
THE BEGINNINGS OF NATURAL HISTORY IN AMERICA.

BY

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Is not science a growth? Has not science, too, its embryology? And must not the neglect of its embryology lead to a misunderstanding of the principles of its evolution and of its existing organization?

SPENCER: *The Genesis of Science.*

ANALYSIS.

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I.

Three centuries ago the only English settlement in America was the little colony of one hundred and eight men which Raleigh had planted five months before upon Roanoke Island, in North Carolina.

The 17th of August, 1885, was the anniversary of one of the most noteworthy events in the history of America, for it marked the three hundredth return of the date when Sir Richard Grenville brought to its shores this sturdy company of pioneers, who, by their sojourn on this side of the Atlantic, prepared the way for the great armies of immigrants who were to follow.

It was also the anniversary of an important event in the history of science, for among the colonists was Thomas Harriot, the first English man of science who crossed the Atlantic. His name is familiar to few save those who love the time-browned pages and quaint narrations of Hakluyt, Purchas, and Pinkerton; yet Harriot was foremost among the

¹Annual presidential address delivered at the sixth anniversary meeting of the Biological Society of Washington, February 6, 1886, in the lecture room of the United States National Museum.

scholars of his time—the Huxley or the Stokes of his day—a man of wide culture, a skillful astronomer, a profound mathematician, the author of a standard treatise upon algebra, and a botanist, zoologist, and anthropologist withal. “He had been the mathematical instructor of Raleigh, and in obeying this summons to go forth upon the present expedition gave to it,” says Anderson, “the most valuable aid which could be derived from human strength.”¹

This eminent man deserves more than a passing notice on this occasion, and I have taken pains to bring together all that is known about him. He was born at Oxford in 1560, or, as old Anthony Wood quaintly expresses it, “he tumbled out of his mother’s womb into the lap of the Oxonian muses,” and at an early age was entered as a scholar in St. Mary’s Hall, receiving his bachelor’s degree in 1579. He was soon received into Raleigh’s family as his instructor in mathematics, and at the age of twenty-five made his voyage to America.

After his return he was introduced by Raleigh to Henry Percy, Earl of Northumberland, one of the most munificent patrons of science of that day, who allowed him a pension of £120 a year. “About the same time,” we are told, “Hues, well known by his *Treatise upon the Globes*,² and Walter Warner, who is said to have given Harvey the first hint concerning the circulation of the blood, being both of them mathematicians, received from him (Northumberland) pensions of less value; so that in 1606, when the Earl was committed to the Tower for life, Harriott, Hues, and Warner were his constant companions, and were usually called the Earl of Northumberland’s Magi.”³

One thing, at least, have three centuries accomplished for science. Its greatest workers are not now, as they were at the beginning of the seventeenth century, dependent upon the liberality and caprice of wealthy men, classed as their “pensioners” and “servants,” and assigned places at their tables which they must needs accept or famish.

Harriot appears to have passed the latter years of his life at Sion College, near Isleworth, where he died in 1621. He was buried in St. Christopher’s Church, London, and the following eulogy was embodied in his epitaph:

QUI OMNES SCIENTIAS CALLUIT AC IN OMNIBUS EXCELLUIT
MATHEMATICIS, PHILOSOPHICIS, THEOLOGICIS,
VERITATIS, INDAGATOR STUDIOSSIMUS,
DEI TRINIUNIUS PISSIMUS.

¹James S. M. Anderson, *History of the Church of England in the Colonies*, p. 86, London, 1845-56.

²Robert Hues, *Tractatus de Globis*, etc., 1611-63.

³Harriot was also a friend and companion of Raleigh during his imprisonment in the Tower (1603-1616), and was his collaborator in the preparation of the *History of the World*. His fidelity was rewarded by that distinguished authority, Chief Justice Popham, who denounced him from the bench as “a devil.”



S. M. Voinstall

He was especially eminent in the field of mathematics. "Harriott," says Hallam, "was destined to make the last great discovery in the pure science of algebra. . . . Harriott arrived at a complete theory of the genesis of equations, which Cardan and Vieta had but partially conceived."¹

His improvements in algebra were adopted, we are told, by Descartes, and for a considerable time imposed upon the French as his own invention, but the theft was at last detected and exposed by Doctor Wallis in his *Treatise of Algebra, both Theoretical and Practical*, London, 1685.

"Oldys, in his *Life of Sir Walter Raleigh*, has shown," says Stith, "that the famous French philosopher, Descartes, borrowed much of his light from this excellent mathematician, and that the learned Doctor Wallis gave the preference to Harriot's improvements before Descartes's, although he had the advantage of coming after and being assisted by him."²

Harriot's papers were left after his death in the possession of the Percy family at Petworth, where they were examined in 1787 by Doctor Zach, and later by Professor Rigaud, of Oxford, who, in 1833, published in his supplement to the works of James Bradley, *An Account of Thomas Harriot's Astronomical Papers*. His observations on Halley's comet in 1607 are still referred to as being of great importance. Zach pronounced him an eminent astronomer, both theoretical and practical. "He was the first observer of the solar spots, on which he made a hundred and ninety-nine observations; he also made many excellent observations on the satellites of Jupiter, and, indeed, it is probable that he discovered them as early if not earlier than Galileo."³

A posthumous work, *Artes Analyticæ Praxis ad Æquationes algebraicas nova, expedita et generali Methodo resolvendas, e posthumis Thomas Harriot*, was published in 1631 by his friend and associate, Walter Warner, and there is in the library of Sion College a manuscript work of his entitled *Ephemeris Chyrometrica*.

Wood says that, "notwithstanding his great skill in mathematics, he had strange thoughts of the Scriptures, always undervalued the old story of the creation of the world, and would never believe that trite proposition, 'Ex nihilo nihil fit.'"

Stith, the historian of Virginia, protests, however, against the charge

¹ Henry Hallam, *Introduction to the Literature of Europe in the Fifteenth, Sixteenth, and Seventeenth Centuries*, 4th ed., 1854; I, pp. 454, 456; II, p. 223; III, p. 181. See also J. E. Montucla, *Histoire des Mathématiques*; Ersch and Gruber, *Allgemeine Encyclopædie*.

² It would appear, however, that Wallis may have been too enthusiastic in his admiration of the English mathematician. Hallam states that he ascribed to Harriot a long list of discoveries which have since been reclaimed for Cardan and Vieta.

³ William Stith, *History of The First Discovery and Settlement of Virginia*, Williamsburg, 1747, p. 20.

⁴ John M. Good and Olinthus Gilbert Gregory, *The Pantologia*, V, 1813.

that Harriot had led his pupil Raleigh into atheism. "As to this groundless Aspersion," he remarked, "the Truth of it, perhaps, was that Sir *Walter* and Mr. *Harriot* were the first who ventured to depart from the beaten Tract of the Schools, and to throw off and combat some hoary Follies and traditionary Errors which had been riveted by Age, and rendered sacred and inviolable in the Eyes of weak and prejudiced Persons. Sir *Walter* is said to have been first led to this by the manifest Detection, from his own Experience, of their erroneous Opinions concerning the *Torrid Zone*; and he intended to have proceeded farther in the Search after more solid and important Truths 'till he was chid and restrained by the Queen, into whom some Persons had infused a Notion that such Doctrine was against God."¹

The erroneous opinions concerning the torrid zone which were called in question by Harriot and Raleigh were based upon a statement of Aristotle, in those days accepted as an article of faith, that the equatorial zone of the earth was so scorched and dried by the sun's heat as to be uninhabitable. Even the experience of explorers was for many years overpowered by the weight of this time-worn dogma. The Jesuit, Acosta, was accused of atheism on the same grounds by his Spanish contemporaries, but he rejoiced that he had seen for himself and that the climate under the equator was so different from what he had expected that "he could but laugh at Aristotle's meteors and his philosophy."

Harriot's Brief and True Report of the New Found Land of Virginia, a thin volume in quarto, printed at Frankfort on the Main in 1590,² is now one of the rarest and most precious works relating to America³ and is full of interest to the naturalist. Harriot's description of the Indians and their customs and beliefs, though strongly tingured

¹ History of the First Discovery and Settlement of Virginia, Williamsburg, 1747, p. 20.

² 1590. HARIOT (or Harriott), THOMAS. A Briefe and True Report | of the New Found Land of Virginia | of the commodities and of the nature and man | ners of the naturall inhabitants. Discovered by the English Colony there seated by Sir Richard | Greinville Knight In the yeere 1585. Which rema | ined Vnder the government of twelue monethes, | At the special charge and direction of the Honou- | rable SIR WALTER RALEIGH Knight lord Warden | of the stanneries Who therein hath bene fauoured | and authorised by her MAIESTIE | : and her letters patents: | This tore booke Is made in English | By Thomas Harriot, seruanto to the above named | Sir WALTER, a member of the Colony and there | imployed in discovering | CUM GRATIA ET PRIVILEGIO CAES. MATIS SPECIALE | Francoforti ad Moenum | Typis Ioannis Wecheli, sumtibus vero Theodori | DeBry Anno CIC IC XC, | venales reperuntur in officina Sigismundi Feirabendii. | 4°. pp. 1-33 (1). Title page with ornamental border of architectural design.

³ There are now only six or seven perfect copies in existence. These, we are told by Sabine, are in the British Museum and Bodleian libraries, and in the private collections of Messrs. Lenox, Brown, Christie-Miller, and Mann, besides an imperfect copy in the library of Harvard College and one in the possession of Sir Thomas Phillipps. At a sale in London in 1883 a copy sold for £300. A reproduction in photolithographic facsimile was issued by Sabine in New York in 1875.

with prepossessed ideas concerning them, is thorough and scholarly, and one of the fullest and most reliable of the early treatises upon the inhabitants of North America.

The chief man of the Roanoke colony, Sir Ralph Lane, usually spoken of as the first governor of Virginia, was a man of great energy and enterprise,¹ and with the help of Harriot planned and conducted expeditions in every direction—southward, 80 leagues to Secotan, “an Indian town, lying between the rivers Pampticoe and Neus;” to the northwest, up the Albemarle Sound and Chowan River to the forks of the Meherrin and Nottaway; and north, 130 miles to the Elizabeth River, on the south side of Chesapeake Bay.

Besides his description of the Indians, Harriot wrote “a particular narrative of all the beasts, birds, fishes, fowls, fruits, and roots, and how they may be useful.” A systematic report could hardly be expected from one who lived a century and a half before Linnæus, but if we keep in mind the condition of zoology at that day we can but be pleased with the fullness of his narrative.

He collected the names of twenty-eight species of mammals, twelve of these, including the black bear, the gray squirrel, the cony or hare, the otter, and the possum and raccoon (*Saquenúckot* and *Maquówooc*), he saw, beside the civet cat or skunk, which he observed by means of another sense. He was the first to distinguish the American from the European deer, stating that the former have longer tails, and the snags of their horns look backward—a brief diagnosis, but one which was not replaced by a better one for nearly two centuries.

Of birds he collected the names of eighty-six “in the countrie language,” and had pictures drawn of twenty-five. He mentions turkeys, stockdoves, partridges, crows, herons, and, in winter, great store of swans and geese.

With aquatic animals he seems to have been well acquainted. He refers to some by English names, and to many others which had no names “but in the countrey language.” In the plates accompanying the first edition of his book are figured several familiar forms, then for the first time made known in Europe, among them the gar pike (*Lepidosteus*),² and the horse shoe or king crab (*Limulus*),³ “*Seckanauk*, a kinde of

¹ Edward Everett Hale's *Life of Sir Ralph Lane*. *Archæologia Americana*, IV, pp. 317-344.

² Subsequently referred to by Champlain in 1613, and Sagard in 1636, under the name *chaousarou*, and figured by Champlain on his map of Nouvelle France. Du Creux, in his *Historiæ Canadensis*, 1663, also mentions it.

³ It has been generally supposed that Champlain was the first to notice this characteristic American animal, and Slaughter, in his notes upon Champlain's works [Publications of the Prince Society, *Champlain's Voyages*, II, p. 87], makes a statement to that effect, and is followed by Higginson in his *History of the United States*. Actually, the French explorer did not observe it until twenty years after Harriot, and his account of it was not printed until 1613.

crustie shell fishe which is good meate, about a foot in breadth, having a crustie tayle, many legges like a crabbe, and her eyes in her back."

Harriot also alludes to various kinds of trees and shrubs, usually by their Indian names. Among them may easily be recognized the pitch pine, sassafras, shoemake, chestnut, walnut, hickory, persimmon, prickly pear, Nelumbium, Liriodendron, holly, beech, ash, and so on, beside the maize and tobacco cultivated by the natives.

