is

Resolved, That it is the sense of this committee, that it is advisable to form a Joint Commission of the Anthropological, Biological, Chemical, Geographic and Philosophical Societies of Washington to consider questions of common interest;

That such Joint Commission shall consist of three representatives from each of the five Societies;

That its functions shall be advisory, except that it may execute instructions on general subjects, and in special cases, from two or more of the Societies participating;

Provided, That no Society shall be bound by the Commission to an act as to which it has not given instruction.

The above resolution resulted in the establishment of a permanent Joint Commission, composed of the following delegates:

Anthropological Society.

ROBERT FLETCHER,
WASHINGTON MATTHEWS,
F. A. SEELY.

Biological Society.

WILLIAM H. DALL,
C. HART MERRIAM,
RICHARD RATHBUN.

Chemical Society.

J. H. KIDDER,
F. W. CLARK,
H. W. WILEY.

National Geographic Society.

GARDNER HUBBARD,
HENRY GANNETT,
JOHN R. BARTLETT.

Philosophical Society.

GARRICK MALLERY,
J. W. POWELL,
MARCUS BAKER.

PROCEEDINGS.*

Ninetieth Meeting, February 20, 1886.

The President in the chair, and thirty-seven persons present.

Dr. D. E. Salmon and Dr. Theobald Smith presented a paper, which was read by the latter, entitled, On a New Method of Producing Immunity From Contagious Diseases.

A paper by Prof. C. V. Riley, describing A Carnivorous Butterfly Larva, Fenesica tarquinius,† was read by Mr. J. B. Smith. Specimens of both the larva and imago were exhibited.

Prof. L. F. Ward spoke upon The Plane Tree and its Ancestors,‡ and exhibited specimens and figures of both the recent and fossil species.

Dr. C. Hart Merriam described A New Species of Aplodontia from California,§ and exhibited skins and skulls of the only two species of the genus at present known.

Ninety-First Meeting, March 6, 1886.

The President in the chair, and thirty-six persons present.

Dr. George Vasey spoke upon New and Recent Species of North American Grasses.

Mr. Charles Hallock read a paper entitled Hyper-Instinct in Animals.

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*Until March 19, 1887, the meetings were held either in the Lecture Room or in the office of the National Museum, and subsequently in the Assembly Hall of the Cosmos Club, on Lafayette Square.

†1886. Amer. Nat., June; and Proc. Ent. Soc., Washington, i, No. 2, p. 37.

‡The Paleontological History of the Genus Platanus. <Proc. U. S. Nat. Mus., xi. (In course of publication.)

§1886. Merriam, C. Hart. *Description of a New Species of Aplodontia from California.* <Ann. N. Y. Acad. Sci., iii, No. 10, pp. 312–328, plates 19, 20, and two tables.

NINETY-SECOND MEETING, March 20, 1886.

The President in the chair, and twenty-one persons present.

The following communications were presented:

Dr. D. E. Salmon and Dr. Theobald Smith. NOTES ON SOME BIOLOGICAL ANALYSES OF POTOMAC DRINKING WATER.

Dr. H. G. Beyer. REMARKS ON ANTI-PYRETICS.

Dr. W. S. Barnard, THE EFFECTS OF KEROSENE ON ANIMAL AND VEGETABLE LIFE, with exhibition of a fungus that had developed in an emulsion of kerosene and milk.

Mr. F. H. Knowlton, ADDITIONS TO, AND CHANGES IN, THE FLORA COLUMBIANA FOR 1885.*

NINETY-THIRD MEETING, April 3, 1886.

The President in the chair, and twenty-two members present.

Mr. J. B. Smith read a paper entitled SOME PECULIAR SECONDARY SEXUAL CHARACTERS IN THE DELTOIDS, AND THEIR SUPPOSED FUNCTIONS.

Dr. C. Hart Merriam described a NEW SUBSPECIES OF GRAY SQUIRREL FROM CENTRAL MINNESOTA.†

A paper by Dr. R. W. Shufeldt, on SOME EARLY, AND AS YET UNPUBLISHED, DRAWINGS OF AUDUBON, was read by Mr. F. W. True. Photographs of the drawings were exhibited.

Dr. Frank Baker and Mr. J. L. Wortman spoke upon RECENT INVESTIGATIONS INTO THE MECHANISM OF THE ELBOW JOINT.‡

NINETY-FOURTH MEETING, April 17, 1886.

Prof. Ward, Vice-President, in the chair, and seventeen persons present.

Prof. Theodore Gill described THE CHARACTERISTICS AND FAMILIES OF INIOMOUS FISHES.

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* 1886. These Proceedings, iii, pp. 106-132.

† Science, April 16, 1886, 351.

‡ Embodied in the article, "Elbow-joint," Wood's Reference Hand-book of Medical Sciences, vol. ii.

Mr. F. A. Lucas read a paper entitled NOTES ON THE VERTEBRÆ OF AMPHIUMA, SIREN, AND MENOPOMA.*

Mr. F. W. True gave an account of SOME DISTINCTIVE CRANIAL CHARACTERS OF THE CANADIAN LYNX,† with exhibition of specimens, and also exhibited a specimen of a wood hare, showing an abnormal growth of fur.

NINETY-FIFTH MEETING, May 1, 1886.

The President in the chair, and twenty-six persons present.

Prof. R. E. C. Stearns read a paper entitled INSTANCES OF THE EFFECT OF MUSICAL SOUNDS ON ANIMALS.

Mr. John A. Ryder spoke upon THE EVOLUTION OF THE MAMMALIAN PLACENTA,‡ which, he contended, had passed in its evolution from a diffuse, through a zonary, to a discoidal condition.

Mr. W. H. Dall exhibited specimens of LINGULA (GLOTTIDIA) PYRAMIDATA, Stimpson, attached to sand and bits of shell by the tip of the peduncle. He also described THE SUPERFICIAL ANATOMY OF DIFFERENT SPECIES OF THE GENUS PECTEN.§

NINETY-SIXTH MEETING, May 29, 1886.

The President in the chair, and twenty-two persons present.

Mr. J. B. Smith read a paper on ANTS' NESTS AND THEIR INHABITANTS.‖

Dr. T. H. Bean presented a communication on THE TROUT

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* 1886. LUCAS, F. A. *The Sacrum of Menopoma.* <Amer. Nat., xx, pp. 561, 562, June.

† 1887. Proc. U. S. Nat. Mus., x, pp. 8, 9.

‡ A Theory of the Origin of Placental Types, and on certain vestigiary structures on the placentæ of the mouse, rat, and field-mouse. American Naturalist, August, 1887, pp. 770-784 (with two figs.)

See also (the placentation of the two-toed ant-eater, Cycloturus didactylus), Proc. Acad. Nat. Sci., 1887, p. ——.

§ 1886. Bull. Mus. Comp. Zool., xii, No. 6.

‖ 1886. Amer. Nat., xx, pp. 679-687, August.

of North America, with exhibition of specimens, which was followed by a long discussion, in which many members participated.

Prof. L. F. Ward exhibited a Specimen of the Palo La Cruz, or Wood of the Cross, obtained in Northern Brazil.

Ninety-Seventh Meeting, October 16, 1886.

The President in the chair, and twelve members present.

The Secretary read a letter from Dr. Basil Norris, U. S. A., Spokane Falls, W. T., descriptive of the larval form of a species of *Amblystoma*, probably *A. tigrina*, a specimen of which was exhibited.

Mr. F. H. Knowlton read a paper on Fasciation in Ranunculus and Rudbeckia, exhibiting specimens of each of the genera, and reviewing the different theories held by authors as to the cause of this structure. Remarks upon the same subject were made by Dr. Fernow, Prof. Ward, and Mr. Mann.

Mr. J. B. Smith gave an account of an abnormal abundance of Dynastes tityus, one of the largest of the American beetles, and having an intensely disagreeable odor. It occasionally occurs in the District of Columbia, and ranges south and west from there into Texas and Mexico.*

Mr. F. W. True presented A Revision of the Genus Lagenorhynchus. He also exhibited an abnormally developed hoof of a mule, which was curved and twisted like a ram's horn, and a living specimen of the *Almiqui* (*Solenodon cubanus*) from Cuba, the largest known American Insectivore.

Ninety-Eighth Meeting, October 30, 1886.

The President in the chair, and ten members present.

Prof. Theodore Gill presented a communication on Tæniosomous Fishes.†

* 1887. Popular Science Monthly, xxx, pp. 409, 410, January.

† The Characteristics and Relations of the Ribbon-fishes. <Am. Nat., v. 21, p. 86, Jan., '87.

Dr. H. G. Beyer, U. S. N., called attention to an alleged method of instructing the memory, which is being widely advertised.

Ninety-Ninth Meeting, November 13, 1886.

The President in the chair, and twenty-two persons present.

The following amendment to the Constitution, on motion of Mr. Dall, was unanimously adopted: "No person shall be considered a member of the Society until he shall have signified to the Secretary, in writing, his acceptance of election, and shall have paid his entrance fee and annual dues for the year in which he shall have been elected."

Dr. Filip Trybom, Inspector of Fisheries, of Sweden, read a paper On the Recent Progress of Zoölogy in Sweden.*

Prof. J. W. Chickering, Jr., under the title. Travels in Alaska, gave a graphic description of the coast scenery of British Columbia and southeastern Alaska, as seen from the deck of a passenger steamer.

Mr. William H. Dall presented some Historical Notes on the Department of Mollusks of the National Museum.†

One Hundredth Meeting, November 27, 1886.

The President in the chair, and twenty-five persons present.

Prof. W. H. Seaman presented a communication entitled Notes on Marsilia quadrifolia, illustrating his remarks with stereopticon views, and herbarium and microscopical specimens. Prof. Ward referred to the paleontological history of the order containing the *Marsilia*.

Prof. L. F. Ward spoke upon The Autumnal Hues of the Columbian Flora, which he thought were much brighter and finer than farther north. This paper gave rise to a long discussion, in which Prof. Riley, Dr. Merriam, Mr. Mann, and Mr. Goode participated.

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* 1887. Trybom, Filip. *The Present Condition of the Natural Sciences in Sweden.* < Amer. Nat., xxi, pp. 409–415, May.

† Annual Rept. U. S. Nat. Mus. for 1886.

Dr. C. Hart Merriam described A New Species of Bat, Vespertilio ciliolabrum, from the Western States.*

One Hundred and First Meeting, December 11, 1886.

The President in the chair, and twenty-three persons present.

The following papers were read:

Dr. Theobald Smith, Parasitic Bacteria and Their Relation to Saprophytes.

Mr. F. A. Lucas, On the Osteology of the Spotted Tinamou, Nothura maculosa.†

Mr. C. D. Walcott, Crustacean Tracks Found on Strata of Upper Cambrian (Potsdam) Age.

Dr. Frank Baker, The Foramen of Magendie.‡

Dr. C. Hart Merriam, Description of a New Sub-species of Pocket Gopher, from the Colorado Desert of Southern California.§

One Hundred and Second Meeting, January 8, 1887.

(Seventh Annual Meeting.)

The President in the chair, and twenty-one members present.

The annual reports of the Secretary and Treasurer were read and accepted.

The following board of officers was elected for the ensuing year:

President—Mr. William H. Dall.

Vice-Presidents—Prof. Lester F. Ward, Dr. Frank Baker, Mr. C. D. Walcott, Dr. C. Hart Merriam.

Secretaries—Mr. Richard Rathbun, Mr. Frederic A. Lucas.

Treasurer—Mr. F. H. Knowlton.

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* 1886. These Proceedings, iv, pp. 1–4 (Extras issued Dec. 17, 1886).

† 1886. Proc. U. S. Nat. Mus., p. 157.

‡ Embodied in the article, "Meninges," Wood's Reference Hand-book of Medical Sciences, vol. viii.

§ Science, Dec. 24, 1886, 588.

Additional Members of the Council—Dr. T. H. Bean, Dr. George Vasey, Prof. O. T. Mason. Dr. H. G. Beyer, Prof. R. E. C. Stearns.

ONE HUNDRED AND THIRD MEETING, January 22, 1887.

(Seventh Anniversary Meeting.)

The President, Mr. Dall, occupied the chair, and about seventy-five persons were present, including invited guests.

The retiring President, Mr. G. Brown Goode, delivered an address, entitled, THE BEGINNINGS OF NATURAL HISTORY IN AMERICA—THE THIRD CENTURY.*

ONE HUNDRED AND FOURTH MEETING, February 5, 1887.

The President occupied the chair, and thirty-five persons were present, including Mr. Alfred Russel Wallace, of England.

Mr. William T. Hornaday read a paper entitled THE LAST OF THE BUFFALO, in which he described the rapid destruction of this species, and narrated his recent experiences in obtaining specimens for the National Museum.

Prof. Cope, Dr Merriam, and Mr. Fernow made remarks upon the same subject.

Mr. Richard Rathbun exhibited a series of temperature charts prepared by the U. S. Fish Commission to illustrate the surface water temperatures of the Atlantic sea coast of the United States, in connection with the migrations of fishes.†

Mr. Dall spoke upon the value of temperature observations in studying the distribution of marine animals.

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* These Proceedings, pp. 9-94. Extras printed with cover and title page.

† 1887. RATHBUN, RICHARD. *Ocean Temperatures of the Eastern Coast of the United States, from observations made at twenty-four light-houses and light-ships.* <U. S. Commission of Fish and Fisheries. * * * The Fisheries and Fishery Industries of the United States. * * * By George Brown Goode * * * and a Staff of Associates, Section iii, pp. 155–176, 32 folding plates, quarto.

Dr. C. Hart Merriam described A New Species of Wood Rat, Neotoma Bryanti, from Cerros Island, off Lower California.*

Mr. Leonhard Stejneger exhibited specimens of several New Species of Birds from the Sandwich Islands,† and made remarks upon the avifauna of that region.

Mr. Eaduard Muybridge, of Philadelphia, by invitation, exhibited a series of his photographic views of animals in motion, and explained the process of taking them. The assistance of these views in explaining some obscure points in the evolution of vertebrates was pointed out by Prof. Cope.

One Hundred and Fifth Meeting, February 19, 1887.

Prof. Ward, Vice-President, in the chair, and twenty-two persons present.

The presiding officer announced that an invitation had been received from the Cosmos Club to use its new hall for the future meetings of the Society. It was accepted.

Prof. E. D. Cope described A New Species of Snake, from the District of Columbia, closely related to the common Water Snake, *Tropidonotus sipedon*, which he proposes to call *T. bisectus*.‡ He also spoke upon The Hyoid Apparatus in the Urodele Batrachians.

Dr. George Vasey made some remarks upon A Recent Collection of Mexican Grasses, obtained by Dr. E. Palmer, and exhibited specimens of the rarer species.

Prof. R. E. C. Stearns read a paper on The Asclepiad Plant, Araujia albans,§ and explained the mechanism of its blossoms in capturing Lepidoptera. This subject was further discussed by Prof. Riley, Mr. Smith, Prof. Ward, Dr. Baker, and Prof. Cope.

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* 1887. Amer. Nat., xxi, No. 2, pp. 191–193.

† 1887. Stejneger, Leonhard. *Birds of Kauai Island, Hawaiian Archipelago, collected by Mr. Valdemar Knudsen, with descriptions of new species.* <Proc. U. S. Nat. Mus., x, pp. 75–102.

‡ 1887. Proc. U. S. Nat. Mus., x, p. 146.

§ 1887. Stearns, R. E. C. *Araujia albens as a moth trap.* <Am. Nat., xxi, pp. 501–507.

ONE HUNDRED AND SIXTH MEETING, March 5, 1887.

Prof. Ward, Vice-President, in the chair, and twenty-eight persons present.

Mr. P. L. Jouy presented a communication entitled COREA; THE COUNTRY AND THE PEOPLE, and exhibited a large series of native implements and utensils, and also many photographs.

Dr. Frank Baker described SOME UNUSUAL MUSCULAR VARIATIONS IN THE HUMAN BODY,* which had recently come under his notice, illustrating his remarks with the aid of diagrams and prepared specimens.

Dr. C. Hart Merriam exhibited and described A NEW SPECIES OF WOOD MOUSE, EVOTOMYS CANADENSIS, recently received from the mountains of North Carolina.

Dr. H. G. Beyer made some remarks upon THE PRESERVATION OF BOTTLED MUSEUM SPECIMENS, especially in the line of Materia Medica.

ONE HUNDRED AND SEVENTH MEETING, March 19, 1887.

Prof. Ward, Vice-President, in the chair, and twenty-two persons present.

Mr. L. O. Howard read a paper entitled A ROCK CREEK PHILANTHROPIST,† the philanthropist being the larva of a species of *Hydropsyche*, which preys upon the abundant larvæ of the black fly (*Simulium venustum*).

Mr. Charles Hallock described THE TRANS-CONTINENTAL RANGE OF THE MOOSE, ALCES MACHLIS, IN NORTH AMERICA.‡

Dr. T. H. Bean compared AMERICAN AND EUROPEAN WORK IN DEEP SEA ICHTHYOLOGY, much to the credit of the former country.

Mr. F. A. Lucas noted THE OCCURRENCE OF NOCTURNAL LEPIDOPTERA AT SEA, mentioning some twelve or thirteen species which had been found distant from land.§

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* Published in the New York Medical Record, December 31, 1887, vol. xxxii, No. 27, under the title, "Some Unusual Muscular Anomalies."

† 1886. Published in part in Annual Rept., Dept. of Agriculture, 1886, p. 510.

‡ 1887. American Field, xxvii, 15, 344, April 9.

§ Science, April 8, 1887.

Capt. J. W. Collins, under the title SOME NOVEL FACTS IN THE NATURAL HISTORY OF THE CODFISH, described certain curious variations in the species, and exhibited several articles found in the stomachs or imbedded in the flesh. The most peculiar of these was a small hand-made knife of curious workmanship.

Dr. C. Hart Merriam described A NEW SPECIES OF MOUSE FROM NEW MEXICO (HESPEROMYS ANTHONYI).*

ONE HUNDRED AND EIGHTH MEETING, April 2, 1887.

The Society met for the first time in the Assembly Hall of the Cosmos Club. The President occupied the chair, and thirty persons were present.

Dr. Theobald Smith described the QUANTITATIVE VARIATIONS IN THE GERM LIFE OF POTOMAC WATER DURING 1886.

Dr. Edward Eggleston made an interesting communication, in the form of queries, addressed to the members of the Society, respecting CERTAIN PLANTS AND ANIMALS KNOWN TO THE FIRST COLONISTS OF NORTH AMERICA. Many replies were obtained.

Prof. O. T. Mason exhibited and described a large series of REPRESENTATIONS OF ANIMAL LIFE IN ESKIMO ART.

Mr. F. W. True gave an account of THE BLACKFISH OF OUR SOUTHERN WATERS.

ONE HUNDRED AND NINTH MEETING, April 16, 1887.

The President in the chair, and forty-one persons present.

Mr. W. H. Dall described some RECENT GEOLOGICAL EXPLORATIONS IN SOUTHWESTERN FLORIDA,† made by himself. The observations were discussed by Mr. G. K. Gilbert and Dr. T. Sterry Hunt.

Dr. H. G. Beyer spoke upon THE ACTION OF CAFFEINE UPON THE KIDNEYS.

* 1887. These Proceedings, iv, pp. 5–8. (Extras issued April 15, 1887.)

† 1887. DALL, WILLIAM H. *Notes on the Geology of Florida.* <Amer. Jour. Sci., xxxiv, pp. 162–170.

Dr. C. Hart Merriam read a paper detailing the RAVAGES OF THE BOBOLINK IN THE RICE FIELDS OF THE SOUTH.*

ONE HUNDRED AND TENTH MEETING. April 30, 1887.

The President in the chair, and thirty-eight persons present.

Dr. J. H. Kidder exhibited a rounded concretion-like mass taken from the stomach of a codfish; and also several rounded grass balls from a small salt pond near Pyramid Lake, Nevada, and explained their composition. These gave rise to much discussion, and Mr. McGee, who had collected the grass balls, described the manner of their formation.

Mr. F. A. Lucas spoke upon THE OS PROMINENS IN BIRDS.

Mr. W. T. Hornaday read a paper entitled CIVILIZATION AS AN EXTERMINATOR OF SAVAGE RACES, which led to some remarks by Prof. Ward and Mr. Dall.

Mr. W. H. Dall called attention to A GENUS OF BIVALVE MOLLUSKS NEW TO NORTH AMERICA. The genus is *Cyrenella*.†

ONE HUNDRED AND ELEVENTH MEETING, May 14, 1887.

The President in the chair, and forty-two persons present.

Prof. C. V. Riley presented some BIOLOGICAL NOTES ON SOUTHERN CALIFORNIA, suggested by a recent trip to that region. Remarks were made by Dr. Vasey, Dr. Merriam, Prof. Stearns, and Mr. Dall.

Mr. P. L. Jouy exhibited specimens of A BIRD NEW TO JAPAN, PITTA OREAS OF SWINHOE, from the island of Tsushima.

Mr. F. H. Knowlton made a communication on THE RECENT SHOWER OF POLLEN IN WASHINGTON, the so-called "sulphur shower." The distance which pollen may be carried by the winds gave rise to remarks by Dr. Vasey, Prof. Riley, and Prof. Ward.

* 1887. Published in part in Annual Rept. Dept. of Agriculture for 1886, pp. 246–250.

† 1887. Amer. Jour. Sci., xxxiv, p. 170.

The question, "Does the Flying Fish Fly?" was discussed by Mr. W. B. Barrows, Engineer G. W. Baird, U. S. N., Mr. Lucas, Mr. Goode, Mr. Hallock, Mr. Dall, and Prof. Riley.

One Hundred and Twelfth Meeting, May 28, 1887.

The President in the chair, and twenty-one persons present.

Prof. R. E. C. Stearns read a paper entitled The Protective Devices in the "Carrier Shell," Xenophora, and exhibited specimens of several species.

Mr. R. T. Hill explained The True Geological Horizon of some hitherto Unplaced Faunas, with special reference to the Cretaceous of Texas. Mr. McGee made some remarks on Mr. Hill's paper.

Mr. G. Brown Goode exhibited a series of Japanese Chromo-Lithographs of Fishes, recently published. Mr. Baba, of Japan, spoke upon Japanese methods of delineation, and the subject was further discussed by Prof. Gill, Prof. Riley, Mr. Dall, Mr. Stejneger, and Prof. Seaman.

One Hundred and Thirteenth Meeting, October 22, 1887.

The President in the chair, and forty persons present.

The President announced the death, during the summer recess, of Prof. Spencer F. Baird, the only honorary member of the Society, and of Dr. Charles Rau, one of its most distinguished active members.

Mr. L. O. Howard described An Ant-Decapitating Parasite, the larva of a species of Diptera, probably belonging to the family *Conopidæ*, from New Hampshire.

Dr. George Vasey presented some Notes on Western Grasses.

Mr. F. A. Lucas read a paper entitled The Bird Rocks of the Gulf of Saint Lawrence in 1887.* These rocks are situated in the Gulf of St. Lawrence, and were visited, during the

* 1888. The Auk, April.

summer of 1887, by Mr. Lucas with the Fish Commission schooner *Grampus*.

Mr. A. A. Crozier, under the title, Some Botanical Terms, referred to the ambiguity attending the use of the words "sinistrorse" and "dextrorse," as applied to twining plants.

Dr. C. Hart Merriam gave an account of the Fauna and Flora of the Great Smoky Mountains in North Carolina and Tennessee.

One Hundred and Fourteenth Meeting, November 5, 1887.

The President in the chair, and thirty-six persons present.

Mr. John B. Smith read a paper on Some Geographical Variations of Insects, with special reference to local variations in Lepidoptera and Coleoptera.

Dr. T. H. Bean presented a communication respecting The Young Forms of Some of Our Food Fishes, and exhibited alcoholic specimens of the same.

Mr. N. P. Scudder explained The Period of Gestation in the Common Caged White Mouse.

Mr. H. E. Van Diemen exhibited specimens of the fruit and colored drawings of the foliage, flowers, and fruit of The Japanese Persimmon, Diospyros kaki.

Prof. Theodore Gill described the characteristics of The Fish Fauna of the South Temperate or Notalian Realm.

One Hundred and Fifteenth Meeting, Nov. 19, 1887.

Prof. Ward, Vice-President, in the chair, and thirty-two persons present.

Col. Marshall McDonald presented an Explanation of Past Failures in the Culture of the Salmonidæ.

Mr. Walter B. Barrows read a paper entitled Freshet Notes on the Rio Uruguay, South America.

Dr. T. H. Bean described A New Species of Thyrsitops

FROM THE NEW ENGLAND FISHING BANKS,* with the aid of photographs and a life-size crayon sketch.

Mr. F. W. True gave a review of some of the more important works on Cetaceans published since 1886.

Mr. F. A. Lucas read a paper entitled AN ALCINE CEMETERY, being the resting-place of the Great Auk on Funk Island, off Newfoundland.

Mr. H. E. Van Diemen called attention to a cluster of the fruit of the date palm, *Phœnix dactylifera*, from New Orleans, which he had placed upon the table for examination.

ONE HUNDRED AND SIXTEENTH MEETING, December 3, 1887.

The President in the chair, and thirty-nine persons present.

Mr. Charles Hallock read a paper descriptive of THE GREAT ROSEAU SWAMP of northwestern Minnesota.

A communication from Dr. C. A. White, on THE RAPID DISAPPEARANCE OF THE SHED ANTLERS OF THE CERVIDÆ, was read by the Secretary.

Dr. Theobald Smith made a few remarks upon PEPTONIZING FERMENTS AMONG BACTERIA.

Mr. C. D. Walcott exhibited A FOSSIL LINGULA PRESERVING THE CAST OF THE PEDUNCLE, from the Hudson Terrane, near Rome, N. Y.

Prof. Theodore Gill discussed THE PHYLOGENY OF THE CETACEA.

ONE HUNDRED AND SEVENTEENTH MEETING, Dec. 17, 1887.

Dr. C. Hart Merriam, Vice-President, in the chair, and twenty-three persons present.

Mr. C. L. Hopkins read a paper entitled NOTES RÉLATIVE TO THE SENSE OF SMELL IN THE TURKEY BUZZARD.

Dr. Cooper Curtice described some recent observations respecting THE TIMBER LINE OF PIKE'S PEAK.

* Proc. U. S. Nat. Mus., x (in course of publication).

Mr. C. D. Walcott exhibited a SECTION OF A FOSSIL ENDOCERAS OVER EIGHT FEET IN LENGTH, and explained its structure and relations to other shell-bearing Cephalopoda, both fossil and recent.

Mr. Leonhard Stejneger read a paper entitled HOW THE GREAT NORTHERN SEA COW, RHYTINA, BECAME EXTERMINATED.*

ONE HUNDRED AND EIGHTEENTH MEETING, Dec. 31, 1887.

The President occupied the chair, and sixteen persons were present.

Mr. W. J. McGee spoke upon THE OVER-LAPPING HABITATS OF STURNELLA MAGNA AND STURNELLA NEGLECTA, IN IOWA.

Dr. C. Hart Merriam exhibited and described A NEW SPECIES OF FIELD MOUSE, ARVICOLA (CHILOTUS) PALLIDUS, FROM THE BAD-LANDS OF NORTHWESTERN DAKOTA.

Mr. W. B. Barrows described THE SHAPE OF THE BILL IN SNAIL-EATING BIRDS, with special reference to the Kite, *Rostrhamus sociabilis*, and the "crying" birds, *Aramus*.

A paper by Mr. H. Justin Roddy, on the FEEDING HABITS OF SOME YOUNG RAPTORES, was read by Mr. Lucas.

ONE HUNDRED AND NINETEENTH MEETING, Jan. 14, 1888.

(Eighth Annual Meeting).

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

The annual reports of the Secretary and Treasurer were read and accepted.

The following board of officers was elected for the ensuing year:

President—Mr. William H. Dall.

Vice-Presidents—Dr. C. Hart Merriam, Prof. L. F. Ward, Prof. C. V. Riley, Mr. Richard Rathbun.

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* 1887. American Naturalist, xxi, pp. 1047–1054, December.

Secretaries—Mr. J. B. Smith, Mr. F. A. Lucas.

Treasurer—Mr. F. H. Knowlton.

Additional Members of the Council—Dr. T. H. Bean, Dr. J. H. Kidder, Prof. R. E. C. Stearns, Mr. F. W. True, Dr. George Vasey.

The President announced the following Committee on Saturday Lectures: Prof. G. Brown Goode, Chairman; Dr. Frank Baker, Mr. G. K. Gilbert, Dr. C. Hart Merriam, Prof. C. V. Riley.

ONE HUNDRED AND TWENTIETH MEETING, Jan. 28, 1888.

(Eighth Anniversary Meeting).

The eighth anniversary meeting of the Society was held in the lecture hall of Columbian University, on the evening of January 28, about seventy-five persons being present.

The President, Mr. William H. Dall, delivered an address, entitled, SOME AMERICAN CONCHOLOGISTS.*

SATURDAY LECTURES, 1886.

The fifth course of Saturday Lectures under the auspices of the Biological Society and the Anthropological Society was begun March 6, 1886. The lectures were delivered in the lecture room of the National Museum, and the following programme was carried out:

March 6: Mr. WILLIAM HALLOCK. The Geysers of the Yellowstone.

March 12: Prof. WILLIAM HARKNESS. How the Solar System is measured.

March 20: Prof. T. C. MENDENHALL. The Nature of Sound.

March 27: Prof. F. W. CLARKE. The Chemistry of Coal.

April 3: Dr. C. HART MERRIAM. The Migration of Birds.

April 10: Dr. WASHINGTON MATTHEWS. The Gods of the Navajos.

April 16: Dr. D. B. SIMMONS. Social Status of the Women of Japan.

April 24: Prof. W. K. BROOKES. Life.

May 1: Prof. LESTER F. WARD. Heredity and Opportunity.

May 8: Dr. JOHN S. BILLINGS. Animal Heat.

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* These Proceedings, pp. 95–134. Extras printed with title page and cover.

SATURDAY LECTURES, 1887.

The sixth course of Saturday Lectures was begun March 12, 1887, under the auspices of the Biological, Philosophical, and Anthropological Societies. The lectures were delivered in the lecture hall of the National Museum, eight being given on Saturday afternoons, and four on Wednesday evenings with the aid of the stereopticon. The programme was as follows:

March 12: Gen. A. W. Greely, U. S. A. Animals of the Arctic Region.
March 19: Capt. C. E. Dutton, U. S. A. Earthquakes.
March 23: Mr. W. J. McGee. The Charleston Earthquake. (Evening lecture.)
March 26: Prof. Otis T. Mason. The Natural History of Human Arts.
April 2: Dr. B. E. Fernow. Our Forestry Problem.
April 6: Mr. Thomas Wilson. Pre-historic Man in Europe. (Evening lecture.)
April 16: Dr. Edward M. Hartwell. The Aims and Effects of Physical Training.
April 20: Dr. Frank Baker. Facial Expression. (Evening lecture.)
April 23: Miss H. C. DeS. Abbott. The Chemistry of the Higher and Lower Plants.
April 30: Prof. Harrison Allen. Rights and Lefts.
May 4: Prof. S. P. Langley. Sunlight and the Earth's Atmosphere. (Evening lecture.)
May 7: Dr. J. H. Bryan. The Mechanism of the Human Voice.

BAIRD MEMORIAL MEETING.

January 11, 1888, a meeting commemorative of the life and scientific work of Prof. Spencer Fullerton Baird was held in the lecture hall of the Columbian University, under the joint auspices of the Anthropological, Biological, and Philosophical Societies of Washington. A very large number of persons was in attendance. Mr. Garrick Mallery, President of the Philosophical Society, presided, and the following addresses were delivered:

Relations between Professor Baird and the Participating Societies, by Mr. Garrick Mallery.

Professor Baird as Administrator, by Mr. William B. Taylor, of the Smithsonian Institution.

PROFESSOR BAIRD IN SCIENCE, by Mr. William H. Dall, President of the Biological Society.

THE PERSONAL CHARACTERISTICS OF PROFESSOR BAIRD, by Mr. J. W. Powell, President of the Anthropological Society.*

BOTANICAL SECTION.

A preliminary meeting of persons interested in Botany took place November 21, 1887, in the office of the Botanist of the Department of Agriculture. A second meeting was held December 5, at which a Botanical Section of the Biological Society was formally organized. Dr. George Vasey was elected President, and Mr. A. A. Crozier, Secretary. The first regular meeting was held January 4, 1888, when the following papers were read:

1. RECENT PROGRESS IN THE STUDY OF FRESH-WATER ALGÆ, Prof. E. A. Burgess.

2. A CASE OF SEWER OBSTRUCTION BY TREE ROOTS, Prof. F. H. Knowlton.

3. FUNGI OF THE ARID REGIONS, Prof. S. M. Tracy.

4. GLŒOSPORIUM OF THE WAX BEAN, Miss E. A. Southworth.

The Section is to meet monthly.

* These addresses, together with a portrait of Professor Baird, have been printed in the Bulletin of the Philosophical Society, vol. x, pp. 41–77, 1888. Also separately issued with independent pagination.

DESCRIPTION OF A NEW SPECIES OF BAT FROM THE WESTERN UNITED STATES.

(*Vespertilio ciliolabrum* sp. nov.)

By Dr. C. Hart Merriam.

(Read November 27, 1886.)

Specimens of a small and apparently hitherto undescribed species of bat have reached me from two widely separated localities in the Western United States. The first were collected by Mr. A. B. Baker in Trego County, Kansas; the second by Mr. A. W. Anthony in Grant County, in the extreme southwestern corner of New Mexico.

Mr. Baker writes me that "the first two of these bats were found in bluffs or cañons near the town of Banner, and were hidden away in clefts in the chalk rock. The others were captured at a bluff several miles distant. They had secreted themselves in abandoned swallows' nests which were inaccessible; but the bats were easily dislodged by means of stones. They were followed to their various places of refuge, and seven were secured."

These bats belong to the group of American *Vespertilios*, of which *V. nitidus* may be considered fairly typical. They differ from *V. nitidus*, however, in size, proportions, and color, as well as in the much larger size of the ear.

The Kansas specimens vary in color from nearly pure white to pale yellowish-brown, or even isabella-brown, while those from New Mexico are tawny-isabella above and much paler underneath.

The following characters will serve to distinguish the species from its allies:

VESPERTILIO CILIOLABRUM* sp. nov.
(Type No. 2797 female ad., Merriam Collection).

Dental formula: i. $\frac{2-2}{6}$, c. $\frac{1-1}{1-1}$, pm. $\frac{3-3}{3-3}$, m. $\frac{3-3}{3-3}$ = $\frac{18}{20}$ = 38.

The outer upper incisor of each side slopes forward and inward parallel to the inner, contrary to the rule in the genus *Vespertilio*, in which these teeth usually are divergent; cusp of inner upper incisor bifid, the anterior point being larger. First upper premolar small and crowded against (and usually somewhat internal to) the canine; second upper premolar minute and wholly internal to the tooth-row so that it is not visible from the outside except in immature individuals; third premolar very large, nearly or quite equal to canine. Middle lower premolar smallest; posterior largest.

Sides of upper lip fimbriate. Glandular prominences between eyes and nostrils moderately developed. Tip of ear laid forward extends to end of muzzle.

The calcaneum reaches about half-way from the foot to the tip of the tail; the postcalcaneal lobule is large for a *Vespertilio;* the calcaneum ends in a projecting tooth or lobule.

The form of the ear is somewhat intermediate between that of *V. nitidus* and that of *V. nigricans:* Internal basal lobe slightly rounded; middle three-fourths of anterior margin strongly convex; tip shortly rounded off, forming a small, projecting lobe posteriorly, beneath which the outer border is sharply emarginated for about one-third of its entire length; bottom of emargination straight or slightly convex; below this

*The specific name *ciliolabrum* refers to the fringe of hairs along the sides of the upper lip.

the outer margin becomes abruptly convex and then nearly straight, with a distinct reflexed lobe near its base. Tragus attenuated above; inner margin straight or slightly convex; outer margin slightly concave in upper half, then slightly convex, with a distinct lobule at the base, which is separated by a notch from the convexity above.

Thumb very small, considerably shorter than the foot. Foot small. Wings from base of toes. Upper surface of wing-membranes haired from about the middle of the humerus to the knee: basal third of upper surface of interfemoral membrane covered with hair; on under surface of interfemoral the hair is arranged in little tufts along transverse lines, about thirteen in number. Half of last vertebra of tail free.

Fur long and soft; basal portion dusky; apical portion varying from whitish or yellowish-white to isabella-brown (tawny-isabella in the New Mexico specimens), which in some individuals is nearly as dark as in *V. subulatus;* the colored apical portion varies in extent from less than one-third to more than one-half the length of the hairs.

Measurements from alcoholic specimens.—Male adult (No. 2794 Merriam Collection): Head and body, 42 mm.; head, 16.25 mm.; tail, 37 mm.; ear, from inner basal angle, 15 mm.; tragus, 6.75 mm.; humerus, 22 mm.; forearm, 32.50 mm.; thumb, 3.75 mm.; third finger, 56 mm.; fifth finger, 44 mm.; tibia, 11.25 mm.; hind foot, 7 mm.

Female adult (type, No. 2797 Merriam Collection): Head and body, 43 mm.; head, 16.25 mm.; tail, 40 mm.; ear, from inner basal angle, 15 mm.; tragus, 6.75 mm.; humerus, 22 mm.; forearm, 33 mm.; thumb, 3.50 mm.; third finger, 56 mm.; fifth finger, 45.50 mm.; tibia, 11.50 mm.; hind foot, 7.50 mm.

Measurements of nine alcoholic specimens of Vespertilio ciliolabrum.

(All measurements are in millimetres).

No., Mus. C. H. M.	Locality.	Sex.	Head and body.	Tail.	Head.	Ear from internal basal angle.	Tragus from inner base.	Humerus.	Forearm.	Thumb.	3d finger.	5th finger.	Tibia.	Hind foot.	Collector.	Date.
2792	Trego Co., Kan.	♂ ad.	42.	35.	16.50	15.	6.75	22.50	33.	3.75	56.	44.	11.50	7.	A. B. Baker	August, 1885
2793	"	♂	42.	39.	16.	15.	6.	21.50	32.50	3.50	52.50	41.50	11.25	6.	"	" "
2794	"	♂	42.	37.	16.25	15.	6.75	22.	32.50	3.75	56.	44.	11.25	7.	"	" "
2795	"	♀	43.50	40.	16.50	15.	6.50	22.50	33.	3.25	56.	44.50	11.50	7.25	"	" "
2796	"	♀	43.50	42.	16.50	15.50	6.75	22.50	33.	3.50	57.	44.50	11.50	7.	"	" "
2797	"	♀	43.	40.	16.25	15.	6.75	22.	33.	3.50	56.	45.50	11.50	7.50	"	" "
2798	"	♀	42.	39.	16.	15.	6.25	21.50	32.	3.25	54.50	42.	11.50	6.50	"	" "
2786	Grant Co., N. M.	♀ ad.	41.	38.	16.	14.50	6.50	21.	33.	3.50	55.	43.50	11.50	6.50	A. W. Anthony	Aug. 25, 1886
2787	"	♂ im.	.....	41.	15.	14.50	6.	20.	32.	3.	56.	42.	11.	7.	"	April 6, "

DESCRIPTION OF A NEW MOUSE FROM NEW MEXICO.

Hesperomys (*Vesperimus*) *Anthonyi* sp. nov.

By Dr. C. Hart Merriam.

(Read March 19, 1887).

During the spring and summer of 1886, Mr. A. W. Anthony, of Denver, Colorado, made his headquarters at Camp Apache, Grant county, New Mexico (about lat. 31° 20′). Camp Apache is in a hot desert region in the extreme southwestern corner of the Territory, and only about four miles from the Mexican boundary.

The following extract from one of Mr. Anthony's letters sufficiently describes the region. He writes: "You can form some idea of my location when I tell you that our nearest water is a very small spring nine miles across the valley, from which all our water is carried in wagons. The only trees within forty miles are a few very small stunted cedars and oaks. The only other vegetation consists of cacti and other plants characteristic of these hot dry deserts."

While in this region Mr. Anthony made a valuable collection of mammals, which he has very kindly presented to me. Among other things of interest it contains five specimens of a pretty little mouse, hitherto unknown in the United States, which I believe to be undescribed, and which, therefore, I take pleasure in dedicating to its discoverer. In coloration, proportions, and cranial characters this mouse differs so rad-

ically from all previously known species, that comparison with others is unnecessary. Unfortunately, nothing is known of its habits. It may be distinguished from its congeners by the following diagnosis:

HESPEROMYS (VESPERIMUS) ANTHONYI sp. nov.

Type No $\frac{2333}{2841}$, male ad., Merriam Collection.

Size, small; tail considerably longer than head and body; ears large and scant haired; whiskers long, reaching past shoulders. Soles naked, 6 tuberculate; palms 5 tuberculate; thumb armed with a blunt nail.

Color.—Upper parts from nose to tail, uniform clear ash-gray, more or less darkened by black-tipped hairs; sides bright buffy-fulvous; under parts white, the plumbeous basal portion of the hairs showing through on the chin and throat, which are thinly clothed with rather short hairs; belly strongly washed with salmon, which may be due to earth-staining. Pelage soft. The fur covering the breast, abdomen, and flanks is very much more dense than that of the rest of the body, from which it may be distinguished at a glance. In fact, on the sides it forms well-marked flank patches or tufts. Possibly this character may be seasonal; if not, it is very remarkable. In the young the belly is pure white, and the buffy-fulvous flank patches are not apparent.

The material at hand consists of five skins and skulls, collected in April and May. All are males. Nos. 2332 and 2335 are immature, though the latter is full grown. The skins were prepared with unusual care, and consequently afford measurements of approximate accuracy. Moreover, Mr. Anthony recorded the total length of each before skinning.

Table of Measurements of five Specimens of Hesperomys Anthonyi *collected at Camp Apache, Grant County, New Mexico, by A. W. Anthony.*

(*Measurements in millimeters*).

Skin No.	Skull No.	Sex and Age.	Measured in the Flesh.*	Measured from the dry skin.						
			Total length.	Total length.	Head and body.	Tail, to end of		Hind foot.	Height of Ear from crown.	Date.
						Vertebræ.	Hairs.			
2149	2675	♂ ad	165	144	63	80	81 5	18.5	12.	Apr. 12, 1886.
2332	2840	♂ im	162	145	62	82	83.5	18.5	11.	" 5, "
2333	2841	♂ ad	168	145	63	81	82.5	19.5	12.	May 10, "
2334	2842	♂ ad	165	150	66	83	85.	19.5	12.	" " "
2335	2843	♂ im.	162	139	64	74	75.	19.	10.	" " "

Cranial Characters.—The skull, compared with that of *H. leucopus*, is short, broad, and flat. The incisor foramina reach past the anterior plane of the first molar. The nasals are short and do not extend so far posteriorly as the premaxillaries.

Excluding skull No. 2840, which is not full grown, the close agreement in cranial measurements is remarkable.

Cranial Measurements.

	No. 2840	No. 2841	No. 2842	No. 2843
	♂ im.	♂ ad.	♂ ad.	♂
Basilar length (from one of the occipital condyles to posterior edge of alveola of incisor of same side)	18.9	20.	20.3	20.4
Basilar length of Hensel (from inferior lip of foramen magnum to posterior edge of alveola of incisor)	16.5	18.	18.	18.
Greatest zygomatic breadth	12.4	12.8	12.7	12.1
Interorbital constriction	3.8	3.9	3.7	3.7
Greatest length of nasal bones	7.4	7.8	8.5	8.3
Length of upper molar series	3.6	3.8	3.8	3.8
Incisor to molar	5.4	5.6	5.6	5.7
" " post-palatal notch	8.8	9.5	9.5	9.5
Distance between alveolæ of upper molar series anteriorly	2.5	2.5	2. 5	2.5
" " " " " " " posteriorly	2.5	2.5	2.5	2.5
Foramen magnum to post-palatal notch	7.4	8.	8.	8.2
Height of cranium from inferior lip of foramen magnum	6.8	7.3	7.	7.
Fronto-palatal depth (taken at middle of molar series)	5.8	6.2	6.	5.8
Length of mandible	12.6	12.9	12.9	13.2
Length of under molariform series	3.7	3.8	3.8	4.

* The apparent discrepancy between the total length as recorded by Mr. Anthony and that taken from the dry skin is due to the necessary stretching of the fresh specimens for measurement.

THE BEGINNINGS OF AMERICAN SCIENCE.*

THE THIRD CENTURY.

By G. Brown Goode.

VIII.

In the address which it was my privilege, one year ago, to read in the presence of this Society, I attempted to trace the progress of scientific activity in America from the time of the first settlement by the English in 1585 to the end of the Revolution—a period of nearly two hundred years.

Resuming the subject, I shall now take up the consideration of the third century—from 1782 to the present time. For convenience of discussion the time is divided, approximately, into decades, while the decades naturally fall into groups of three. From 1780 to 1810, from 1810 to 1840, from 1840 to 1870, and from 1870 to the close of the century, are periods in the history of American thought, each of which seems to be marked by characteristics of its own. These must have names, and it may not be inappropriate to call the first the period of Jefferson, the second that of Silliman, and the third that of Agassiz.

The first was, of course, an extension of the period of Linnæus, the second and third were during the mental supremacy of Cuvier and Von Baer and their schools, and the fourth or present, beginning in 1870, belongs to that of Darwin, the extension of whose influence to America was delayed by the tumults of the civil convulsion which began in 1861 and ended in 1865.

The "beginnings of American science" do not belong entirely

*Annual Presidential Address delivered at the Seventh Anniversary Meeting of the Biological Society of Washington, January 22, 1887, in the Lecture Room of the U. S. National Museum.

to the past. Our science is still in its youth, and in the discussion of its history I shall not hesitate to refer to institutions and to tendencies which are of very recent origin.

It is somewhat unfortunate that the account book of national progress was so thoroughly balanced in the Centennial year. It is true that the movement which resulted in the birth of our Republic first took tangible form in 1776, but the infant nation was not born until 1783, when the treaty of Paris was signed, and lay in swaddling clothes until 1789, when the Constitution was adopted by the thirteen States.

In those days our forefathers had quite enough to do in adapting their lives to the changed conditions of existence. The masses were struggling for securer positions near home, or were pushing out beyond the frontiers to find dwelling-places for themselves and their descendants. The men of education were involved in political discussions as fierce, uncandid, and unphilosophical in spirit as those which preceded the French revolution of the same period.

The master minds were absorbed in political and administrative problems, and had little time for the peaceful pursuits of science, and many of the men who were prominent in science—Franklin, Jefferson, Rush, Mitchill, Seybert, Williamson, Morgan, Clinton, Rittenhouse, Patterson, Williams, Cutler, Maclure, and others—were elected to Congress or called to other positions of official responsibility.

IX.

The literary and scientific activities of the infant nation were for many years chiefly concentrated in Philadelphia, until 1800 the federal capital and largest of American cities. Here, after the return of Franklin from France in 1785, the meetings of the American Philosophical Society were resumed. Franklin continued to be its president until his death in 1790, at the same

time holding the presidency of the commonwealth of Pennsylvania, and a seat in the Constitutional Convention. The prestige of its leader doubtless gave to the Society greater prominence than its scientific objects alone would have secured.

In the reminiscences of Dr. Manasseh Cutler there is to be found an admirable picture of Franklin in 1787. As we read it we are taken back into the very presence of the philosopher and statesman, and can form a very clear appreciation of the scientific atmosphere which surrounded the scientific leaders of the post-Revolutionary period.

Dr. Cutler wrote:

"Dr. Franklin lives on Market street. His house stands up a court at some distance from the street. We found him in his garden sitting upon a grass-plot, under a large mulberry tree, with several gentlemen and two or three ladies. When Mr. Gerry introduced me he rose from his chair, took me by the hand, expressed his joy at seeing me, welcomed me to the city, and begged me to seat myself close by him. His voice was low, his countenance open, frank, and pleasing. I delivered to him my letters. After he had read them he took me again by the hand and, with the usual compliments, introduced me to the other gentlemen, who are, most of them, members of the Convention. Here we entered into a free conversation, and spent the time most agreeably until it was quite dark. The tea-table was spread under the tree, and Mrs. Bache, who is the only daughter of the Doctor and lives with him, served it to the company.

"The Doctor showed me a curiosity which he had just received and with which he was much pleased. It was a snake with two heads, preserved in a large vial. It was about ten inches long, well proportioned, the heads perfect, and united to the body about one-fourth of an inch below the extremities of the jaws. He showed me a drawing of one entirely similar, found near Lake Champlain. He spoke of the situation of this snake if it was travelling among bushes, and one head should choose to go on one side of the stem of a bush and the other head should prefer the other side, and neither head would consent to come back or give way to the other. He was then going to mention a humorous matter that had that day occurred in the Convention in consequence of his comparing the snake to America; for he seemed to forget that everything in the Convention was to be kept a profound secret. But this was suggested to him, and I was deprived of the story.

"After it was dark we went into the house, and he invited me to his library, which is likewise his study. It is a very large chamber and high-studded. The walls are covered with shelves filled with books; beside these, four large alcoves, extending two-thirds the length of the chamber, filled in the same manner. I presume this is the largest and by far the best private library in America. He showed me a glass machine for exhibiting the circulation of the blood in the arteries and veins of the human body. The circulation is exhibited by the passing of a red fluid from a reservoir into numerous capillary tubes of glass, ramified in every direction, and then returning in similar tubes to the reservoir, which was done with great velocity, and without any power acting visibly upon the fluid, and had the appearance of perpetual motion. Another great curiosity was a rolling press for taking copies of letters or other writing. A sheet of paper is completely copied in two minutes, the copy as fair as the original, and without defacing it in the smallest degree. It is an invention of his own, extremely useful in many circumstances of life. He also showed us his long artificial hand and arm for taking down and putting up books on high shelves, out of reach, and his great arm-chair, with rockers and a large fan placed over it, with which he fans himself, while he sits reading, with only a slight motion of the foot, and many other curiosities and inventions, all his own, but of lesser note. Over his mantel he has a prodigious number of medals, busts, and casts in wax or plaster of Paris, which are the effigies of the most noted characters of Europe. But what the Doctor wished especially to show me was a huge volume on botany, which indeed afforded me the greatest pleasure of any one thing in his library. It was a single volume, but so large that it was with great difficulty that he was able to raise it from a low shelf and lift it to the table; but, with that senile ambition which is common to old people (Dr. Franklin was eighty-one), he insisted on doing it himself, and would permit no one to assist him, merely to show how much strength he had remaining. It contained the whole of Linnæus's Systema Vegetabilium, with large cuts colored from nature of every plant. It was a feast to me, and the Doctor seemed to enjoy it as well as myself. We spent a couple of hours examining this volume, while the other gentlemen amused themselves with other matters. The Doctor is not a botanist, but lamented he did not in early life attend to this science. He delights in natural history, and expressed an earnest wish that I should pursue a plan I had begun, and hoped this science, so much neglected in America, would be pursued with as much ardor here as it is now in every part of Europe. I wanted, for three months at least, to have devoted myself entirely to this one volume, but, fearing lest I should become tedious to him, I shut the book, though he urged me to examine it longer.

He seemed extremely fond, through the course of the visit, of dwelling on philosophical subjects, and particularly that of natural history, while the other gentlemen were swallowed up in politics. This was a favorable circumstance to me, for almost all his conversation was addressed to me, and I was highly delighted with the extensive knowledge he appeared to possess of every subject, the brightness of his faculties, the clearness and vivacity of his mental powers, and the strength of his memory, notwithstanding his age. His manners are perfectly easy, and everything about him seems to diffuse an unrestrained freedom and happiness. He has an incessant vein of humor, accompanied with an uncommon vivacity that seems as natural and involuntary as his breathing."

To Franklin, as President of the Philosophical Society, succeeded David Rittenhouse [b. 1732, d. 1796], a man of world-wide reputation, known in his day as "*the* American Philosopher."*

He was an astronomer of repute, and his observatory built at Norriton in preparation for the transit of Venus in 1769 seems to have been the first in America. His orrery, constructed upon an original plan, was one of the wonders of the land. His most important contribution to astronomy was the introduction of the use of spider lines in the focus of transit instruments.†

He was an amateur botanist, and in 1771 made interesting physiological experiments upon the electric eel.‡

He was a Fellow of the Royal Society of London, and the first Director of the United States Mint.

Next in prominence to Franklin and Rittenhouse were doubtless the medical professors, Benjamin Rush, William Shippen, John Morgan, Adam Kuhn, Samuel Powell Griffiths, and Caspar Wistar, all men of scientific tastes, but too busy in public affairs and in medical instruction to engage deeply in research, for Philadelphia, in those days as at present, insisted that all

* See obituary in the *European Magazine*, July, 1796; also Memoirs of Rittenhouse, by WILLIAM BARTON, 1813, and Eulogium by Benjamin Rush, 1796.

† VON ZACH: Monatliche Correspondenz, ii, p. 215.

‡ Phila. Medical Repository, vol. 1.

her naturalists should be medical professors, and the active investigators, outside of medical science, were not numerous. Rush, however, was one of the earliest American writers upon ethnology, and a pathologist of the highest rank. He is generally referred to as the earliest professor of chemistry, having been appointed to the chair of chemistry in the College of Philadelphia in 1769; it seems certain, however, that Dr. John Morgan lectured on chemistry as early as 1765.*

Dr. Shippen [b. 1735, d. 1808], the founder of the first medical school [1765] and its professor of anatomy for forty-three years, was still in his prime, and so was Dr. Morgan [b. 1735, d. 1789], a Fellow of the Royal Society, a co-founder of the medical school, and a frequent contributor to the Philosophical Transactions. Morgan was an eminent pathologist, and is said to have been the one to originate the theory of the formation of pus by the secretory action of the vessels of the part.† He appears to have been the first who attempted to form a museum of anatomy, having learned the methods of preparation from the Hunters and from Süe in Paris. The beginning was still earlier known, for a collection of anatomical models in wax, obtained by Dr. Abraham Chovet in Paris, was in use by Philadelphia medical students before the Revolution.‡

Another of the physicians of colonial days who lived until after the revolution was Dr. Thomas Cadwallader [b. 1707, d. 1779], whose dissections are said to have been among the earliest made in America, and whose "Essay on the West India Dry Gripes," 1775, was one of the earliest medical treatises in America.

Dr. Caspar Wistar [b. 1761, d. 1818] was also a leader,

* BARTON's Memoirs of Rittenhouse, p. 614.

† THACHER. American Medical Biography, i. p. 408.

‡ This eventually became the property of the University. See Barton's Rittenhouse, p. 377. Trans. Amer. Phil. Soc., ii, p. 368.

and was at various times professor of chemistry and anatomy. His contributions to natural history were descriptions of bones of *Megalonyx* and other mammals, a study of the human ethmoid, and experiments on evaporation. He was long Vice-President of the Philosophical Society, and in 1815 succeeded Jefferson in its presidency. The Wistar Anatomical Museum of the University and the beautiful climbing shrub *Wistaria* are among the memorials to his name.*

Still another memorial of the venerable naturalist may perhaps be worthy of mention as an illustration of the social conditions of science in Philadelphia in early days. A traveller visiting the city in 1829 thus described this institution, which was continued until the late war, and then discontinued, but has been resumed within the last year:

"Dr. Wistar in his lifetime had a party of his literary and scientific friends at his house, one evening in each week, and to this party strangers visiting the city were also invited. When he died, the same party was continued, and the members of the Wistar party, in their turn, each have a meeting of the club at his house, on some Saturday night in the year. This club consists of the men most distinguished in science, art, literature, and wealth in the city. It opens at early candle-light, when not only the members themselves appear, but they bring with them all the strangers of distinction in the city."†

The "Wistar parties" were continued up to the beginning of the civil war in 1861, and have been resumed since 1887. A history of these gatherings would cover a period of three-quarters of a century at the least, and could be made a most valuable and entertaining contribution to scientific literature.

Packard, in his History of Zoölogy,‡ states that zoölogy, the world over, has sprung from the study of human anatomy, and

* Hosack: Tribute to the Memory of Wistar, New York, 1818.

† Atwater: Remarks made on a tour to Prairie du Chiēn; thence to Washington City, in 1829. Columbus, 1831, p. 238.

‡ Standard Natural History, pp. lxii–lxxii.

that American zoölogy took its rise, and was fostered chiefly, in Philadelphia, by the professors in the medical schools.

It was fully demonstrated, I think, in my former address, that there were good zoölogists in America long before there were medical schools, and that Philadelphia was *not* the cradle of American natural history; although, during its period of political pre-eminence, immediately after the Revolution, scientific activities of all kinds centred in that city. As for the medical schools it is at least probable that they have spoiled more naturalists than they have fostered.

Dr. Adam Kuhn [b. 1741, d. 1817] was the professor of botany in 1768*—the first in America—and was labeled by his contemporaries "the favorite pupil of Linnæus." Professor Gray, in a recent letter to the writer, refers to this saying as a "myth;" and it surely seems strange that a disciple beloved by the great Swede could have done so little for botany. Barton, in a letter, in 1792, to Thunberg, who then occupied the seat of Linnæus in the University of Upsala, said:

"The electricity of your immortal Linné has hardly been felt in this Ultima Thule of science. Had a number of the pupils of that great man settled in North America its riches would have been better known. But, alas! the only one pupil of your predecessor that has made choice of America as the place of his residence has added nothing to the stock of natural knowledge."†

The Rev. Nicholas Collin, Rector of the Swedish Churches in Pennsylvania, was a fellow-countryman and acquaintance of Linnæus‡ and an accomplished botanist, having been one of the editors of Muhlenberg's work upon the grasses and an early writer on American linguistics. He read before the Philosophical Society, in 1789, "An Essay on those inquiries in

* See p. 99, *ante*.

† B. S. Barton, in Transactions American Philosophical Society, iii, p. 339.

‡ "I often heard the great Linnæus wish that he could have explored the continent of North America." Collin: Trans. Amer. Phil. Soc., iii, p. xv.

Natural Philosophy which at present are most beneficial to the United States of North America," which was the first attempt to lay out a systematic plan for the direction of scientific research in America. One of the most interesting suggestions he made was that the Mammoth was still in existence.

"The vast Mahmot," said he, "is perhaps yet stalking through the western wilderness; but if he is no more let us carefully gather his remains, and even try to find a new skeleton of this giant, to whom the elephant was but a calf." *

Gen. Jonathan Williams, U. S. A. [b. 1750, d. 1815], was first superintendent of the Military Academy at West Point and "father of the corps of engineers." He was a nephew of Franklin, and his secretary of legation in France, and, after his return to Philadelphia, was for many years a judge of the court of common pleas, his military career not beginning till 1801. This versatile man was a leading member of the Philosophical Society and one of its Vice-Presidents. His paper "On the Use of the Thermometer in Navigation" was one of the first American contributions to scientific seamanship.

The Rev. Dr. John Ewing [b. 1732, d. 1802], also a Vice-President, was Provost of the University. He had been one of the observers of the transit in 1769, of which he published an account in the Transactions of the Philosophical Society. He early printed a volume of lectures on Natural Philosophy, and was the strongest champion of John Godfrey, the Philadelphian, in his claim to the invention of the reflecting quadrant.†

* *Id.*, p. xxiv.

† "Thomas Godfrey," says a recent authority, "was born in Bristol, Penn., in 1704, and died in Philadelphia in December, 1749. He followed the trade of a glazier in the metropolis, and, having a fondness for mathematical studies, marked such books as he met with, subsequently acquiring Latin, that he might become familiar with the mathematical work in that language. Having obtained a copy of Newton's 'Principia,' he described an improvement he had made in Davis' quadrant to James Logan,

Dr. James Woodhouse [b. 1770, d. 1809] was author and editor of several chemical text-books and Professor of Chemistry in the University, a position which he took after it had been refused by Priestley. He made experiments and observations on the vegetation of plants, and investigated the chemical and medical properties of the persimmon tree. He it was who first demonstrated the superiority of anthracite to bituminous coal by reason of its intensity and regularity of heating power.*

The Rev. Ebenezer Kinnersley [b. in Gloucester, England, Nov. 30, 1711, d. in Philadelphia, July 4, 1778] survived the Revolution, though, in his latter years, not a contributor to science. The associate of Franklin in "the Philadelphia Experiments" in electricity, his discoveries were famous in Europe as well as in America.† It is claimed that he originated the theory of the positive and negative in electricity; that he first demonstrated the passage of electricity through water; and that he first discovered that heat could be produced by electricity; besides inventing numerous mechanical devices of scientific interest. From 1753 to 1772 he was connected with the University of Pennsylvania, where there may still be seen a window dedicated to his memory.

Having already referred to the history of scientific instruction in America,‡ and shown that Hunter lectured on comparative anatomy in Newport in 1754; Kuhn on Botany, in Philadelphia, in 1768, Waterhouse on natural history and botany, at Cambridge, in 1788; and some unidentified scholars upon chemistry and natural history, in Philadelphia, in 1785, it would seem unjust not to speak of Kinnersley's career as a lecturer.

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who was so impressed that he at once addressed a letter to Edmund Halley in England, giving a full description of the construction and uses of Godfrey's instrument."

* Silliman: American Contributions to Chemistry, p. 13.

† See *Priestley's* History of Electricity.

‡ P. 99, *ante*.

He seems to have been the first to deliver public scientific lectures in America, occupying the platform in Philadelphia, Newport, New York, and Boston, from 1751 to the beginning of the Revolution. The following advertisement was printed in the "Pennsylvania Gazette" for April 11, 1751:

> NOTICE is hereby given to the *Curious* that Wednesday next Mr. Kinnersley proposes to begin a Course of Experiments on the newly-discovered *Electrical Fire*, containing not only the most curious of those that have been made and published in Europe, but a considerable Number of New Ones lately made in this City, to be accompanied with methodical *Lectures* on the Nature and Properties of that Wonderful Element.

Francis Hopkinson [b. 1737, d. 1791], signer of the Declaration of Independence, was treasurer of the Philosophical Society, and among other papers communicated by him was one in 1783, calling attention to the peculiar worm parasitic in the eye of a horse. The "horse with a snake in its eye" was on public exhibition in Philadelphia in 1782, and was the object of much attention, for the nature and habits of this peculiar *Filaria* were not so well understood then as now.