A companion of Harriot's, whose labors are deserving of notice, was John With or White, the first delineator of plants and animals who visited this continent. Concerning him and the ultimate utilization of his work, Stith discourses as follows:

UPON this Voyage, Sir *Walter Raleigh*, by the Queen's Advice and Directions, sent, at no small Expence, Mr. *John With*, a skilful and ingenious Painter, to take the Situation of the Country, and to paint, from the Life, the Figures and Habits of the Natives, their Way of Living, and their several Fashions, Modes, and Superstitions; which he did with great Beauty and Exactness. There was one *Theodore de Bry*, who afterwards published, in the Year 1624, the beautiful *Latin* Edition of Voyages, in six Volumes, *Folio*, a most curious and valuable Work. He being in *England* soon after, by the Means of the Rev. Mr. *Richard Hackluyt*, then of *Christ's-Church*, in *Oxford*, who, *De Bry* tells us, had himself seen the Country, obtained from Mr. *With* a Sight of these Pieces, with Permission to take them off in Copper Plates. These, being very lively and well done, he carried to *Frankfort*, on the *Maine*, where he published a noble Edition of them, with *Latin* Explanations, out of *John Wechelius's* Press, in the Year 1590. And these are the Originals from which Mr. *Beverley's*, and the Cuts of many of our late Writers and Travellers, have been chiefly imitated.¹

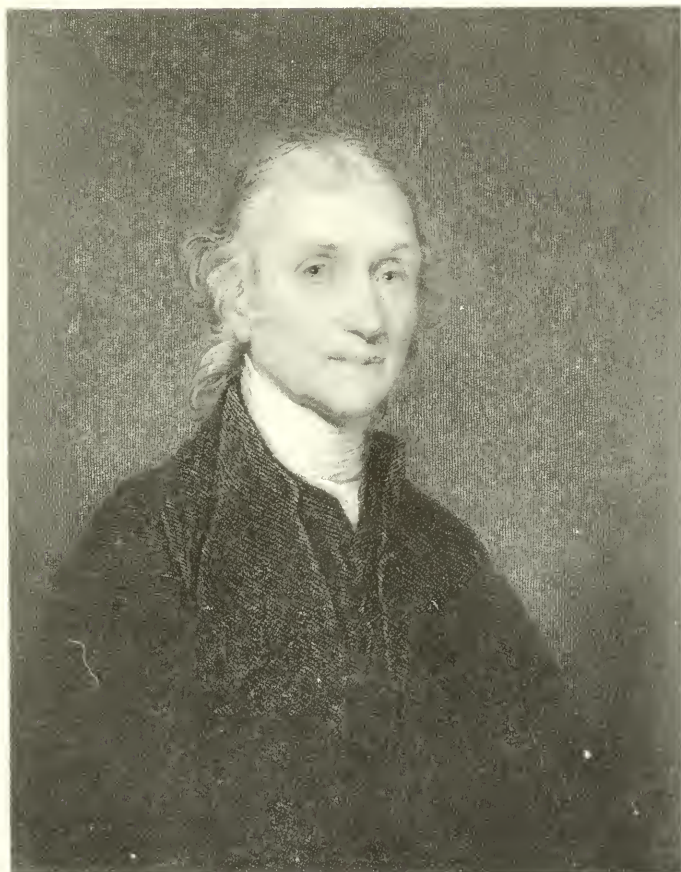
With's drawings are still in the British Museum,² where they were examined in 1860 by Doctor E. E. Hale, who reported upon their condition to the American Antiquarian Society.³

This collection, he says, consists of one hundred and twelve drawings in water color, very carefully preserved. They are very well drawn, colored with skill, and even in the present state of art would be considered anywhere valuable and creditable representations of the plants, birds, beasts, and men of a new country. Mr. Hale gives a list of these drawings as identified by Sloane and others. Among these were the bald eagle, the red-headed, hairy, and golden-winged woodpeckers, the blue-bird, red-wing blackbird, towhee, redbird, blue jay, and fox-colored thrush, the crow blackbird, and apparently the mocking bird—" *Artamockes*, the linguist; a bird that imitateth and useth the sounds and tones of almost all birds in the countrie." Among the fish we recognize the mullet (*Tetszo*), the menhaden or oldwife (*Masunnehockeo*), and the sturgeon (*Coppaulco*), and perhaps the squeteague or chigwit (*Chigwusso*).

¹ History of the First Discovery and Settlement of Virginia, Williamsburg, 1747, p. 16.

² Sir Hans Sloane and additional Manuscripts, 5270.

³ Archæologia Americana, IV, pp. 21-24.



JOSEPH PRIESTLEY.

The science of North America, then, began with Thomas Harriot. Let us review together to-night its progress for a period of two centuries—a period coinciding almost exactly with the colonial portion of the history of the United States.

“The present generation,” says Whewell, “finds itself the heir of a vast patrimony of science, and it must needs concern us to know the steps by which these possessions were acquired and the documents by which they are secured to us and our heirs forever. Our species from the time of its creation has been traveling onward in pursuit of truth; and now that we have reached a lofty and commanding position, with the broad light of day around us, it must be grateful to look back on the line of our past progress; to review the journey begun in early twilight amid primeval wilds, for a long time continued with slow advance and obscure prospects, and gradually and in later days followed along more open and lightsome paths, in a wide and fertile region. The historian of science, from early periods to the present time, may hope for favor on the score of the mere subject of his narrative, and in virtue of the curiosity which the men of the present day may naturally feel respecting the events and persons of his story.”

II.

Although Harriot was the first who described the natural characteristics of North America, it would not be proper to ignore the fact that the first scientific exploration of the Western Continent was accomplished by Spaniards and Frenchmen.

Gonzalo Fernandez de Oviedo y Valdes, the first historian of the New World [b. 1478, d. 1557], was an Asturian of noble birth, who began life as a page in the palace of Ferdinand and Isabella. He saw Columbus at Burgos on his second return from America in 1496. He came over in 1514 to Santo Domingo, having been appointed inspector of gold smelting, and was subsequently governor of that island and royal historiographer of the Indies. In 1525 he transmitted to Charles V his *Sumario de la Natural Historia de las Indias*, printed at Toledo two years later, and in 1535 began the publication of his *Historia Natural y General de las Indias*, a task which was finally completed only thirty years ago by the Spanish Royal Academy of History.

Las Casas said that Oviedo's books were “as full of lies almost as pages,” but whatever may have been his methods in the discussion of history and politics, he seems, in his descriptions, to have been both minute and accurate. Among the American animals which he was first to mention was the tapir or *dant*—“of the biguesse of a meane mule, without hornes, ash-coloured,” and the *churchia*, evidently a species of *Didelphys*, allied to our possum. This was the first notice of any member of the great group of marsupial mammals. I quote a portion of the

description in Oviedo's Sumario, employing the quaint phraseology of Purchas's translation:

The *Churchia* is as bigge as a small *Conie*, tawnie, sharpe-snowted, dog-toothed, long-tayled and eared like a *Rat*. They do great harm to their Hennes, killing sometimes twenty or more at once to sucke their blood; And if they then have young, shee carrieth them with her in a bagge of skin under her belly, running alongst the same like a Satchell, which shee opens and shuts at pleasure to let them in and out.¹

He characterized and described at length many other animals, among them the manatee, the iguana (*Iuanna*), the armadillos (*Bardati*), the ant-eaters, the sloth, the pelican, the ivory-billed woodpecker, and the humming birds.

There are found in the firme land [he wrote] certaine birds, so little that the whole bodie of one of them is no bigger then the top of the biggest finger of a mans hand, and yet is the bare body without the feathers not half so bigge. This Bird, besides her littlenesse, is of such velocitie and swiftnes in flying, that who so seeth her flying in the aire, cannot see her flap or beate her wings after any other sort then doe Dorres, or the Humble Bees, or Beetles. . . . And I know not whereunto I may better liken them, then to the little birds which the lymners of bookes are accustomed to paint on the margent of Church Bookes, and other Bookes of Divine Service. Their Feathers are of manie faire colours, golden, yellow, and greene.

That the spirit of Oviedo's work was scientific and critical, and not credulous and marvel-seeking, like that of many of his contemporaries, is everywhere manifest. His materials are classified in systematically arranged chapters. His methods may be illustrated by referring to his chapter On tigers.

"In Terra Firma," he begins, "are found many terrible beasts which the first Spaniards called tigers—which thing, nevertheless, I dare not affirm." He then reviews concisely and critically what is known of tigers elsewhere, and goes on to describe the supposed American tiger at length, and in such terms that it is at once evident that the mammal under discussion is one of the spotted cats, doubtless the jaguar (*Felis onca*).²

The second in order of time to publish a book upon American natural history was Jean de Lery [b. 1534, d. 1611], a Calvinistic minister, who was a member of the Huguenot colony founded by the Chevalier de Villegagnon in 1555, on the small island in the bay of Rio de Janeiro, which still bears his name. He remained in Brazil less than five years, and in 1578 published at Rouen a work entitled *Voyage en Amerique, avec la description des Animaux et Plantes de ce Pays*.

Joseph d'Acosta was another Spanish explorer who preceded Harriot, and was a man of much the same school and temper of mind. Born in the province of Leon about the year 1539, he entered the society of Jesuits at the age of fourteen, and in 1571 went to Peru, where he traveled as a missionary for seventeen years. After his return to Spain

¹ Sumario, Chap. XXVII, p. 491. Purchas, His Pilgrimmes, Chapter III, 1625, p. 995.

² Idem, Chap. XI, p. 487.

he filled several important ecclesiastical offices and died February 15, 1600, rector of the University of Salamanca. His first book, *De Natvra Novi Orbis Libri duo*, was published in 1589. His *Historia Natvral y Moral delas Indias* appeared in 1590, and is one of the best known and most useful of the early Spanish works on America, having passed through numerous editions in many languages.

Acosta was, perhaps, the most learned of the early writers upon America, and his writings, though modeled after those of the mediæval schoolmen, were full of suggestive observations, "touching the naturall historie of the heavens, ayre, water, and earth at the West Indies, also of their beasts, fishes, fowles, plants, and other remarkable varieties of nature." He discoursed "of the fashion and form of heaven at the new-found world," "of the ayre and the winds," of ocean physics, of volcanoes and earthquakes, as well as of metals, pearls, emeralds, trees, beasts, and fowls.

He discussed the appearance and habits of the manatee and the crocodile, and described the Indian methods of whaling and pearl fishing. He dwelt at length upon the condition of the domestic animals, sheep, kine, goats, horses, asses, dogs, and cats which the Spaniards had introduced into the New World and which were already thoroughly acclimated. It seems strange to learn from his pages that in the year 1587, 99,794 hides of domestic cattle were exported from Santo Domingo and New Spain to Seville. Lynceus has suggested that some of these skins were from the bison herds, believed at that time to have been abundant in the north of Mexico.

He gives a formidable catalogue of the animals of Central and South America, in which occur the familiar names of armadillo, iguana, chinchilla, viscacha, vicugna, paco, and guanaco, and describes many of them at length, especially the peccary (*Saino*), the tapirs, the sloths, and the vicugna. He speaks of the cochineal insect, which had already become of importance in the arts.

He was the first to call attention to the existence in South America of immense fossil bones; these he supposed to be the remains of gigantic individuals of the human species.

His description of the flora is very full, and he dwells at length upon the useful applications of the cacao bean and its product, the drink which they call chocolate—"whereof they make great account in that country, foolishly and without reason"—the plantain, the yucca, the cassava, the magney, the tunall or cactus, and very many more.

It is, however, as a scientific theorist that Acosta has the highest claim to our attention. He appears to have been the first to discuss America from the standpoint of the zoogeographer.

In considering the question, "How it should be possible that at the Indies there should be any sorts of beasts, whereof the like are nowhere else," he owns that he is quite unable to determine whether they were

special creations or whether they came out of the ark. He evidently prefers the first alternative, although so trammelled by the prevalent opinions of his day and sect that he is unable to bring himself quite to its avowal. He approaches so close to the limits of heterodoxy, however, that Purchas, in *His Pilgrimages*, feels obliged to print a footnote, pronouncing it "un-Christian to say that America was not drowned with the flood."

Acosta thoroughly appreciated the peculiar character of the American fauna, and remarked that "if the kinds of beasts are to be judged by their properties, it would be as reasonable to call an egg a chestnut as to seeke to reduce to the known kinds of Europe the divers kinds of the Indies." He was even willing to admit that it may not be necessary to say that the creation of the world was finished in six days, and that beasts of a more perfect character may have been made subsequently; and in his anxiety to escape the alternative of a Noah's ark almost committed himself to a theory of evolution. "We may consider well upon this subject," he wrote, "whether these beasts differ in kinde and essentially from all others, or if this difference be accidentall, which might grow by divers accidents, as we see in the Images of men, some are white, others black, some Giants, others Dwarfes; and in Apes, some have no taile, others have; and in Sheepe, some are bare, others have fleeces, some great and strong with a long necke, as those of Peru, others weake and little, having a short necke, as those of Castile. But to speak directly, who so would preserve the propagation of beasts at the Indies and reduce them to those of Europe, hee shall undertake a charge he will hardly discharge with his honour."

Francesco Hernandez, a representative physician and man of science, was sent by Philip II of Spain to Mexico, with unlimited facilities for exploration, and remained in that country from 1593 to 1600. His notes and collections seem to have been very extensive, and it is said that over 1,200 drawings of plants and animals were prepared under his direction. Editions of his works were published in Mexico in 1604 and 1615. I am assured by Mexican naturalists that his work was careful and valuable, the only defect being that he trusted too implicitly in what he was told by the native Mexicans.

Among the animals not met with in previous writings are the coyote (Aztec, *Coyotl*), the buffalo, the axolotl, the porcupine (*Hoitztlacuatzin*), the prong-buck (*Mazame*), the horned lizard (*Tapayaxin*), the bison, the peccary (*Quapizotl*), and the toucan.

Among those of which figures are for the first time published are the ocelot (*Ocelotl*), the rattlesnake (*Teuhllacot zanhqui*), the manatee (*Manati*), the alligator (*Aquetzpalin*), the armadillo (*Ayotochtli*), the pelican (*Ayototl*).

The figures of plants are numerous, and in most instances, I should judge, recognizable.



SAMUEL PURCHAS.

Many other Spaniards published their observations upon America in the sixteenth and seventeenth centuries, but it is perhaps not necessary to refer to them even by name. They were, as a rule, travelers, not explorers. Purchas assures us that "Acosta and Oviedo have best deserved of the studios of Nature—that is, of the knowledge of God in his workes."