The father of Francis, Thomas Hopkinson [b. in London, 1709, d. in Philadelphia, 1751], who was overlooked in my previous address, deserves, at least, a passing mention. Coming to Philadelphia in 1731 he became lawyer, prothonotary, Judge of the Admiralty, and member of the Provincial Council. As an incorporator of the Philadelphia Library Company, and original trustee of the College of Philadelphia, and first President of the American Philosophical Society in 1743, his public spirit is worthy of our admiration. He was associated with Kinnersley and Franklin in the "Philadelphia Experiments;" and Franklin said of him:

> "The power of points to throw off the electrical fire was first communicated to me by my ingenious friend, Mr. Thomas Hopkinson."*

* WILSON & FISKE: Cyclopædia of American Biography, iii, 260.

The name of Philip Syng is also mentioned in connection with the Philadelphia experiments, and it would be well if some memorials of his work could be placed upon record.

William Bartram [b. 1739, d. 1823] was living in the famous botanical garden at Kingsessing, which his father, the old King's botanist, had bequeathed him in 1777. He was for some years professor of botany in the Philadelphia college, and in 1791 printed his charming volume descriptive of his travels in Florida, the Carolinas, and Georgia. The latter years of his life appear to have been devoted to quiet observation. William Bartram has been, perhaps, as much underrated as John Bartram has been unduly exalted. He was one of the best observers America has ever produced, and his book, which rapidly passed through several editions in English and French, is a classic and should stand beside White's "Selborne" in every naturalist's library. Bartram was doubtless discouraged early in his career by the failure of his patrons in London to make any scientific use of the immense botanical collections made by him in the South before the Revolution, which, many years later, was lying unutilized in the Banksian herbarium. Coues has called attention very emphatically to the merits of his bird work, which he pronounces "the starting-point of a distinctly American school of ornithology." Two of the most eminent of our early zoölogists, Wilson and Say, were his pupils; the latter his kinsman, and the former his neighbor, were constantly with him at Kingsessing and drew much of their inspiration from his conversation. "Many birds which Wilson first fully described and figured were really named and figured by Bartram in his Travels, and several of his designations were simply adopted by Wilson."*

Bartram's "Observations on the Creek and Cherokee Indians"†

* COUES: Key to North American Birds, p. xvi

† Trans. Am. Ethnological Society, iii, 1851.

was an admirable contribution to ethnography, and his general observations were of the highest value.

In the introduction to his "Travels," and interspersed through this volume, are reflections which show him to have been the possessor of a very philosophic and original mind.

His "Anecdotes of an American Crow" and his "Memoirs of John Bartram"* were worthy products of his pen, while his illustrations to Barton's "Elements of Botany" show how facile and truthful was his pencil.

His love for botany was such, we are told, that he wrote a description of a plant only a few minutes before his death, a statement which will be readily believed by all who know the nature of his enthusiasm. Thus, for instance, he wrote of the Venus's Fly Trap:

"Admirable are the properties of the extraordinary Dionæa muscipula! See the incarnate lobes expanding; how gay and sportive they appear! ready on the spring to entrap incautious, deluded insects! What artifice! There! behold one of the leaves just closed upon a struggling fly; another has gotten a worm; its hold is sure; its prey can never escape—carnivorous vegetable! Can we, after viewing this object, hesitate for a moment to confess that vegetable beings are endowed with some sensible faculties or attributes similar to those that dignify animal nature? They are living, organical, and self-moving bodies; for we see here in this plant motion and volition."†

Moses Bartram, a cousin of William, and also a botanist, was also living near Philadelphia, and in 1879 published "Observations on the Native Silk Worms of North America," and Humphrey Marshall [1722–1801], the farmer-botanist, had a botanical garden of his own, and in 1785 published "The American Grove—Arbustrium Americanum"—a treatise on the forest trees and shrubs of the United States, which was the first strictly

* Nicholson's Journal, 1805.

† Travels, 1793, p. xiv.

American botanical book, and which was republished in France a few years later in 1789.

Gotthilf Muhlenberg [b. 1753, d. 1815], a Lutheran clergyman, living at Lancaster, was an eminent botanist, educated in Germany, though a native of Pennsylvania. His "Flora of Lancaster" was a pioneer work In 1813 he published a full catalogue of the Plants of North America, in which about 2,800 species were mentioned. He supplied Hedwig with many of the rare American mosses, which were published either in "Stirpes Cryptogamicæ" of that author or in the "Species Muscorum." To Sir J. E. Smith and Mr. Dawson Turner he likewise sent many plants. He made extensive preparations, writing a general flora of North America, but death interfered with his project. The American Philosophical Society preserves his herbarium, and the moss *Funeria Muhlenbergii*, the violet, *Viola Muhlenbergii*, and the grass *Muhlenbergia*, are among the memorials to his name.*

To Pennsylvania, but not to Philadelphia, came, in 1794, Joseph Priestley (1733–1804), the philosopher, theologian, and chemist. Although his name is more famous in the history of chemistry than that of any living contemporary, American or European, his work was nearly finished before he left England. He never entered into the scientific life of the country which he sought as an exile, and of which he never became a citizen, and he is not properly to be considered an element in the history of American science.

His coming, however, was an event of considerable political importance; and William Cobbett's "Observations on the Emigration of Doctor Joseph Priestley. By Peter Porcupine," was followed by several other pamphlets equally vigorous in expression. McMaster is evidently unjust to some of the public

* Hooker: On the Botany of America. Edinburgh Journal of Science, iii, p. 103, *et seq.*

men who welcomed Priestley to America, though no one will deny that there were unprincipled demagogues in America in the year of grace 1794. Jefferson was undoubtedly sincere when he wrote to him the words quoted elsewhere in this address.

Another eminent exile, welcomed by Jefferson, and the writer, at the President's request, of a work on national education in the United States, was M. Pierre Samuel Dupont de Nemours [b. in Paris, 1799, d. 1817]. He was a member of the Institute of France, a statesman, diplomatist, and political economist, and author of many important works. He lived in the United States at various times, from 1799 to 1817, when he died near Wilmington, Delaware. Like Priestley, he was a member of the American Philosophical Society, and affiliated with its leading members.

The gunpowder works near Wilmington, Delaware, founded by his son in 1798, are still of great importance, and the statue of one of his grandsons, an Admiral in the U. S. Navy, adorns one of the principal squares in the National Capital.

Among other notable names on the roll of the society, in the last century, were those of Gen. Anthony Wayne and Thomas Payne. His Excellency General Washington was also an active member, and seems to have taken sufficient interest in the society to nominate for foreign membership the Earl of Buchan, President of the Society of Scottish Antiquarians, and Dr. James Anderson, of Scotland.

The following note written by Washington is published in the Memoirs of Rittenhouse :

"The President presents his compliments to Mr. Rittenhouse, and thanks him for the attention he has given to the case of Mr. Anderson and the Earl of Buchan.

"SUNDAY AFTERNOON, 20*th April*, 1794."

Of all the Philadelphia naturalists of those early days, the one who had the most salutary influence upon the progress of science

was, perhaps, Benjamin Smith Barton [b. 1766, d. 1815.] Barton was the nephew of Rittenhouse, and the son of the Rev. Thomas Barton, a learned Episcopal Clergyman of Lancaster, who was one of the earliest members of the Philosophical Society, and a man accomplished in science.

He studied at Edinburgh and Göttingen, and at the age of 19, in 1785, he was the assistant of Rittenhouse and Ellicott, in the work of establishing the western boundary of Pennsylvania, and soon after was sent to Europe, whence, having pursued an extended course of scientific and medical study, he returned in 1789, and was elected professor of natural history and botany in the University of Pennsylvania. He was a leader in the Philosophical Society, and the founder of the Linnæan Society of Philadelphia, before which, in 1807, he delivered his famous "Discourse on some of the Principal Desiderata in Natural History," which did much to excite an intelligent popular interest in the subject. His essays upon natural history topics were the first of the kind to appear in this country. He belonged to the school of Gilbert White and Benjamin Stillingfleet, and was the first in America of a most useful and interesting group of writers, among whom may be mentioned John D. Godman, Samuel Lockwood, C. C. Abbott, Nicholas Pike, John Burroughs, Wilson Flagg, Ernest Ingersoll, the Rev. Dr. McCook, Hamilton Gibson, Maurice Thompson, and W. T. Hornaday, as well as Matthew Jones, Campbell Hardy, Charles Waterton, P. H. Gosse, and Grant Allen, to whom America and England both have claims.

Barton published certain descriptive papers, as well as manuals of botany and materia medica, but in latter life had become so absorbed in medical affairs that he appears to have taken no interest in the struggles of the infant Academy of Natural Sciences, which was founded three years before his death, but of which he never became a member.

His nephew and successor in the Presidency of the Linnæan Society and the University Professorship, William P. C. Barton [b. 1786, d. 1856], was a man of similar tendencies, who in early life published papers on the flora of Philadelphia [Floræ Philadelphiæ Prodromus, 1815], but later devoted himself chiefly to professional affairs, writing copiously upon materia medica and medical botany.

The admirers of Benjamin Smith Barton have called him "the father of American Natural History," but I cannot see the propriety of this designation, which is equally applicable to Mitchill or Jefferson, and perhaps still more so to Peter Collinson, of London. The praises of Barton have been so well and so often sung that I do not feel guilty of injustice in passing him briefly by.*

The most remarkable naturalist of those days was Rafinesque, [b. 1784, d. 1872], a Sicilian by birth, who came to Philadelphia in 1802.

Nearly fifty years ago this man died, friendless and impoverished, in Philadelphia. His last words were these: "Time renders justice to all at last." Perhaps the day has not yet come when full justice can be done to the memory of Constantine Rafinesque, but his name seems yearly to grow more prominent in the history of American zoölogy. He was in many respects the most gifted man who ever stood in our ranks. When in his prime he far surpassed his American contemporaries in versatility and comprehensiveness of grasp. He lived a century too soon. His spirit was that of the present period. In the latter years of his life, soured by disappointments, he seemed to become unsettled in mind, but as I read the story of his life his eccentricities seem to me the outcome of a boundless enthusiasm for the study of nature. The picturesque events of his life have

* W. P. C. Barton: Biography of Benjamin S. Barton, Philadelphia, 1815

been so well described by Jordan,* Chase,† and Audubon‡ that they need not be referred to here. The most satisfactory gauge of his abilities is perhaps his masterly "Survey of the Progress and Actual State of Natural Sciences in the United States of America," printed in 1817.§ His own sorrowful estimate of the outcome of his mournful career is very touching:

"I have often been discouraged, but have never despaired long. I have lived to serve mankind, but have often met with ungrateful returns. I have tried to enlarge the limits of knowledge, but have often met with jealous rivals instead of friends. With a greater fortune I might have imitated Humboldt or Linnæus."

Dr. Robert Hare [b. 1781, d. 1858] began his long career of usefulness in 1801, at the age of twenty, by the invention of the oxy-hydrogen blow-pipe. This was exhibited at a meeting of the Chemical Society of Philadelphia in 1801.‖

This apparatus was perhaps the most remarkable of his original contributions to science, which he continued without interruption for more than fifty years. It belongs to the end of the post-revolutionary period, and is therefore noticed, although it is not the purpose of this essay to consider in detail the work of the specialists of the present century.

Dr. Hugh Williamson [b. Dec. 5, 1735, d., in New York, May 22, 1719] was a prominent but not particularly useful promoter of science, a writer rather than a thinker. His work has already been referred to. The names of Maclure, who came to Philadelphia about 1797, the Rev. John Heckewelder, and Albert Gallatin [b. 1761, d. in 1849], a native of Switzerland, a statesman and financier, subsequently identified with the scientific cir-

* JORDAN: Bulletin xv, U. S. National Museum: Science Sketches, p. 143.

† CHASE: Potter's American Monthly, vi, pp. 97–101.

‡ AUDUBON: The Eccentric Naturalist < Ornithological Biography, p. 455.

§ Amer. Monthly Magazine, ii, 81.

‖ Amer. Month. Mag., i, 80.

cles of New York, complete the list of the Philadelphia savans of the last century.

There is not in all American literature a passage which illustrates the peculiar tendencies in the thought of this period so thoroughly as Jefferson's defense of the country against the charges of Buffon and Raynal, which he published in 1783, which is particularly entertaining because of its almost pettish depreciation of our motherland.

"On doit etre etonné" (says Raynal) "que l'Amerique n'ait pas encore produit un bon poëte, un habile mathematicien, un homme de génie dans un seul art ou un seule science."

"When we shall have existed a people as long as the Greeks did before they produced a Homer, the Romans a Virgil, the French a Racine and Voltaire, the English a Shakespeare and Milton, should this reproach still be true, we will inquire from what unfriendly causes it has proceeded that the other countries of Europe and quarters of the earth shall not have inscribed any name on the rôle of poets.

"In war we have produced a *Washington* whose name will in future ages assume its just station among the celebrated worthies of the world, when that wretched philosophy shall be forgotten which would have arranged him among the degeneracies of nature.

"In physics we have produced a *Franklin*, than whom no one of the present age has made more important discoveries, nor has enriched philosophy with more, or more ingenious, solutions of the phænomena of nature.

"We have supposed *Mr. Rittenhouse* second to no astronomer living; that in genius he must be the first because he is self-taught. He has not indeed made a world; but he has by imitation approached nearer its Maker than any man who has lived from the creation to this day. There are various ways of keeping the truth out of sight. Mr. Rittenhouse's model of the planetary system has the plagiary appellation of an orrery; and the quadrant invented by *Godfrey*, an American also, and with the aid of which the European nations traverse the globe, is called Hadley's quadrant.

"We calculate thus: The United States contain three millions of inhabitants; France twenty millions; and the British Islands ten. We produce a Washington, a Franklin, a Rittenhouse. France then should have half a dozen in each of these lines, and Great Britain half that number, equally eminent. It may be true

that France has; we are but just becoming acquainted with her, and our acquaintance so far gives us high ideas of the genius of her inhabitants.

"The present war having so long cut off all communications with Great Britain, we are not able to make a fair estimate of the state of science in that country. The spirit in which she wages war is the only sample before our eyes, and that does not seem the legitimate offspring either of science or civilization. The sun of her glory is fast descending to the horizon. Her philosophy has crossed the channel, her freedom the Atlantic, and herself seems bearing to that awful dissolution whose issue is not given human forethought to scan."*

This was one phase of public sentiment. Another, no less instructive, is that shown forth in the publications of Jefferson's fierce political opponents in 1790, paraphrased, as follows, by McMaster in his "History of the People of the United States:"

"Why, it was asked, should a philosopher be made President? Is not the active, anxious, and responsible station of Executive illy suited to the calm, retired, and exploring tastes of a natural philosopher? Ability to impale butterflies and contrive turn-about chairs may entitle one to a college professorship, but it no more constitutes a claim to the Presidency than the genius of Cox, the great bridge-builder, or the feats of Ricketts, the equestrian. Do not the pages of history teem with evidence of the ignorance and mismanagement of philosophical politicians? John Locke was a philosopher, and framed a constitution for the colony of Georgia, but so full was it of whimsies that it had to be thrown aside. Condorcet, in 1793, made a constitution for France, but it contained more absurdities than were ever before piled up in a system of government, and was not even tried. Rittenhouse was another philosopher; but the only proof he gave of political talents was suffering himself to be wheedled into the presidency of the Democratic Society of Philadelphia. But suppose that the title of philosopher is a good claim to the Presidency, what claim has Thomas Jefferson to the title of philosopher? Why, forsooth!

"He has refuted Moses, dishonored the story of the Deluge, made a penal code, drawn up a report in weights and measures, and speculated profoundly on the primary causes of the difference between the whites and blacks. Think of such a man as President! Think of a foreign minister surprising him in the act of anatomizing the kidneys and glands of an African to find out why the negro is black and odoriferous!

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*Notes on Virginia, 1788, pp. 69–71.

"He has denied that shells found on the mountain tops are parts of the great flood. He has declared that if the contents of the whole atmosphere were water, the land would only be overflowed to the depth of fifty-two and a half feet. He does not believe the Indians emigrated from Asia.

"Every mail from the South brought accounts of rumblings and quakes in the Alleghanies, and strange lights and blazing meteors in the sky. These disturbances in the natural world might have no connection with the troubles in the political world; nevertheless it was impossible not to compare them with the prodigies all writers of the day declare preceded the fatal Ides of March."

X.

In New York, although a flourishing medical school had been in existence from 1769, there was an astonishing dearth of naturalists until about 1790. Governor Colden, the botanist and ethnologist, had died in 1776, and the principal medical men of the city, the Bards, Clossy, Jones, Middleton, Dyckman, and others, confined their attention entirely to professional studies. A Philosophical Society was born in 1787, but died before it could speak. A Society for the Promotion of Agriculture, Arts, and Manufactures, organized in 1791, was more successful, but not in the least scientific. Up to the end of the century New York State had but six men chosen to membership in the American Philosophical Society, and, up to 1809, but five in the American Academy. Leaders, however, soon arose in Mitchill, Clinton, and Hosack.

Samuel Latham Mitchill, the son of a Quaker farmer [b. 1764, d. 1831], was educated in the medical schools of New York and Edinburgh, and in 1792 was appointed Professor of Chemistry, Natural History, and Philosophy in Columbia College. Although during most of his long life a medical professor and editor, and for many years representative and senator in Congress, he continued active in the interests of general science. He made many contributions to systematic natural history, notably a History of the Fishes of New York, and his edition of Bewick's

"General History of Quadrupeds," published in New York in 1804, with notes and additions, and some figures of American animals, was the earliest American work of the kind. He was the first in America to lecture upon geology, and published several papers upon this science. His "Mineralogical Exploration of the banks of the Hudson River" in 1796, under the "Society for the Promotion of Agriculture, Manufactures, and Useful Arts," founded by himself, was our earliest attempt at this kind of research, and in 1794 he published an essay on the "Nomenclature of the New Chemistry," the first American paper on chemical philosophy, and engaged in a controversy with Priestley, in defence of the nomenclature of Lavoisier, which he was the first American to adopt.

His discourse on "The Botanical History of North and South America" was also a pioneer effort. He was an early leader in ethnological inquiries and a vigorous writer on political topics. His "Life of Tammany, the Indian Chief" (New York, 1795), is a classic, and he was well known to our grandfathers as the author of "An Address to the Fredes or People of the United States," in which he proposed that "Fredonia" should be adopted as the name of the nation.

Dr. Mitchill was a poet,* and a humorist, and a member of the literary circles of his day. In "The Croakers" Rodman Drake thus addressed him as "The Surgeon General of New York:"

> "It matters not how high or low it is
> Thou knowest each hill and vale of knowledge,
> Fellow of forty-nine societies
> And lecturer in Hosack's College."

Fitz-Greene Halleck also paid his compliments in the following terms:

> "Time was when Dr. Mitchill's word was law,
> When Monkeys, Monsters, Whales and Esquimaux,
> Asked but a letter from his ready hand,
> To be the theme and wonder of the land."

*Examples of his verses may be found in Duyckinck's Cyclopædia of American Literature.

These and other pleasantries, of which many are quoted in Fairchild's admirable "History of the New York Academy of Sciences," gives us an idea of the provinciality of New York sixty years ago, when every citizen would seem to have known the principal local representatives of science, and to have felt a sense of personal proprietorship in him and in his projects.

Mitchill was a leader in the New York Historical Society; founder of the Literary and Philosophical Society, and of its successor, the Lyceum of Natural History, of which he was long president. He was also President of the New York Branch of the Linnæan Society of Paris, and of the N. Y. State Medical Society, and Surgeon-General of the State Militia; a man of the widest influence and universally beloved. He served four terms in the House of Representatives, and was five years a member of the U. S. Senate.*

DeWitt Clinton [b. 1769, d. 1828], statesman and philanthropist, U. S. Senator, and Governor of New York, was a man of similar tastes and capacities. What Benjamin Franklin was to Philadelphia in the middle of the eighteenth century DeWitt Clinton was to New York in the beginning of the nineteenth. He was the author of the Hibernicus "Letters on the Natural History and Internal Resources of the State of New York" (New York, 1822), a work of originality and merit. As President of the Literary and Philosophical Society he delivered in 1814 an "Introductory Discourse," which, like Barton's in

* See FRANCIS, JOHN W. Life of Dr. Mitchill, in Williams's American Medical Biography, pp. 401–411, and eulogy in Discourse in Commemoration of 53d Anniversary of N. Y. Hist. Soc., 1857, 56-60; and in his Old New York; also—

Sketch by H. L. Fairchild in History of the New York Academy of Sciences, 1887, pp. 57-67; also Dr. Mitchill's own pamphlet: Some of the Memorable Events and Occurrences in the Life of Samuel S. Mitchill, of New York, from the year 1786 to 1827.

A biography by Akerly was in existence, but has never been printed.

Numerous portraits are in existence, which are described by Fairchild.

Philadelphia, ten years before, was productive of great good. It was, moreover, laden with the results of original and important observations in all departments of natural history. Another important paper was his "Memoirs on the Antiquities of Western New York" printed in 1818.

Clinton's attention was devoted chiefly to public affairs, and especially to the organization of the admirable school system of New York and other internal improvements. He did enough in science, however, to place him in the highest ranks of our early naturalists.*

Hosack has been referred to elsewhere as a pioneer in mineralogy and the founder of the first botanic garden. He was long president of the Historical Society, and exercised a commanding influence in every direction. His researches were, however, chiefly medical.

Samuel Akerly [b. 1785, d. 1845], the brother-in-law of Mitchill, a graduate of Columbia College, 1807, was an industrious worker in zoölogy and botany and the author of the "Geology of the Hudson River." John Griscom [b. 1774, d. 1852], one of the earliest teachers of chemistry, began in 1806 a career of great usefulness. "For thirty years," wrote Francis, "he was the acknowledged head of all other teachers of chemistry among us (in New York), and he kept pace with the flood of light which Davy, Murray, Gaylussac, and Thenard, and others shed on the progress of chemical philosophy at that day." About 1820 he went abroad to study scientific institutions, and his charming book, 'A Year in Europe,' supplemented by his regular contributions to *Silliman's Journal*, commenting on scientific affairs in other countries, did much to stimulate the growth of scientific and educational institutions in America.

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*Hosack: Memoirs of DeWitt Clinton. New York, 1829. Renwick: Life of DeWitt Clinton. New York, 1840. Campbell: Life and Writings of DeWitt Clinton. New York, 1849.

Francis tells us that he was for thirty years the acknowledged head of the teachers of chemistry in New York.*

A zealous promoter of zoölogy in those days was F. Adrian Vanderkemp, of Oldenbarnavelt, New York, who in 1795, we are told, delivered an address before an Agricultural Society in Whitesburg, N. Y., in which he offered premiums for essays upon certain subjects, among which was one "for the best anatomical and historical account of the moose, fifty dollars, or for bringing one in alive, sixty dollars."†

Having mentioned several American naturalists of foreign birth, it may not be out of place to refer to the American origin of an English zoölogist of high repute, Dr. Thomas Horsfield, born in Philadelphia in 1773, and after many years in the East became, in 1820, a resident of London, where he died in 1859. His name is prominent among those of the entomologists, botanists, and ornithologists of this century, especially in connection with Java.

XI.

In New England, science was more highly appreciated than in New York. Massachusetts had in John Adams a man who, like Franklin and Jefferson, realized that scientific institutions were the best protection for a democratic government, and to his efforts America owes its second scientific society — the American Academy of Arts and Sciences, founded in 1780. When Mr. Adams travelled from Boston to Philadelphia, in the days just before the Revolution, he several times visited at Norwalk, we are told, a curious collection of American birds and insects made by Mr. Arnold. "This was afterwards sold to Sir Ashton Lever, in whose apartments in London Mr. Adams saw it again, and felt a new regret at our imperfect knowledge of the productions of

* Griscom, John H.: Memoir of John Griscom. New York, 1859.

† DeWitt Clinton, in Trans. Lt. Phil. Soc. N. Y., p. 59.

the three kingdoms of nature in our land. In France his visits to the museums and other establishments, with the inquiries of Academicians and other men of science and letters respecting this country, and their encomiums on the Philosophical Society of Philadelphia, suggested to him the idea of engaging his native State to do something in the same good but neglected cause."*

The Academy, from the first, was devoted chiefly to the physical sciences, and the papers in its memoirs for the most part relate to astronomy and meteorology.

Among its early members I find the names of but two naturalists: The Rev. Manasseh Cutler, pastor of Ipswich Hamlet, one of the earliest botanists of New England,† and William Dandridge Peck [b. 1763, d. 1882], the author of the first paper on systematic zoölogy ever published in America, a "Description of four remarkable fishes, taken near the Piscataqua in New Hampshire," published in 1794.‡ Peck, after graduating at Harvard, lived at Kittery, N. H., and first became interested in natural history by reading a wave-worn copy of Linné's "System of Nature," which he obtained from the ship which was wrecked near his house. He became a good entomologist, and communicated much valuable material to Kirby in England, and was also one of our first writers on the fungi. He was the first to occupy the chair of natural history in Harvard University, to which he was appointed in 1800.

The Rev. Dr. Jedediah Morse [b. 1761, grad. Yale, 1783, d. 1826] was the earliest of American geographers, and appears, especially in the later gazetteers published by him, to have printed important facts concerning the number and geographical distribution of the various Indian tribes.

The Connecticut Academy of Arts and Sciences was founded

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*KIRTLAND: Mem. Amer. Acad. New Series, vol. 1, p. xxii.

† See previous address, p. 95.

‡ Mem. Amer. Acad. Sci., ii, Part ii, p. 46. 1797.

in 1799, one of the chief promoters being President Dwight [b. 1752. d. 1817], whose "Travels in New England and New York," printed in 1821, abounds with scientific observations.

Another was E. C. Herrick [b. 1811, d. 1862], for many years librarian and subsequently treasurer of Yale College, whose observations upon the aurora, made in the latter years of the last century, are still frequently quoted; and later an active investigator of volcanic phenomena, and the author of a treatise on the Hessian fly and its parasites, the results of nine years' study; and of another on the existence of a planet between Mercury and the sun.

Benjamin Silliman [b. in Trumbull, Conn., Aug. 8, 1779, d. in New Haven, Nov. 27, 1869], who, in 1802, became Professor of Chemistry at Yale, began there his career of usefulness as an organizer, teacher, and critic. One of his introductions to popular favor was the paper which he, in conjunction with Prof. Kingsley, published, "An account of the meteor which burst over Weston, in Connecticut, in December, 1807." This paper attracted attention everywhere, for the nature of meteors was not well understood in those days. Jefferson was reputed to have said in reference to it, "that it was easier to believe that two Yankee professors could lie than to admit that stones could fall from heaven;" but I think this must be pigeon-holed with the millions of other slanders to which Jefferson was subjected in those days. I find in the papers by Rittenhouse and Madison, published twenty years before, by the Philosophical Society, matter-of-fact allusions to the falling of meteors to the earth.

Silliman was the earliest of American scientific lecturers who appeared before popular audiences, and, as founder and editor of the Journal of Science, did a service to science, the value of which is beyond estimate or computation.

Benjamin Waterhouse, Professor of the Theory and Practice of Medicine in Harvard, 1783–1812, was one of the earliest

teachers of natural botany in America, and the author of a poem entitled "The Botanist."* The Rev. Jeremy Belknap [b. 1744, d. 1798], in his "History of New Hampshire," and the Rev. Samuel Williams [b. 1743, d. 1817], in his "Natural and Civil History of Vermont,"† made contributions to local natural history, and Capt. Jonathan Carver [b. 1732, d. 1780], in his "Travels through the Interior Parts of America,"‡ gave some meagre information as to the zoölogy and botany of regions previously unknown.

In the South the prestige of colonial days seemed to have departed. Except Jefferson, the only naturalist in Virginia was Dr. James Greenway, of Dinwiddie Co., a botanist of some merit. Mitchell returned to England before the Revolution, and Garden followed in 1784. H. B. Latrobe, of Baltimore, was an amateur ichthyologist, and Dr. James MacBride, of Pineville, S. C. [b. 1784, d. 1817], was an active botanist. Dr. Lionel Chalmers [b. 1715, d. 1777], who was for many years the leader of scientific activity in South Carolina, was omitted in the previous address. A graduate of Edinburgh, he was for forty years a physician in Charleston. He recorded observations on meteorology from 1750 to 1760, the foundation of his "Treatise on the Weather and Diseases of South Carolina" [London, 1776], and published also valuable papers on pathology. He was the host and patron of many naturalists, such as the Bartrams.

There was no lack of men in the South who were capable of appreciating scientific work. Virginia had fourteen members in the American Philosophical Society from 1780 to 1800, while Massachusetts and New York had only six each, the Carolinas had eight, and Maryland six. The population of the South was, however, widely dispersed and no concentration of effort

* Biography in Polyanthus, vol. ii.
† Walpole, N. H., 1794, 8vo, p. 416.
‡ 1778.

was possible. To this was due, no doubt, the speedy dissolution of the Academy of Arts and Sciences founded in Richmond in 1788.*

A name which should, perhaps, be mentioned in connection with this is that of Dr. William Charles Wells, whom it has been the fashion of late to claim as an American. It would be gratifying to be able to vindicate this claim, for Wells was a man of whom any nation might be proud. He was the originator of the generally-accepted theory of the origin of dew, and was also, as Darwin has shown, the first to recognize and announce the theory of evolution by natural selection.† Unfortunately Wells's science was not American science. We might with equal propriety claim as American the art of James Whistler, the politics of Parnell, the fiction of Alexandre Dumas, the essays of Grant Allen, or the science of Rumford and Le Vaillant.

Wells was the son of an English painter, who emigrated, in 1753, to South Carolina, where he remained until the time of the Revolution, when, with other loyalists, he returned to England. He was born during his father's residence in Charleston, but left the country in his minority; was educated at Edinburgh, and though he, as a young physician, spent four years in the United States, he was permanently established in London practice fully twenty-eight years before he read his famous letter before the Royal Society.

The first American naturalist who held definite views as to evolution was, undoubtedly, Rafinesque. In a letter to Dr. Torrey, Dec. 1, 1832, he wrote:

"The truth is that species, and perhaps genera also, are forming in organized beings by gradual deviations of shapes, forms, and organs taking place in the lapse of time. There is a tendency

* See previous discourse, p. 98.

† DARWIN: Origin of species, 6th Amer. Ed., p xv. MORSE: Proc. Amer. Assoc. Adv. Science, xxv, p. 141.

to deviation and mutation in plants and animals by gradual steps, at remote, irregular periods. This is a part of the great universal law of *perpetual mutability* in everything."

It is pleasant to remember that both Darwin and Wallace owed much of their insight into the processes of nature to their American explorations. It is also interesting to recall the closing lines, almost prophetic as they seem to-day, of the "Epistle to the Author of the Botanic Garden,"* written in 1798 by Elihu Hubbard Smith, of New York, and prefixed to the American editions of "The Botanic Garden:"

> "Where Mississippi's turbid waters glide
> And white Missouri pours its rapid tide;
> Where vast Superior spreads its inland sea
> And the pale tribes near icy empires sway;
> Where now Alaska lifts its forests rude
> And Nootka rolls her solitary flood.
> Hence keen incitement prompt the prying mind
> By treacherous fears, nor palsied nor confined;
> Its curious search embrace the sea and shore
> And mine and ocean, earth and air explore.
>
> "Thus shall the years proceed,—till growing time
> Unfold the treasures of each different clime;
> Till one vast brotherhood mankind unite
> In equal bonds of knowledge and of right;
> Thus the proud column, to the smiling skies
> In simple majesty sublime shall rise,
> O'er ignorance foiled, their triumph loud proclaim,
> And bear inscribed, immortal, DARWIN'S name."

XII.

During the three decades which made up the post-revolutionary period there were several "beginnings" which may not well be referred to in connection with individuals or localities.

The first book upon American insects was published in 1797, a sumptuously-illustrated work, in two volumes, with 104 colored plates, entitled "The Natural History of the rarer Lepidopterous Insects of Georgia." This was compiled by Sir James E. Smith from the notes and drawings of John Abbot

*Erasmus, grandfather of Charles Darwin.

[b. about 1760], living in England in 1840, an accomplished collector and artist, who had been for several years a resident of Georgia, gathering insects for sale in Europe. Mr. Scudder characterizes him as "the most prominent student of the life histories of insects we have ever had."*

There had, however, been creditable work previously done in what our entomologists are pleased to call the biological side of the science. As early as 1768, Col. Landon Carter, of "Sabine Hall," Virginia, prepared an elaborate paper "On the Habits of the Fly-Weevil that destroys the Wheat," which was printed by the American Philosophical Society,† accompanied by an extended report by "The Committee of Husbandry." In the same year Moses Bartram presented his "Observations on the native Silk-Worms of North America."‡

Organized effort in economic entomology appears to date from the year 1792, when the American Philosophical Society appointed a committee to collect materials for a natural history of the Hessian Fly, at that time making frightful ravages in the wheat-fields, and so much dreaded in Great Britain that the import of wheat from the United States was forbidden by law. The Philosophical Society's committee was composed of Thomas Jefferson, at that time Secretary of State in President Washington's cabinet, Benjamin Smith Barton, James Hutchinson, and Caspar Wistar. In their report, which was accompanied by large drawings, the history of the little marauder was given in considerable detail.

The publication of Wilson's American Ornithology, beginning in 1808, was an event of great importance. It was in 1804

*There is a whole series of quarto or folio volumes in the British Museum done by him, and a few volumes are extant in this country. Besides, all the biological material in Smith-Abbot's Insects of Georgia is his."—*Letter of S. H. Scudder.*

† Transactions of the American Philosophical Soc., 1, 274.

‡ *Ibid.*, p. 294.

that the author, a schoolmaster near Philadelphia, decided upon his plan. In a letter to Lawson he wrote:

"I am most earnestly bent on pursuing my plan of making a Collection of all the Birds of North America. Now, I don't want you to throw cold water on this notice, Quixotic as it may appear. I have been so long accustomed to the building of Airy Castles and brain Windmills that it has become one of my comforts of life, a sort of rough Bone, that amuses me when sated with the dull drudgery of Life."

I need not eulogize Wilson. Every one knows how well he succeeded. He has had learned commentators and eloquent biographers. Our children pore over the narrative of the adventurous life of the weaver naturalist, and we all are sensible of the charms which his graceful pen has given to the life-histories of the birds.

His poetical productions are immortal, and his lines to the Blue Bird and the Fisherman's Hymn are worthy to stand by the side of Bryant's Waterfowl, Trowbridge's Wood Pewee, Emerson's Titmouse, Thaxter's Sandpiper, and, possibly best of all, Walt. Whitman's Mocking-Bird in "Out of the Cradle endlessly Rocking."

Ichthyology in America dates also from these last years of the century. Garden was our only resident ichthyologist until Peck and Mitchill began their work, but Schœpf, the Hessian military surgeon, printed a paper on the Fishes of New York in 1787, and William Bryant, of New Jersey, and Henry Collins Flagg, of South Carolina, made observations upon the electric eel, in addition to those which Williamson, of North Carolina, laid before the Royal Society in 1775.

Paleontology had its beginning at about the same time in the publication of Jefferson's paper on the Megalonyx or "Great Claw" in 1797.*

* The first vertebrate fossils were found in Virginia. Samuel Maverick, of Massachusetts, reported to the colony at Boston in 1836 that, at a place

This early study of a fossil vertebrate was followed 20 years later by the first paper which touched upon invertebrates—that by Say on "Fossil Zoölogy," in the first volume of Silliman's Journal. Lesueur seems to have brought from France some knowledge of the names of fossils, and identified many species for the early American geologists.

Stratigraphical and physical geology also came in at this time, and will be referred to later.

The science of mineralogy was brought to America in its infancy. The first course of lectures upon this subject ever given in London was in the winter of 1793–4, by Schmeisser, a pupil of Werner. Dr. David Hosack, then a student of medicine at Edinburgh, was one of his hearers, and inspired by his enthusiasm began at once to form the collection of minerals which he brought to America on his return in 1794, which was the first mineralogical cabinet ever seen on this side of the Atlantic. This collection was exhibited for many years in New York (and in 1821 was given to Princeton College). Howard soon after obtained a select cabinet from Europe, and the museum of the American Philosophical Society acquired the Smith collection. In 1802, Mr. B. D. Perkins, a New York bookseller, brought from London a fine collection, which soon passed into the possession of Yale College, and in 1803 Dr. Archibald Bruce brought over one equally fine, which was made the basis of lectures when in 1806 he became professor of mineralogy in Columbia College. George Gibbs, in 1805, imported the magnificent collection which was long in the custody of the American Geological Society. Seybert, about the same time, brought to Philadelphia the cabinet which in 1813 was bought by the Academy of Natural Sciences and was lectured upon by Troost in 1814.

on the James River, about sixty miles above its mouth the colonists had found shells and bones, among these bones that of a whale, eighteen feet below the surface.—Neill's *Virginia Carolorum*, p. 131.

Much of the early botanical exploration was, however, carried out by European botanists: André Michaux [b. near Versailles, 1746, d. Madagascar, 1802], a pupil of the Jussiens and an experienced explorer, was sent by this government, in 1785, to collect useful trees and shrubs for naturalization in France. He remained eleven years; made extensive explorations in the regions then accessible, and as far west as the Mississippi; sent home immense numbers of living plants; and, after his return, in 1796, published his treatise on the American Oaks,* and prepared the materials for his posthumous "Flora Boreali-Americanas."

François André Michaux [b. near Versailles, 1770, d. at Vauréal, 1855] was his father's assistant in these early travels, and in 1802 and 1806 himself made botanical explorations in the Mississippi Valley. His botanical works were of great importance,† especially that known in its English translation as the "North American Sylva," afterward completed by Nuttall, and still the only work of the kind, though soon to be supplemented, we hope, by Professor Sargent's projected monographs.

Frederick Pursh [b. 1774, in Tobolsk, Siberia, d. June 11, 1820, in Montreal, Canada] carried on botanical explorations between 1799 and 1819; living, from 1802 to 1805, in Philadelphia, and from 1807 to 1810 in New York. In 1814 he published in London his "Flora Americæ Septemtrionalis." Pursh's Flora was largely based upon the labors of the American botanists Barton, Hosack, LeConte, Peck, Clayton, Walter, and Lyon, and the botanical collection of Lewis and Clarke, and enumerated about 3,000 species of plants, while Michaux's, printed eleven years before, had only about half that number.

A. von Enslen collected plants at this time, in the South and West, for the Imperial Cabinet in Vienna. C. C. Robin, who

* Histoire des chênes de l'Amerique Septentrionale, 1801; 36 plates.

† Voyage à l'ouest des monte Alléghany, &c. 8vo, pp. 684 Paris, 1808. Histoire des arbres forestières de l'Amerique, Septentrionale.

travelled from 1802 to 1806 in what are now the Gulf States, wrote a botanical appendix to his Travels, published in 1807, on which Rafinesque founded his "Florula Ludoviciana" (New York, 1817).

Thaddeus Hænke [b. 1761, d. in Cochabamba, Bolivia, 1817] visited Western North America with the Spaniards late in the last century, and made large collections of plants, which were sent to the National Museum of Bohemia, at Prague, and in part described in Presl's "Reliquiæ Hænkianæ," 72 plates.

Archibald Menzies [b. 1754, d. 1842], an English naval surgeon, also collected on our Pacific coast, under Vancouver, in 1780–95, and his plants found their way to Edinburgh and Kew.

Captain Wangenheim, Surgeon Schoepf, of the Hessian contingent of the British army, Olaf Swartz, a Swedish botanical explorer, and others, also gathered plants in these early days, and, in some instances, published in Europe their botanical observations.

Other collectors of this same class were L. A. G. Bosc [1759–1828], who made botanical researches in the Carolinas during the last two years of the century, and returned to France in 1800 with a herbarium of 1,600 species. He also collected fishes, and his name is perpetuated in connection with at least two well-known American fauna. Another was M. Milbert, who collected for Cuvier in New York, Canada, the Great Lake region, and the Mississippi Valley from 1817 to 1823.

The Baron Palisot de Beauvois [b. 1755, d. 1820] came from Santo Domingo to America in 1791. He travelled extensively, and being a zoölogist as well as a botanist, made observations upon our native animals, particularly the reptiles.

It is to him that we owe the most carefully recorded of existing observations of young rattlesnakes crawling down their parent snakes' throats for protection from enemies.

Most of these men did not contribute largely to the advance-

ment of American scientific institutes or affiliate with the naturalists of the day.

Of quite another type was the Count Luigi Castiglioni, who travelled, soon after the Revolution, throughout the Eastern States, and published in 1790 two volumes of his travels.*

The Count Volney [b. at Craon Feb. 3, 1757, d. in Paris April 25, 1820], traveller, statesman, and historian, travelled in this country from 1795 to 1798, and in 1803, while a Senator of the French Republic, published his famous work upon the United States, containing his observations upon its soil and its climate, and upon the Indians, together with the first doctrines of the language of the Miamis,† and also giving a description of the physical and botanical features of the country. Volney was an admirer and intimate friend of Franklin, and it was in his home at Passy, we are told, that he conceived the idea of his most famous book "Les Ruines."‡

Among the traditions of Fauquier county, Virginia, is one which is of interest to naturalists, since it relates to an incident showing the interest of our first President in science:

"About the year 1796," runs the story, "at the close of a long summer's day, a stranger entered the village of Warrenton. He was alone, and on foot, and his appearance was anything but prepossessing. His garments, coarse and dust-covered, indicated an individual in the humble walks. From a cane across his shoulders was suspended a handkerchief containing his clothing. Stopping in front of Turner's tavern, he took from his hat a paper and handed it to a gentleman standing on the steps; it read as follows:

"The celebrated historian and naturalist
VOLNEY needs no recommendation from
"G. WASHINGTON."

* Viaggio negli Stati Uniti del America Settentrionali.

† Tableau du climat et du sol des Etats-Unis d'Amerique, suivi d'eclaircissements sur la Floride, sur la colonie française a Scioto sur quelques colonies canadiennes, et sur les savages. Paris, 1803. 8vo, 2 vols. 2d edition. Paris. 8vo, 1 vol., pp. 494. Map.

‡ BIGELOW, JOHN: Franklin's Home and Host. in France. *The Century*, May, 1888, p. 743

In 1801 Jefferson began his eight years of presidency. Since he was the only man of science who has ever occupied the chief magistracy, he has a right to a high place in the esteem of such a society as ours, and I only regret that, having spoken of him at length a year ago, I cannot now discuss his scientific career in all its aspects.

I then spoke of the credit which was due to him for beginning so early as 1780 to agitate the idea of a government exploring expedition to the Pacific, which culminated in the sending out by Congress of the expedition of Lewis and Clarke, in 1803. Captain Lewis [b. 1774, d. 1809], the leader of this expedition, was a young Virginian, the neighbor, and for some years the private secretary, of President Jefferson. He set out in the summer of 1803, accompanied by his associate, Captain Clarke, and twenty-eight men. They entered the Missouri, May 14, 1804, before the middle of the following July had reached the great falls, and by October were upon the western slope, where, embarking in canoes upon the Kouskousky, a branch of the Columbia, they descended to its mouth, where they arrived on the 15th of November, 1805. The following spring they retraced their course, arriving at St. Louis in September.* The results of the expedition were first made known in Jefferson's message to Congress, read February 19, 1806.

The statue of Meriwether Lewis is one of those at the base of the Washington Monument in Richmond, Virginia, and is worthy of the man and his career.

Dr. Asa Gray in a recent letter says:

"I have reason to think that Michaux suggested to Jefferson the expedition which the latter was active in sending over to the Pacific. I wonder if he put off Michaux for the sake of having it in American hands?"†

The idea of an expedition to the Pacific was one which was likely

* See a complete bibliography of the various reports of this expedition, by Elliott Coues, in the Bulletin of the U. S. Geological Survey.

† See Amer. Journ. Sci., xii, No. 1.

to occur to any thoughtful American, and was, after all, simply the continuing of a plan as old as the Spanish days of discovery. Jefferson, at all events, was an active promoter of all such enterprises, and after a quarter of a century's effort the expedition was dispatched, while in 1805 Gen. Z. M. Pike was sent to explore the sources of the Mississippi river and the western parts of "Louisiana," penetrating as far west as "Pike's Peak," a name which still remains as a memento of this enterprise.

The organization of these early expeditions marked the beginning of one of the most important portions of the scientific work of our government—the investigation of the resources and natural history of the public domain. The expeditions of Lewis and Clarke, and of Pike, were the precursors and prototypes of the magnificent organization now accomplishing so much for science under the charge of Major J. W. Powell.

As early as 1806, Jefferson, inspired by Patterson and Hassler, urged the establishment of a national Coast Survey, and in this was earnestly supported by his Secretary of the Treasury, Albert Gallatin, who drew up a learned and elaborate project for its organization, and an act authorizing its establishment was passed in 1807. During his administration, in 1802, the first scientific school in this country was established, the Military Academy at West Point. The Military Academy was a favorite project of General Washington, who is said to have justified his anxiety for its establishment by the remark that "an army of asses led by a lion is vastly superior to an army of lions led by an ass."

Jefferson has been heartily abused for not gratifying Alexander Wilson's request to be appointed naturalist to Pike's expeditions. It is possible that even in those days administrators were hampered by lack of financial resources. It must also be remembered that in 1804 Wilson was simply an enthusiastic projector of ornithological undertakings, and had done nothing whatever to establish his reputation as an investigator.

One of Jefferson's first official acts was to throw his presidential mantle over Priestley. Two weeks after he became President of the United States he wrote these words:

"It is with heartfelt satisfaction that, in the first moments of my public action, I can hail you with welcome to our land, tender to you the homage of its respect and esteem, cover you under the protection of those laws which were made for the wise and good like you, and disclaim the legitimacy of that libel on legislators which, under the form of a law, was for some time placed among them."

* * * "Yours is one of the few lives precious to mankind, and for the continuance of which every thinking man is solicitous. Bigots may be an exception. What an effort, my dear sir, of bigotry in politics and religion have we gone through. * * * All advances in science were prescribed as innovations. They pretended to praise and encourage education, but it was to be the education of our ancestors. We were to look backwards, not forwards for improvement; the President (Washington) himself declaring in one of his answers to addresses that we were never to expect to go beyond them in real science. This was the real ground of all the attacks on you; those who live by mystery and *charlatanerie* fearing you would render them useless by simplifying the Christian philosophy, the most sublime and benevolent, but most perverted system that ever shone on man, endeavored to crush your well-earned and well-deserved fame."*

XIII.

With the close of the third decade ended the first third of a century since the Declaration of Independence. We have now passed in review a considerable number of illustrious names and have noted the inception of many worthy undertakings.

"Still, however," in the words of Silliman, "although individuals were enlightened, no serious impression was produced on the public mind; a few lights were, indeed, held out, but they were lights twinkling in an almost impervious gloom."†

This was a state of affairs not peculiar to America. A gloom no less oppressive had long obscured the intellectual atmosphere

* Jefferson's Works (T. J. Randolph ed.), 1830, iii, 461.

† Silliman, i, 37.

of the old world. There were a goodly number of men of science, and many important discoveries were being made, but no bonds had yet been formed to connect the interests of the men of science and the men of affairs.

Speculative science, in the nature of things, can only interest and attract scholarly men, and though its results, concisely and attractively stated, may have a passing interest to a certain portion of every community, it is only by its practical applications that it secures the hearty support of the community at large.

Huxley, in his recent discourse upon "The Advance of Science in the Last Half Century,"* has touched upon this subject in a most suggestive and instructive manner, and has shown that Bacon, with all his wisdom, exerted little direct beneficial influence upon the advancement of natural knowledge, which has after all been chiefly forwarded by men like Galileo and Harvey, Boyle and Newton, "who would have done their work quite as well if neither Bacon nor Descartes had ever propounded their views respecting the manner in which scientific investigation should be pursued."

I think we should look upon Bacon as the prophet of modern scientific thought, rather than its founder. It is no doubt true, as Huxley has said, that his "scientific insight" was not sufficient to enable him to shape the future course of scientific philosophy, but it is scarcely true that he attached any undue value to the practical advantages which the world as a whole, and incidentally science itself, were to reap from the applications of scientific methods to the investigation of nature.

Even though the investigations of Descartes, Newton, Leibnitz, Boyle, Torricelli, and Malpighi, had directly helped no man to either wealth or comfort, the cumulative results of their labors, and those of their pupils and associates, resulted in a condition

* Wood, T. H.: The Reign of Victoria; a survey of Fifty Years of Progress. London, 1887.

of scientific knowledge from which, sooner or later, utilitarian results must necessarily have sprung.

It is true, as Huxley tells us, that at the beginning of this century weaving and spinning were still carried on with the old appliances; true that nobody could travel faster by sea or by land than at any previous time in the world's history, and true that King George could send a message from London to York no faster than King John might have done. Metals were still worked from their ores by immemorial rule of thumb, and the centre of the iron trade of these islands was among the oak forests of Sussex, while the utmost skill of the British mechanic did not get beyond the production of a coarse watch.

It cannot be denied that although the middle of the eighteenth century was illuminated by a host of great names in science, chemists, biologists, geologists, English, French, German, and Italian, the deepening and broadening of natural knowledge had produced next to no immediate practical benefits. Still I cannot believe that Bacon, the prophet, would have been so devoid of "scientific insight" as to have failed to foresee at this time the ultimate results of all this intellectual activity.

But Huxley says:

"Even if, at this time, Francis Bacon could have returned to the scene of his greatness and of his littleness, he must have regarded the philosophic world which praised and disregarded his precepts with great disfavor. If ghosts are consistent, he would have said, "these people are all wasting their time, just as Gilbert, and Kepler, and Galileo, and my worthy physician Harvey did in my day. Where are the fruits of the restoration of science which I promised? This accumulation of bare knowledge is all very well, but *cui bono?* Not one of these people is doing what I told him specially to do, and seeking that secret of the cause of forms, which will enable him to deal at will with matter and superinduce new nature upon old foundations."

As Huxley, however, proceeds himself to show, in the discussion which immediately follows this passage, a "new nature,

begotten by science upon fact," has been born within the past few decades, and pressing itself daily and hourly upon our attention, has worked miracles which have not only modified the whole future of the lives of mankind, but has reacted constantly upon the progress of science itself.

It is to the development of this new nature, then in its very infancy, that we must look for the revival of interest in science on this side of the Atlantic.

The second decade of the century was marked by a great accession of interest in the sciences. The second war with Great Britain having ended, the country, for the first time since colonial days, became sufficiently tranquil for peaceful attention to literature and philosophy. The end of the Napoleonic wars and the restoration of tranquillity to Europe tended to scientific advances on the other side of the Atlantic, and the results of the labors of Cuvier, whose glory was now approaching its zenith, of Brongniart, of Blainville, of Jussieu, of Decandolle, of Werner, of Hutton, of Buckland, of De la Beche, of Magendie, of Humboldt, Daubuisson, Berzelius, Von Buch, of Herschel, of Laplace, of Young, of Fresnel, of Oersted, of Cavendish, of Lavoisier, Wollaston, Davy, and Sir William Hooker, were eagerly welcomed by hundreds in America.

"In truth," wrote one who was among the most active in promoting these tendencies, "in truth, a thirst for the Natural Sciences seemed already to pervade the United States like the progress of an epidemic."

The author of these enthusiastic words was Amos Eaton [b. in Chatham, N. Y., 1776, d. May 6, 1842], one of the most interesting men of his day. In 1816, at the age of forty, he abandoned the practice of law and went to New Haven to attend Silliman's lectures on Mineralogy and Geology. He was a man of great force and untiring energy, and one of the pioneers of American geology; though the name, "father of Amer-

ican geology," sometimes applied to him, would seem to belong more appropriately to Maclure, or, perhaps, to Mitchill. He was, however, only some eight years later than Maclure in beginning geological field-work. Eaton's "Index to the Geology of the Northern States of America," printed in 1817, was the first strictly American treatise, and seems to have had a very stimulating effect. He was pre-eminently an agitator and an educator. He travelled many thousands of miles on foot throughout New England and New York, delivering, in the meantime, at the principal towns, short courses of lectures on natural history. In March, 1817, having received an invitation to aid in the introduction of the Natural Sciences in Williams College, his Alma Mater, he delivered a course of lectures in Williamstown. "Such," he remarks, "was the zeal at this institution that an uncontrollable enthusiasm for natural history took possession of every mind; and other departments of learning were, for a time, crowded out of the college. The authorities allowed twelve students each day (seventy-two per week) to devote their whole time to the collection of minerals and plants, in lieu of all other exercises."*

In April, 1818, he went to Albany on the special invitation of Gov. DeWitt Clinton and delivered a course of lectures on Natural History. "In Albany I found," wrote he, "Dr. T. Romeyn Beck, and in Troy, Doctors Burrett, Robbins, and Dale, zealous beyond description in the cause of Natural Science. By the exertions of these gentlemen a taste for the study of Nature was strongly excited in those two cities, especially for that of geology. They, together with several others, had become members of the New York Lyceum of Natural History, and, in the fall of 1818, established a society of the same name and upon a similar plan in Troy. Collections were made with such zeal that, in the course of a few months, Troy could boast

* Geological Text-Book, 2d ed., 1832, p. 16.

of a more extensive collection of American geological specimens than Yale College, or any other institution upon this continent."*

"In this period," remarked Bache, "the prosecution of mathematics and physical science was neglected; indeed barely kept alive by the calls for boundary and land surveys of the more extended class, by the exertions necessary in the lecture-room, or by isolated volunteer efforts.

"As the country was explored and settled the unworked mine of natural history was laid open, and the attention of almost all the cultivators of science was turned toward the development of its riches.

"Descriptive natural history is the pursuit which emphatically made that period. As its experiment may be taken the admirable descriptive mineralogy of Cleaveland, which seemed to fill the measures of that day and be, as it were, its chief embodiment, appearing just as the era was passing away."†

The leading spirits of the day seem to have been Silliman, Hare, Maclure, Mitchill, Gibbs, Cleaveland, DeWitt Clinton, and Caspar Wistar.

Names familiar to us of the present generation began now to appear in scientific literature: Isaac Lea began to print his memoirs on the *Unionidæ;* Edward Hitchcock, principal of the Deerfield Academy, was writing his first papers on the geology of Massachusetts; Prof. Chester Dewey, of Williams College, [b. 1781, d. 1867], afterwards known to us all from his excellent work upon the Carices, was discussing the mineralogy and geology of Massachusetts; Dr. John Torrey, also to be famous as a botanist, was then devoting his attention to mineralogy and

* The Troy Lyceum of Natural History was incorporated in 1819, and a lectureship was created, filled by Mr. Eaton (*Silliman's Journal*, ii, 173). In 1820 a similar association, "The Hudson Association for Improvement in Science," was founded in the city of Hudson, and in 1821 the Delaware Chemical and Geological Society.

† Presidential Address Am. Assoc. Adv. Sci., 1851, pp. vi, xlvi.

chemistry; Dr. Jacob Porter was making botanical observations in central Massachusetts; quaint old Caleb Atwater, at that time almost the only scientific observer west of the Alleghanies, was discussing the origin of prairies, meteorology, botany, geology, mineralogy, and scenery of the Ohio country, and a little later the remains of mammoths.

Prof. J. W. Webster, of Boston, was making general studies in geology; the Rev. Elias Cornelius and Mr. John Grammer were writing of the geology of Virginia; Mr. J. A. Kain, upon that of Tennessee, I. P. Brace, that of Connecticut, and James Pierce, that of New Jersey.

To this period belonged the brilliant Constantine Rafinesque, with Torrey, Silliman, Cleaveland, Gibbs, James, Schoolcraft, Gage, Akerly, Mitchill, Dana, Beck, and Featherstonhaugh.

Dr. Henry R. Schoolcraft, afterwards prominent in ethnology, printed, in 1819, his "View of the Lead Mines of Missouri," the first from American contributors to economic geology; and in the same year his "Transallegania," a mineralogical poem, probably the last as well as the first of its kind written in America. In 1821 he published a scholarly "Account of the Native Copper on the Southern shore of Lake Superior."*

Mineralogy and geology were the most popular of the sciences.

American Geology dated its beginning from this previous decade. Prof. S. L. Mitchill was one of the first to call attention to the teachings of Kirwan and the pioneers of European geology, and very early in the century began to instruct the students of Columbia College in the principles of geology as then understood. He published Observations on the Geology of America, and also edited a New York edition of Cuvier's "History of the Earth," contributing to this work an appendix which was constantly quoted by early writers.

The first geological explorer was William Maclure [b. in Ayr,

* Amer. Jour. Science, iii, pp. 201–210.

Scotland, 1763, d. in San Angel, Mexico, Mar. 23, 1840], a Scotch merchant who amassed a large fortune by commercial connections with this country, and became a citizen of the United States about 1796. His most important service to American science was that of a patron, for he was a liberal supporter of the infant Academy of Sciences in Philadelphia, and for twenty-two years its president, besides being an upholder of other important enterprises.

The publication in 1809 of his "Observations on the Geology of the United States" marks the beginning of American geographical geology and the first attempt at a geological survey of the United States. This had long been the object of his ambition, and, in order to prepare himself for the task, he had spent several years in travel throughout Europe, making observations and collecting objects in natural history, which he forwarded to the country of his adoption.

His undertaking was undoubtedly a remarkable one. "He went forth with his hammer in his hand and his wallet on his shoulder, pursuing his researches in every direction, visiting almost every State and Territory, wandering often amidst pathless tracts and dreary solitudes until he had crossed and recrossed the Alleghany mountains not less than fifty times. He encountered all the privations of hunger, thirst, fatigue, and exposure, month after month and year after year, until his indomitable spirit had conquered every difficulty and crowned his enterprise with success,"* and after the publication of his memoir he devoted eight years more to collecting materials for a second and revised addition.

The geological map of the United States, published in 1809, appears to have been the first of the kind ever attempted for an entire country. Smith's geological map of England was six years later, and Greenough's still subsequent in date.

* MARTIN: Memoir of William Maclure, p. 11.

The publication in London in 1813 of Bakewell's "Introduction to Geology" seems to have given a great stimulus to geological researches in this country, as may be judged from the publication of an American edition a year or two later.

Mitchill, Bruce, and Maclure soon had a goodly band of associates. Naturalists were not confined to limited specialties in those days, and we find all the chemists, botanists, and zoölogists absorbed in the consideration of geological problems. Maclure and most of the Americans were disciples of Werner.

Silliman, writing in 1818, said:

"A grand outline has recently been drawn by Mr. Maclure with a masterly hand and with a vast extent of personal observation and labour; but, to fill up the detail, both observation and labour still more extensive are demanded; nor can the object be effected till more good geologists are formed and distributed over our extensive territory."

On the 6th of September, 1819, the American Geological Society was organized in the philosophical room of Yale College, an event of great importance in the history of science, hastening, as it seems to have done, the establishment of State surveys and stimulating observation throughout the country. This Society, which continued in existence until about 1826, may fairly be considered the nucleus of the Association of American Geologists and Naturalists, and, consequently, of the American Association for the Advancement of Science. Members appended to their names the symbols, M. A. G. S., and it was for a time the most active of American scientific societies.

The characteristics of the leading spirits were summed up by Eaton at the time of its beginning:

"The President, William Maclure, has already struck out the grand outline of North American geographical geology. The first Vice-President, Col. G. Gibbs, has collected more facts and amassed more geological and mineralogical specimens than any other individual of the age. The second Vice-President, Professor Silliman, gives the true scientific dress to all the naked

mineralogical subjects which are furnished to his hand. The third Vice-President, Professor Cleaveland, is successfully employed in elucidating and familiarizing those interesting scenes; and thus smoothing the rugged paths of the student. Professor Mitchill has amassed a large store of materials and annexed them to the labors of Cuvier and Jameson. The drudgery of climbing cliffs and descending into fissures and caverns, and of traversing in all directions our most rugged mountainous districts, to ascertain the distinctive characters, number, and order of our strata, has devolved upon me."*

Eaton has very fairly defined his own position among the early geologists, which was that of an explorer and pioneer. The epithet, "Father of American Geology," which has sometimes been applied to him, might more justly be bestowed upon Maclure, or even upon Mitchill. The name of Amos Eaton [b. 1776, d. 1872] will always be memorable, on account of his connection with the geological survey of New York, which was begun in 1820, at the private expense of Hon. Stephen Van Rensselaer; also as the founder, in 1824, of the Rensselaer Polytechnic Institute, the first of its class on the continent.

The State of New York was not pre-eminently prompt in establishing an official survey, but the liberality of Van Rensselaer and the energy of Eaton gave to New York the honor of attaching the names of its towns and counties to a large number of the geological formations of North America.

In these early surveys Eaton was associated with Dr. Theodore Romeyn Beck and Mr. H. Webster, naturalist and collector, one of the first being a survey of the county of Albany, under the special direction of a County Agricultural Society, followed by similar surveys of Rensselaer county and Saratoga county and others along the Erie Canal.

In July, 1818, Professor Silliman began the publication of the *American Journal of Science*, which has been for more than two-thirds of a century the most prominent register of the scien-

* Index to the Geology of the Northern States. 2d ed. 1820. p. viii.

tific progress of this continent. Silliman's journal succeeded, and far more than replaced, the *American Mineralogical Journal*, the earliest of American scientific periodicals, which was established in New York 1810 by Dr. Archibald Bruce, and which was discontinued after the close of the first volume, in 1814, on account of the illness and untimely death of its projector.* The *Mineralogical Journal* was not so limited in scope as in name, and was for a time the principal organ of our scientific specialists.†

We can but admire the spirit of Silliman, who remarks in the preface to the third volume:

"It must require several years from the commencement of the work to decide the question [whether it is to be supported], and the editor (if God continues his life and health) will endeavour to prove himself neither impatient nor querulous during the time that his countrymen hold the question undecided, *whether there shall be an American Journal of Science and Arts.*"

In the fall of 1822 he announced that a trial of four years had decided the point that the American public would support this journal.

Prior to the establishing of Silliman's journal, the principal organs of American science were the *Medical Repository*, commenced in 1798, of which Dr. Mitchill was the chief proprietor; the *New York Medical and Physical Journal*, conducted chiefly by Dr. Hosack; the *Boston Journal of Philosophy and the Arts*, and other similar periodicals. Our students looked chiefly, however, to the English journals—Tilloch's *Philosophical Magazine* and Nicholson's *Journal of Natural Philosophy*, and later, Thomson's *Annals of Philosophy*, the *Annales de Chimie*.

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*"No future historian of American science will fail to commemorate this work as our earliest *purely scientific* journal, supported by *original American communications*," said Silliman in his prospectus, 1817.

†The only copies of this journal known to be in existence are in the N. Y. State Library and the Harvard Library.