III.

A personage who must on no account be overlooked in the consideration of these early days is Garcilasso de la Vega. Born in Peru in 1539, his father the Spanish governor of Cuzco, his mother a princess of the Inca blood, he boasted of a lineage traced through the line of ancient Peruvian monarchs back to Manco Capac and the Sun. He served as a soldier in Europe and died in Spain about the year 1617. His Royal Commentaries of Peru, constitutes a magnificent contribution to the history of pre-Columbian America, and was said by some authorities to have been first written in the Peruvian language.¹

Be this as it may, De la Vega's commentaries, though more valuable to the civil than to the natural historian, will always possess a peculiar interest, not only because the author was the first native of America who wrote concerning its animals and plants, but for the reason that it represents to us the historic and scientific lore of the aboriginal inhabitants of this continent.

De la Vega describes in an intelligible manner the condor (*Cuntur*) of South America, of which, as he tells us, there was a famous Indian painting in the temple at Cacha, the mountain cats or ocelots (Inca *Ozcollo*, Aztec *Occoltl*), the puma, the viscacha, the tapir, and the three-toed ostrich. He was one of the first to notice the skunk (*Mephitis*, sp.), "which the Indians call Amas, the Spanish *Zorinnas*." "It is well," he remarks, "that these creatures are not in great numbers, for if they were, they were able to poison and stench up a whole countrey." He devotes a chapter to "the tame cattel which God hath given to the Indians of Peru"—the llama and the huanaco—and speaks also of the paco and the vicuna, clearly distinguishing and describing the appearance and habits of the four species of Tylopoda which occur on the west coast of South America, although European naturalists a century later knew but two of them. He describes the annual vicuna hunts which were conducted by the Inca kings in person, assisted by twenty or thirty thousand Indians.

The fauna of Peru, as catalogued by him, included nearly fifty species,

¹A Paris edition of 1633 had the following title: *Commentaire Royal ou l'Histoire des Yncas Roys de Peru, etc. Ensemble une description particulière des Animaux, des Fruits, des Mineraux, des Plantes, etc. Ecrite en langue Peruvienne et traduit sur la version Espagnole par I. Baudouin, Paris, 1633; Amsterdam, 1704 and 1715. See Artedi, Bibliotheca Ichthyologica, 1788, p. 65.*

and the minuteness of his observations and the accuracy of his descriptions are very surprising. He discusses at length the plants of Peru, especially the maguey, the pineapple, the tobacco, and "the pretious leaf called *Cuca*," whose virtues pharmacologists now hold in such high esteem, and devotes chapters to "The Emeralds, Turquoises, and Pearls of that Countrey;" to gold and silver, and to quicksilver.

De la Vega refers to a certain place in the city of Cuzco, where lions and other fierce creatures are kept in captivity. The taste for menageries and gardens seems to have been less pronounced in Peru, however, than in Mexico.

Much has been written concerning the wonderful collection of animals and plants which the Spanish conquistadors found in Montezuma's capital city. Carus, in his *Geschichte der Zoölogie* declares that at the time of the discovery of Mexico, Europe had no menageries and botanical gardens which could be compared with those of Chapoltepec and Huextepec, a statement which is quite within the bounds of truth, for the earliest botanical garden in the Old World was that founded at Pisa in 1543.¹ Our fellow member, Doctor Charles Rau, has also described the zoological gardens of Mexico in glowing terms,² and Professor E. B. Tylor states that in the palace gardens of Mexico all kinds of birds and beasts were kept in well-appointed zoological gardens, where there were homes even for alligators and snakes, and declares that this testifies to a cultivation of natural history which was really beyond the European level of the time.

Is it not to be regretted that the capital of the United States in 1885 is still unprovided with a means of public instruction which was to be found in the capital of Mexico four hundred years ago?

I have examined the historians of Mexico with care, and must express my conviction that the truth is more nearly touched in the bluff, soldier-like narrative of Cortez himself than in the flowery and redundant paraphrases of Prescott. We may, probably, safely accept the story as told by Bernal Diaz del Castillo, one of the companions of Cortez, to whom Torquemada, Robertson, Lockhart, Rau, and others give high praise as a truthful narrator.

Diaz presents a most vivid word-painting of the city of Mexico, and was particularly impressed by the royal aviaries:

We saw here every kind of eagle, from the king's eagle³ to the smallest kind included; and every species of bird, from the largest known to the little colibris,⁴ in their full splendor of plumage. Here also were to be seen those birds from which the Mexicans take the green-colored feathers, of which they manufacture their

¹ William Whewell, *A History of the Inductive Sciences, from the Earliest to the Present Time*, III, 1837, p. 325.

² Carl Rau, *Thiergärten*. *New Yorker Staats-Zeitung*, April 26, 1863.

³ The golden eagle, says Aguilera.

⁴ Humming birds.

beautiful feathered stuffs. These last-mentioned birds very much resemble our Spanish jays and are called by the Indians *quezales*.¹

The species of sparrows² were very curious, having five distinct colors in their plumage—green, red, white, yellow, blue.

There were such vast numbers of parrots and such a variety of kinds that I can not remember all their names; and geese of the richest plumage and other large birds.

These were at stated periods stripped of their feathers, that new ones might grow in their place. All these birds had appropriate places to breed in and were under the care of several Indians of both sexes, who had to keep their nests clean, give to each kind its proper food, and set the birds for breeding.

In another place, near a temple, were kept all manner of beautiful animals, the names of which were not noted by Diaz, nor their peculiarities described.

In the building where the human sacrifices were perpetrated there were dens in which were kept poisonous serpents, and among them "a species at the end of whose tail there was a kind of rattle." This last-mentioned serpent, which is the most dangerous, was kept in a cabin in which a quantity of feathers had been strowed; here it laid its eggs, and it was fed with the flesh of dogs and of human beings which had been sacrificed. . . . When all the tigers and lions³ roared together with the howlings of the jackals⁴ and foxes and hissing of the serpents, it was quite fearful, and you could not suppose otherwise than that you were in hell.

This is the first record of the rattlesnake, and brings to mind the captive snakes of the Mokis, their annual snake dance, and their use of feathers in the same connection.⁵

I am not yet prepared to believe in the marvelous aquaria described by Prescott, although fish ponds there doubtless were.

I am assured by our fellow-member, Señor Aguilera, that the locations of the gardens of Montezuma are well identified, and that the Mexican Indians still possess a marvelous knowledge of the medicinal virtues of plants, which is handed down by tradition from generation to generation. From this he infers that in the days of Aztec glory the knowledge of the uses of plants must have been very comprehensive.

Who shall say that the spirit of true science did not inspire the Inca Pachacutec, when many centuries ago he handed down to his descendants maxims such as this:

A herbalist who knows the names but is ignorant of the virtues and qualities of herbs, or he who knows few but is ignorant of most, is a mere quack and mountebank, and deserves not the name and repute of a physician until he is skillful as well in the noxious as in the salutiferous qualities of herbs.

Impressed with the extent of the knowledge of nature among the aborigines of America, I asked one of the most learned of our anthro-

¹ Trogons, known as *quetzales* by the Mexican Indians of to-day. Excellent examples of their pictorial use of trogon feathers may be seen in the United States National Museum.

² *Cyanopiza versicolor*.

³ Ocelot, jaguars, pumas, cyras, jaguarundis.

⁴ The coyote (*coyoll*), *Canis latrans*.

⁵ John G. Bourke, *The Snake Dance of the Moquis of Arizona*, New York, 1884.

pologists for his opinion in regard to its character, and received the following statement:

WASHINGTON, *January 5, 1886.*

MY DEAR MR. GOODE: We make a very grave mistake if we think there was no study of nature before the science of natural history. In all branches of study whatever there was lore before there was science. Before the Weather Bureau was weather lore, a kind of rough induction which the ancient people made, and which was very far from erroneous. Doctor Washington Matthews read a paper before the Washington Philosophical Society more than a year ago¹ to draw attention to the marvelous intimacy of the Navajo Indians with the plant kingdom around them, and their vocabulary, which contained names for many species constructed so as to connote qualities well known to them. You are familiar with the stories concerning the respect in which certain animals are held by the Eskimo, and the minute acquaintance of all our aborigines of both continents with the life histories of many animals. The Eskimo, as well as the Indian tribes, carve and depict forms so well that the naturalist can frequently determine the species. Mr. Lucien Turner collected carvings in ivory of fetal forms.

Very truly, yours,

O. T. MASON.

Professor Mason also called attention to a long paper upon Tame Animals among the Red Men of America, by Doctor E. F. im Thurn,² in which it is stated that the Indian of South America finds means to tame almost every wild bird and beast of his country, so that these domesticated animals are ever among the most prominent members of his household, not because of any affection for them, but because he enjoys their bright colors, makes use of them in various ways, and employs them as a medium of exchange. They even know how to change the colors of a living bird from green to yellow. In one settlement he counted twenty-one kinds of monkeys. Nearly all of the thirty or more species of Guiana parrots are tamed, two species of deer, two of peccaries, two of coati-mundis, jaguars, pacas, capybaras, agoutis, hawks, owls, herons, plovers, toucans, troupials, rupicolas, and iguanas were also observed in captivity. The mere fact that these animals are kept in captivity is not in itself especially significant, but it renders it possible to understand how splendor-loving rulers of Mexico succeeded in building up the great menageries.

Bearing in mind the animal myths which Major Powell has found so prevalent among the Indians of Arizona and New Mexico, and has so charmingly translated, and those which Schoolcraft and others recorded in the north long ago, and which Longfellow has arranged in metric form, we can not but be impressed with the idea that the red man of old, living close to nature as he did, knew many of her secrets which we should be glad to share with him at the present day.

¹ Washington Matthews, *Natural Naturalists*. Bulletin of the Philosophical Society Washington, VII, 1885, p. 73 (abstract).

² Timelri, being the Journal of the Royal Agricultural and Commercial Society of British Guiana. Demerara, I, 1882, pp. 25-43.



CONSTANTINE SAMUEL RAFINESQUE.

Garcilasso de la Vega was not the only descendant of the aboriginal Americans who has written upon their history. Among the authors of works upon Mexican archæology published in the seventeenth and eighteenth centuries were Taddeo de Niza and Gabriel d'Ayala, "noble Indians" of Tlazcala and Tezcuco, the three named Ixtlilxochitl, and ten or twelve more. Gongora, a native Mexican, professor of mathematics in the University of Mexico, was one of the earliest American astronomers, the author of the Mexican Cyclography, printed two centuries ago. Herrera, Martínez, García, Torquemada, Castillejo, De Betancourt, De Solis, Del Pulgar, and Beneducei have done what they could to preserve a portion of this ancient American lore, and it seems almost incredible that, sometime in the future when American archæology shall have gained a firmer footing, some of the treasures of fact which these men garnered up are not to have an important function in elucidating anthropological problems which are as yet entirely unsolved.

IV.

The colony on Roanoke Island having been abandoned by the English, twenty years elapsed before their next effort toward peopling America. Then came the adventurers to Jamestown in 1606, and with them that picturesque personage, Captain John Smith, who, though unversed in the mathematics and astronomy which made up to a great extent the science of the day, was a keen observer and an enterprising explorer. His contributions to geography were important, and his descriptions of the animals and plants of Virginia and New England supplement well those of his predecessor, Harriot.

Captain Smith was the first to describe the raccoon, the musquash, and the flying squirrel:

There is a beast they call *Aroughcun* (raccoon), much like a badger, but useth to live on trees, as Squirrels doe. Their Squirrels some are neare as great as our smallest sort of wilde Rabbits, some blackish, or blacke and white, but most are gray. A small beast they have they call *Asapanick*, but we call them flying Squirrels, because, spreading their legs, and so stretching the largenesse of their skins that they have been seene to fly 30 or 40 yards. An *Opossum* hath a head like a Swine, and a taile like a Rat, and is of the bignesse of a Cat. Under her belly she hath a bagge, wherein she lodgeth, carrieth, and suckleth her young. A *Musascus* (musquash) is a beast of the forme and nature of our water Rats, but many of them smell exceedingly strongly of Muske.

And in the same strain he goes on to mention a score of mammals, identifying them with those of Europe with surprising accuracy.

His "*Uchun quoyes*, which is like a Wild Cat," is evidently the bay lynx. With the birds he was less familiar, but he mentions a number which resemble those of Europe, and states that many of them were

unfamiliar. He was the first to refer to the red-wing blackbird (*Agelaius phoeniceus*).

He catalogues twenty-five kinds of fish and shellfish, using the names by which many of them are known to this day.

He gives also a very judicious account of the useful trees of Virginia, referring, among novel things, to the Chechinquamin (chinkapin), and another which no one can fail to recognize.

Plums, [he says], are of three sorts. . . . That which they call *Putchamins* grow as high as a *Palmeta*; the fruit is like a Medler; it is first green, then yellow, and red when it is ripe; if it be not ripe it will draw a man's mouth awry with much torment.¹

In his description of New England, Smith mentions twelve species of mammals, including the "moos," now spoken of for the first time,² sixteen of birds, and twenty-seven "fishes." His descriptions of the abundance of fishes are often quoted.³

Smith's first work upon Virginia was printed in 1612 and his General History in 1624. In the interim, Ralphe Hamor, the younger, secretary of the colony, issued his True Discourse of the Present Estate of Virginia, published in London in 1615.⁴ Hamor was not a naturalist, but his name is usually referred to by zoological bibliographers, since he mentions by name over sixty native animals. He was the first to describe the great flocks of wild pigeons, of which he remarks: "In winter, beyond number or imagination, myselfe hath seene three or foure houres together flockes in the aire so thicke that even they have shadowed the skie from us."⁵ He gives an amusing description of the "opossum," and also speaks of the introduction and successful acclimation of the Chinese silkworm.

In 1620 the Plymouth Colony was planted, and its members also began to record their impressions of the birds and the beasts and the plants which they found, for the instruction of their kinsfolk at home.

Bradford and Winslow's Journal, printed in London in 1622, contains various passing allusions to the animals and plants observed by the Pilgrims, as does also Bradford's History, which, however, was not printed until long after its completion. They added nothing, however, to what had already been said by Smith.

Edward Winslow's News from New England, printed in London

¹ Generall Historie, 1624, p. 27.

² From the Indian word *Moosoa*. Slafter, in his notes on Champlain's Voyages, I, p. 265, supposes the *Orignac* referred to by this explorer in his *De Sauvages*, etc., Paris, 1607, to have been the Moose, and his *Ceryf* to have been the Caribou.

³ Generall Historie, 1624, pp. 216, 217.

⁴ A copy of this rare work was sold in London, 1883, for £69. A reprint was issued by Joel Munsell at Albany in 1860, but this privately printed edition consisted of only 200 copies and it is already scarce.

⁵ Page 21.

in 1624, contains one of the earliest descriptions of the Indians of the Northeast.

William Wood's *New England's Prospect*, which was issued in London in 1634, and Morton's *New English Canaan*, printed three years later in Amsterdam, were the first formal treatises upon New England and its animals and plants. The two authors were very unlike, and their books even more so—yet complementing each other very satisfactorily. Morton was the best educated man, brightest, and most observant; Wood the most conscientious and the most laborious in recording minute details.

"Thomas Morton, of Clifford's Inn, Gent.," was by no means a representative man in the Puritan community in which he lived. His habits were those of an English man of fashion, and his Rabelaisian humor, when directed against his fellow-colonists and their institutions, was no recommendation to their favor. We can not wonder that he was hunted from settlement to settlement and even cast into prison, to endure, without bedding or fire, the rigor of a New England winter.

As a naturalist, Morton appears to have been the most accurate of the two of this time. In those parts of his book which describe animals and plants he manifests a definite scientific purpose. He discriminates between species, and frequently points out characters by which American and European forms may be distinguished. He was the first to banish the lion from the catalogue of the mammals of eastern North America. Even Wood, though he admitted that he could not say that he ever saw one with his own eye, evidently believed that lions inhabited the woods of Massachusetts. Morton was a skeptic because, as he said, "it is contrary to the Nature of the beast to frequent places accustomed to snow; being like the Catt, that will hazard the burning of her tayle, rather than abide from the fire." His brief biographies, especially those of mammals, indicate that he was an observer of no slight acuteness.

Twenty species of mammals, thirty-two of birds, twenty of fishes, eight of marine invertebrates, and twenty-seven of plants are mentioned, usually in such definite terms that they may readily be identified.

A thorough pagan himself, he seems to have commanded the confidence of the Indians more than others, to have lived in their society, and learned to comprehend the meaning of their customs. His first book, *The Originall of the Natives, their Manners and Customs*, seems to have been the careful record of rather critical observations.

Wood's book is no less deserving of praise. The climate and the soil are judiciously discussed, and the herbs, fruits, woods, waters, and minerals, then "the beasts that live on land," "beasts living in the water," "birds and fowls both of land and water," and fish, after which follows a topographical description of the colony. His catalogues of species are in verse, and his adjectives are so descriptive and pictorial that his subsequent remarks in prose are often superfluous. I quote his

catalogue of the trees of New England, an imitation in manner and meter of Spenser's famous catalogue in *The Faerie Queene*:

Trees both in hills and plaines in plenty be
 The long liv'd Oake, and mourneful Cypris tree
 Skie trowing pines, and Chestnuts coated rough,
 The lasting Cedar and the Walnut tough;
 The rozin dropping Firre for masts in use.
 The boatmen seeke for Oares light neeate growne sprewse,
 The brittle Ash, the ever trembling Aspes,
 The broad-spread Eline, whose concave harbours waspes
 The water-springie Alder, good for nought
 Small Elderes by the Indian Fletchers sought
 The knottie Maple, pallid Birtch, Hawthornes,
 The Horne bound tree that to be cloven scornes;
 Which from the tender Vine oft takes his spouse,
 Who twinds embracing armes about his boughes.
 Within this Indian Orchard fruites be some
 The ruddie Cherrie, and the jettie Plumbe
 Snake murthering Hazell, with sweet Saxaphrage
 Whose steemes in beere allays hot fever's rage.
 The Diar's Shumach, with more trees there be
 That are both good to use and rare to see.

Thus he describes the Animals of New England:

The Kingly Lyon and the strong arm'd Beare
 The large limbed Mooses, with the tripping Deare.
 Quill darting Porcupines, and Rackcoones bee
 Castell'd in the hollow of an aged Tree
 The skipping Squirrel, Rabbet, purblind Hare
 Immured in the selfe same Castle are
 Least red-eyed Ferrets, wily Foxes should
 Them undermine if ramperd but with mould.
 The grim fac't Ounce, and ravenous howling Woolfe
 Whose meagre Paunch sucks like a swallowing Gulfe,
 Black glistening Otters and rich coated Beaver
 The Civet scented Musquash, smelling ever.

His subsequent remarks upon the mammals are expanded from his rhyme, and extended by tales which he has heard from hunters. One of the animals whose name would not lend itself to poesy is the "squuncke," which he classified among the "beasts of offence." This seems to be the first use of the name.

In the second part of Wood's book the Indians are discussed, and a very creditable vocabulary is given.

Most admirable work was now being done among the Indians by some of the colonial clergymen. Chief among them was the Rev. John Eliot [b. 1604, d. 1690], who, during a residence of more than half a century at Roxbury, mastered the language of the Massachusetts branch of the great Algonquin tribe and published his grammars and translations. He was a graduate of Jesus College, Cambridge, and came to Massachu-



Wm. C. Cope

setts in 1631. The Rev. Abraham Peirson, one of the founders of the colony at Newark, during his residence in New England made valuable investigations upon the language of the Quiripi or Quinmipiac Indians of the New Haven colony. The extensive bibliography of which Mr. Pilling has recently published advance sheets gives an excellent idea of the attention which American linguistics have since received.

That very eminent colonial statesman, John Winthrop the younger, the first governor of Connecticut [b. 1587, d. 1649], stood high in the esteem of English men of science, and was invited by the newly founded Royal Society, of which he was a fellow, "to take upon himself the charge of being the chief correspondent in the West, as Sir Philiberto Vernatti was in the East Indies." The secretary of the Royal Society said of him: "His name, had he put it to his writings, would have been as universally known as the Boyles, the Wilkins's, and the Oldenburghs, and been handed down to us with similar applause."¹

Governor Winthrop's name occurs from time to time in the Philosophical Transactions, and it was to him that science was indebted for its first knowledge of the genus *Astrophyton*.

John Winthrop, F. R. S. [b. 1606, d. 1676], son of the last, and also governor of Connecticut in 1662, is said to have been "famous for his philosophical knowledge." He was a founder of the Royal Society, being at the time of its origin in England as agent of the colony. And the second governor's grandson, John Winthrop, F. R. S. [b. 1681, d. 1747], who passed the latter part of his life in England, was declared to have increased the Royal Society's repository "with more than six hundred curious specimens, chiefly in the mineral kingdom," and since the founder of the museum of the Royal Society, "the benefactor who has given the most numerous collections."²

The Rev. John Clayton, rector of Crofton, at Wakefield, in Yorkshire, made a journey to Virginia in 1685, and in 1688 communicated to the Royal Society An Account of several observables in Virginia and in his Voyage thither.³ Clayton seems to have been a man of scientific culture, and to have been the author, in company with Doctor Moulin, of a treatise upon comparative anatomy. He was of the same school with Harriot and Wood, though more philosophical. His essay was, however, the most important which had yet been published upon the natural history of the South, and his annotated catalogue of mammals, birds, and reptiles is creditably full.

Thomas Glover also published about this time An Account of Vir-

¹ Doctor Cromwell Mortimer, in the dedication of Volume XI, Philosophical Transactions.

² Tuckerman, in *Archæologia Americana*, IV, pp. 123-124. See also The Winthrop Papers. Massachusetts Historical Society Collections, 5th ser., VIII, p. 571.

³ Philosophical Transactions, XVII, pp. 781-795, 978-999; XVIII, pp. 121-135, and in *Miscellaneous Curiosa*, III; also reprinted in Force's Historical Tracts, III.

ginia,¹ in which he discussed the natural history of the colony after the manner of Wood and Morton. The Rev. Hugh Jones also published a similar but shorter paper upon Several Observables in Maryland,² in which, however, no new facts are mentioned. He collected insects and plants for Petiver.

Benjamin Bullivant, of Boston, was another of the men who, to use the language of the day, was "curious" in matters of natural history. One of his letters was published in the Philosophical Transactions,³ and his notes on the "hum-bird" are sometimes referred to.

Bullivant was not a naturalist; he is less worthy of our consideration than Harriot, although a century later. A fit companion for Bullivant was John Josselyn.

Josselyn's famous work entitled *New England's Rarities Discovered in Birds, Beasts, Fishes, Serpents, and Plants of that Country*, was printed in London in 1672; his *Account of Two Voyages to New England*, in 1675 (second edition). No writer of his period is more frequently quoted than Josselyn, whose quaint language and picturesque style are very attractive. Although no more in sympathy with his Puritan associations than the author of *New England's Prospect*, he was evidently more justly entitled to subscribe himself as "Gentleman," and his books are not disfigured by personalities and political aspersions.

Josselyn does not seem to me to be the peer, as a naturalist, of many of those who preceded him. He was a bright, though superficial, man, and a ready compiler. He evidently had some botanical work in his possession, possibly, as Tuckerman has suggested, a recently published edition of Gerard's *Herbal*, and this he used with such skill as to give him a certain standing in botanical literature. In his zoological chapters I find little which had not been recorded before, while the author's fondness for startling anecdotes greatly mars the semblance of accuracy in his work. His catalogue of fishes is a strange olla-podrida of names and scraps of information, compiled, collected, and invented. His method of arrangement is not more scientific than his spirit, and it is questionable whether he is entitled to a place among naturalists.

Here is an example of his style:

"The *Basse*," writes he, "is a salt water fish too . . . one writes that the fat in the bone of a *Basses* head is his braines which is a lye."

To this period belongs, also, Lawson, the author of a *History of Carolina* and *A New Voyage to Carolina*, made in 1700 and the following years, while acting as surveyor-general of the colony. Lawson was burnt at the stake in 1709 by the Indians, who resented his encroachments upon their territory. His lists of the animals and plants of the region are very full and his observations accurate. Coues's "Lawsonian period" in the

¹ Philosophical Transactions, XI, p. 6323.

² Idem., XXI, p. 436.

³ Idem., XX, p. 167.

history of American ornithology is hardly justifiable. Lawson belonged to the school of Harriot and the first Clayton.

Edward Bohun and Job Lord, of Carolina, appear to have been interested in natural history at this time and to have been collecting specimens for Petiver in London, while William Vernon was engaged in similar occupations in Maryland.

In those early days all Europe was anxious to hear of the wonders of America, and still more eager to see the strange objects which explorers might be able to preserve and bring back with them. Public museums were as yet unknown, but the reigning princes sought eagerly to secure novelties in the shape of animals and plants.

Columbus was charged by Queen Isabella to collect birds, and it is recorded that he took back to Spain various skins of beasts. Even to this day may be seen, in Siena, hanging over the walls of the old collegiate church, a votive offering, placed there nearly four centuries ago by the discoverer of America, then in the prime of his glory. It consists of the helmet and armor worn by him when he first stepped upon the soil of the New World, and the rostrum of a swordfish killed on the American coast.

The State papers of Great Britain contain many entries of interest to naturalists. King James I was an enthusiastic collector. December 15, 1609, Lord Southampton wrote to Lord Salisbury that he had told the King of the Virginia squirrels brought into England, which were said to fly. The King very earnestly asked if none were provided for him—whether Salisbury had none for him—and said he was sure Salisbury would get him one. The writer apologizes for troubling Lord Salisbury, “but,” he continues, “you know so well how he (the King) is affected to such toys.”

Charles I appears to have been equally curious in such matters. In 1637 he sent John Tradescant, the younger, to Virginia “to gather all rarities of flowers, plants, and shells.”

In 1625 we find Tradescant writing to one Nicholas that it is the Duke of Buckingham’s pleasure that he should deal with all merchants from all places, but especially from Virginia, Bermudas, Newfoundland, Guinea, the Amazons, and the East Indies for all manner of rare beasts, fowls and birds, shells and shining stones, etc.¹

In the Domestic Correspondence of Charles I, in another place,² July, 1625, is a “Note of things desired from Guinea, for which letters are to be written to the merchants of the Guinea Company.” Among other items referred to are “an elephant’s head with the teeth very large; a river horse’s head; strange sorts of fowls; birds and fishes’ skins; great flying and sucking fishes; all sorts of serpents, dried fruits, shining stones, etc.” Still further on is a note of one Jeremy Blackman’s charge, in all

¹ Calendar of Colonial Papers, IV, 1625, p. 77.

² *Idem.*, III, p. 75, Nos. 155, 156.

£20, for transporting four deer from Virginia, including corn and a place made of wood for them to lie in.¹

Not only did the kings make collections, but the keepers of public houses made museums then, as they do now, for the pleasure of their patrons.