The American Monthly Magazine, established in 1814 by Charles Brockden Brown, was fully as much devoted to science as to literature, and an examination of this and other journals of the early portion of the century will, I think, satisfy the student that scientific subjects were more seriously considered by our ancestors than by the Americans of to-day. *The American Monthly* published elaborate reviews of technical works, such as Cleaveland's Mineralogy, and summaries of the world's progress in science, as well as the monthly proceedings of all the scientific societies in New York, and papers on systematic zoölogy and botany by Rafinesque.

In 1812 the American Antiquarian Society was established at Worcester, and before 1820, when its first volume of transactions appeared, had collected 6,000 books and "a respectable cabinet." This was a pioneer effort in ethnological science. *Archæologia Americana* contained papers by Mitchill, Atwater, and others, chiefly relating to the aboriginal population of America. The name of Isaiah Thomas, LL. D. [b. in Boston 1749, d. in Worcester 1831], the founder and first president of the society, who at his own expense erected a building for its accommodation and endowed its first researches, should be remembered with gratitude by American naturalists. He was one of the most eminent of American printers, and styled by DeWarville "the Didot of America."

In 1812 the Academy of Natural Sciences of Philadelphia was founded, the outgrowth of a social club, whose members, we are told, had no conception of the importance of the work they were undertaking when, in a spirit of burlesque, they assumed the title of an academy of learning.

In 1816 the Coast Survey, after years of discussion, was placed in action under the supervision of Hassler (who had been appointed its head as early as 1811), but, two years later, the work going on too slowly to please the Government, it was stopped.

The Linnæan Society of New England, established in Boston about this time, was the precursor of the Boston Society of Natural Science.

The publication of an American edition of Rees's Cyclopædia, in Philadelphia, was begun in 1810, and the 47th volume completed in 1824. This was an event in the history of American science, for it furnished employment and thus fostered the investigations of several eminent naturalists, among whom were Alexander Wilson, Thomas Say, and Ord; while, at the same time, it fostered a taste for science in the United States and gave currency to several rather epoch-making articles, such as Say's upon Conchology and Entomology.

Mr. Bradbury, the publisher of this Cyclopædia, was the first of a goodly company of liberal and far-seeing publishers who have done much for science in this country by their patronage of important scientific publications.

In 1817 Josiah Meigs, Commissioner of the Land Office, issued a circular to the several Registers of the Land Offices of the United States requiring them to keep daily meteorological observations, and also to report upon such phenomena as the times of the unfolding of leaves of plants and the dates of flowering, the migrations of birds and fishes, the dates of spawning of fishes, the hibernation of animals, the history of locusts and other insects in large numbers, the falling of stones and other bodies from the atmosphere, the direction of meteors, and discoveries relative to the antiquities of the country.

It does not appear that anything ever resulted from this step, but it is referred to as an indication that, seventy years ago, our Government was willing to use its civil service officials in the interest of science. A few years later the same idea was carried into effect by the Smithsonian Institution.

In those early days each of the principal cities had public museums founded and supported by private enterprise. Their pro-

prietors were men of scientific tastes, who affiliated with the naturalists of the day and placed their collections freely at the disposal of investigators.

The earliest was the Philadelphia Museum, established by Charles Wilson Peale, and for a time housed in the building of the American Philosophical Society. In 1800 it was full of popular attractions.

"There were a mammoth's tooth from the Ohio, and a woman's shoe from Canton; nests of the kind used to make soup of, and a Chinese fan six feet long; bits of asbestos, belts of wampum, stuffed birds and feathers from the Friendly Islands, scalps, tomahawks, and long lines of portraits of great men of the Revolutionary War. To visit the Museum, to wander through the rooms, play upon the organ, examine the rude electrical machine, and have a profile drawn by the physiognomitian, were pleasures from which no stranger to the city ever refrained."

Dr. Hare's oxyhydrogen blow-pipe was shown in this Museum by Mr. Rubens Peale as early as 1810.

The Baltimore Museum was managed by Rembrandt Peale, and was in existence as early as 1815 and as late as 1830.*

Earlier efforts were made, however, in Philadelphia. Dr. Chovet, of that city, had a collection of wax anatomical models made by him in Europe, and Prof. John Morgan, of the University of Pennsylvania, who learned his methods from the Hunters in London and Sué in Paris, was also forming such a collection before the Revolution.†

The Columbian Museum and Turrell's Museum, in Boston, are spoken of in the annals of the day, and there was a small collection in the attic of the State House in Hartford.

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* "Baltimore has a handsome museum superintended by one of the Peale family, well known for their devotion to natural science and to works of art. It is not their fault if the specimens which they are enabled to display in the latter department are very inferior to their splendid exhibitions in the former."—MRS. TROLLOPE, *Domestic Manners of the Americans*. London, 1831.

† Trans. Amer. Phil. Soc., ii, p. 366.

The Western Museum, in Cincinnati, was founded about 1815, by Robert Best, M. D., afterwards of Lexington, Ky., who seems to have been a capable collector, and who contributed matter to Godman's "American Natural History." In 1818 a society styled the Western Museum Society was organized among the citizens, which, though scarcely a scientific organization, seems to have taken a somewhat liberal and public-spirited view of what a museum should be. To the naturalist of to-day there is something refreshing in such simple appeals as the following:

"In collecting the fishes and reptiles of the Ohio the managers will need all the aid which their fellow-citizens may feel disposed to give them. Although not a very interesting department of zoölogy, no object of the Society offers so great a prospect of novelty as that which embraces these animals.

"The obscure and neglected race of insects will not be overlooked, and any specimen sufficiently perfect to be introduced into a cabinet of entomology will be thankfully received."*

Major John Eatton LeConte, U. S. A. [b. 1784, d. 1860], was a very successful student of botany and zoölogy. He published many botanical papers and contributions to descriptive zoölogy, and also in Paris, in conjunction with Boisduval, the first instalment of a work, of which he was really sole author, upon the Lepidoptera of North America.†

The elder brother, Dr. Lewis LeConte [b. 1782, d. 1838], was equally eminent as an observer, and was, for forty years, one of the most prominent naturalists in the South. On his plantation in Liberty county, Ga., he established a botanical garden and a chemical laboratory. His zoölogical manuscripts were destroyed in the burning of Columbia just at the close of the civil war, but his observations, which he was averse to publishing in his own name, were, we are told, embodied in the writings of his

*An Address to the people of the Western Country, dated Cincinnati, Sept. 15, 1818, and signed by Elijah Slack, James Findlay, William Steele, Jesse Embrees, and Daniel Drake, Managers.

† Histoire Generale et Iconographie.

brother, of Stephen Elliott, of the Scotch botanist Gordon,* of Dr. William Baldwin, and others.† ‡

Stephen Elliott, of Charleston, South Carolina [b. 1711, d. 1830], was a graduate of Yale in the class of 1791, and, while prominent in the political and financial circles of his State, found time to cultivate science. He founded in 1813 the Literary and Philosophical Society of South Carolina, and was its first president; and in 1829 was elected Professor of Natural History and Botany in the South Carolina Medical College, which he aided to establish. He published "The Botany of South Carolina and Georgia" (Charleston, 1821–27), having been assisted in its preparation by Dr. James McBride; and had an extensive museum of his own gathering. The Elliott Society of Natural History, founded in 1853, or before, and subsequently continued under the name of the Elliott Society of Science and Art, 1859–75, was named in memory of this public-spirited man.

Jacob Green [b. 1790, d. 1841], at different times professor in the College of New Jersey and in Jefferson Medical College, was one of the old school naturalists, equally at home in all of the sciences. His paper on Trilobites (1832) was our first formal contribution to invertebrate paleontology; his "Account of some new species of Salamanders,"§ one of the earliest steps in American herpetology; his "Remarks on the Unios of the United States,"‖ the beginning of studies subsequently extensively prosecuted by Lea and some other entomologists. He also wrote upon the crystallization of snow, and was the author of "Chemical

* Loudon's Gardeners' Magazine.

† A. H. Stephens in *Johnson's Cyclopædia*, p. 1702.

‡ The LeConte family deserves a place in Galto's "Hereditary Genius." Prof. John LeConte, the physicist, and Prof. Joseph LeConte, the geologist, were sons of Dr. Lewis LeConte; while Dr. J. L. LeConte is the son of his brother, Major LeConte.

§ Contributions of the Maclurian Lyceum, i, Jan., 1827, p. 3.

‖ Ibid, i, ii, 41.

Philosophy," "Astronomical Researches," and a work upon Botany of the United States.

The earlier volumes of Silliman's Journal were filled with notes of his observations in all departments of natural history.

José Francisco Correa da Serra, secretary of the Royal Academy of Lisbon, was resident in Philadelphia in 1813, in the capacity of Portuguese minister, and affiliated with our men of science in botanical and geological interests. In 1814 he lectured on botany in the place of B. S. Barton, and also published several botanical papers, as well as one upon the soil of Kentucky.

Alire Raffenau Delile, formerly a member of Napoleon's scientific expedition to Egypt, and the editor of the "Flora of Egypt," was in New York about this time, for the purpose of completing his medical education, and seems to have done much to stimulate interest in botanical studies.

To this as well as to the subsequent period belonged Dr. Gerard Troost [b. in Holland, Mar. 15, 1776, ed. at Leyden, d. at Nashville, Aug. 17, 1850], a naturalist of Dutch birth and education, who came to Philadelphia in 1810, and was a founder and the first President of the Philadelphia Academy. In 1826 he founded a Geological Survey of the environs of Philadelphia; in 1827 became Professor of Chemistry, Mineralogy and Geology in the University of Nashville. As State geologist of Tennessee from 1831–49 he published some of the earliest State geological reports.

Another expedition, well worthy of mention, though not exceedingly fruitful, was one made under the direction of Mr. Maclure, President of the Philadelphia Academy, to the Sea Islands of Georgia and the Florida peninsula. The party consisted of Maclure, Say, Ord, and Titian R. Peale, and its results, though not embodied in a formal report, may be detected in the scientific literature of the succeeding years. This was early in 1818, while Florida was still under the dominion of

Spain, and the expedition was finally abandoned, owing to the hostile attitude of the Seminole Indians in that territory.

XIV.

The third decade of the century, beginning with 1820, was marked by a continuation of the activities of that which preceeded. In 1826 there were in existence twenty-five scientific societies, more than half of them especially devoted to natural history,* and nearly all of very recent origin.

The leading spirits were Mitchill, Maclure, Webster, Torrey, Silliman, Gibbs, LeConte, Dewey, Hare, Hitchcock, Olmstead, Eliot, and T. R. Beck.

Nathaniel Bowditch [b. 1773, d. 1838], who, in 1829, began the publication of his magnificent translation of the "Mecanique Celeste" of La Place, with those scholarly commentations which secured him so lofty a place among the mathematicians of the world.

Still more important was the lesson of his noble devotion of his life and fortune to science. The greater part of his monumental work was completed, we are told, in 1817, but he found that to print it would cost $12,000, a sum far beyond his means. A few years later, however, he began its publication from his own limited means, and the work was continued, after his death, by his wife. The dedication is to his wife, and tells us that "without her approbation the work would not have been undertaken."

Another person was W. C. Redfield [b. 1789, d. 1857], who, in 1827, promulgated the essential portions of the theory of storms, which is now pretty generally accepted, and which was subsequently extended by Sir William Reid in Barbadoes and Bermuda, and greatly modified by Professor Loomis, of New Haven. An eloquent eulogy of Redfield was pronounced by

* Amer. Journ. Sci., x, p. 368. (Cut).

Professor Denison Olmsted at the Montreal meeting of the American Association in 1857.*

Among the rising young investigators appear the names of Joseph Henry, A. D. Bache, C. U. Shepard, the younger Silliman, Henry Seybert, William Mather, Ebenezer Emmons, Percival, the poet geologist, DeKay, Godman, and Harlan.

The organization, in 1824, of the Rensselaer School, afterwards the Rensselaer Polytechnic Institute, at Troy, marked the beginning of a new era in scientific and technological education. Its principal professors were Amos Eaton and Dr. Lewis C. Beck.

In 1820 an expedition was sent by the General Government to explore the Northwestern Territory, especially the region around the Great Lakes and the sources of the Mississippi. This was under charge of Gen. Lewis Cass, at that time Governor of Michigan Territory. Henry R. Schoolcraft accompanied this expedition as mineralogist, and Capt. D. B. Douglass, U. S. A., as topographical engineer; and both of these sent home considerable collections reported upon by the specialists of the day. Cass himself, though better known as a statesman, was a man of scientific tastes and ability, and his "Inquiries respecting the History, Traditions, Languages, &c., of the Indians," published at Detroit in 1823, is a work of high merit.

Long's expeditions into the far West were also in progress at this time, under the direction of the General Government; the first, or Rocky Mountain, exploration in 1819–20; the second to the sources of the St. Peter's, in 1823. In the first expedition Major Long was accompanied by Edwin James as botanist and geologist, who also wrote the Narrative published in 1823. The second expedition was accompanied by William H. Keating, Professor of Mineralogy and Chemistry in the University of Pennsylvania, who was its geologist and historiographer. Say

* See History of N. Y. Academy of Science, p. 76.

was the zoölogist of both explorations. De Schweinitz worked up the botanical material which he collected.

The English expeditions sent to Arctic North America under the command of Sir John Franklin were also out during these years, the first from 1819 to 1822, the second from 1825 to 1827, and yielded many important results. To naturalists they have an especial interest, because Sir John Richardson, who accompanied Franklin as surgeon and naturalist, was one of the most eminent and successful zoölogical explorers of the century, and had more to do with the development of our natural history than any other man not an American.

His natural history papers in Franklin's reports, 1823 and 1828, his "Fauna Boreali Americana," published between 1827 and 1836, his report upon the "Zoölogy of North America," are all among the classics of our zoölogical literature.*

The third decade was somewhat marked by a renewal of interest in zoölogy and botany, which had, during the few preceding years, been rather overshadowed by geology and mineralogy.

Rafinesque had retired to Kentucky, where, from his professor's chair in Transylvania University, he was issuing his *Annals of Nature* and his *Western Minerva;* and his brilliancy being dimmed by distance, other students of animals had a chance to work.

One of the most noteworthy of the workers was Thomas Say [b. 1787, d. 1834], who was a pioneer in several departments of systematic zoölogy. A kinsman of the Bartrams, he spent many of his boyhood days in the old botanic garden at Kingsessing, in company with the old naturalist, William Bartram, and the ornithologist Wilson. At the age of twenty-five, having been unsuccessful as an apothecary, he gave his whole time to zoölogy. He slept in the hall of the Academy of Natural

* See Rev. John McIlwraith's Life of Sir John Richardson, C. B., LL. D. London, 1868. Also Obituary in *London Reader*, 1865, p. 707.

Sciences, where he made his bed beneath the skeleton of a horse, and fed himself upon bread and milk. He was wont, we are told, to regard eating as an inconvenient interruption to scientific pursuits, and to wish that he had been created with a hole in his side, through which his food might be introduced into his system. He built up the museum of the society, and made extensive contributions to biological science.

His article on conchology, published in 1816 in the American edition of Nicholson's Cyclopædia, was the foundation of that science in this country, and was republished in Philadelphia in 1819, with the title, "A Description of the Land and Fresh-water Shells of the United States."

"This work," remarked a contemporary, "ought to be in the possession of every American lover of Natural Science. It has been quoted by *M. Lamarck* and adopted by *M. de Ferrusac*, and has thus taken its place in the scientific world."

Such was fame in America in the year of grace 1820.

In 1817 he did a similar service for systematic entomology, and his contributions to herpetology, to the study of marine invertebrates, especially the crustacea, and to that of invertebrate paleontology, were equally fundamental.

As naturalist of Long's expeditions he described many Western vertebrates, and also collected Indian vocabularies, and it is said that the narrative of the expeditions was chiefly based upon the contents of his note-books.

In 1825 he removed from Philadelphia to New Harmony, Indiana, and, in company with Maclure and Troost, became a member of the community founded there by Owen of Lanark. Comparatively little was thenceforth done by him, and we can only regret the untimely close of so brilliant a career.*

* See Memoirs by B. H. Coates, read before American Philosophical Society, Dec. 16, 1834. Memoirs by George Ord; also a tribute to his memory in Dall's presidential address before the Society in January, 1888.

Charles Alexander Lesueur [b. at Havre-de-Grace, France, Jan. 1, 1778, d. at Havre, Dec. 12, 1846], the friend and associate of Maclure and Say, accompanied them to New Harmony. The romantic life of this talented Frenchman has been well narrated in his biography by Ord.* He was one of the staff of the Baudin expedition to Australia in 1800, and to his efforts, seconding those of Peron, his associate, were due most of the scientific results which France obtained from that ill-fated enterprise. Lesueur, though a naturalist of considerable ability, was, above all, an artist. The magnificent plates in the reports prepared by Peron† and Freycinet‡ were all his. He was called "the Raffaelle of zoölogical painters," and his removal to America in 1815 was greatly deplored by European naturalists. He travelled for three years with Maclure, exploring the West Indies and the eastern United States, making a magnificent collection of drawings of fishes and invertebrates, and in 1818 settled in Philadelphia, where, supporting himself by giving drawing lessons, he became an active member of the Academy of Sciences, and published many papers in its Journal.

No one ever drew such exquisite figures of fishes as Lesueur, and it is greatly to be regretted that he never completed his projected work upon North American Ichthyology. He issued a prospectus, with specimen plates, of a "Memoir on the Medusæ," and his name will always be associated with the earliest American work upon marine invertebrates and invertebrate paleontology, because it was to him that Say undoubtedly owed his first acquaintance with these departments of zoölogy. In 1820, while at Albany in the service of the United States and Canadian Boundary Commission, he gave lessons to Eaton and identified his fossils, thus laying the foundations for the future work of the rising school of New York paleontologists.

* Ord: Memoir of Charles Alexander Lesueur. *Am. Jour. Sci.*, 2d ser., viii, p. 189.

† Voyage des Decouvertes aux Terres Australes.

‡ Voyage aux Terres Australes.

Twelve years of his life were wasted at New Harmony, and in 1837, after the death of Say, he returned to France, carrying his collections and drawings to the Natural History Museum at Havre, of which he became Curator. His period of productiveness was limited to the six years of his residence in Philadelphia. But for their sacrifice to the socialistic ideas of Owen, Say and Lesueur would doubtless be counted among the most distinguished of our naturalists, and the course of American zoölogical research would have been entirely different.

The Rev. Daniel H. Barnes [b. 1785, d. 1828], of New York, a graduate of Union College and a Baptist preacher, was one of Say's earliest disciples, and from 1823 he published papers on conchology, beginning with an elaborate study of the fresh-water mussels. This group was taken up in 1827 by Dr. Isaac Lea, and discussed from year to year in his well-known series of beautifully illustrated monographs.

Mr. Barnes published, also, papers on the "Classification of the Chitonidæ," on "Batrachian Animals and Doubtful Reptiles," and on "Magnetic Polarity."

The officers of the Navy had already begun their contributions to natural history which have been so serviceable in later years. One of the earliest contributions by Barnes was a description of five species of *Chiton* collected in Peru by Capt. C. S. Ridgely, of the "Constellation."

In this period (1828+) was begun the publication of Audubon's folio volumes of illustrations of North American birds—a most extraordinary work, of which Cuvier enthusiastically exclaimed: "C'est le plus magnifique monument que l'Art ait encore élevé a la Nature."

Wilson was the Wordsworth of American naturalists, but Audubon was their Rubens. With pen as well as with brush he delineated those wonderful pictures which have been the delight of the world.

Born in 1781, in Louisiana, while it was still a Spanish colony, he became, at an early age, a pupil of the famous French painter David, under whose tuition he acquired the rudiments of his art. Returning to America, he began the career of an explorer, and for over half a century his life was spent, for the most part, in the forests or in the preparation of his ornithological publications—occasionally visiting England and France, where he had many admirers. His devotion to his work was as complete and self-sacrificing as that of Bowditch, the story of whose translation of LaPlace has already been referred to. It was a great surprise to his friends (though his own fervor did not permit him to doubt) that the sale of his folio volumes was sufficient to pay his printer's bills. Audubon was not a very accomplished systematic zoölogist, and when serious discriminations of species was necessary, sometimes formed alliances with others. Thus Bachman became his collaborator in the study of mammals, and the youthful Baird was invited by him, shortly before his death in 1851, to join him in an ornithological partnership. His relations with Alexander Wilson form the subject of a most entertaining narration in the "Ornithological Biography."*

Thomas Nuttall [b. in Yorkshire, 1786, d. at St. Helens, Lancashire, Sept. 10, 1859] was so thoroughly identified with American natural history and so entirely unconnected with that of England that, although he returned to his native land to die, we may fairly claim him as one of our own worthies. He crossed the ocean when about twenty-one years of age, and travelled in every part of the United States and in the Sandwich Islands studying birds and plants. From 1822 to 1828 he was curator and lecturer at the Harvard Botanical Garden. Besides numerous papers in the Proceedings of the Philadelphia Academy, he published in Philadelphia, in 1818, his "Genera of North

* 1, p. 439.

American Plants," in his "Geological Sketch of the Valley of the Mississippi," in 1821; his "Journal of Travels into the Arkansas Territory," a work abounding in natural history observations; in 1832–4 his "Manual of the Ornithology of the United States and Canada;" and in 1843–9 his "North American Sylva," a continuation of the Sylva of Michaux. About 1850 he retired to a rural estate in England, where he died in 1859.

Nuttall was not great as a botanist, as a geologist, or a zoölogist, but was a man useful, beloved, and respected.

Richard Harlan, M. D. [b. 1796, d. 1843], who, with Mitchill, Say, Rafinesque, and Gosse, was one of the earliest of our herpetologists, and who was one of Audubon's chief friends and supporters, published in 1825 the first instalment of his "Fauna Americana," which treated exclusively of mammals. This was followed, in 1826, by a rival work on mammals, by Godman. Harlan's book was a compilation, based largely on translations of portions of Desmarest's "Mammalogie," printed three years before in Paris. It was so severely criticised that the second portion, which was to have been devoted to reptiles, was never published, and its author turned his attention to medical literature. Godman's "North American Natural History, or Mastology," contained much original matter, and, though his contemporaries received it with faint praise, it is the only separate, compact, illustrated treatise on the mammals of North America ever published, and is useful to the present day. John D. Godman [b. in Annapolis, Md., Dec. 20, 1794, d. in Germantown, Pa., Apl. 17, 1830] died an untimely death, but gave promise of a brilliant and useful career as a teacher and investigator. His "Rambles of a Naturalist" is one of the best series of essays of the Selborne type ever produced by an American, and his "American Natural History" is a work of much importance, even to the present day, embodying as it does a large number of original observations.

Michaux's Sylva was, as we have seen, continued by Nuttall:

Wilson's American Ornithology was, in like manner, continued by Charles Lucien Bonaparte [b. in Paris, May 24, 1803, d. in Paris, July 30, 1857], Prince of Canino, and nephew of Napoleon the First, a master in systematic zoölogy. Bonaparte came to the United States about the year 1822, and returned to Italy in 1828. His contributions to zoölogical science were of great importance. In 1827, he published in Pisa his "Specchio comparativo delle ornithologie di Roma e di Filadelfia," and from 1825 to 1833 his "American Ornithology," containing descriptions of over one hundred species of birds discovered by himself.

The publication of Torrey's "Flora of the Middle and Northern Sections of the United States" was an event of importance, as was also Dr. W. J. Hooker's essay on the Botany of America,* the first general treatise upon the American flora or fauna, by a master abroad, is pretty sure evidence that the work of home naturalists was beginning to tell.

So, also, in a different way, was the appearance in 1829 of the first edition of Mrs. Lincoln's "Familiar Lectures on Botany," a work which did much toward swelling the army of amateur botanists.

Important work was also in progress in geology. Eaton and Beck were carrying on the Van Rensselaer survey of New York, and in 1818 the former published his "Index to the Geology of the Northern States." Prof. Denison Olmstead, of the University of North Carolina, was completing the official survey of that State—the first ever authorized by the government of a State.

Prof. Lardner Vanuxem, of North Carolina, in 1828, made an important advance, being the first to avail himself successfully of paleontology for the determination of the age of several of our formations, and their approximate synchronism with European beds.†

* Brewster's Edinburgh Journal of Science, iii, p. 103.

† Gill.

Horace H. Hayden, of Baltimore [b. 1769, d. 1844], published in 1820 "Geological Essays, or an inquiry into some of the geological phenomena to be found in various parts of America and elsewhere,"* which was well received as a contribution to the history of alluvial formations of the globe, and was apparently the first general work on geology published in this country. Silliman said that it should be a text-book in all the schools. He published, also, a "New Method of preserving Anatomical Preparations,"† "A Singular ore of Cobalt and Manganese,"‡ on "The Bare Hills near Baltimore,"‖ and on "Silk Cocoons,"§ and was a founder and vice-president of the Maryland Academy of Sciences.

XV.

In the fourth decade (1830–40) the leading spirits were Silliman, Hare, Olmstead, Hitchcock, Torrey, DeKay, Henry, and Morse.

Among the men just coming into prominence were J. W. Draper, then professor in Hampden Sidney College, in Virginia, the brothers W. B. and H. D. Rogers, A. A. Gould the conchologist, and James D. Dana.

Henry was just making his first discoveries in physics, having, in 1829, pointed out the possibility of electro-magnetism as a motive power, and in 1831 set up his first telegraphic circuit at Albany. In 1832 the United States Coast Survey, discontinued in 1818, was reorganized under the direction of its first chief, Hassler, now advanced in years.¶

The natural history survey of New York was organized by the

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* Rev. Sill. Journ., iii, 47. Blackwood's Mag., xvi, 420; xvii, 56.

† American Medical Record, 1822.

‡ *Ibid.* 1832. ‖ Silliman's Journal, 1822.

§ Journ. Amer. Silk Company, 1839.

¶ Proc. Amer. Assoc. Adv. Sci., ii, 163.

State in 1836, and James Hall and Ebenezer Emmons were placed upon its staff.

G. W. Featherstonhaugh [b. 1780, d. 1866] was conducting (1834–5) a Government expedition, exploring the geology of the elevated country between the Missouri and Red rivers and the Wisconsin territories. He bore the name of "United States Geologist," and projected a geological map of the United States, which now, half a century later, is being completed by the U. S. geologist of to-day. Besides his report upon the survey just referred to, Featherstonhaugh printed a "Geological Reconnoissance, in 1835, from Green Bay to Coteau des Prairies," and a "Canoe Voyage up the Minnay Sotor," in London, 1847.

In 1838 the United States Exploring Expedition under Wilkes was sent upon its voyage of circumnavigation, having upon its staff a young naturalist named Dana, whose studies upon the crustaceans and radiates of the expedition have made him a world-wide reputation, entirely independent of that which he has since gained as a mineralogist and geologist. It is customary to refer to the Wilkes expedition as having been sent out entirely in the interests of science. As a matter of fact it was organized primarily in the interests of the whale fishery of the United States.

Dana, before his departure with Wilkes, had published, in 1837, the first edition of his "System of Mineralogy," a work which, in its subsequent editions, has become the standard manual of the world.

The publication of Lyell's "Principles of Geology" at the beginning of this decade (1830) had given new direction to the thoughts of our geologists, and they were all hard at work under its inspiration.

With 1839 ended the second of our thirty-year periods—the one which I have chosen to speak of as the period of Silliman—not so much because of the investigations of the New Haven professor, as on account of his influence in the promotion of American Science and scientific institutions.

This was a time of hard work, and we must not withhold our praise from the noble little company of pioneers who were, in those years, building the foundations upon which the scientific institutions of to-day are resting.

The difficulties and drawbacks of scientific research at this time have been well described by one who knew them:*

"The professedly scientific institutions of our country issued, from time to time, though at considerable intervals, volumes of transactions and proceedings unquestionably not without their influence in keeping alive the scarcely kindled flame, but whose contents, as might be expected, were, for the most part, rather in conformity with the then existing standard of excellence than in advance of it. Natural history in the United States was the mere sorting of genera and species. The highest requisite for distinction in any physical science was the knowledge of what European students had attained. Astronomy was, in general, confined to observations, and those not of the most refined character, and its merely descriptive departments were estimated far more highly than the study of its laws. Astronomical computation had hardly risen above the ciphering out of eclipses and occultations. Indeed, I risk nothing in saying that astronomy had lost ground in America since those colonial times, when men like Rittenhouse kept up a constant scientific communication with students of astronomy beyond the seas. And I believe I may farther say, that a single instance of a man's devoting himself to science as the only earthly guide, aim, and object of his life, while unassured of a professor's chair or some analogous appointment upon which he might depend for subsistence, was utterly unknown.

"Such was the state of science in general. In astronomy the expensive appliances requisite for all observations of the higher class were wanting, and there was not in the United States, with the exception of the Hudson Observatory, to which Professor Loomis devoted such hours as he could spare from his duties in the college, a single establishment provided with the means of making an absolute determination of the place of any celestial body, or even relative determinations at all commensurate in accuracy with the demands of the times. The only instrument that could be thought of for the purpose was the Yale College telescope, which, although provided with a micrometer, was destitute of the means of identifying comparison-stars. A better idea of American astronomy a dozen years ago can hardly be obtained than by quot-

* Gould, B. A. Address in commemoration of Sears Cook Walker. <*Proc. Amer. Assoc. Ad. Sci.*, viii, 25

ing from an article published at that time by the eminent geometer who now retires from the position of President of this Association. He will forgive me the liberty for the sake of the illustration. 'The impossibility,' said he, 'of great national progress in astronomy, while the materials are, for the most part, imported, can hardly need to be impressed upon the patrons of science in this country. * * * And next to the support of observers is the establishment of observatories. Something has been done for this purpose in various parts of the country, and it is earnestly to be hoped that the intimations which we have heard regarding the intentions of Government may prove to be well founded; that we shall soon have a permanent national observatory equal in its appointments to the best furnished ones of Europe; and that American ships will ere long calculate their longitudes and latitudes from an American nautical almanac. That there is on this side of the Atlantic a sufficient capacity for celestial observations is amply attested by the success which has attended the efforts, necessarily humble which have hitherto been made.'"*

XVI.

Just before the middle of the century a wave, or to speak more accurately, a series of waves of intellectual activity began to pass over Europe and America. There was a renaissance, quite as important as that which occurred in Europe at the close of the Middle Ages. Draper and other historians have pointed out the causes of this movement, prominent among which were the introduction of steam and electricity, annihilating space and relieving mankind from a great burden of mechanical drudgery. It was the beginning of the "age of science," and political as well as social and industrial changes followed in rapid succession.

In Europe the great work began a little earlier. Professor Huxley, in his address to the Royal Society in 1885, took for a fixed point his own birthday in 1825, which was four months before the completion of the railway between Stockton and Darlington—"the ancestral representative of the vast reticulated fetching and carrying organism which now extends its meshes over the civilized world." Since then, he remarked, "the greater

* PEIRCE, BENJAMIN, Cambridge Miscellany, 1842, p. 25.

part of the vast body of knowledge which constitutes the modern sciences of physics, chemistry, biology, and geology has been acquired, and the widest generalizations therefrom have been deduced, and, furthermore, the majority of those applications of scientific knowledge to practical ends which have brought about the most striking differences between our present civilization and that of antiquity have been made within that period of time."

It is within the past half century, he continued, that the most brilliant additions have been made to fact and theory and serviceable hypothesis in the region of pure science, for within this time falls the establishment on a safe basis of the greatest of all the generalizations of science, the doctrines of the Conservation of Energy and of Evolution. Within this time the larger moiety of our knowledge of light, heat, electricity, and magnetism has been acquired. Our present chemistry has been, in great part, created, while the whole science has been remodelled from foundation to roof.