At the middle of the last century there appear to have been several collections of curiosities.

In Artedi's ichthyological works there are numerous references to places where he had seen American fishes, especially at Spring-garden² and at the Naggshead, and the White-bear, and the Green Dragon in Stepney, in those days a famous hostelry in London. He speaks also of collections at the houses of Mr. Lillia and Master Saltero's³ in Chelsey and at Stratford, and also in the collection of Seba, in Amsterdam, and in that of Hans Sloane.

With the exception of "*the monk or Angel-fish, Anglis aliis Mermaid-fish*," probably a species of *Squatina*, which he saw at the Nag's Head, all the fishes in these London collections belonged to the order Plectognathi.

Josselyn, after telling us how a Piscataway colonist had the fortune to kill a Pilhannaw—the king of birds of prey—continues, "How he disposed of her I know not, but had he taken her alive and sent her over into England neither Bartholomew nor Sturbridge Fair could have produced such another sight."⁴

Shakespeare's mirror strongly reflects the spirit of the day. When Trinculo, cast ashore upon a lonesome island, catches a glimpse of Caliban he exclaims:

"What have we here,—a man or a fish? Dead or alive? A fish; he smells like a fish; a very ancient and fish-like smell. . . . A strange fish! Were I in England now, (as once I was,) and had but this fish painted, not a holiday fool there but would give a piece of silver; there would this monster make a man; any strange beast there makes a man: when they will not give a doit to relieve a lame beggar, they will lay out ten to see a dead Indian."⁵

The compilers of the great encyclopedialike works on natural history were quick to pick up the names and descriptions of the American animals which had found their way to Europe, and many such are mentioned in the writings of Gesner, Clusius and Aldrovandus, Lister, Laet, and Willughby.⁶

¹ Calendar of Colonial Papers, I, 1638, p. 285.

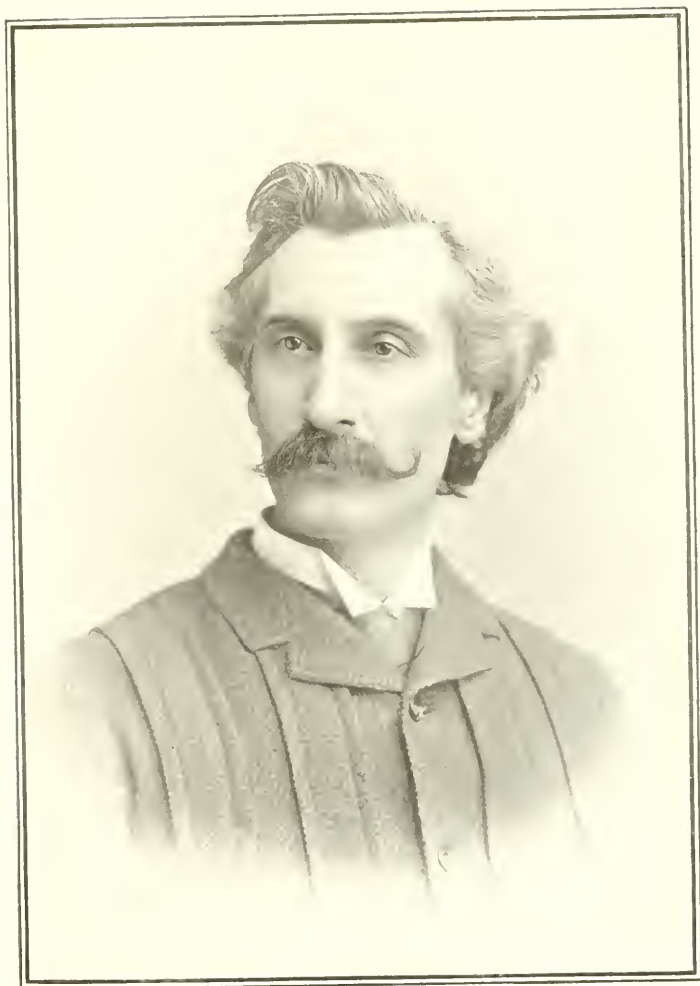
² Later known as Vauxhall Gardens, a famous place of resort.

³ The barber virtuoso, described in Bulwer's Devereux.

⁴ John Josselyn, *An Account of Two Voyages to New England* (made during the years 1638, 1663), Boston, 1865.

⁵ *The Tempest*, Act II, Scene 2.

⁶ In Nehemiah Grew's Catalogue and description of the natural and artificial Rarities, belonging to the Royal Society and preserved at Gresham College, Whereunto is subjoined the comparative Anatomy of Stomachs and Guts, London, 1694, are descriptions and figures of every American animal.



CHARLES VALENTINE RILEY.

Creatures of remarkable appearance, which could be preserved with ease, were the first to become known. Among fishes, for instance, those with a hard, inflexible integument, such as the trunk fishes. Every species of the family *Ostraciontidae* was known in Europe as early as 1685; most of them probably a century before. We know that Columbus caught a trunk fish and described it in his Voyages.

Professor Tuckerman has traced in a most instructive manner the beginnings of European acquaintance with American plants, finding traces of the knowledge of a few at a very early period:

Dalechamp, Clusius, Lobel, and Alpinus—all authors of the sixteenth century—must be cited occasionally in any complete synonymy of our *Flora*. The Indian-corn, the side-saddle flower (*Sarracenia purpurea* and *S. flava*), the columbine, the common milkweed (*Asclepias cornuti*), the everlasting (*Antennaria margaritacea*), and the *Arbor vite*, were known to the just-mentioned botanists before 1600. *Sarracenia flava* was sent either from Virginia, or possibly from some Spanish monk in Florida. Clusius's figure of our well-known northern *S. purpurea* . . . was derived from a specimen furnished to him by one Mr. Claude Gonier, apothecary at Paris, who himself had it from Lisbon; whither we may suppose it was carried by some fisherman from the Newfoundland coast. The evening primrose (*Erythronium biennis*) was known in Europe, according to Linnæus, as early as 1614. *Polygonum sagittatum* and *arifolium* (tear-thumb) were figured by De Laet, probably from New York specimens, in his *Novus Orbis*, 1633. Johnson's edition of Gerard's *Herbal* (1636) . . . contains some dozen North American species, furnished often from the garden of Mr. John Tradescant . . . and John Parkinson—whose *Theatrum Botanicum* (1640) is declared by Tournefort to embrace a larger number of species than any work which had gone before it—describes, especially from Cornuti, a still larger number.¹

All the early voyagers were striving for the discovery of a western passage to India, and the West Indies, so called, were considered simply a stage on the journey toward the East Indies. It is not strange, therefore, that writers should often have failed to distinguish the faunal relations of the animals which they described. Many curious paradoxes in nomenclature have thus arisen—*Cassis madagascariensis*, for instance, a very misleading name for a common West India mollusk.

V.

The seventeenth century bears upon its roll the names of many explorers besides those of English origin who have already been named. Within fifty years of the time of Harriot and of the planting of the colony at Roanoke, the number and extent of the European settlements in America had become very considerable. Virginia and the New England plantations were growing populous and Maryland was fairly established. Insular colonies were thriving at Newfoundland and Bermuda and on Barbados and elsewhere in the West Indies.

New Spain and Florida marked the northern limits of the domain of the Spaniards, who had already overrun almost all of South America.

¹ *Archæologia Americana*, IV, pp. 116, 117.

New France bounded New England on the north, and the French were pushing their military posts and missionary stations down into the Mississippi Valley.

The Dutch were established on Manhattan Island and elsewhere in the surrounding country, and the Dutch West India Company had already a foothold in Brazil and Guiana. A colony of Scandinavians had been planted by the Swedish West India Company near the present site of Philadelphia, and the forsaken Danish colonies of Greenland were soon to be reestablished. The Portuguese had flourishing settlements in Brazil, for the possession of which they were contending with the Dutch.

Every European nation was represented in the great struggle for territory save Italy and Germany, Switzerland and Russia; but the Italians and Germans, the Swiss and the Russians were to hold their own in the more generous emulation of scientific exploration which was to follow.

During the seventeenth and eighteenth centuries numerous explorations were made both in North and South America by Spanish, French, Dutch, German, and Scandinavian explorers. Although these men have been studied in the preparation of this address, I do not intend to speak of them at any length, but to confine my attention in the main to the growth of scientific opinions and institutions in the English colonies.

The number of volumes of reports and narratives, often sumptuously printed and expensively illustrated, which were published during the seventeenth and eighteenth centuries, impresses upon one most powerfully the idea of the earnestness, diligence, and intelligence of their writers.

The Spaniards.—Even as early as the beginning of the century, Spanish influence was less prominent in the affairs of the New World; in no respect more strikingly so than in explorations. The political supremacy of Spain was gone, her intellectual activity was waning, and the mighty storm of energy, by which her domain in America had been so suddenly and widely established, seemed to have completely exhausted the energy of her people, depleted as it had been by wars without and religious prosecution within.

From this time forward the record of Spanish achievements in the fields of science and discovery is very meager. Between the day of Hernandez and that of Azara and Mutis, who explored South America in the latter part of the eighteenth century, I find but two names worthy of mention, and these seem properly to belong with the naturalists who lived a hundred years before them. I refer to José Gumilla, who published, in 1741, a work on the natural history of the Orinoco region, and Miguël Venegas, whose *Noticia de la California* appeared in 1757.

The French.—One of the first French explorers who left a record of his observations was Samuel de Champlain, who made a voyage to the West Indies and Mexico, 1599-1602, and began his travels in New France in 1603. He was the founder of Quebec, where he died in 1635,

and his geographical explorations and maps are of great value. His observations upon the animals and plants are disappointing. He describes the gar-pike and the king-crab, already described and figured by Harriot many years before, and refers in unmistakable terms to the shearwater, the caribou, the wild turkey, and the scarlet tanager. His lists of animals which occur now and again in the course of his narrative are too vague to be of value.¹

Much higher in the esteem of naturalists was Gabriel Sagard Théodat, a Franciscan friar, whose *Le Grand Voyage du Pays des Hurons*, printed in 1632, was the most scholarly work upon America which had yet appeared, and whose *History of Canada and of the journeys made by the Franciscans for the conversion of the infidels* also contains most valuable records.

The first work on the plants of North America was that of Cornuti—*Canadensium Plantarum, aliarumque nondum editarum historia*—printed in Paris in 1635, which described thirty-seven species, thirty-six of these being illustrated by elaborate engravings upon copper. The botanical part of this treatise is usually ascribed to Vespasian Robin, and Tuckerman supposes that the local notes, as well as the specimens described, were probably the result of the labors of the worthy Franciscan missionary, Sagard.²

A few years later, Pierre François Xavier de Charlevoix [b. 1682, d. 1761], a Jesuit priest, having by royal command traveled through the northern part of North America, published his *Histoire et Description Générale de la Nouvelle France*, Paris, 1744, which was full of important biological and ethnological observations, the accuracy of which is not questioned.

He subsequently traveled in South America, and published in 1760 a work full of statements concerning the animals, plants, and fruits of that country, and also particularly interesting from the account which it gives of the singular Jesuit establishment in Paraguay.

Other French missionaries, Brebœuf, Du Poisson, Jaques, Joliet, La Chaise, Lallemant, Marquette, Senat, and Souel, followed Charlevoix in the exploration of these regions. Their works contain many valuable notes upon animals and plants.

Jean Baptiste du Tertre, in his *Histoire Générale des Antilles, habitées par les François*, published in Paris in 1667 [ed. 1667-71], described and illustrated many of the New World animals.

In 1672 Nicolas Denyse published in Paris two comprehensive works upon America, viz: *Histoire Naturelle des Peuples, des Animaux des Arbres and Plantes de l'Amérique*,³ and *Description Geographique des Costes de l'Amérique Septentrionale, avec l'Histoire Naturelle du País*.⁴

¹ Publications of Prince Society, Boston, 1878; Hakluyt Society, XXIV, 1850.

² *Archæologia Americana*, IV, p. 119.

³ Paris, 1672, octavo.

⁴ 1672, duodecimo, 2 vols.

F. Froger, a companion of De Gennes in his voyage made in 1695-1697 to the coast of Africa, the Straits of Magellan, Brazil, Cayenne, and the Antilles, published a report in 1698.¹ The book has been overlooked by recent bibliographers, but, judging from Artedi's remarks upon its ichthyological portion, it was fully equal to similar works of its day.

Baron de la Houtan, lord lieutenant of the French colony at Placentia, printed at the Hague in 1703 his *Voyages dans l'Amérique*, which is sometimes referred to by zoologists.

Louis Feuillée, who traveled by royal commission from 1707 to 1712 in Central and South America, published four volumes of physical mathematics and botanical observations, 1714-1725, in Paris.

The Père Jean Baptiste Labat visited the West Indies as a missionary early in the eighteenth century, and *Nouveau Voyage aux Isles de l'Amérique*, printed in Paris, 1722, is very full of interesting and copious details of natural history.

The Père Laval visited Louisiana and published in Paris, 1728, his *Voyage de la Louisiane*.

M. Le Page Du Pratz followed, in 1758, with his *Histoire de la Louisiane*,² full of geographical, biological, and anthropological observations upon the lower valley of the Mississippi, and Captain Bossu, of the French marines, also published a book upon the same region,³ translated into English in 1771 by John Reinhold Forster, whose notes gave to the work its only value. These men are all catalogued with the seventeenth-century naturalists because they were of the old school of general observers and only indirectly contributed to the progress of systematic zoology.

Charles Plumier [b. 1646, d. 1704] was sent thrice by the King of France to the Antilles during the latter years of the seventeenth century. He published three magnificently illustrated works upon the plants of America⁴ and left an extensive collection of notes and drawings of animals and plants, many of which have proved of value to naturalists of recent years. His colored drawings of fishes were of great service to Cuvier in the preparation of his great work upon ichthyology, and in some instances species were founded upon them.

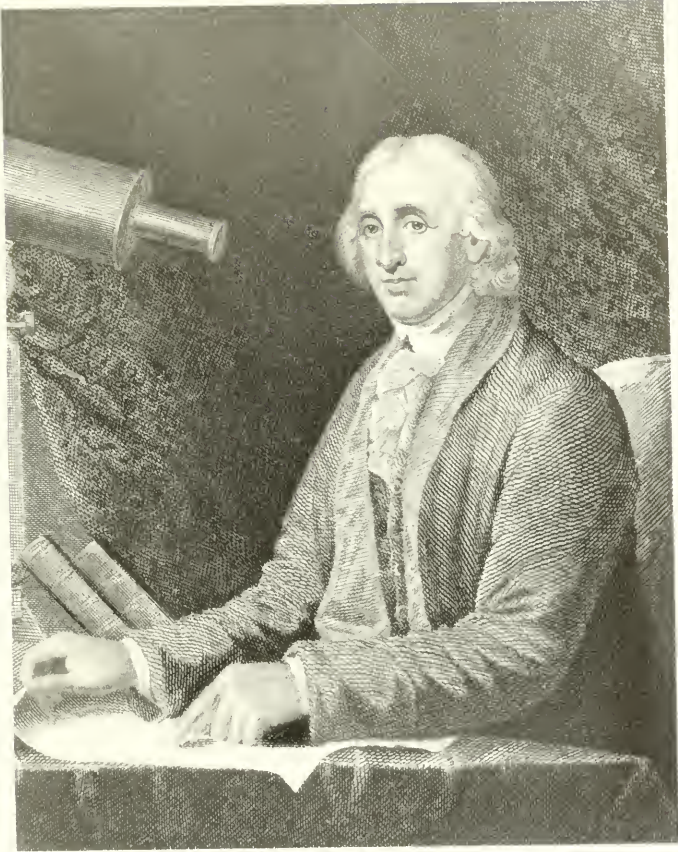
The Dutch.—There were few lovers of nature among the colonists of Manhattan, and with the exception of certain names which have clung to well-known animals, such as the mossbunker and weakfish, naturalists have little to remind them of the days of Van Twiller and Stuyvesant. Van Der Donck, in 1659, described the fauna, and Jakob Steendam's poem, "In praise of the Netherlands," catalogued many of the animals.

¹ Paris, 1698; Amsterdam, 1699; London (translation), 1698.

² Paris, 1758.

³ *Nouveaux Voyages aux Indes Occidentales*, etc., Paris, 1768.

⁴ *Nova Plantarum Americanarum Genera*, 1703. *Traité Des Fougères de l'Amérique* 1705.



David Rittenhouse

The achievements of Prince Maurice of Nassau (b. 1604, d. 1679), the conqueror of Brazil, during his residence in that country from 1636 to 1644, were far more important than those of any one man in the seventeenth century, and entitled the Netherlands to a leading place in the early history of American scientific explorations. The notes and figures which were collected by him and his scientific assistants, Maregrave, Piso, and Cralitz, were published in part under the editorship of Golius and Laet, and have been frequently used by naturalists of the present century. An atlas of colored drawings from the hand of Prince Maurice is still preserved in the Royal Library in Berlin. Here are depicted 34 species of mammals, 100 of birds, 55 of reptiles, 69 of fishes, and 77 of insects, besides many of plants.

Maregrave's *Historia Rerum Naturalium Brasilie* was printed in Amsterdam in 1648, four years after his untimely death while exploring the coast of Guinea.

Piso's *Medicina Braziliensis*, 1648, and his *Natural History and Medicine of both Indies*, 1658, were also results of Prince Maurice's expedition.

Among other contributions made by the Netherlands to the natural history of America were the *Relation du Voyage de Isle Tobago*, Paris, 1606, and the *Histoire Naturelle et Morale des Iles Antilles*, Rotterdam, 1658,¹ written by N. Rochefort, a Protestant missionary to the West Indies, and Jan Nieuhof's *See und Landreize benessens een bondege Beschreyving van gantsch Nederland Brazil so van Landschappen Steden, deren Gewaffen*, etc., printed in 1682.

Jan Jacob Hartsuick, a Dutch traveler in Guiana, printed a book of scientific travels at Amsterdam in 1770.

Philippe Ferriin, a Dutch naturalist, resident for many years in Surinam, published in Amsterdam two important works upon the natural history of that region, in 1765 his *Histoire Naturelle de la Hollande Equinoxiale*, and in 1769 his *Description de Surinam*. I refer to these works as important, not because they are of great value to zoological writers of to-day, but because they, in their day, marked distinct advances in knowledge.

The Scandinavians.—Danish enterprise at an early day sent explorers to the Western Continent, and the scholarly tendencies of the Scandinavian mind were soon manifest in a literature of geographical and scientific observations.

Hans Egede, a missionary who went to Greenland at least as early as 1715, published in 1741 his comprehensive work upon Greenland, of which so many editions have been published.

Otho Fabricius [b. 1744, d. 1822], another missionary, long resident in Greenland, published in 1780 his *Fauna Greenlandica*, a work which

¹ First edition without name of author; others, Paris, 1665; Lyons, 1667; Amsterdam, 1716.

in scientific accuracy has never been excelled—a most important contribution to systematic zoology. David Crantz's History of Greenland, published in 1770, is another important scientific work from the hand of a missionary, and Zоргdrager's notices of the Greenland fisheries deserve a passing notice.

The travels of Kalm, a Swede and a pupil of Linnæus, are noticed elsewhere. Peter Loeffling, another pupil of Linnæus, visited Spanish America, and in his *Iter Hispanicum*, printed in Stockholm, 1758, described many animals and plants observed by him.

Olaf Swartz, a Swede, discovered and described 850 new species of West Indian plants from 1785 to 1789. He spent a year in the Southern United States before going to the West Indies.¹

The Germans.—Germany, too, soon began to send its students across the Atlantic. Johann Anderson, a burgomaster of Hamburg, published in 1746 his *Tidings from Iceland, Greenland, and Davis Straits*, for the benefit of Science and Commerce. Hans Just Winkelmann published in Oldenburg in 1664 *Der Amerikanischen neuen Welt Beschreibung*, etc., with descriptions and figures of animals and plants.

Christian Bullen in 1667 made a voyage to Greenland and Spitzbergen, an account of which, including interesting observations on whales and the whale fishery, was printed at Bremen in 1668.

Maregrave, Krieg, the two Forsters, and Schœpf are referred to elsewhere. Steller, Pallas, and Chamisso are mentioned in connection with Russian explorations.

Madame Maria Sibilla Merian [b. 1647, d. 1717], who was a native of Frankfort, was an enthusiastic entomologist who traveled in Surinam from 1699 to 1701. Her paintings of tropical insects were reproduced in a magnificent folio volume, printed 1705–1709, which was one of the wonders of her day, and which, together with her other writings upon insects, have secured her a prominent place in the early history of science.

VI.

The seventeenth century was not, upon the whole, a period favorable to the promotion of science, for all Europe was agitated by war and political strife, and men had neither opportunity nor inclination for intellectual pursuits. During its latter half, however, and with the return of peace and tranquillity, science grew in favor as it had never done before. The restoration of the Stuarts to the English throne was quickly followed by the establishment of the Royal Society. Louis XIV made the period of his accession memorable by founding the Royal Academy of Sciences, and by building an observatory.

This was the period of intellectual activity which followed the revival of letters in Europe. Carus, in his *Geschichte der Zoologie*, 1872, p. 259, calls it the period of encyclopædia-making (*Periode der encyklopädischen*

¹ Brendel, *American Naturalist*, December, 1879, p. 757.

Darstellungen), filling the interspace between "The Zoology of the Middle Ages" and "the period of Systematic Classification." Students of science had ceased to compile endless commentaries on the works of Aristotle, and had begun to record their own observations and thoughts, to gather new facts and materials, which were to serve as a basis for the systematic work for their successors.

The greatest names of the day among naturalists were those of Ray, Tournefort, Lister, Jonston, Goedart, Redi, Willughby, Swammerdam, Sloane, Jung, and Morrison; names not often referred to at the present day, but worthy of our recollection and veneration, for they were men of a new era—the pioneers in systematic zoology and botany.

Among the earliest representatives of the new school in North America were Banister, Clayton, Mitchell, and Garden. John Banister, a clergyman of the Church of England, emigrated to Virginia before 1688, and in addition to his clerical duties applied himself assiduously to the study of natural history. He was a disciple and also, no doubt, a pupil of the great English naturalist, John Ray, who called him in his *Historia Plantarum*, "erudissimus vir et consummatissimus Botanicus," and corresponded also with Lister, and Compton, Bishop of London. He was the first to observe intelligently the mollusks and insects of North America. In a paper communicated to the Royal Society in 1693 he refers to drawings of ten or twelve kinds of land snails and six of fresh-water mussels. The drawings were not published, nor were the notes, except those in reference to the circulation of a species of snail.¹

He sent to Petiver, in 1680, a collection of fifty-two species of insects, his observations upon which, with notes by Petiver, were a few years later communicated to the Royal Society.² Among them many familiar forms are recognizable—the mudwasp, seventeen-year locust, cimex, cockroach, firefly, the spring beetle (*Elater*), and the tobacco moth. He appears to have drawn and described several phases of the life history of the ichneumon fly. He had in his possession in 1686, and exhibited to an English traveler, large bones and teeth of fossil mammals from the interior of Virginia, the first of which we have any record in North America.³

It was as a botanist, however, that he was best known. He made drawings of the rarer species, and transmitted these with his notes and dried specimens to Compton and Ray. Banister's *Catalogus Plantarum in Virginia Observatarum*, printed in 1686,⁴ was the first systematic paper

¹ Philosophical Transactions, XVII, 1693, pp. 671, 672. See also Transactions of the Linnean Society, VII, p. 227.

² Some Observations concerning Insects made by Mr. John Banister, in Virginia, A. D. 1680, with Remarks on them by Mr. James Petiver, etc. Philosophical Transactions, XXII, 1701, pp. 807-814.

³ Perhaps the *Megalonyx jeffersonii*, subsequently discovered.

⁴ In Ray's *Historia Plantarum*, London, 1686.

upon natural history which emanated from America. In one of his botanical excursions, about the year 1692, he visited the falls of the Roanoke, and, slipping among the rocks, was killed.¹

Lawson, the historian of North Carolina, writing at the beginning of the next century, remarked: "Had not the ingenious Mr. Banister (the greatest virtuoso we ever had on this continent) been unfortunately taken out of this world, he would have given the best account of the plants of America of any that ever yet made such an attempt in these parts."² The memory of John Banister is still cherished in Virginia, where his descendants are numerous.³

John Clayton was also an excellent representative of the new school, and should not be confounded with the Rev. John Clayton who visited America in 1685. John Clayton, the naturalist, as he is styled in Virginian history, appears to have been born in Fulham, a suburb of London, in 1693, and to have accompanied his father, John Clayton, subsequently attorney-general of Virginia, when he came to this country in 1705. He was clerk of Gloucester County, Virginia, for fifty-one years, and died December 15, 1773. "He passed a long life," says Thacher, "in exploring and describing the plants of this country, and is supposed to have enlarged the botanical catalogue as much as any man who ever lived." He was a correspondent of Linnæus, Gronovius, and other naturalists, as well as of Collinson, who wrote of him in 1764 as "my friend John Clayton, the greatest botanist of America."

Clayton's *Flora Virginica*, which was edited by J. F. Gronovius, assisted by the young Linnæus, who was just entering upon his career of success and was then resident in Leyden, began to appear in 1739, subsequent portions being published in 1743 and 1762. It seems to be the opinion of botanists that Gronovius deserves less credit for his share in this work than has usually been allowed him, and that Clayton's descriptions were those of a thorough master of botanical science as then understood. He communicated to the Royal Society various botanical papers, including one upon the culture of the different kinds of tobacco. On his death he left two volumes of manuscripts, and an herbarium, with marginal notes and references for the engraver who should prepare the plates for his proposed work. These were in the possession of his son when the Revolutionary war commenced, and were placed in the office of the clerk of New Kent County for security from the invading enemy. The building was burned down by incendiaries, and thus perished not only the records of the county, but probably one of the most important works on American botany written before the days of Gray and Torrey.

¹ His papers and collections were sent to the Bishop of London. The plants are said to have passed into the hands of Sloane, and to be still preserved in the British Museum. It would be interesting to know what has become of his manuscripts.

² John Lawson, *History of North Carolina*, Raleigh edition, p. 134.

³ See *The Bland Papers and Slaughter's History of Bristol Parish*, 1st and 2d editions.



JOHN RODGERS.