"It may be natural," continued Professor Huxley, "that progress should appear most striking to me among those sciences to which my own attention has been directed, but I do not think this will wholly account for the apparent advance 'by leaps and bounds' of the biological sciences within my recollection. The cell theory was the latest novelty when I began to work with the microscope, and I have watched the building of the whole vast fabric of histology. I can say almost as much of embryology, since Von Baer's great work was published in 1828. Our knowledge of the morphology of the lower plants and animals and a great deal of that of the higher forms has very largely been obtained in my time; while physiology has been put upon a totally new foundation, and, as it were, reconstructed, by the thorough application of the experimental method to the study of the phenomena of life, and by the accurate determination of the purely physical and chemical components of these phenomena.

The exact nature of the processes of sexual and non-sexual reproduction has been brought to light. Our knowledge of geographical and geological distribution and of the extinct forms of life has been increased a hundredfold. As for the progress of geological science, what more need be said than that the first volume of Lyell's 'Principles' bears the date of 1830."

It cannot be expected that, within the limits of this address, I should attempt to show what America has done in the last half century. I am striving to trace the beginnings, not the results, of scientific work on this side of the Atlantic. I will simply quote what was said by the London *Times* in 1876:

"In the natural distribution of subjects, the history of enterprise, discovery, and conquest, and the growth of republics, fell to America, and she has dealt nobly with them. In the wider and more multifarious provinces of art and science she runs neck and neck with the mother country and is never left behind."

It is difficult to determine exactly the year when the first waves of this renaissance reached the shores of America. Silliman, in his Priestley address, placed the date at 1845. I should rather say 1840, when the first national scientific association was organized, although signs of awakening may be detected even before the beginning of the previous decade. We must, however, carefully avoid giving too much prominence to the influence of individuals. I have spoken of this period of thirty years as the period of Agassiz. Agassiz, however, did not bring the waves with him; he came in on the crest of one of them; he was not the founder of modern American natural history, but, as a public teacher and organizer of institutions, he exerted a most important influence upon its growth.

One of the leading events of the decade was the reorganization of the Coast Survey in 1844, under the sage administration of Alexander Dallas Bache,* speedily followed by the beginning of

* Proc. Amer. Assoc. Adv. Sci., ii, 164.

investigations upon the Gulf Stream, and of the researches of Count Pourtales into its fauna, which laid the foundations of modern deep-sea exploration. Others were the founding of the Lawrence Scientific School, the Cincinnati Observatory, the Yale Analytical Laboratory, the celebration of the Centennial Jubilee of the American Philosophical Society in 1843, and the enlargement of Silliman's "American Journal of Science."

The Naval Astronomical Expedition was sent to Chili, under Gibbon (1849), to make observations upon the parallax of the sun. Lieut. Lynch was sent to Palestine (in 1848) at the head of an expedition to explore the Jordan and the Dead Sea.

Frémont conducted expeditions, in 1848, to explore the Rocky Mountains and the territory beyond, and Stansbury, in 1849–'50, a similar exploration of the valley of the Great Salt Lake. David Dale Owen was heading a Government Geological Survey in Wisconsin, Iowa, and Minnesota (1848), and from all of these came results of importance to science and to natural history.

In 1849, Prof. W. H. Harvey, of Dublin, visited America and collected materials for his *Nereis Boreali-Americana*, which was the foundation of our marine botany.

Sir Charles Lyell, ex-President of the Geological Society of London, visited the United States in 1841 and again in 1845, and published two volumes of travels, which were, however, of much less importance than the effects of his encouraging presence upon the rising school of American geologists. His "Principles of Geology," as has already been said, was an epoch-making work, and he was to his generation almost what Darwin was to the one which followed.

Certain successes of our astronomers and physicists had a bearing upon the progress of American science in all its departments, which was, perhaps, even greater than their actual importance would seem to warrant. These were the discovery, by the Bards

of Cambridge, of Bards comet in 1846, of the satellite Hyperion in 1848, of the third ring of Saturn in 1850, the discovery by Herrick and Bradley, in 1846, of the bi-partition of Belas comet, and the application of the telegraph to longitude determination after Locke had constructed, in 1848, his clock for the registration of time observations by means of electro-magnetism.

It is almost ludicrous at this day to observe the grateful sentiments with which our men of science welcomed the adoption of this American method in the observatory at Greenwich.

Americans were still writhing under the sting of Sidney Smith's demand "Who reads an American book?" and the narrations of those critical observers of national customs, Dickens, Basil Hall, and Mrs. Trollope.

The continental approval of American science was like balsam to the sensitive spirits of our countrymen.

John William Draper's versatile and original researches in physics were also yielding weighty results, and as early as 1847 he had already laid the foundations of the science of spectroscopy which Kirchhoff so boldly appropriated many years later.

Most important of all, by reason of its breadth of scope, was the foundation of the Smithsonian Institution, which was organized in 1846 by the election of Joseph Henry to its secretaryship. Who can attempt to say what the conditions of science in the United States would be to-day, but for the bequest of Smithson? In the words of John Quincy Adams, "Of all the foundations or establishments for pious or charitable uses which ever signalized the spirit of the age or the comprehensive beneficence of the founder, none can be named more deserving the approbation of mankind."

Among the leaders of this new enterprise and of the scientific activities of the day may be named: Silliman, Hare, Henry, Bache, Maury, Alexander, Locke, Mitchel, Peirce, Walker, Draper, Dana, Wyman, Agassiz, Gray, Torrey, Haldeman,

Morton, Holbrook, Gibbes, Gould, DeKay, Storer, Hitchcock, Redfield, the brothers Rogers, Jackson, Hays, and Owen.

Among the rising men were Baird, Adams the conchologist, Burnett, Harris the entomologist, and the LeConte brothers among zoölogists; Lapham, D. C. Eaton, and Grant, among botanists; Sterry Hunt, Brush, J. D. Whitney, Wolcott Gibbs, and Lesley, among chemists and geologists, as well as Schiel, of St. Louis, who had before 1842 discovered the principle of chemical homology.

I have not time to say what ought to be said of the coming of Agassiz in 1846. He lives in the hearts of his adopted countrymen. He has a colossal monument in the museum which he reared, and a still greater one in the lives and works of pupils such as Agassiz, Allen, Burgess, Burnett, Brooks, Clarke, Cooke, Faxon, Fewkes, Gorman, Hartt, Hyatt, Joseph LeConte, Lyman, McCrady, Morse, Mills, Niles, Packard, Putnam, Scudder, St. John, Shaler, Verrill, Wilder, and David A. Wells.

XVII.

They were glorious men who represented American science at the middle of the century. We may well wonder whether the present decade will make as good a showing forty years hence.

The next decade was its continuation. The old leaders were nearly all active, and to their ranks were added many more.

An army of new men was rising up.

It was a period of great explorations, for the frontier of the United States was sweeping westward, and there was need of a better knowledge of the public domain.

Sitgreaves explored the region of the Zuñi and Colorado rivers in 1852, and Marcy the Red River of the North. The Mexican boundary survey, under Emory, was in progress from 1854 to 1856, and at the same time the various Pacific railroad surveys. There was also the Herndon exploration of the valley of the Am-

azon, and the North Pacific exploring expedition under Rogers. These were the days, too, when that extensive exploration of British North America was begun, through the co-operation of the Hudson's Bay Company with the Smithsonian Institution.

It was the harvest-time of the museums. Agassiz was building up with immense rapidity his collections in Cambridge, utilizing to the fullest extent the methods which he had learned in the great European establishments and the public spirit and generosity of the Americans. Baird was using his matchless powers of organization in equipping and inspiring the officers of the various surveys, and accumulating immense collections to be used in the interest of the future National Museum.

Systematic natural history advanced with rapid strides. The magnificent folio reports of the Wilkes expedition were now being published, and some of them, particularly those by Dana on the crustaceans and the zoöphytes and geology, that of Gould upon the mollusks, those by Torrey, Gray, and Eaton upon the plants, were of great importance.

The reports of the domestic surveys contained numerous papers upon systematic natural history, prepared under the direction of Baird, assisted by Girard, Gill, Cassin, Suckley, LeConte, Cooper, and others. The volumes relating to the mammals and the birds, prepared by Baird's own pen, were the first exhaustive treatises upon the mammalogy and ornithology of the United States.

The American Association was doing a great work in popular education through its system of meeting each year in a different city. In 1850 it met in Charleston, and its entire expenses were paid by the city corporation as a valid mark of public approval, while the foundation of the Charleston museum of natural history was one of the direct results of the meeting.

In 1857 it met in Montreal, and delegates from the English scientific societies were present; this was one of the earliest of those manifestations of international courtesy upon scientific ground of which there have since been many.

In the seventh decade, which began with threatenings of civil war, the growth of science was almost arrested. A meeting of the American Association was to have been held in Nashville in 1861, but none was called. In 1866, at Buffalo, its sessions were resumed with the old board of officers elected in 1860. One of the vice-presidents, Gibbes, of South Carolina, had not been heard from since the war began, and the Southern members were all absent. Many of the Northern members wrote, explaining that they could not attend this meeting because they could not afford it, "such had been the increase of living expenses, without a corresponding increase in the salaries of men of science." Few scientists were engaged in the war, though one, O. M. Mitchel, who left the directorship of the Dudley observatory to accept the command of an Ohio brigade, died in service in 1862, and another, Couthouy, sacrificed his life in the navy. Others, like Ordway, left the ranks of science never to resume their places as investigators.

Scientific effort was paralyzed, and attention was directed to other matters. In 1864, when the Smithsonian building was burned, Lincoln, it is said, looking at the flames from the windows of the Executive Mansion, remarked to some military officers who were present: "Gentlemen, yonder is a national calamity. We have no time to think about it now. We must attend to other things."

The only important events during the war were two; one the organization of the National Academy of Sciences, which soon became what Bache had remarked the necessity for in 1851, when he said: "An institution of science, supplementary to existing ones, is much needed to guide public action in reference to scientific matters."*

The other was the passage, in 1862, of the bill for the establishment of scientific educational institutions in every State.

* Proc. Amer. Assoc. Adv. Sci., vi, xlviii.

The agricultural colleges were then, as they still are, unpopular among many scientific men, but the wisdom of the measure is apparently before long to be justified.

Before the end of the decade, the Northern States* had begun a career of renewed prosperity, and the scientific institutions were reorganized. The leading spirits were such men as Pierce, Henry, Agassiz, Gray, Barnard, the Goulds, Newberry, Lea, Whittlesey, Foster, Rood, Cooke, Newcomb, Newton, Wyman, Winchell.

Among the rising men, some of them very prominent before 1870, were Barker, Bolton, Chandler, Eggleston, Hall, Harkness, Langley, Mayer, Pickering, Young, Powell, Pumpelly, Abbe, Collett, Emerson, Hartt, Lupton, Marsh, Whitfield, Williams, N. H. Winchell, Agassiz, the Allens, Beale, Cope, Coues, Canby, Dall, Hoy, Hyatt, Morse, Orton, Perkins, Rey, Riley, Scudder, Sidney Smith, Stearns, Tuttle, Verrill, Wood.

Soon after the war the surveys of the West, which have coalesced to form the U. S. Geological Survey, were forming under the direction of Clarence Cook, Lieut. Wheeler, F. V. Hayden, and Major Powell.

The discovery of the nature of the corona of the sun by Young and Harkness in 1869 was an event encouraging to the rising spirits of our workers.

XVIII.

With 1869 we reach the end of the third period and the threshold of that in which we are living. I shall not attempt to define the characteristics of the natural history of to-day, though I wish to direct attention to certain tendencies and conditions which exist. Let me, however, refer once more to the past, since it leads again directly up to the present.

* See A. D. White's Scientific and Industrial Education in the United States. < Popular Science Monthly, v, p. 170.

In a retrospect published in 1876,* one of our leaders stated that American science during the first forty years of the present century was in "a state of general lethargy, broken now and then by the activity of some first-class man, which, however, commonly ceased to be directed into purely scientific channels." This depiction was, no doubt, somewhat true of the physical and mathematical sciences concerned, but not to the extent indicated by the writer quoted. What could be more unjust to the men of the last generation than this? "It is," continues he, "strikingly illustrative of the absence of everything like an effective national pride in science that two generations should have passed without America having produced anything to continue the philosophical researches of Franklin."

I may not presume to criticise the opinion of the writer from whom these words are quoted, but I cannot resist the temptation to repeat a paragraph from Prof. John W. Draper's eloquent centennial address upon "Science in America:"

"In many of the addresses on the centennial occasion," he said, "the shortcomings of the United States in extending the boundaries of scientific knowledge, especially in the physical and chemical departments, have been set forth. 'We must acknowledge with shame our inferiority to other people,' says one. 'We have done nothing,' says another. * * * But we must not forget that many of these humiliating accusations are made by persons who are not of authority in the matter; who, because they are *ignorant* of what has been done, *think* that nothing *has* been done. They mistake what is merely a blank in their own information for a blank in reality. In their alacrity to depreciate the merit of their own country they would have us confess that, for the last century, we have been living on the reputation of Franklin and his thunder-rod."

These are the words of one who, himself an Englishman by birth, could, with excellent grace, upbraid our countrymen for their lack of patriotism.

The early American naturalists have been reproached for de-

* North American Review.

voting their time to explorations and descriptive natural history, and their work depreciated, as being of a character beneath the dignity of the biologists of to-day.

"The zoölogical science of the country," said the president of the Natural History Section of the American Association a few years since, "presents itself in two distinct periods: The first period may be recognized as embracing the lowest stages of the science; it included, among others, a class of men who busied themselves in taking an inventory of the animals of the country, an important and necessary work to be compared to that of the hewers and diggers who first settle a new country, but in their work demanded no deep knowledge or breadth of view."

It is quite unnecessary to defend systematic zoölogy from such slurs as this, nor do I believe that the writer quoted would really defend the ideas which his words seem to convey, although, as Professor Judd has regretfully confessed in his recent address before the Geological Society of London, systematic zoölogists and botanists have become somewhat rare and out of fashion in Europe in modern times.

The best vindication of the wisdom of our early writers will be, I think, the presentation of a counter-quotation from another presidential address, that of the venerable Dr. Bentham before the Linnæan Society of London, in 1867:

"It is scarcely half a century," wrote Bentham, "since our American brethren applied themselves in earnest to the investigation of the natural productions and physical condition of their vast continent; their progress, especially during the latter half of that period, had been very rapid until the outbreak of the recent war, so deplorable in its effects in the interests of science as well as on the material prosperity of their country. The peculiar condition of the North American Continent requires imperatively that its physical and biological statistics should be accurately collected and authentically recorded, and that this should be speedily done. It is more than any country, except our Australian colonies, in a state of transition. Vast tracts of land are still in what may be called almost a primitive state, unmodified by the effects of civilization, uninhabited, or tenanted only by the remnants of ancient tribes, whose unsettled life never exercised

much influence over the natural productions of the country. But this state of things is rapidly passing away; the invasion and steady progress of a civilized population, whilst changing generally the face of nature, is obliterating many of the evidences of a former state of things. It may be true that the call for recording the traces of previous conditions may be particularly strong in Ethnology and Archæology; but in our own branches of the science, the observations and consequent theories of Darwin having called special attention to the history of species, it becomes particularly important that accurate biological statistics should be obtained for future comparison in those countries where the circumstances influencing those conditions are the most rapidly changing. The larger races of wild animals are dwindling down, like the aboriginal inhabitants, under the deadly influence of civilized man. Myriads of the lower orders of animal life, as well as of plants, disappear with the destruction of forests, the drainage of swamps, and the gradual spread of cultivation, and their places are occupied by foreign invaders. Other races, no doubt, without actually disappearing, undergo a gradual change under the new order of things, which, if perceptible only in the course of successive generations, require so much the more for future proof an accurate record of their state in the still unsettled condition of the country. In the Old World almost every attempt to compare the present state of vegetation or animal life with that which existed in uncivilized times is in a great measure frustrated by the absolute want of evidence as to that former state; but in North America the change is going forward, as it were, close under the eye of the observer. This consideration may one day give great value to the reports of the naturalist sent by the Government, as we have seen, at the instigation of the Smithsonian Institution and other promoters of science, to accompany the surveys of new territories."

Having said this much in defence of the scientific men of the United States, I wish, in conclusion, to prefer some very serious charges against the country at large, or, rather, as a citizen of the United States, to make some very melancholy and humiliating confessions.

The present century is often spoken of as "the age of science," and Americans are somewhat disposed to be proud of the manner in which scientific institutions are fostered and scientific investigators encouraged on this side of the Atlantic.

Our countrymen have made very important advances in many

departments of research. We have a few admirably organized laboratories and observatories, a few good collections of scientific books, six or eight museums worthy of the name, and a score or more of scientific and technological schools, well organized and better provided with officers than with money. We have several strong scientific societies, no one of which, however, publishes transactions worthy of its own standing and the collective reputation of its members. In fact, the combined publishing funds of all our societies would not pay for the annual issue of a volume of memoirs, such as appears under the auspices of any one of a dozen European societies which might be named.

Our Government, by a liberal support of its scientific departments, has done much to atone for the really feeble manner in which local institutions have been maintained. The Coast Survey, the Geological Surveys, the Department of Agriculture, the Fish Commissions, the Army, with its Meteorological Bureau, its Medical Museum and Library, and its explorations; the Navy, with its Observatory, its laboratories and its explorations; and in addition to these, the Smithsonian Institution, with its systematic promotion of all good works in science, have accomplished more than is ordinarily placed to their credit. Many hundreds of volumes of scientific memoirs have been issued from the Government printing office since 1870, and these have been distributed in such a generous and far-reaching way that they have not failed to reach every town and village in the United States where a roof has been provided to protect them.

It may be that some one will accuse the Government of having usurped the work of the private publisher. Very little of value in the way of scientific literature has been issued during the same period by publishers, except in reprints or translations of works of foreign investigators. It should be borne in mind, however, that our Government has not only published the results of investigations, but has supported the investigators and provided them

with laboratories, instruments and material, and that the memoirs which it has issued would never, as a rule, have been accepted by private publishers.

I do not wish to underrate the efficiency of American men of science, nor the enthusiasm with which many public men and capitalists have promoted our scientific institutions. Our countrymen have had wonderful successes in many directions. They have borne their share in the battle of science against the unknown. They have had abundant recognition from their fellow-workers in the Old World. They have met perhaps a more intelligent appreciation abroad than at home. It is the absence of home appreciation that causes us very much foreboding for the future.

In Boston or Cambridge, in New York, Philadelphia, Baltimore, Washington, Chicago, or San Francisco, and in most of the college towns, a man interested in science may find others ready to talk over with him a new scientific book, or a discovery which has excited his interest. Elsewhere, the chances are, he will have to keep his thoughts to himself. One may quickly recite the names of the towns and cities in which may be found ten or more people whose knowledge of any science is aught than vague and rudimentary. Let me illustrate my idea by supposing that every inhabitant of the United States, over fifteen years of age, should be required to mention ten living men eminent in scientific work, would one out of a hundred be able to respond? Does any one suppose that there are three or four hundred thousand people enlightened to this degree?

Let us look at some statistics, or, rather, some facts, which it is convenient to arrange in statistical form. The total number of white inhabitants of the United States in 1880 was about forty-two millions. The total number of naturalists, as shown in the *Naturalist's Directory* for 1886, was a little over 4,600. This list includes not only the investigators, who probably do not exceed five hundred in number, and the advanced teachers, who

muster, perhaps, one thousand strong, but all who are sufficiently interested in science to have selected special lines of study.

We have, then, one person interested in science to about ten thousand inhabitants. But the leaven of science is not evenly distributed through the national loaf. It is the tendency of scientific men to congregate together. In Washington, for instance, there is one scientific man to every 500 inhabitants, in Cambridge one to 850, and in New Haven one to 1,100. In New Orleans the proportion is one to 8,800, in Jersey City one to 24,000, in New York one to 7,000, and in Brooklyn one to 8,500. I have before me the proportions worked out for the seventy-five principal cities of the United States. The showing is suggestive, though no doubt in some instances misleading. The tendency to gregariousness on the part of scientific men may, perhaps, be further illustrated by a reference to certain societies. The membership of the National Academy of Sciences is almost entirely concentrated about Boston, New York, Philadelphia, Washington and New Haven. Missouri has one member, Illinois one, Ohio one, Maryland, New Jersey and Rhode Island three, and California four—while thirty-two States and Territories are not represented. A precisely similar distribution of members is found in the American Society of Naturalists. A majority of the members of the American Association for the Advancement of Science live in New York, Massachusetts, Pennsylvania, the District of Columbia, Michigan, Minnesota, Ohio, Illinois and New Jersey.

It has been stated that the average proportion of scientific men to the population at large is one to ten thousand. A more minute examination shows that while fifteen of the States and Territories have more than the average proportion of scientific men, thirty-two have less. Oregon and California, Michigan and Delaware have very nearly the normal number. Massachusetts, Rhode Island, Connecticut, Illinois, Colorado and Florida have about one to four thousand. West Virginia, Nevada, Arkansas,

Mississippi, Georgia, Kentucky, Texas, Alabama and the Carolinas are the ones least liberally furnished. Certain cities appear to be absolutely without scientific men. The worst cases of destitution seem to be Paterson, New Jersey, a city of 50,000 inhabitants, Wheeling, with 30,000, Quincy, Illinois, with 26,000, Newport, Kentucky, with 20,000, Williamsport, Pennsylvania, and Kingston, New York, with 18,000, Council Bluffs, Iowa, and Zanesville, Ohio, with 17,000, Oshkosh and Sandusky, with 15,000, Lincoln, Rhode Island, Norwalk, Connecticut, and Brockton and Pittsfield, Massachusetts, with 13,000. In these there are no men of science recorded, and eight cities of more than 15,000 inhabitants have only one, namely, Omaha, Nebraska, and St. Joseph, Missouri, Chelsea, Massachusetts, Cohoes, New York, Sacramento, California, Binghamton, New York, Portland, Oregon, and Leadville, Colorado.

Of course these statistical statements are not properly statistics. I have no doubt that some of these cities are misrepresented in what has been said. This much, however, is probably true, that not one of them has a scientific society, a museum, a school of science, or a sufficient number of scientific men to insure even the occasional delivery of a course of scientific lectures.

Studying the distribution of scientific societies, we find that there are fourteen States and Territories in which there are no scientific societies whatever. There are fourteen States which have State academies of science or societies which are so organized as to be equivalent to State academies.

Perhaps the most discouraging feature of all is the diminutive circulation of scientific periodicals. In addition to a certain number of specialists' journals, we have in the United States three which are wide enough in scope to be necessary to all who attempt to keep an abstract of the progress of science. Of these, the *American Journal of Science* has, we are told, a circulation of less than 800; the *American Naturalist*, less than 1,100, and *Science*, less

than 6,000. A considerable proportion of the copies printed go, as a matter of course, to public institutions, and not to individuals. Even the *Popular Science Monthly* and the *Scientific American*, which appeal to large classes of unscientific readers, have circulations absurdly small.

The most effective agents for the dissemination of scientific intelligence are, probably, the religious journals, aided to some extent by the agricultural journals, and to a very limited degree by the weekly and daily newspapers. It is much to be regretted that several influential journals, which ten or fifteen years ago gave attention to the publication of trustworthy scientific intelligence, have of late almost entirely abandoned the effort. The allusions to science in the majority of our newspapers are singularly inaccurate and unscholarly, and too often science is referred to only when some of its achievements offer opportunity for witticism.

The statements which I have just made may, as I have said, prove, in some instances erroneous, and, to some extent, misleading, but I think the general tendency of a careful study of the distribution of scientific men and institutions is to show that the people of the United States, except in so far as they sanction by their approval the work of the scientific departments of the Government, and the institutions established by private munificence, have little reason to be proud of the national attitude toward science.

I am, however, by no means despondent for the future. The importance of scientific work is thoroughly appreciated, and it is well understood that many important public duties can be performed properly only by trained men of science. The claims of science to a prominent place in every educational plan are every year more fully conceded. Science is permeating the theory and the practice of every art and every industry, as well as every department of learning. The greatest danger to science is, perhaps, the fact that all who have studied at all within the

last quarter of a century have studied its rudiments and feel competent to employ its methods and its language, and to form judgments on the merits of current work.

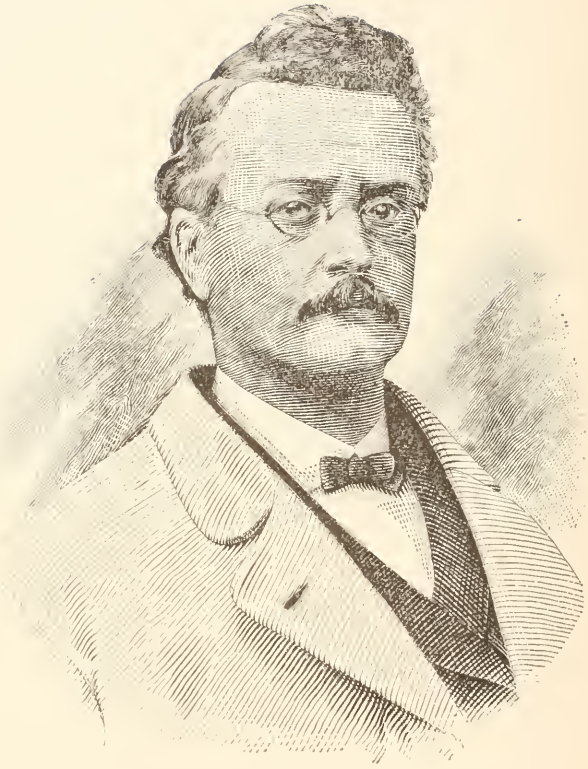
In the meantime the professional men of science, the scholars, and the investigators seem to me to be strangely indifferent to the questions as to how the public at large is to be made familiar with the results of their labors. It may be that the tendency to specialization is destined to deprive the sciences of their former hold upon popular interest, and that the study of zoölogy, botany and geology, mineralogy and chemistry will become so technical that each will require the exclusive attention of its votaries for a period of years. It may be that we are to have no more zoölogists such as Agassiz and Baird, no more botanists such as Gray, and that the place which such men filled in the community will be supplied by combinations of a number of specialists, each of whom knows, with more minuteness, limited portions of the subjects grasped bodily by the masters of the last generation. It may be that the use of the word naturalist is to became an anachronism, and that we are all destined to become, generically biologists, and, specifically, morphologists, histologists, embryologists, physiologists, or, it may be, cetologists, chiropterologists, oölogists, carcinologists, ophiologists, helmintholo-gists, actinologists, coleopterists, caricoölogists, mycologists, muscologists, bacteriologists, diatomologists, paleo-botanists, crystallographers, petrologists, and the like.

I can but believe, however, that it is the duty of every scientific scholar, however minute his specialty, to resist in himself, and in the professional circles which surround him, the tendency toward narrowing technicality in thought and sympathy, and above all in the education of non-professional students.

I cannot resist the feeling that American men of science are in a large degree responsible if their fellow-citizens are not fully awake to the claims of scientific endeavor in their midst.

I am not in sympathy with those who feel that their dignity is lowered when their investigations lead toward improvement in the physical condition of mankind, but I feel that the highest function of science is to minister to their mental and moral welfare. Here in the United States, more than in any other country, it is necessary that sound, accurate knowledge and a scientific manner of thought should exist among the people, and the man of science is becoming, more than ever, the natural custodian of the treasured knowledge of the world. To him, above all others, falls the duty of organizing and maintaining the institutions for the diffusion of knowledge, many of which have been spoken of in these addresses—the schools, the museums, the expositions, the societies, the periodicals. To him, more than to any other American, should be made familiar the words of President Washington in his farewell address to the American people:

"PROMOTE, THEN, AS AN OBJECT OF PRIMARY IMPORTANCE, INSTITUTIONS FOR THE GENERAL DIFFUSION OF KNOWLEDGE. IN PROPORTION AS THE STRUCTURE OF A GOVERNMENT GIVES FORCE TO PUBLIC OPINIONS IT SHOULD BE ENLIGHTENED.



WILLIAM STIMPSON.

SOME AMERICAN CONCHOLOGISTS.*

By William H. Dall.

I had selected another theme as the subject of my address on this occasion. But the press of engagements which had to be met prevented the completion of the work required by my first choice, and in looking about for a substitute which would require less original research I remembered that we have not anywhere an epitome of the biography of those naturalists who began in this country the study of the mollusca and who may be truly said to be the pioneers of American conchology.

There was the more propriety in the selection of this topic at the present time since in the year 1887 came the seventieth anniversary of the publication in the United States of the first paper on the American shells, by an American, which ever appeared. We can regard it as forming the extreme limit which might have been attained by a single life, mature enough in 1817 to have appreciated in some measure the dawn of conchological investigation in America. The only naturalist whose life nearly coincided with this period, the late Dr. Isaac Lea, passed over to the majority about a year ago, and, as it happens, his attention was not called to what the French call "the beautiful Science" until 1825.

The contributions of American investigators to the sum of our knowledge of the mollusca have been numerous and important. Many American publications are among the classics of this branch of science.†

*Annual presidential address, delivered at the Eighth Anniversary Meeting of the Biological Society, January 28, 1888, in the lecture-room of Columbian University.

† Consult Binney (W. G.): Bibliography of North-American Conchology, previous to the year 1860, prepared for the Smithsonian Institution,

But it is not to their publications that I desire to direct your attention, nor to the reputation, due to their labors, acquired for the United States among foreign investigators. It is to the men themselves, the circumstances of their lives, their struggles in an inappreciative age, their unwearied and self-sacrificing devotion to the study of nature.

Of course, in an address of this sort, there is only time for the briefest mention of many facts of interest and value to the biographer; and it would be quite impossible to do even as much as this for all those who have a right to appear on a complete record. So I have confined my attention to some of those who may fairly be considered as pioneers, reserving for another occasion those still active, and many other worthy names.

Following the example of Coues and Goode in their classification of the students of vertebrate zoölogy, I may divide the study of mollusca in this country into three periods, although these are connected by many intermediate links. The infancy of the science, with a Linnæan classification, has no representation in American conchological literature, which sprang, full-grown, like Minerva from the head of Jove, from the Lamarckian school

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Part i. Washington, Smithsonian Institution, March 1863; Part ii, June, 1864, 8vo, viii, 650, and iv, 298 pp. Also Tryon (G. W.): A Sketch of the History of Conchology in the United States (Am. Journ. Science, xxxiii, March 1862, pp. 13–32), and List of American Writers on Recent Conchology, with the titles of their memoirs and dates of publication. New York, Baillière, 1861, 8vo, 68 pp.

There are also a number of portraits of the more distinguished Conchologists given in the first and second volumes of the American Journal of Conchology, though these are not always as good as might be wished.

The above-mentioned works, which contain almost no biographical details, and various dictionaries and encyclopedias have been freely consulted for the material used in this address, but a good deal of it has been the result of personal inquiry, letter-writing, and even advertisement in the newspapers for dates and other missing details. To numerous correspondents I take this opportunity of expressing my thanks for data furnished and which would probably in a few years have been irretrievably lost.

of Europe. The first period might fitly bear the name of its inaugurator, Thomas Say. It is characterized by a rapid advance in the determination of the fauna, the classification of the species, and the exploration of vast areas. It extended from 1817 to 1841.