Jefferson declares that Clayton was a native Virginian, and such is the confusion in the records that it is quite possible that such may be the fact.¹

Still another pioneer was Doctor John Mitchell, born in England about 1680, and settled early in the last century at Urbana, Virginia, on the Rapahannock, where he remained nearly fifty years, practicing medicine and promoting science. He appears to have been a man of genius and broad culture, and was one of the earliest chemists and physicists in America. His political and botanical writings were well received, and his map of North America is still an authority in boundary matters. He was a correspondent of Linnæus, and in 1740 sent Collinson a paper in which thirty new genera of Virginia plants were proposed.² His Dissertation upon the Elements of Botany and Zoology³ was dated Virginia, 1738, and was thus almost contemporary with the first edition of the *Systema Naturæ* of Linnæus, though it was not printed until ten years after it was written. This was the first work upon the principles of science ever written in America. In 1743 he communicated to the Royal Society An Essay upon the Causes of the different Colours of People in different Climates,⁴ writing from the standpoint of an evolutionist. He also communicated An Account of the Preparation and Uses of the various Kinds of Potash,⁵ and a Letter concerning the Force of electrical Cohesion.⁶ His fame rests chiefly, however, upon his investigations into the yellow fever epidemic of 1737-1742, published after his death by his friends, Franklin and Rush.⁷ In 1743 he appears to have been engaged in physiological researches upon the opossum, which, however, were never published. In 1746 Doctor Mitchell returned to England, and upon the voyage was captured by French or Spanish pirates, and his collections and apparently his manuscripts destroyed. He became a Fellow of the Royal Society, and in 1748 was writing a work upon the natural and medical history of North America.⁸ He died at an advanced age, about 1772. His name is perpetuated in that of our beautiful little partridge berry, *Mitchella repens*. "Mitchell and Clayton together," says Tuckerman, "gave to the botany of Virginia a distinguished luster."

Doctor John Tenment, of Port Royal, Virginia, seems to have been a man of botanical tastes. He it was who brought into view the virtues of the Seneca snake root, publishing at Williamsburg, in 1736, an essay

¹ Spotswood Letters, I, pp. 1, 8; II, pp. 44, 58, 354.

² Darlington, Memorials of John Bartram and Humphrey Marshall, p. 21.

³ *Dissertatio brevis de Principiis Botanicorum et Zoologorum, deque novo stabiliendo naturæ rerum congruo cum Appendice aliquot generum plantarum recens conditorum et in Virginia observatorum.* Nuremberg, 1748.

⁴ Philosophical Transactions, XI, III, 1744, p. 102.

⁵ *Idem.*, XLV, 1748, p. 541.

⁶ *Idem.*, LI, Pt. 1, 1759, p. 390.

⁷ American Medical and Philosophical Register, IV.

⁸ James Edward Smith, Correspondence of Linnæus, II, pp. 442-451.

on pleurisy, in which he treats of the Seneca as an efficient remedy in the cure of this disease.¹ He also wrote other botanical treatises.² Doctor George Greham, of Dumfries, Virginia, was a man of similar tastes, and it is said by Mr. Jefferson that we are indebted to him for the introduction to America of the tomato.

David Krieg, F. R. S., a German botanist, collected insects for Petiver in Maryland, and gathered also hundreds of species of plants. He seems to have returned to England very early in the century, for his name appears in the Philosophical Transactions in 1701.

Colonel William Byrd, of Westover, Virginia [b. 1764, d. 1793], was a man of European education, the owner of a magnificent library, in which Stith wrote his history of Virginia, founder of the city of Richmond, colonial agent in London, and president of the King's council. He was a Fellow of the Royal Society, to which he communicated a paper *An Account of a Negro Boy that is dappeld in several Places of his Body with White spots*,³ and was a correspondent of Collinson, Bartram, and other naturalists. His *History of the Dividing Line*, and his *Journey to the Land of Eden*, in 1733, contain many interesting observations upon Indians and general natural history. He it was who, in 1694, carried to England a female opossum, which furnished the materials for the first dissertation upon the anatomy of the marsupiates.⁴

One of the most eminent of our colonial naturalists was Doctor Alexander Garden, born in Scotland about 1728 [d. 1791]. He emigrated to America about 1750, and practiced medicine in Charleston, South Carolina, until after the close of the Revolutionary war, when he returned to England and became very prominent in scientific and literary circles, and vice-president of the Royal Society in 1783. He was an excellent botanist, but did his best work upon fishes and reptiles. He sent large collections of fishes to Linnæus, which were so well prepared that when I examined the fishes in the Linnæan collection in London, in 1883, I found nearly every specimen referred to by him in his letters in excellent condition, though few collected by others were identifiable. Garden was the discoverer of *Amphiuma means*, and was instrumental in first sending the electrical eel to Europe. His letters to Linnæus and to Ellis are voluminous and abound in valuable information. In 1764 he published a description of *Spigelia marilandica*, with an account of its medicinal properties.

James Logan [b. 1664, d. 1751], a native of Ireland and member of

¹ James Thacher, *Medical Biography*, I, p. 73.

² Mitchell, writing to Linnæus, in 1748, remarks: "I can now only send you . . . some dissertations of Mr. Tenment upon the *Polygala*, two of which only have come out among his latest publications. His former ones, of inferior merit, are not now to be had."

³ *Philosophical Transactions*, XIX, 1697, p. 781.

⁴ Edward Tyson, *Carigueya, seu Marsupiale Americanum, or the Anatomy of an Opossum, etc.* *Philosophical Transactions*, XX, 1698, p. 105.

the Society of Friends, accompanied William Penn to this country in 1682 in the capacity of secretary, and became a public man of prominence, serving for two years as governor of the colony of Pennsylvania. He was a man of broad culture and was the author of a translation of Cicero's *De Senectute*, printed by Benjamin Franklin in 1744. To Logan belongs the honor of having carried on the first American investigations in physiological botany, the results of which were published in Leyden, in 1739, in an essay entitled *Experimenta et Meletemata de Plantarum Generationis*. This essay, which related to the fructification of the Indian corn, was accepted in its day as a valuable contribution to knowledge.

Cadwallader Colden [b. 1688, d. 1776] was also a statesman and a naturalist. A native of Scotland, he came to America in 1708, and, after a short residence in Pennsylvania, settled in New York, where he held the office of surveyor-general and member of the King's council, and in later life was for many years lieutenant-governor, and frequently acting governor of the province. His intellectual activity manifested itself in various directions, and his *History of the Five Indian Nations of Canada*, New York, 1727, was one of the earliest ethnological works printed in America. He also was interested in meteorology and astronomy, and as a correspondent of Linnæus and Collinson did much to advance the study of American botany. His daughter, Miss Jane Colden, was the first lady in America to become proficient in the study of plants. She was the author of a *Flora of New York*, which was never published.¹ Governor Colden's *Plantæ Coldenhamiæ*, the first part of a catalogue of the plants growing in the neighborhood of his country residence, Coldenham, near Newburg, was the first treatise on the flora of New York. It was published in 1744 in the acts of the Royal Society of Upsala.² A most interesting collection of papers from the scientific correspondence of Colden was published many years ago by Doctor Asa Gray.³

Hans Sloane, a young Irish physician [b. 1660, d. 1753], who had been a pupil of Tournefort and Magnol, visited the West Indies in 1684, and after his return printed a *Catalogue of Jamaica Plants* in 1696, and later a sumptuously illustrated work on the natural history of Jamaica (1707-1725). After his return he became an eminent physician, and in 1727 succeeded Isaac Newton as president of the Royal Society. The collection of animals and plants made by Sir Hans Sloane in America was greatly increased by him during his long and active life, and, having been bequeathed by him to the nation, became, upon his death in 1753, the nucleus of the British Museum.

Another naturalist of the same general character was Mark Catesby [b. 1679, d. 1749], who lived in Virginia, 1712 to 1721, collecting and

¹ Brendel in *American Naturalist*, December, 1879, p. 756.

² John Torrey, *Flora of New York*, Albany, 1843.

³ *American Journal of Science*, XLIV, 1843, p. 85.

making paintings of birds and plants; in the Carolinas, 1722 to 1725, and a year also in the Bahamas. His magnificent illustrated work upon the Natural History of Carolina, Florida, and the Bahama Islands,¹ is still of great value to students of natural history.

The name of John Bartram, the Quaker naturalist of Philadelphia, is possibly better remembered than those of his contemporaries. This is no doubt due to the fact that he left behind him a lasting monument in his botanic garden on the banks of the Schuylkill. He was the earliest native American to prosecute studies in systematic botany, unless Jefferson's statement concerning Clayton proves to be true. Linnæus is said to have called him "the greatest natural botanist in the world," and George III honored him in 1765 with the title of Botanist to his Majesty for the Floridas and a pension of £50 a year. Bartram was a most picturesque and interesting personage, and a true lover of nature. He did great service to botany by supplying plants and seeds to Linnæus, Dillenius, Collinson, and other European botanists. He was a collector, however, rather than an investigator, and his successes seem to have been due, in the main, to the patient promptings and advice of his friend Collinson in London. Garden, whom he visited at Charleston in 1765, after his appointment as King's Botanist, wrote of him to Ellis:

I have been several times into the country, and places adjacent to town, with him, and have told him the classes, genera, and species of all the plants that occurred, which I knew. I did this in order to facilitate his enquiries, as I find he knows nothing of the generic characters of plants, and can neither class them nor describe them; but I see that, from great natural strength of mind and long practice, he has much acquaintance with the specific characters; though this knowledge is rude, inaccurate, indistinct, and confused, seldom determining well between species and varieties. He is, however, alert, active, industrious, and indefatigable in his pursuits.²

Fothergill says in his Memoir of Collinson "that the eminent naturalist, John Bartram, may almost be said to have been created by my friend's assistance."

The foregoing remarks concerning the elder Bartram are simply for the purpose of calling attention to his proper position among the American naturalists of his day. It is not that I esteem Bartram the less, but that I esteem Garden, Clayton, Mitchell, and Colden more. The name of Bartram brings up at once that of his friend and patron, Peter Collinson, just as that of Garden reminds us of John Ellis.

Collinson and Ellis were never in America, yet if any men deserve to be called the fathers of American natural history it is they. For a period of thirty years or more, that period during which Linnæus was bringing about those reforms which have associated his name forever with the history of the classificatory sciences, these enlightened and science-loving London merchants seem to have held the welfare of American science in their keeping and to have faithfully performed their trust. I know few

¹ London, 1754-1771.

² Smith, Correspondence of Linnæus, I, p. 537.



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books which are more delightful than Darlington's Memorial or Bartram and Smith's Correspondence of Linnæus, made up as they are largely of the letters which passed between Collinson and Ellis and their correspondents in America, and with Linnæus, to whom they were constantly transmitting American notes and specimens.¹

Humphrey Marshall [b. 1722, d. 1801] was a farmer-botanist of the Bartram type, and the author of *The American Grove*, a treatise upon the forest trees and shrubs of the United States, the first botanical work which was entirely American. Darlington's Memorials of Bartram and Marshall is a worthy tribute to this useful man.

Moses Bartram, a nephew of John, was also a botanist, and William, his son [b. 1739, d. 1823], was a much more prominent figure in American science. His *Travels through North and South Carolina*, published in 1791, was, in the opinion of Coles, the starting point of the distinctively American school of ornithology.

Collinson was a correspondent of Benjamin Franklin, and is said not only to have procured and sent to him the first electrical machine which came to America, but to have made known to him in 1743 the results of the first experiments in electricity, the continuation of which gave to Franklin his European reputation as a man of science. Collinson was instrumental in introducing grape culture in Virginia, and in acclimating here many foreign ornamental shrubs.

Ellis was a more eminent man of science, and his name is associated with the beginnings of modern marine zoology.

Linnæus wrote to him in 1769: "Your discoveries may be said to vie with those of Columbus. He found out America, or a new India, in the west; you have laid open hitherto unknown Indies in the depths of the ocean." He was royal agent for West Florida, and had extraordinary facilities for obtaining specimens from the colonies.

His nephew, Henry Ellis, F. R. S. [b. 1720, d. 1805], was the author of *A Voyage to Hudson's Bay in 1746 and 1747 for Discovering a North West Passage*, which contains some valuable notes upon zoology. He was in 1756 appointed governor of the colony of Georgia, and in 1758 published in the *Philosophical Transactions* an essay on *The Heat of the Weather in Georgia*. In 1760 he made a voyage for the discovery of a new passage to the Pacific, and later was governor of Nova Scotia, where we can but believe he continued his observations and his correspondence with the savans of Europe. "Finally," says Jones, "having attained a venerable age, and to the last intent upon the prosecution of some favorite physical researches, he fell in sleep, as did Pliny the Elder, within sight of Vesuvius, and upon the shores of the beautiful Bay of Naples."²

¹ William Darlington, *Memorials of John Bartram and Humphrey Marshall*. Philadelphia, 1849, 1850.

² Charles C. Jones, *History of Georgia*. Boston and New York, 1863.

Jones, in his *History of Georgia* [I, p. 444], refers to the Rev. Stephen Hales—"equally renowned as a naturalist and a divine"—who lived for a time in Georgia during the last century. Can this have been the famous author of *Vegetable Statics*? I have been unable to find any allusion to a sojourn in America, in the published notices of the English Hales, and equally unable to discover a second Hales in the annals of science.

The central figure among eighteenth-century naturalists was of course Linnæus. His *Systema Naturæ* was an epoch-making work, and with the publication of its first edition at Leyden in 1735 the study of the biological sciences received an impress which was soon felt in America.

In 1738, while in Leyden, he assisted Gronovius in editing the notes sent by Clayton from Virginia, and it is evident that Linnæus was already, at the age of thirty, recognized by European botanists as an authority upon the plants of America. It was in this year that he visited Paris. He at once made his way to the Garden of Plants, and entered the lecture room of Bernard de Jussieu, who was describing some exotics to his pupils in Latin. There was one which the demonstrator had not yet determined, and which seemed to puzzle him. The Swede looked on in silence at first, but observing the hesitation of the learned professor, cried out: "*Haec plantam faciem Americanam habet.*" Jussieu turned about quickly with the exclamation, "You are Linnæus."