The second period should bear the name of Dr. A. A. Gould. It was inaugurated by his report on the Invertebrata of Massachusetts, and characterized by the broader scope of investigation, the interest in geographical distribution, the anatomy of the soft parts, and the more precise definition and exact discrimination of specific forms, as exemplified in his writings.

The third period would be appropriately called after Dr. William Stimpson, who eagerly adopted the radical changes in classification rendered necessary by the discoveries of Lovèn, and stood ready to welcome the theory of evolution with all the light it shed in dark places.

Though violently opposed to evolution, the teachings of Agassiz did much to hasten the fruition of the new school of students. For the rational methods of teaching and investigation which he devised or made popular, the present era is greatly in his debt. This period can hardly be said to have been introduced by any epoch-making work, but gradually the old methods were discarded for the new.

The latter were fully exemplified by such works as Morse's "Pulmonifera of Maine" (1864), Stimpson's "Hydrobiinæ" (1865), and a long list of subsequent publications.

Of men belonging to the Sayian period may be mentioned Say, Lesueur, Barnes, Green, Morton, Couthouy, Warren, Anthony, Nuttall, Haldeman, and Conrad.

Rafinesque was *sui generis*, and Lea links this period with the next.

Of the Gouldian period are Gould, Amos Binney, C. B. Adams, Carpenter.

Of the Stimpsonian period I can only refer to Bland, whose place is here rather than with Gould; and lastly, Stimpson himself.

Thomas Say.

Thomas Say was born at Philadelphia, of Quaker ancestry, July 27, 1787. His father, as was usual in those days, united to the profession of a physician the duties of an apothecary. Young Say received a very rudimentary education in one of the Quaker schools and at the "Friends' Academy" at Weston, a few miles from Philadelphia. At a later time he studied pharmacy under his father's supervision, and was established in that business with another person whose steady habits it was supposed would ensure success. Among his acquaintance Say's name was always associated with honor and veracity. Conscious of rectitude himself, ingenuous and sincere, he took for granted that others were so, and, as is too often the case, he fell a victim to his trust in others. Having endorsed the business paper of ostensible friends, through their failure he was involved in financial ruin. His heart was not in business, he attended to it with indifference, and, from his school days, was drawn irresistibly toward a study of animated nature. March 21, 1812, he became a member of the Academy of Natural Sciences, then in the process of transformation from a social club to an association of naturalists. The president, William Maclure, seems to have been a warm and intimate friend of Say, and assisted him pecuniarily, for he became the first curator of the embryo museum and lived on its premises for several years, part of the time subsisting on such frugal fare as might be obtained for twelve cents a day! His time was devoted to study and his reputation as a naturalist was already somewhat spread, for he was selected by the publishers to furnish several articles on American Natural History to the American edition of Nicholson's British Encyclopedia, a work which rapidly reached its third edition. In the winter of 1816–17 appeared the second

volume, in which the article "Conchology," consisting of fifteen pages and illustrated by four plates, was prepared by Say, and has the honor of being the first paper on American Conchology by an American which appeared in this country. It contained a general statement of the principles of the science as then understood, followed by descriptions of American land and fresh-water shells to the number of thirty-one species. The article was issued separately, with a title page, as "Descriptions of Land and Fresh-water Shells of the United States." The second edition, issued the following year, contained some improvements, and the third edition (1819) had the article considerably enlarged, as it forms twenty pages of the fourth volume of the series.*

The readiness with which Say responded to the requests of others, his liberality in communicating his knowledge to those who sought it, and his agreeable social qualities were the cause of so many interruptions that he was led to devote to study the hours which he should have given to repose, and often worked all night. This injudicious course resulted in serious derangement of the digestive organs, and weakened his constitution. These causes, together with habits of rigid austerity in diet, were probably instrumental in bringing about his premature decease.

In 1818, Say, Ord, Maclure, and Peale made an expedition to the sea islands of Georgia and the country east of Florida, then under Spanish rule. Later, Say was appointed chief zoölogist to the two expeditions to the headwaters of the Mississippi, etc., commanded by Major Long. The same modesty which led him to decline a professorship in an institution of learning on the ground of inadequate scholarship led him to decline the position of

*The first edition is very rare. A copy is said to exist in the library of the U. S. Naval Academy. The second edition occurs in the library of the Boston Athenæum and the Franklin Institute of Philadelphia. The original manuscript is in the archives of the Academy of Natural Sciences of Philadelphia.

historian of Long's expedition after the death of Dr. Baldwin, the first appointee. This modesty led to habits of retirement, and withdrew him from society, except that of his private friends, among whom he was idolized. His domestic virtues were beyond eulogy, and his disposition was so truly amiable, his manners so charming, that no one, having once formed his acquaintance, could cease to esteem him.

These qualities led him to be influenced by those whom he admired, and who possessed a more pushing and self-assertive disposition. It is probable that the great mistake of his life was due to influence thus exerted by his friend and patron, Wm. Maclure.

About the year 1824 the recurrence of one of those waves of sentiment, which, like spots on the sun, appear at intervals, with a certain regularity, to obscure the common sense of the most benevolent and enlightened of mankind, led to the disinterested, though foolish, investment by Robert Owen of large sums in a socialistic enterprise. At the village of New Harmony, in a malarious situation on the Wabash river of Indiana, the sun of righteousness, letters, and science was to rise and illuminate the benighted Western world. Mr. Maclure became convinced of the truth of the gospel according to Owen, and, in 1825, set out for the New Jerusalem, involving in his train his friend Say and several other naturalists. With them went several ladies of intelligence and beauty, one of whom, Lucy Sistare, became the devoted wife of Say, and long survived him.* In a little more than a year the community went to pieces, one founder retiring to Europe, and the other to Mexico, disgusted with the intractability of human nature. It is sufficient to quote a criticism by the son, Robert Dale Owen, himself a member of the community, as given in his autobiography fifty years later:† "I do not believe that any

*She died in 1886, according to Mr. Schwarz.

†Threading my Way, by Robert Dale Owen. 8vo. New York, Carleton & Co., 1874; p. 290.

industrial experiment can succeed which proposes equal remuneration to all men, the diligent and the dilatory, the skilled artisan and the common laborer, the genius and the drudge. What may be safely predicted is that a plan which remunerates all alike will, in the present condition of society, ultimately eliminate from a co-operative association the skilled, efficient, and industrious members, leaving an ineffective and sluggish residue, in whose hands the experiment will fail, both socially and pecuniarily."

But Say had become involved for life. He had married, he had accepted the agency of the property, the duties of which compelled his presence on the spot; he had no other means of support, and therefore resigned himself with his usual philosophy to await the course of events, appropriating all his moments of leisure to his favorite pursuits, and preserving unruffled the serenity of his mind. Mrs. Say prepared drawings and lithographs, and on a little hand-press the early numbers of the "American Conchology" were printed.

The malaria began to influence his health. Had he felt free to follow his medical advice or the affectionate solicitation of his friends, he would have returned to the more genial climate of his native city. But a sense of duty predominated over the claims of affection and the terrors of death, and he remained to become a sacrifice to a fever, which carried him off on the 10th of October, 1834.

I have seen no description of Mr. Say's personal appearance, but his portrait* indicates that his face and expression were in harmony with his amiable character.

*National Portrait Gallery, vol. iv. Copied in Am. Journ. Conchology, vol. i, 1865. Biography, by Ord, in LeConte's edition of Say's American Entomology, and in Waldie's Select Circular Library, vol. v, 1835, by B. H. Coates, M. D. It seems evident from the hypercritical and patronizing tone of Ord's biography that his old friendship for Say had been severely wrenched, if not broken, by the personal controversies which raged so violently at Philadelphia, and involved nearly all the scientific workers, or those interested in the progress of science, of which Philadelphia was then the American centre. A better biography of Say is greatly needed.

His conchological work was far above the average of its day, and fully abreast of the knowledge of the time.

His monument,* erected in 1846 by Alexander, brother of William Maclure, in the garden of the Maclure mansion at New Harmony, bears the following appropriate lines:

> Votary of Nature, even from a child,
> He sought her presence in the trackless wild.
> To him the shell, the insect, and the flower
> Were bright and cherished emblems of her power;
> In her he saw a spirit all divine,
> And worshipped like a pilgrim at her shrine.

Charles Alexander Lesueur.

Second, in point of time, among those who published in America on American and other mollusks, is Charles Alexander Lesueur,† born at Havre-de-Grace, France, Jan. 1, 1778.

He grew up with a love for natural history so great that in order to accompany the scientific expedition of the "Geographe" under Baudin in the year 1800 he enlisted as a landsman among the crew. Another enthusiast who had, as it were, forced himself upon the expedition was François Péron, who discovered the unusual talents of Lesueur as an artist and succeeded in getting him transferred to the position of zoölogical draughtsman, where those talents could be put to their proper use. Henceforth the two young men were inseparable friends. The commander of the expedition turned out to be most unfit for his position. Besides exhibiting great inhumanity to his subordinates, it is alleged that he was no better than a thief and appropriated to his own emolument the stores of the expedition. He died at last, with many of the others, and finally of the scientific staff only Péron and Lesueur returned to France in 1804. Six years later Péron

* Recently described by Mr. E. A. Schwarz in Proc. Ent. Soc., Wash., vol. i, No. 2.

† See Memoir, by George Ord, in Silliman's Journal, second series, vol. viii, p. 189, 1849.

died in the midst of his labors. Lesueur, inconsolable, was induced to take a voyage to the Antilles and the United States to remove the melancholy which oppressed him. He arrived in the United States in 1816 and settled in Philadelphia the following year, where he taught drawing and pursued his studies, being very cordially received by the resident naturalists. After a residence of nine years in Philadelphia, where he was in a situation most congenial to his tastes and useful to science, he was impelled, through a mistaken sense of duty, to join the settlement of Socialists at New Harmony, Indiana. The presence of Mr. Say rendered the new situation endurable for a time, but with his death in 1834 the delusive expectation that human virtue would increase in the ratio that human individuality was stifled faded completely away, and the position was no longer bearable. He departed for New Orleans and for France, where his tastes and acquirements found their opportunity of fruition at Paris, near the Jardin des Plantes, and afterward at Havre, where a museum was established, of which he was appointed curator in 1845. He was attacked by sudden inflammation of the lungs, which carried him off on the 12th of Dec., 1846, in the 68th year of his age.

Lesueur was a man of unobtrusive and modest manners and social and amicable disposition. Frugal himself, he was generous to others, even in cases where prudence would justify reserve. He suffered from robbery, perpetrated under the guise of friendship, yet with the remnant he had left, and the infirmities of age coming upon him, he shared with others whose necessities were greater than his own.

Lesueur was more of an ichthyologist than a conchologist, but his paper on Firola, in vol. 1 of the Journal of the Academy of Natural Sciences, was the second paper on mollusks published in the United States and the first on exotic mollusks which appeared here.

Daniel Henry Barnes.

The Rev. Daniel Henry Barnes, of the Baptist denomination, was born in Canaan, N. Y., April 25, 1785, and was killed by falling from a stage coach between Nassau and Troy, N. Y., October 27, 1828. He graduated at Union College in 1809, and took charge for three years of the classical school there, at a later time. Afterward he was professor of languages in the Baptist Theological Seminary, and in 1824 was associate principal of the New York High School for Boys, an institution he is said to have originated and conducted with great ability. He declined calls to the Presidency of Waterville College, Maine, and the Columbian University, of Washington, D. C. He was a man of high reputation for character and culture, and one of the chief promoters of the New York Lyceum of Natural History, now the New York Academy of Sciences. He assisted Webster in the preparation of his dictionary, and published several early papers on the *Unionidæ* and Chitons, of which he described several forms, while others have been named in his honor by several naturalists.

Jacob Green.

Another of the earliest contributors to molluscan literature in America was Dr. Jacob Green, who was born July 26, 1790, at Philadelphia, and died there February 1, 1841. He was the son of Ashbel Green, President of Princeton College in 1812, and grandson of the Revolutionary patriot, the Rev. Jacob Green, who was President of the College of New Jersey in 1757. Our conchologist graduated at the University of Pennsylvania in 1806, was professor of chemistry and natural history at Princeton 1818–22, and then professor of chemistry in the Jefferson Medical College, of Philadelphia, until his death. While his contributions to conchology were not numerous they were of a high order of merit, and on other subjects, such as chemistry, paleontology

(Trilobites), and botany, his work procured him a wide-spread and excellent reputation.

John Warren.

It may not be amiss to mention here an old Englishman named John Warren, who for many years dealt in shells and curiosities in Boston. About 1857 he was still extant. I have little personal information about him, but remember him as a stout, florid old gentleman, who supplied Miss Sarah Pratt and other Boston amateurs with handsome shells at high prices. In 1834 he published a small quarto edition of Lamarck's genera of shells, illustrated with 17 plates, which he entitled "The Conchologist."

He did no original work, but, singularly enough, in Carus and Englemann's Bibliography, he is confounded with Dr. J. C. Warren, the distinguished surgeon of Boston, who published some papers on molluscan anatomy.

Samuel George Morton.

Among those who have promoted the study of mollusca from the paleontological side, one of the earliest and most distinguished names is that of Samuel George Morton.* Born in Philadelphia Jan. 26, 1799, of Irish ancestry and of a family in which the gifts of education were highly prized and abundantly enjoyed, he early lost his father, and at the age of sixteen entered a counting-room to be prepared for a mercantile career. His desire for study monopolized his leisure, and in 1817 he entered the medical school of the University of Pennsylvania, where he graduated in 1820 with honors, and afterwards pursued his studies at Paris and in Edinburgh. In 1826 he returned to Philadelphia, where he practiced his profession and pursued his scientific studies, and the following year he married Rebecca Pearsall. His career was terminated on the 15th of May, 1851, by an attack of pneumonia,

* See Silliman's Journal, 2d series, vol. xiii, p. 153, March, 1852.

but not until his name, through his scientific work, had become familiar to scholars in both hemispheres. His synopsis of the organic remains in the Cretaceous formation of the United States gave him a high reputation and materially advanced the science. Morton was enthusiastic and energetic, but neither vain nor arrogant. He was drawn into the early controversies which involved the Philadelphian group of naturalists, and appears in them as the especial champion of Say and Conrad. He had a literary turn and strong religious convictions, both of which are perceptible in his scientific publications.

Thomas Nuttall.

Although he was especially distinguished in the domain of botany, yet by his shell collections in various parts of America, and somewhat belated studies of this conchological material, it becomes proper to include in this summary, a notice of Thomas Nuttall. Born in Settle, Yorkshire, in 1786, he was in very humble circumstances, and as a journeyman printer had few opportunities for mental development. Yet he was endowed with a strong, clear intellect, the faculty of self-denial, and the passion for study and for the investigation of nature. A hope of improving his position in life and of finding opportunity for study of the natural sciences brought him to the United States in 1808, when only 22 years of age. Through the influence of Barton, the botanist, he was led to take up the study of plants, and a large part of his life was thenceforth devoted to exploration and research. In 1817 he already had been admitted to several scientific societies of high standing. In 1822 he succeeded Peck in charge of the botanic garden at Cambridge, Mass. In 1842 a small estate near Liverpool was left him by a relative, on the condition that he resided upon it at least nine months of every year. He then returned to England, where he died at the age of seventy-three, September 10, 1859. Durand says of him:* "He was a

* Biographical Notice, Proc. Am. Philos. Soc., vii, p. 297, 1860.

remarkable looking man; his head was very large, bald, and bore marks of a vigorous intellect; his forehead expansive, but his features diminutive, with a small nose, thin lips, and round chin, and with gray eyes under fleshy eyebrows. His height was above the middle, his person stout, with a slight stoop; and his walk peculiar and mincing, resembling that of an Indian. Nuttall was naturally shy and reserved in his manners in general society, but not so with those who knew him well. If silent or perhaps morose in the presence of those for whom he felt a sort of antipathy, yet, when with congenial companions, he was affable and courteous, communicative and agreeable." * * * "I have frequently seen him in social circles when he was the delight of the company, from his cheerful and natural replies to all questions, and his voluntary details on the subject of his travels and adventures." * * * "Nuttall was extremely economical in his habits and careless about his dress. None of his Philadelphia friends, I believe, ever knew where he resided, or in what manner he lived." The profession of science is not a very profitable one, yet, in spite of the few opportunities he had for accumulating, he had succeeded, through the strictest saving, in laying aside enough for his old age, even if he had not inherited the estate of Nut Grove, which was encumbered with annuities and burdened with a heavy income tax.

Nuttall's adventures and privations while exploring among hostile Indians, or during long voyages, were many and exciting, but he declared to his friends that hardships were cheaply purchased if they brought him the opportunity for travel and the contemplation of nature, which he found a source of constant delight.

J. P. COUTHOUY.

Joseph Pitty Couthouy.

Among the early papers on mollusca in the Journal of the Boston Society of Natural History none are more finished and satisfactory than those by Joseph Pitty Couthouy. Born in Boston January 6, 1808, of French extraction, I learn that he joined the Boston Latin School with the class which entered in 1820. His tastes were for a seafaring life; he shipped on board his father's vessel and rose rapidly in his profession. He married Mary Greenwood Wild, March 9, 1832. He became a member of the Boston Society of Natural History April 6, 1836, and in the reference to his first paper, read October 5, 1836, I find him styled Captain Couthouy. A year later the United States exploring expedition under Wilkes was projected, and, full of enthusiasm,

Couthouy came on in person and applied to President Andrew Jackson for a position on the scientific corps. The President said he could not seriously entertain the application as the list of officers was already complete. To which the irrepressible young sailor replied, "Well, General, I'll be hanged if I don't go, if I have to go before the mast!"* This pleased "Old Hickory," who told him, "Go back to Boston and I will see if anything can be done for you." There, a few days after his return, his commission as Conchologist of the Scientific Corps was received. He sailed with the expedition August 18, 1838. After leaving Samoa his health suffered. Wilkes, who was preparing a narrative of the expedition, demanded that Couthouy should turn all his notes and drawings over to his commander. Couthouy refused, as he considered that his subsequent work would be crippled by the absence of notes and drawings already made, and that as a member of the scientific corps he was entitled to retain his papers until the end of the voyage. He was thereupon suspended by Wilkes and ordered home from Honolulu in 1840, "for disobedience of orders."

He had made many valuable drawings and notes, many of which are preserved in the report on the Mollusca and Shells of the expedition. He had numbered his notes with a serial number, and a tin tag, similarly numbered, was attached to the specimen, which was preserved in spirits for future anatomical study and identification. The authorities in Washington had appointed a reverend gentleman who knew nothing of science, with a fat salary, to unpack and take care of the specimens sent home by the expedition. This gentleman, finding that the presence of some lead in the tinfoil tags was whitening the alcohol, carefully removed all the tags and put them in a bottle by themselves without replacing them by any other means of identification. Twenty years ago I saw this bottle of tags on a shelf at

* *i. e.*, as a common sailor.

the Smithsonian and heard its mournful history. Prominent conchologists resident in the United States were favored, for a consideration, with many rare specimens before any of the expedition naturalists had returned. Some of those contemporary with the events have told me of the prizes secured in this immoral manner, unworthy of a true naturalist, though doubtless the temptation was great.

The result of such proceedings may be imagined. Couthouy found that the shells to which many of his notes related could not be identified, and others had disappeared altogether. He worked over the mass that remained until the return of the expedition, when, to crown all his misfortunes, the pay of the naturalists was reduced forty-four per cent., though low enough previously. For Couthouy, who had a wife and two children to support, it was the last straw. He declined to attempt the report, and his papers and collections, after sundry vicissitudes, were put into the hands of Dr. A. A. Gould, who bears willing testimony to the value of Couthouy's work. After this he returned to his profession as a master in the mercantile marine, visiting South America and the Pacific. In 1854 he took command of an expedition to the Bay of Cumana, where he spent three years in the unsuccessful search for the wreck of a Spanish treasure ship, the San Pedro, lost there early in the century. Our next trace of him is shortly after the outbreak of the rebellion. He volunteered in the navy, and, August 26, 1861, was appointed acting volunteer lieutenant. Five days later he was ordered to command the U. S. bark *Kingfisher;* December 31, 1862, to command U. S. S. *Columbia*, which was wrecked, and Couthouy made prisoner. After three months at Salisbury he was exchanged, and, May 29, 1863, ordered to the Mississippi squadron to command the monitor *Osage*, but was transferred to U. S. steamer *Chillicothe*. On the 3d of April, 1864, while off Grand Ecore, Louisiana, on the turret of his vessel, he was shot from an ambush on the

shore, and died the following day. The dispatches announcing his death bore testimony to his value as an officer. He was eulogized by Admiral Porter and his fellow officers of the flotilla.

Those who knew Couthouy describe him as active and enthusiastic, with reminders of his French ancestry in his physiognomy and manner; of middle height, dark complexion, and more trim in his dress and refined in his ways than would have been expected from one who had always followed the sea. One friend says of him: "As brave and gallant a soul as ever trod a deck, and a lively and always entertaining companion."

I am informed that he left a son, Joseph P., and two daughters in Boston, and the family is not extinct there. His signature to some documents at the Navy Department is in a handsome flowing hand. He was a good linguist, speaking Spanish, French, Italian, and Portuguese with fluency, and had even mastered several dialects used among the Pacific Islands.

I have not yet come on the track of any published portrait of Couthouy, and none of the biographical dictionaries or cyclopedias refer to him. I have therefore gone into detail a little more fully than I should otherwise have done to preserve from oblivion the memory of a patriotic officer and a good conchologist.

The sketch portrait which accompanies these notes, in default of a better, was derived from an unsatisfactory photograph, the only thing available, taken between 1861 and 1863 and kindly lent to the writer by a surviving relative.

John Gould Anthony.

A naturalist who has left his mark on the classification of our fresh-water shells was John Gould Anthony, who was born in Providence, Rhode Island, May 17, 1804, and died in Cambridge, Mass., Oct. 16, 1877. Mr. Anthony had few educational advantages, leaving school at the age of twelve years, and, going to Cincinnati, engaged in business, where he continued for thirty-

five years. In 1863 he was placed in charge of the mollusk collection at the Museum of Comparative Zoölogy in Cambridge by Prof. Louis Agassiz, whom he accompanied to Brazil on the Thayer expedition in 1865. Mr. Anthony was a man of small and delicate frame, with a well-shaped head, whose brilliant dark eyes were a marked feature in his countenance. He suffered in later years from an affection which impaired his sight, and at times prevented him from doing any work. To this cause is due the fact that some of his later work was occasionally wanting in the precision and accuracy which characterized that of an earlier time. He wrote a very beautiful, clear hand, and his labels were as elegant as if engraved on copper. The attractiveness of the Cambridge collection is largely due to his unwearied efforts. A portrait of Mr. Anthony, though not a very good one, was published in the American Journal of Conchology, vol. ii, part 2, 1866. His collection was added to that of the museum at Cambridge.

Samuel Stehman Haldeman.

Samuel Stehman Haldeman was born at Locust Grove, Pennsylvania, Aug. 12, 1812, and died at Chickies on the 10th of September, 1880.

He studied in a classical school at Harrisburg and for two years at Dickinson College, but did not graduate. In 1836 he was called to assist the late H. D. Rogers in the geological survey of New Jersey, and from 1837 to 1842 was engaged in geological work on the State Survey of Pennsylvania. In 1851 he was professor of natural science in the University of Pennsylvania, and from 1869–80 professor of comparative philology in the same institution. He was a member of the National Academy of Sciences. His papers number over two hundred titles, and include such subjects as chess, the natural sciences, and especially philology. He was a distinguished philologist, but to American

conchologists his memory will always be grateful, since he was the first to illustrate a work on American mollusks with the beautiful engravings on copper, which were the product of Lawson's burin. These illustrations, though issued as early as 1840, are as fine as anything which can be found in the literature to the present day. Haldeman was short and thickset, with a very peculiar voice, piercing dark eyes, and a pleasant and unaffected manner. He was in easy circumstances, and the freedom which this gave him resulted in a wide and somewhat desultory range of study, and heightened some personal peculiarities of mind.

Timothy Abbott Conrad.

Distinguished among conchologists and paleontologists alike was Timothy Abbott Conrad, born in New Jersey in 1803, who died at Trenton Aug. 9, 1877. Information in regard to him I have found rather difficult to obtain, but it would seem that he was always interested in the natural sciences, especially geology and paleontology, and in 1837 was appointed one of the geologists to the State of New York, and prepared the report for that year. He was paleontologist to the survey in 1838–41. He prepared paleontological reports on the collections of the U. S. exploring expedition under Wilkes, of Lynch's U. S. expedition to the Dead Sea, the Mexican boundary survey, and some of the Pacific Railway explorations. He never married, and during the latter part of his life lived on a small property near Trenton, coming into Philadelphia frequently to pursue his work at the Academy. He was of spare proportions, rather shy and reserved, wrote an abominable hand, and was very careless about his letters, which were largely on scraps of paper without date or location. He drew many of his own plates on stone, and his peculiar style of illustration is very recognizable. Though his contributions to science were multitudinous and long continued, his native carelessness, brief diagnoses, and errors of date and citation gave his

work among the more conservative conchologists a reputation perhaps less than its deserts. His defects were chiefly constitutional, rather than wilful; he had an acute and observant eye, and an excellent, if sometimes hasty, judgment on matters of geology and classification. When we consider his work with that of the naturalists of the French "New School" of the present day, there seems in comparison little to complain of in Conrad's methods. Early in life he undertook several journeys to the South especially for collecting purposes, and several naturalists contributed to his expenses with the view of receiving series of the fossils. An unfortunate controversy arose from the conflicting claims to the right and priority of description of many of these species, to which Conrad's extreme carelessness no doubt in a large part contributed. At all events the conflict raged with great violence for several years, and burdened the literature with many synonyms. The matter was still further complicated by the fact that some of his friends, among whom Morton and Say have been mentioned, to preserve, as they supposed, Conrad's rights, wrote and published certain descriptions from his material during his absence and without his knowledge, of which he was obliged, for their sake, to assume the responsibility on his return. To this day the dates of publication of the various parts of his "Tertiary Fossils" are unknown to the public, and were not remembered by the author within a range of several years. Conrad dabbled in literature, and printed a little volume of poems for distribution among his friends. I have heard that all his invaluable documents and manuscripts were sold or destroyed as waste paper shortly after his death through the ignorance of his heirs.

Constantine Samuel Rafinesque-Schmaltz.

One of the most singular figures in the portrait gallery of scientific men, eccentric as many of them have always been considered, is that of Constantine Samuel Rafinesque-Schmaltz. He

was born in Galata, a suburb of Constantinople, Oct. 22, 1783, and died at Philadelphia, Sept. 18, 1840, of cancer of the stomach. His father's name was Rafinesque, and he was of French extraction, but during the hostilities between the French and Neapolitans, which arose about the time he settled in Sicily, he added the name of his mother to his own and represented himself as an American. He arrived in the United States when only nineteen years of age (1802), and returned to Europe in 1805, after which, according to his own account, he was engaged in commercial pursuits and scientific studies at Palermo. He travelled furiously, and collected wherever he went. In 1815 he returned to this country, but the vessel which brought him was wrecked on the coast of Connecticut, and his collections and property were lost, leaving him in a state of poverty from which he never was able to emerge. He was, however, received by American naturalists and others as became his acquirements, and, in 1819, was appointed professor of botany and natural history in Transylvania University, Lexington, Kentucky, which remained his headquarters, in spite of many pedestrian journeys, until 1826, when he removed to Philadelphia, where he remained until his death. His multitudinous writings have been reviewed by Gray, Haldeman, and Tryon in the American Journal of Science, and by Amos Binney in his Terrestrial Mollusks of the United States.*

Rafinesque was a marked example of the adage, "Great wit to madness nearly is allied," and the workings of a mind of unusual acumen, brilliancy, and activity were always clouded by a certain incoherency due to his highly excitable and versatile temperament. He possessed talents which, properly regulated, would have carried him to the front rank of scientific workers.

* See Silliman's Journal, vol. 40, 1st series, p. 221, 1841; also vol. 42, pp. 280-91, 1842, and vol. xxxiii, 2d series, p. 163, March, 1862; and Terr. Moll., 1, pp. 41-54.

In 1836 we find him insisting, in his Flora Telluriana, that new species and new genera are continually produced by deviation from existing forms. Every variety is a deviation which becomes a species as soon as it is fixed sufficiently to constantly reproduce its kind. Many of the genera he suggested are fully recognized to-day, though by his contemporaries regarded as worthless. But from about 1819 a marked deterioration was noticed in his work, which finally became tinged deeply with a sort of monomania. Societies and journals were obliged to refuse his writings, which poured forth in an ever-increasing flood. When he could obtain means he printed for himself, in shabby and miserable form it is true, but still he printed and projected journals and works which died still-born or never saw the light. His madness seems to have culminated in one of his publications where he describes twelve new species of thunder and lightning.

Of his personal appearance we have the following amusing notes from Audubon's journal:

"A long, loose coat of yellow nankeen, on which the inroads of time were plainly visible, stained as it was with the juice of many a plant, hung about him like a sack. A waistcoat of the same, with enormous pockets and buttoned up to the chin, reached below over a pair of tight pantaloons, the lower parts of which were buttoned down to the ankles. The dignity he acquired from the broad and prominent brow which ornamented his countenance was somewhat diminished by the forlorn appearance of his long beard and the mass of lank black hair which fell from his shoulders." After relating the distance he had walked he expressed his regret that his apparel should have suffered, but at the same time he eagerly refused the offer of any clean clothes, and it was with evident reluctance he accepted an invitation for ablution. The surprise of the ladies of Audubon's family was involuntarily manifested in the exchange of glances which spoke volumes. Soon, however, their astonishment was converted into

admiration at the ease and enlightenment of his conversation. Plants and animals with which he was unfamiliar aroused in him a sort of delirium or ecstacy. At night Audubon was surprised by an uproar in the naturalist's apartment. On reaching it to ascertain the cause, he found his guest divested of all clothing, rushing about the room engaged in a sanguinary contest with the bats which had entered by the open window. His weapon was the handle of Audubon's favorite violin, which had been demolished in the fray. Without noticing the entrance of his host he continued his extraordinary gyrations until he was so exhausted that he could hardly use his voice to request that Audubon would obtain a specimen for him, as he was convinced they were of a new species.

Notwithstanding this unpromising beginning, Rafinesque remained three weeks in Audubon's family, who became perfectly reconciled to his oddities and found him a most agreeable and intelligent companion. One evening, however, he suddenly disappeared, without a word to anyone, and it was only after some weeks that a letter was received which assured his entertainers of his gratitude and his safety.

In contrast to his carelessness about his personal appearance, the older Silliman speaks of his beautiful and exact chirography, and says that his communications were always in the neatest possible form. Even in his direst poverty he always retained friends and admirers. It is certain that he must have possessed many lovable qualities.

In this connection we may call to mind a friend, Charles A. Poulsen, of Philadelphia, who was devoted to conchology and had a fine collection. Mr. Poulsen translated Rafinesque's "Monograph of the Bivalve shells of the river Ohio" in 1832, and for years his cabinet was resorted to in the vain hope of positively determining some of Rafinesque's ill-defined species. Mr. Poulsen died in Philadelphia in 1866, and I have heard that his collection

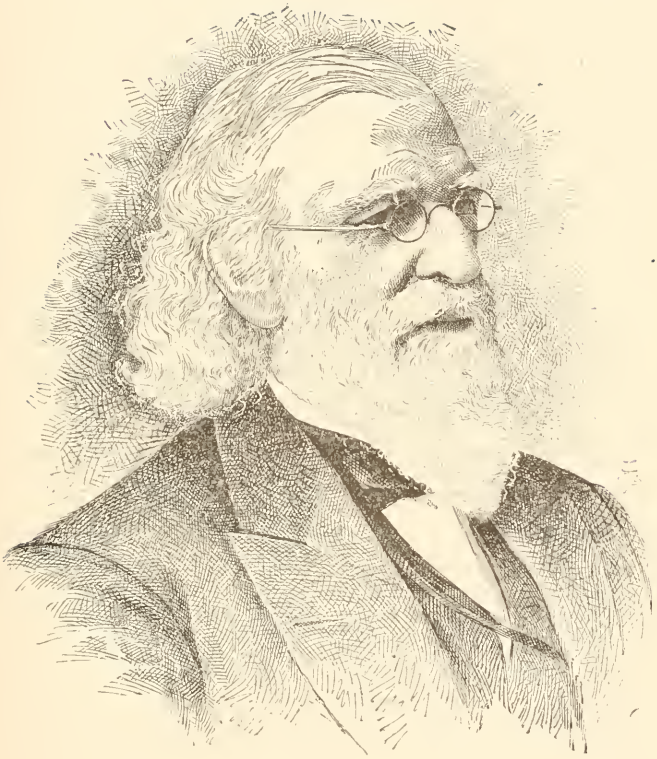
was dispersed, many specimens being acquired by the late well-known conchologist, C. M. Wheatley, of Phœnixville, Pennsylvania.

Isaac Lea.

Dr. Isaac Lea, of Philadelphia, whose long and active life gave him among the younger generation the title of the Nestor of American Naturalists, was born in Wilmington, Delaware, March 4, 1792, and died at his home in Philadelphia in his ninety-fifth year, Dec. 8, 1886. His ancestors came from Gloucestershire, England, accompanying William Penn on his second visit. His taste for natural history manifested itself at an early age, and was fostered by his mother, who was fond of botany, and by his association with Vanuxem, then a youth, who was devoted to mineralogy and geology, then hardly organized as sciences. Their studies were undirected; but, in 1815, they became members of the Academy of Natural Sciences, then about three years old. Though engaged in business, young Lea became an active member of the Academy, and published a mineralogical paper in its journal in 1817. This was followed by a very long series of contributions to mineralogy and conchology, recent and fossil, which have made his name familiar to naturalists all over the world.

He married, in 1821, Miss Frances A. Carey, daughter of Matthew Carey, the well-known economist, and became a member of the publishing house of Carey & Sons, from which he retired in 1851. Mr. Lea's married life was exceptionally long and happy, lasting fifty-two years, and blessed with a daughter and two sons, who still survive. One of these sons is the well-known student of ecclesiastical history, while the other has long stood at the head of American photographic chemists.

In 1825 began those studies of fresh-water and land shells, especially the Unios, with which Dr. Lea's name will always be associated. In 1836 he published his first "Synopsis" of the



DR. ISAAC LEA.

genus, a thin octavo of fifty-nine pages. The fourth edition of this work appeared in 1870, when it had grown to 214 pages quarto.

Dr. Lea was a member of most American and many foreign scientific societies. He visited Europe and studied his favorite mollusks at all the museums. There he made the acquaintance of Férussac, Brogniart, Gay, Kiener, and other distinguished men, whose names now sound like echoes from a past epoch. Up to 1874 he continued ever busy on the Unionidæ, and the number of new forms, recent and fossil, made known by him amounts to nearly 2,000. Not content with figuring and describing the shells alone, he figured the embryonic forms of thirty-eight species of Unio, and described the soft parts of more than 200. He also investigated physiological questions, such as the sensitiveness of these mollusks to sunlight and the differences due to sex. His observations on the genus Unio form 13 quarto volumes, magnificently illustrated. Dr. Lea was president of the American Association for the Advancement of Science in 1860; he presided over the Academy of Natural Sciences in Philadelphia for several terms, and was given the degree of LL. D. by Harvard College in 1852.

His scientific activity extended over more than sixty years. He was active in affairs and vigorously participated in those controversies in which Say, Conrad, Morton, and others were engaged half a century ago. Of these the echoes only have come down to us, but there is plenty of evidence that the battle was often hot and the victory energetically contested.

Dr. Lea had an intellectual and, in later years, a most venerable presence. He was ever anxious to interest the young in scientific pursuits, and was notably active in charitable and religious enterprises. In his youth he manifested more than ordinary artistic talent, much like his distinguished contemporary, Alvan Clark.

It is impossible to do justice to such a life as Dr. Lea's in the proper limits of an address of this sort. It is of the less importance in the present case, because an excellent bibliography of his works, preceded by a biographical sketch and an admirably etched portrait, has been published by the U. S. National Museum,* to whom Dr. Lea bequeathed his invaluable collection of minerals and shells.

Augustus Addison Gould.

Among those, next to Say, who have beneficially influenced the study of mollusca in this country, and interested young people in that pursuit, no name stands higher than that of Augustus Addison Gould. He was born in New Ipswich, New Hampshire, April 23, 1805, and died of cholera in Boston on the 15th of September, 1866. His father was originally named Nathaniel Gould Duren, but, on account of an inheritance, reversed the order of his surnames. The father was a musician, artist, and engraver, noted for his elegant penmanship, and of a good Chelmsford family; but not in affluent circumstances. From him Dr. Gould probably derived his facility as a delineator of shells. In early life young Gould knew privation, but he persevered in his endeavors for an education, and succeeded in carrying himself through college, graduating at Harvard in 1825, and in medicine in 1830.

He devoted his energies largely to his profession, which he regarded as the work of his life, and in which he soon rose to deserved eminence. But natural science claimed his leisure hours, and to increase them he often robbed himself of sleep. He taught botany and zoölogy at Harvard for two years, was one of the founders and earnest supporters of the Boston Society of Natural History, and original member of the National Academy,

* Bulletin No. 23, compiled by N. P. Scudder.

and president of the Massachusetts Medical Society in 1865, and until his death. A brother was a member of the well-known firm of Gould & Lincoln, publishers, and through them a number of Dr. Gould's works were republished during his lifetime. It is unnecessary to enumerate his works—the mollusca of the Wilkes exploring expedition, and the magnificent posthumous work on American land shells, edited by Dr. Gould for the executors of Amos Binney, would have given him lasting fame. But the work which was most useful to American science was his classical Report on the Invertebrata of Massachusetts, published by the State in 1841, and adorned with fine copper-plates from his own drawings. This was practically devoted to the mollusks, and served as a manual for New England shells, excellent in every way, and free from unnecessary technicality or pedantic expressions. The speaker well remembers the value this book had for him in his boyish days, and it is said that to it Stimpson owed the impulse which led him, in spite of obstacles, to devote himself to science.

Dr. Gould was tall, spare, with dark gray eyes, and hair originally dark, but gray at the time I first knew him. He was the ideal of the "Good Physician," with a winning, sympathetic manner; quiet, and slightly reserved to strangers, but with a living spring of gentle humor for his friends. Full of kindliness, true piety, self-denial, and noble impulses, no one could know him, in the midst of his interesting family, without loving and honoring the man as well as admiring the scientist. The clear, straightforward and exact quality of his work made it easy of comprehension, and there is no knowing how many persons were inspired by it to a study of the animals he described. He was particularly able in his study of the smaller forms of land shells, which he drew with wonderful accuracy and artistic taste. A good portrait of Dr. Gould was published in the Annual of Scientific Discovery for 1861 and afterward reprinted in the

American Journal of Conchology, vol. 1, part 4, 1865.* This picture, though well executed, wants the winning expression which was characteristic of his face.

Amos Binney.

The first to project and illustrate in the highest style of the art a work on the Helicidæ of the United States, doing for the land-shells what Haldeman had attempted for the fresh-water gastropods, was Amos Binney, of Boston, born October 18, 1803, who died at Rome, Italy, February 18, 1847, leaving his work still incomplete. He graduated at Brown University in 1821, and in medicine at Harvard in 1826, but his health proving precarious he devoted himself to commercial pursuits with remarkable success, reserving his leisure for science and art, of which he was passionately fond. He was one of the founders and a liberal giver to the Boston Society of Natural History, which elected him its president from 1843 until his death. He was active in establishing the American Association of Naturalists and Geologists, which has since developed into the American Association for the Advancement of Science.

As a member of the Massachusetts General Court† he was instrumental in securing the organization of the zoölogical and botanical commissions to which we owe the classical Massachusetts Reports by Harris, Emerson, Storer, and Gould.

At his death his work on the Terrestrial Mollusks of the United States was unfinished, but he provided in his will for its completion, a work for which his executors designated his friend and townsman, Dr. Gould, as editor. This work is unsurpassed in elegance of execution by any similar publication to the present

* A brief notice of Dr. Gould's life appeared in those copies of the second edition of the "Invertebrata" which were distributed by his family. There is a notice by Dr. Jacob Bigelow in the transactions of the Suffolk County Medical Society in 1866.

† So the legislature is styled in that State.

day. The premature death by pneumonia of Dr. Binney cut off many promising plans for the promotion of science and art in America. Those interested in land shells, however, do not need to be told that his son, Mr. William G. Binney, has well sustained his father's reputation in the same field. Dr. Binney was above the average height, robust, well formed and refined in appearance. His hair and eyes were very dark, and his expression grave and reserved. This and the somewhat severe tone of his voice was apt to convey to those who did not know him an impression of *hauteur*, which did not correspond to the real feelings of the man. An excellent biographical sketch is given by Dr. Gould in the first volume of the Terrestrial Mollusks, which was published in 1851. Dr. Binney was buried at Mount Auburn, where the monument which commemorates him is one of those to which the stranger's attention is always attracted.

Charles Baker Adams.

Charles Baker Adams, one of the most industrious and best known American conchologists, was born in Dorchester, Massachusetts, on the eleventh of January, 1814. Of a family of six children he was the only one spared to his parents. When four years old his father, Mr. Charles J. Adams, removed permanently to Boston, where he engaged in business. At an early age the boy showed great interest in chemistry and natural history, in which he was encouraged by his parents, who gave him the use of a room for a laboratory and furnished the means for procuring chemicals and apparatus. The time usually given to play by most lads of his age was largely occupied by young Adams in experimenting with reagents or studying and arranging the various objects of natural history which he collected in excursions with his father or received from friends. He studied in the Boston schools, at Phillips Academy, Andover, and entered Yale College in October, 1830. In September, 1831, he removed to

Amherst, and joined the sophomore class, graduating in 1834 with the highest honors. Shortly afterward he entered the Theological Seminary at Andover, but in 1836 he left his studies of divinity to join Professor Hitchcock in prosecuting the geological survey of the State of New York. This work being terminated by the illness of Professor Hitchcock he returned to Amherst and busied himself, for several years, partly as a tutor at Amherst and partly by delivering lectures on geology at various educational institutions. In September, 1838, he became professor of chemistry and natural history at Middlebury College, Vermont, and the following February married Mary, daughter of the Rev. Sylvester Holmes, of New Bedford, Mass.

In 1845 he became State Geologist of Vermont, and continued the operations incident to that office for three years. Under his unremitting labors as a popular teacher in the college and his geological work in the field his naturally delicate constitution suffered, and he was obliged to seek a less rigorous climate. He visited the island of Jamaica in the winter of 1843–4, and in 1847 resigned his professorship at Middlebury to accept that of zoölogy and astronomy at Amherst. In the winter of 1848–49 he again visited Jamaica, and in November, 1850, he went to Panama, returning by way of Jamaica the following spring. Anxious to pursue further his investigations on the mollusk-fauna of the West Indian islands, Prof. Adams left for St. Thomas by way of Bermuda in December, 1852, arriving on the 27th, but in his weak condition became a victim of the pernicious malaria of that island, and, though tended with solicitude by his St. Thomas friends, died the 18th of January, 1853. A tablet was placed over his grave by the residents of St. Thomas as a memorial of their esteem and admiration for his character. The Professor's widow, four sons, and a daughter survived him.

Prof. Adams was of middle height, slender and delicate in appearance, with fine expressive eyes and a winning countenance.

In his domestic relations he was gentle and affectionate; in his friendships, faithful and generous. His earnestness and ability as a teacher gave him popularity and success in his college duties, while his private character was above reproach. He was quiet and studious in his habits, but had the true New England genius for hard work; having in his laboratory at the college an old green lounge, where it is said he sought repose in the early morning hours after many a night devoted to original research. Indeed, it is commonly reported among those who knew him that he relinquished to Nature only so much of his time as she imperatively demanded and fairly burned his candle at both ends. Notwithstanding his quiet ways, he was not a man to be imposed upon, and among the college legends, still passed from class to class at Amherst, are several which relate the signal discomfiture of would-be shirkers of their duties, which made him the terror of the lazy men in his classes.

Professor Adams' work was distinguished by care and accuracy, by a philosophical grasp unusual at that day, and which, had he been unhampered by the current theories of the creation and immutability of species, would have given him an even higher rank among naturalists. He monographed the mollusk-fauna of Panama, and did more than any other single naturalist toward making known the riches of the West Indian region. He emphasized the study of the geographical distribution of animals, and as a collector was unparalleled both in enthusiasm and success.

His remarkable collection (probably even now standing third or fourth in the United States in point of interest and value, and its number of contained types) he left under liberal conditions to Amherst College, where it still remains. His publications are among the classics of American conchology, and well bear comparison with many more pretentious works. Like most American naturalists Prof. Adams was never in affluent circumstances,

and the success of his labors was largely due to unremitting self-denial.*

Philip Pearsall Carpenter.

Philip Pearsall Carpenter, who, by his valuable labors on American mollusks and his residence in America, is fairly to be enrolled on the list of American conchologists, was born in Bristol, England, Nov. 4, 1819, and died at Montreal, Canada, May 24, 1877. He belonged to a family whose members have been renowned for their devotion to science, education, liberalism in all good things, and works of benevolence and charity. He described himself as a born teacher, but a naturalist by chance. But his interest in his favorite study developed early. When only twelve years old he had accumulated a large cabinet and mastered the classification of the day. He studied at the University of Edinburgh and at Manchester College, York, which became affiliated with London University, from which he received his degree in 1841. In 1846–58 he labored in the ministry at Warrington, and during this period prepared his classic Memoir on the Mazatlan Shells, and his report to the British Association on the state of our knowledge of the mollusk-fauna of the western coast of America. In December, 1858, he visited the United States and traveled extensively. In the winter of 1859–60 he came to the Smithsonian Institution, where he spent some five months at work upon the shell collections and delivered the lectures on Mollusca which were afterward printed in the Smithsonian Report. In 1860 he returned to England, where he married Miss Minna Meyer, of Hamburg. This union, though entered into somewhat late in life, was most happy. In 1863 he prepared a supplement to his British Association Report of 1856, which has been most useful to students of our west coast shells.

* His portrait and an appreciative biographical sketch by Thomas Bland, of which I have made unsparing use, may be found in the *American Journal of Conchology*, vol. 1, pp. 191–204, 1865.

In October, 1865, he left England for Montreal, which was thenceforth his home, and where his valuable collection, presented by him to McGill University, is suitably housed in the Peter Redpath Museum of that institution. During the period of his activity in Montreal he devoted himself largely to a monographic study of the *Chitonidæ*, with results of the utmost importance to their proper classification, but of which only a concise abstract has yet been published, though a large mass of MSS. had been prepared at the time of his death.

Dr. Carpenter received the degree of Doctor of Philosophy from the New York State University in 1860. He was a man of slight frame, below the middle height, and of striking personal appearance. He was brimful of enthusiasm not only in his studies, but in all that related to good health, morals, and practical religion. His audacity in confronting and attacking abuses was unparalleled, and, like most reformers, he met with much opposition and made many active opponents. But the rich charity of his nature, his single-minded devotion to what he believed to be right, and his disregard of his personal interests in all that concerned the promotion of reforms, made even the bitterest opponents concede him elements of character of which any man or community might be justly proud.*

Thomas Bland.

Thomas Bland, one of our best known naturalists, was born October 4, 1809, in Newark, Nottinghamshire, England. His father was a physician and his mother related to Shepard, the naturalist. He was educated at the famous Charter-House school, London, and was a classmate of Thackeray. Subsequently he studied and practiced law. He went to Barbados, West Indies,

* An excellent memoir of Dr. P. P. Carpenter, accompanied by a good portrait, was prepared by his brother, the Rev. Russell Lant Carpenter, and published by C. Kegan Paul & Co., London, in 1880.

in 1842, and later to Jamaica; visited England in 1850, and in the same year accepted the superintendency of a gold mine at Marmato, New Granada. While a resident of Jamaica, it was visited in 1849 by Prof. C. B. Adams, with whom Mr. Bland cultivated a warm friendship. Stimulated by the enthusiasm of Adams, Bland began those investigations of the land shells for which he afterward became so distinguished. In 1852 he came to New York, which for most of his subsequent life became his home. Here his business lay chiefly in the direction of the affairs of mining companies, with several of which he was connected. He was a man of rather dark complexion, with brilliant dark eyes; somewhat bowed by ill health, induced by his long residence in the tropics, he seemed rather below the middle height. He was of a studious and rather grave demeanor, but notably courteous, and always ready to assist young students or others interested in his favorite pursuit. He avoided controversy, and in spite of his extreme modesty was several times called to posts of honor and responsibility. By those privileged to know him he was held in high esteem, which was not lessened by his bearing under the adversity which unfortunately clouded his later years. Mr. Bland was the author of more than seventy papers treating of the Mollusks, especially of the United States and of the Antilles. His work was not confined to the description of species, but comprised, valuable contributions to their anatomy, classification, geographical distribution, and the philosophy of their development. No American conchologist has shown a more philosophic grasp of the subject, and his discussion of the distribution of the land shells of the West Indies, published in 1861, gave him a wide reputation. He several times returned to this subject in later years, and always with marked success. Since 1869 Mr. Bland was associated with Mr. W. G. Binney in several important works on the terrestrial mollusks of North America. Mr. Bland was a fellow of the Geological Society,

and for many years an active member of the New York Lyceum of Natural History. He died after an illness of several years' duration in Brooklyn, N. Y., August 20, 1885. A convenient bibliography of his papers was prepared by Mr. Arthur F. Gray in 1884, and his portrait is to be found in the American Journal of Conchology, vol. ii, pt. 4, 1866.

William Stimpson.

In the case of William Stimpson we have a good instance of how not merely disadvantageous circumstances may be defied but positive opposition conquered by what may be called an innate devotion to the study of nature. He was born in Roxbury, now within the charter limits of Boston, Feb. 14, 1832. His parents were Herbert H. Stimpson, who, I am informed, was of Virginian origin, and Mary Ann Brewster, of a good New England family. Mr. Stimpson dealt in stoves and ranges, in partnership with his brother Frederick, at Congress and Water streets, Boston, for many years. He was a successful business man, though not liberally educated, and introduced certain improvements into cooking ranges, of which one kind was long familiar to Boston housewives under the name of the "Stimpson range." The early education of the son was in the common schools, and in his sixteenth year he seems to have shown unusual mental powers, as we find him entering the upper class of the Boston High School in September, 1847, from which he graduated the following July. Even before this time he had become deeply interested in natural history. A copy of Gould's Invertebrata of Massachusetts having fallen into his hands his attention was directed towards these animals. He presented himself to the author of the work to find out if it were possible for a copy to be had for his very own. Dr. Gould, with his never-varying kindness, gave him an order on the State librarian for one of the books, and the exulting joy with which the

boy marched out of the State House with the coveted volume under his arm was never forgotten by him and often related in after years. But Dr. Gould's kindness did not stop here; he brought young Stimpson to the notice of Agassiz, then in the first flush of successful teaching at Cambridge, and introduced him to the Boston Society of Natural History. His relatives were anxious that the boy should go into business; his excursions to the sea-shore and the dredging work which, unaided, he had already begun, were looked on with no favorable eye, and only the urgent representations of some of those who had become interested in the boy and saw in him a capacity for better things, saved him from a fate he detested. As a compromise he was sent out with a civil engineer to learn that profession, but his employer declared he was too fond of hunting for land shells to make a good surveyor, and advised that he be allowed to follow the career which his inclinations so strongly declared for. He was allowed to enter the Latin School in 1848. The following summer he managed by some means to get off on a fishing smack bound for Grand Manan, and devoted his whole energies to the collection and study of the marine animals of that vicinity. Still, in the face of strong opposition, he succeeded in joining the workers at Agassiz' laboratory in October, 1850. Wherever he went his enthusiasm and lovable qualities raised up friends, and through their aid an appointment was secured to him as naturalist to the North Pacific exploring expedition under Ringgold (later commanded by Captain John Rodgers, U. S. N.), which was sent out by the United States in 1852. With a paid appointment in Government service, those who had persistently opposed his ambition began to give way and confess that there might be something in it after all, though doubtless laying greater stress on that "something" for which Stimpson cared least.

He joined the expedition Nov. 23, 1852, and was absent four years, during which he visited Japan, Bering Strait, and many

other localities of the greatest interest to the naturalist. No general report on the voyage has yet appeared, and Stimpson's report on the crustacea with its beautiful illustrations still remains in manuscript.

He began to work up his materials at Washington, and for purposes of study visited Europe, dredged on the British coast, and made hosts of friends across the Atlantic.

His preliminary studies of the radiates and crustacea of the expedition ensured his place among the most promising of the young naturalists of the day, and were expressed in elegant Latin. He prepared and published the investigations into marine life made at Grand Manan, and was the leader of an enthusiastic band of students who gathered in the museum of the Smithsonian Institution for work under the influence of Henry and Baird, kept bachelor's hall together under the sobriquet of the Megatherium Club, and instituted the first biological society in Washington under the name of the Potomac-side Naturalists' Club. Most of them subsequently reached distinction in the pursuit of science.

About 1860, Stimpson received the honorary degree of M. D. from the Columbian University. He was afterwards a member of the National Academy of Sciences, instituted while the country was in the midst of its fiercest military struggle. On the twenty-eighth of July, 1864, he married Miss Annie Gordon, of Ilchester, Maryland.

Robert Kennicott, of Illinois, whose name rouses affectionate remembrance in the minds of all who knew him, was Director of the Chicago Academy of Sciences, whose establishment and progress were for the most part due to his enthusiasm, ability, and persistence. He had been a member of the Megatherium Club, and was a devoted friend of Stimpson. He was about to undertake those explorations in Alaska from which he never returned. He knew that his undertaking was arduous, and its outcome uncertain. His child, the Academy, must be provided for, and its

fate not left to accident. Stimpson was the man for the post and was selected. The institution was thriving, with a large membership, an excellent collection, and the nucleus of a library. In June, 1866, the building and nearly all its contents became a prey to fire. But the trustees had suitably insured the collection and, with the growing prosperity of the Society, due largely to Stimpson's social tact and attractive personality, the Academy purchased ground, put up a fire-proof building, and rose like a Phœnix with new vigor from the ashes.

Here Stimpson assembled as in a sure harbor the manuscripts, collections, engravings, and drawings of a lifetime.

He had the finest and most complete collection of East American invertebrates which had ever been brought together, with a vast amount of illustrative material from Europe, the Arctic regions, and other parts of the world. Books and specimens which he did not own were freely lent to him by the Smithsonian and by Eastern naturalists, for was he not a scientific missionary, a biological bishop, *in partibus infidelium*, in the land where the almighty dollar reigned supreme? And more important still, the Academy was fire-proof.

A manual of marine invertebrates of the coast from Maine to Georgia was in preparation for the Smithsonian Institution; there was already much manuscript and many beautiful engravings.

All the Smithsonian shell-fish in alcohol were there; Pourtalès sent his unspeakable treasures newly ravished from the depths of ocean. On every hand a wealth of material, a host of indulgent friends and correspondents, a prospect of good work for science, education, patriotism.

On the 8th of October, 1871, a small fire broke out in South Chicago, which was not extinguished. In forty-eight hours the Queen City of the Northwest was practically in ashes.

The temple of religion, the refuge of the sick and destitute, the palace of the millionaire, the shanty of the day-laborer, the

sanctuary of trade, the gambler's hell, the hospital, the home, and the grog-shop—withered, crumbled, or evaporated into thin air, before a power stronger than them all.

After this universal destruction, when granite became flour, bricks ran to glass, iron shrunk like wax before the roaring and devouring element, all that was left of Stimpson's lifework, of the building and its treasures of art and nature, was a heap of ashes, the calcined foundations, and the clay pipkin of a mound builder, once rescued from a western tumulus to illustrate the arts of barbarism, and now, in this hour of universal wreck, surviving every product of civilization.

The blow was too heavy. The spirit indeed was valiant, but the body was frail. He had long suffered from weakness of the lungs, with periods of low spirits characteristic of the ailment. After an attempt to work on the Gulf Stream with the Coast Survey in the winter of 1871–2, he returned broken down, and died at Ilchester on the 26th of May, 1872.*

Dr. Stimpson was of middle height, slender, with brown, curly hair, and merry eyes, whose expression was rather heightened than impaired by the glasses he habitually wore. His bearing was that of a scholar, rather retiring, except with friends, when the boyish exuberance of his spirits had full sway. Those who had the privilege of his companionship will carry an abiding memory of his abilities as a naturalist, and his noble and lovable characteristics as a man.

The number of persons brought under review in the preceding pages (omitting Poulsen and Warren) is eighteen, a number too small to afford many statistical generalizations.

Eight of the men were college bred, ten of them acquired their education in the common schools, or had even fewer early advan-

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*See memorial notice by J. W. Foster in *Chicago Tribune* of June 12, 1872. Reported from the proceedings of the Academy.

tages. Two were wealthy by inheritance, two became so by business enterprises, fourteen had a modest or insufficient income, and were obliged to work their way through life; of these five were college bred. Seven were devoted to science among other interests; with eleven science was the mainspring of their lives. The average age attained was sixty years; of those dependent on their own industry about 58 years. Divided according to their absorption in scientific pursuits we find those who devoted all their energies to science averaged 62.27 years, the others 55.7 years of life.

The only lesson which may be said to be absolutely clear is, that naturalists are born, and not made; that the sacred fire cannot be extinguished by poverty nor lighted from a college taper. That the men whose work is now classical, and whose devotion it is our privilege to honor, owed less to education in any sense than they did to self-denial, steadfastness, energy, a passion for seeking out the truth, and an innate love of nature. These are the qualities which enabled them to gather fruit of the tree of knowledge. Let us see to it that their successors, while profiting by that harvest, fail not in the virtues which made it possible.

DESCRIPTION OF A NEW FOX FROM SOUTHERN CALIFORNIA.

Vulpes macrotis sp. nov.

LONG-EARED FOX.

By Dr. C. Hart Merriam.

(Read Feb. 11, 1888.)

The fox which is the subject of the present communication was killed at Riverside, San Bernardino county, California. November 1, 1885. It differs so strikingly from the other North American foxes that detailed comparison is unnecessary. It is a small animal, the single specimen before me being a little less in size than the Kit Fox (*Vulpes velox*), agreeing in this respect with the California Island Fox (*Urocyon littoralis*), from which latter animal, however, it differs generically. Its most noticeable external peculiarity consists in its large ears, which character alone suffices to distinguish it from its North American congeners.

It is not a little surprising that so large a mammal as a fox, inhabiting so well explored a region as California, should have escaped notice till the present time; and the fact is still more remarkable from the circumstance that the animal here described differs so notably from its nearest relatives. For these reasons, and others derived from a study of the specimen with a view to the known laws of geographical variation, I am led to the belief that it is a Mexican species, finding its northern limit in southern California. The place where the present specimen was killed (Riverside, San Bernardino county) is only a hundred miles from the Mexican boundary.

The following diagnosis is sufficient for purposes of identification:

VULPES MACROTIS sp. nov.

Type No. $\frac{1792}{2324}$, male, young adult, Merriam Collection.

Riverside, California, November 1, 1885. F. Stephens.

External Characters.—Size, small, equalling or a little less than that of *Vulpes velox;* ears long and broad, relatively much larger than in any other North American fox, and well haired on both sides; muzzle, legs, and tail long and slender, the latter a little longer than the body, and about as slender as in *Urocyon virginianus*. Soles well haired, the plantar tubercles being entirely concealed.

Color.—Upper parts grizzled-gray, palest on the head and darkest on the back; terminal fourth of tail nearly black; sides, upper surface of legs, and pectoral band pale fulvous; under parts white mixed with pale ochraceous-buff. In the only specimen at hand the general color is almost as pale as that of *V. velox*. This is due to the fact that the pure white sub-apical zone of each hair is much enlarged, while the black terminal portion tapers rapidly into a much attenuated, awn-shaped point, the result being that the white predominates over the black. The dorsal hairs are short for a fox, and the pale buff of the under fur shows through, thus completing the combination which gives to the back its grizzled-gray appearance. There is no indication of a dorsal stripe on either back or tail. The convex surface of the ear is well covered with short fur which is pale fulvous in color, and mixed with iron gray, except at the base posteriorly where the gray is nearly absent. The margin of the ear is white, as are the long hairs bordering it inside. Between the white border and the grizzled fulvous of the upper surface of the ear there is an indistinct dark line. The base of the ear in front is covered by a dense growth of fur and hair which completely hides the

meatus. The lower lip is bordered by a narrow margin of blackish hair, which curves upward around the commissure, and extends forward about one-fourth the length of the upper lip. The chin and throat are entirely white. The whiskers are black, and the hair about their bases is darker than on other parts of the face.

Measurements from the dry Skin.

(*All measurements in millimeters*).

Total length,	850.
Head and body,	510.
Tail to end of vertebræ,	290.
Tail to end of hairs,	340.
Hind foot,	110.
Height of ear from crown,	68

Cranial Characters.—The skull is that of a young adult, and probably is not quite full grown; the zygomatic breadth, therefore, is less than it would be in a more aged specimen. Unfortunately, a considerable portion of the occipital region, including both condyles, is broken away; hence the basilar length and several important ratios cannot be taken. The facial part of the skull is much produced and attenuated, the muzzle being relatively longer and more slender than in any other North American fox, and the palatal region correspondingly narrowed. The anterior palatal foramen extends posteriorly to a point opposite the interspace between the canine and first molar. The palatine bones are truncated anteriorly at the post-palatal foramina. The zygomæ arch upward more strongly than usual in the genus, and the audital bullæ are conspicuously larger, deeper, and more rounded, which condition, doubtless, is correlated with the great development of the external ears.

Cranial Measurements.

Basilar length,	*
Occipito-nasal length,	103.
Greatest zygomatic breadth,	58.2
" breadth across parietals,	42.
" " between mastoids,	38.7
Least breadth at interorbital constriction,	19.8
" " " postorbital notch,	20.5
Distance between postorbital processes,	26.3
Palatal length,	55.7
Greatest length of nasals,	40.
Breadth of muzzle at canines,	15 7
" " " midway between canines and root of zygomæ,	14.8
Length of lateral series of teeth (on alveolæ),	51.7
Breadth of palate between canines,	9 7
" " " " 1st premolars,	9.5
" " " " 4th premolars,	17.
" " " " 2d molars,	16.2
Length of mandible,	83.8
Height of coronoid process from angle,	27.
Length of lateral series of teeth (on alveolæ),	57.8
Length of molariform series,	47.5

* Cannot be ascertained because the condyles are broken off.

ALPHABETICAL INDEX.

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P.

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