It is interesting to notice how strongly the Linnæan reforms took root in American soil, and how soon. Collinson wrote to Bartram in 1737: "The *Systema Naturæ* is a curious performance for a young man, but his coining a new set of names for plants tends but to embarrass and perplex the study of botany. As to his system . . . botanists are not agreed about it. Very few like it. Be that as it will, he is certainly a very ingenious man, and a great naturalist."¹ Six years later he wrote to Linnæus himself:

Your system, I can tell you, obtains much in America. Mr. Clayton and Dr. Colden at Albany on Hudson's River in New York, are complete Professors; as is Dr. Mitchell at Urbana on Rappahannock River, in Virginia.²

This may not seem a very numerous following, but twelve years after this (1755) only seven English botanists were mentioned by Collinson in response to a request from Linnæus to know what botanical people in London were skilled in his plan.³

It is a fact not often referred to that during his period of poverty and struggles, Linnæus received, through the influence of his patron, Boerhaave, an appointment in the colony of Surinam. His prospects for a successful career in Europe had, however, brightened, and he decided not to come to America.

¹ Darlington, *Memorials of John Bartram and Humphrey Marshall*. Philadelphia, 1849, 1850, p. 106.

² Smith, *Correspondence of Linnæus*, I, p. 9.

³ *Ibid.*, p. 33.

His interest in American natural history was always very great, and his descriptions of New World forms seem to have been drawn up with especial care. Garden, Colden, Bartram, Mitchell, Clayton, and Ellis were all, as we have seen, active in supplying him with materials, and his pupils, Kalm, Alstroem, Loeffling, Kuhn, and Rolander (who collected for many years in Surinam) sent him many notes and specimens.

The progress of systematic zoology in the interval between Ray and Linnæus may perhaps best be illustrated by some brief statistical references. The former, in 1690, made an estimate of the number of animals and plants known at that time.

The number of beasts, including serpents, he placed at 150, adding that according to his belief not many that are of any considerable bigness in the known regions of the world have escaped the cognizance of the curious.

Linnæus in his twelfth edition (1766) described 210 species of beasts or mammals, and 124 of reptiles, so called. Of the mammals known to Linnæus, 78, or more than one-third, were American, and 88 of the reptiles were attributed to this country.

"The number of birds," said Ray, "may be near 500." Linnæus catalogued 790, of which about one-third were American.

Although at this time the Middle and Southern States were the most active in the prosecution of scientific researches, there were in New England at least two diligent students of nature. Paul Dudley, F. R. S. [b. 1675], chief justice of the colony of Massachusetts, was the author of several papers in the Philosophical Transactions. Among these were A Description of the Moose Deer in America,¹ An Account of a Method lately found out in New England for Discovering where the Bees Hive in the Woods,² An Account of the Rattlesnake,³ and An Essay upon the Natural History of Whales, with a particular Account of the Ambergris found in the Spermaceti Whale,⁴ which is often quoted.

Others were An account of the Poyson Wood Tree in New England,⁵ and Observations on some Plants in New England, with remarkable Instances of the Nature and Power of Vegetation.⁶ He also appears to have sent to Collinson a treatise upon the evergreens of New England.⁷

The Rev. Jared Eliot [b. 1685, d. 1763], minister at Killingworth, in Connecticut, and one of the earliest graduates of Yale College, described by his contemporaries as "the first physician of his day," and as "the first botanist in New England," appears to have been a correspondent of Franklin and a scientific agriculturist.

¹ Philosophical Transactions, XXXI, 1721, pp. 165-168.

² Idem., XXXI, 1721, pp. 148-150.

³ Idem., XXXII, 1723, pp. 292-295.

⁴ Idem., XXXIII, 1725, pp. 256-269.

⁵ Idem., XXI, 1721, pp. 145, 146.

⁶ Idem., XXXIII, 1724, pp. 194-200.

⁷ See Tuckerman in *Archæologia Americana*, IV, pp. 125, 126.

In 1781 appeared Jefferson's Notes on Virginia. This was the first comprehensive treatise upon the topography, natural history, and natural resources of one of the United States, and was the precursor of the great library of scientific reports which have since been issued by the State and Federal Governments.

The book, although hastily prepared to meet a special need, and not put forth as a formal essay upon a scientific topic, was, if measured by its influence, the most important scientific work as yet published in America. The personal history and the public career of Thomas Jefferson are so familiar to all that it would be an idle task to repeat them here. Had he not been a master in statecraft he would have been a master of science. It is probable that no two men have done so much for science in America as Jefferson and Agassiz—not so much by their direct contributions to knowledge as by the immense weight which they gave to scientific interests by their advocacy.

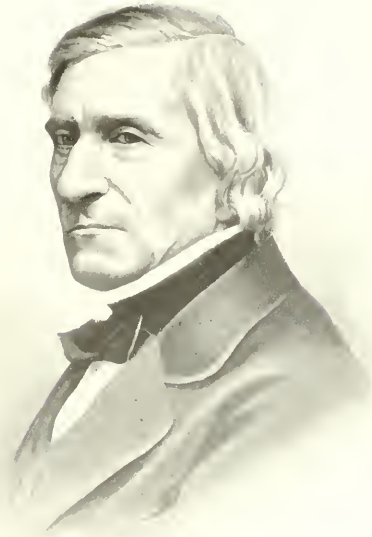
Many pages of Jefferson's Notes on Virginia are devoted to the discussion of Buffon's statements: (1) That the animals common to both continents are smaller in the New World; (2) that those which are peculiar to the New are on a smaller scale; (3) that those which have been domesticated in both have degenerated in America, and (4) that, on the whole, America exhibits fewer species. He successfully overthrows the specious and superficial arguments of the eloquent French naturalist, who, it must be remembered, was at this time considered the highest authority living in such matters. Not content with this, when minister plenipotentiary to Europe a few years later he forced Buffon himself to admit his error.

The circumstance shall be related in the words of Daniel Webster, who was very fond of relating the anecdote:

It was a dispute in relation to the moose, and in one of the circles of the *beaux-esprits* in Paris, Mr. Jefferson contended for some characteristics in the formation of the animal, which Buffon stoutly denied. Whereupon Mr. Jefferson wrote from Paris to General John Sullivan, then residing in Durham, New Hampshire, to procure and send him the whole frame of a moose. The General was no little astonished at a request he deemed so extraordinary, but, well acquainted with Mr. Jefferson, he knew he must have sufficient reason for it, so he made a hunting party of his neighbors and took the field. They captured a moose of unusual proportions, stripped it to the bone, and sent the skeleton to Mr. Jefferson at a cost of £50. On its arrival Mr. Jefferson invited Buffon and some other savants to a supper at his house and exhibited his dear-bought specimen. Buffon immediately acknowledged his error. "I should have consulted you, Monsieur," he said, "before publishing my book on Natural History, and then I should have been sure of my facts."

In still another matter in which he was at variance with Buffon he was manifestly in the right. In a letter to President Madison, of William and Mary College, he wrote:

Speaking one day with M. de Buffon on the present ardor of chemical inquiry, he affected to consider chemistry but as cookery and to place the toils of the laboratory



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on a footing with those of the kitchen. I think it, on the contrary, among the most useful of sciences and big with future discoveries for the utility and safety of the human race.

It was the scientific foresight of Jefferson, so manifest in such letters, which led him to advocate so vigorously the idea that science must be the corner stone of our Republic.

In 1789 he wrote from Paris to Doctor Willard, president of Harvard College:

To Doctor WILLARD:

What a field have we at our doors to signalize ourselves in. The botany of America is far from being exhausted, its mineralogy is untouched, and its natural history or zoology totally mistaken and misrepresented. . . . It is for such institutions as that over which you preside so worthily, sir, to do justice to our country, its productions, and its genius. It is the work to which the young men you are forming should lay their hands. We have spent the prime of our lives in procuring them the precious blessing of liberty. Let them spend theirs in showing that it is the great parent of science and of virtue, and that a nation will be great in both always in proportion as it is free.

THOMAS JEFFERSON.

To Jefferson's interest was due the organization of the first Government exploring expedition. As early as 1780 we find him anxious to promote an expedition to the upper portion of the Mississippi Valley, and offering to raise 1,000 guineas for the purpose from private sources, and while he was President he dispatched Lewis and Clarke upon their famous expedition into the Northwest—the precursor of all the similar enterprises carried on by the General Government, which have culminated in our magnificent Geological Survey.

Jefferson's personal influence in favor of science was of incalculable value. Transferred from the presidency of the principal American scientific society to the Presidency of the nation, he carried with him to the Executive Mansion the tastes and habits of a scientific investigator. Mr. Luther, in his recent essay upon Jefferson as a Naturalist,¹ has shown that during his residence in Paris he kept the four principal colleges—Harvard, Yale, William and Mary, and the College of Philadelphia—informed of all that happened in the scientific circles of Europe.

He wrote to one correspondent: "Nature intended me for the tranquil pursuits of science, by rendering them my supreme delight." To another he said: "Your first gives me information in the line of natural history, and the second promises political news. The first is my passion, the last my duty, and therefore both desirable."

When Jefferson went to Philadelphia to be inaugurated Vice-President he carried with him a collection of fossil bones which he had obtained in Greenbrier County, West Virginia, together with a paper, in which were formulated the results of his studies upon them. This was published in

¹ Magazine of American History, April, 1885, p. 379.

the Transactions of the American Philosophical Society, and the species is still known as *Megalonyx jeffersoni*.

"The spectacle," remarks Luther, "of an American statesman coming to take part as a central figure in the greatest political ceremony of our country and bringing with him an original contribution to the scientific knowledge of the world, is certainly one we shall not soon see repeated."¹

When Jefferson became President his scientific tastes were the subject of much ridicule as well as of bitter opposition among the people in whose eyes, even in that day, science was considered synonymous with atheism. William Cullen Bryant, then a lad of thirteen, wrote a satirical poem, *The Embargo*, since suppressed, in which the popular feeling seems to have been voiced:

Go, wretch, resign the presidential chair,
 Disclose thy secret measures, foul or fair.
 Go, search with curious eyes for horned frogs,
 'Mid the wild wastes of Louisianian bogs;
 Or, where the Ohio rolls his turbid stream,
 Dig for huge bones, thy glory and thy theme.

A prominent personage in the history of this period was Peter Kalm, a pupil of Linnæus and professor in the University of Aobo, who was sent to America by the Swedish Government, and traveled through Canada, New York, New Jersey, and Pennsylvania from 1748 to 1751. Although the ostensible object of his mission was to find a species of mulberry suitable for acclimatization in Sweden, with a view to the introduction of silk culture, it is very evident that he and his master were very willing to make of applied science a beast of burden, upon whose back they could heap up a heavy burden of investigations in pure science. Kalm's botanical collections were of great importance and are still preserved in the Linnæan Herbarium in London. His *Travels into North America* are full of interesting observations upon animals and men, as well as upon plants, and give us an insight into the life of the naturalists at that time resident in America. After his return to Sweden he published several papers relating to his discoveries in America.

Another traveler who deserves our attention, Johann David Schœpf [b. 1752, d. in Baireuth, 1800], the author of one of the earliest monographs of the Testudinata, was a surgeon of mercenary troops under the Marckgrave of Anspach, and was one of the hated Hessian auxiliaries during the Revolutionary war (1776-1783). While stationed at New York he wrote a paper upon the Fishes of New York, which was published in Berlin in 1787. This was the first special ichthyological paper ever written in America or concerning American species. Immediately after the treaty of peace in 1783, Schœpf made an extensive tour

¹ Magazine of American History, April, 1885, p. 386.

through the United States, proceeding from New York south to Florida and the Bahamas. He was accompanied in his more southern excursions by Professor Marter and Doctor Stupicz, who, with several assistants, had been sent to America from Vienna to make botanical explorations. Schœpf's *Nord Amerikanische Reisen* is full of interesting notes upon natural history, and describes nearly all the scientific men at that time resident in the United States. His *Materia Medica Americana*, published in 1787 at Erlangen, was a standard in its day.¹

One of the most prominent names in American natural history is that of John Reinhold Forster [b. 1729, d. 1798], who was a leader in zoological studies in England during the last century. He was a native of Germany, and at the time of his death professor of botany at Halle. He spent many years in England, and was the naturalist of Cooke's second voyage around the world (1772-1775). In 1771 he published in London, in an appendix to his translation of Kalm's *Travels*, *A Catalogue of the Animals of North America*, compiled from the writings of Linnæus, Pennant, Brisson, Edwards, and Catesby, and in the same year a similar nominal catalogue of the plants of North America. His account of the birds sent from Hudson Bay, published in 1772, was a valuable contribution to American ornithology, "notable," says Coues, "as the first formal treatise exclusively devoted to a collection of North American birds sent abroad." Fifty-eight species were described, among which were several new to science. Other papers of equal value were published upon the quadrupeds and fishes of the same region. Forster was one of the earliest students of the geographical distribution of animals, and his *Enchiridion of Natural History* was in its day a standard. His son, John George Forster, who was his companion in the voyage of circumnavigation, owes his fame to his literary rather than to his scientific labors. He published a paper on the *Patella* or Limpet Fish found at Bermuda.²

The annals of Russian explorations upon the west coast of North America have been so exhaustively recorded by Dall in his *Alaska and its Resources* that only passing mention need be made of the two German naturalists, Steller and Chamisso, whose names are identified with the natural history work of the Russian explorer.

Among the other naturalists whose names are associated with America during this period may be mentioned Sonnini de Maucour, an eminent French zoologist, who traveled in Surinam from 1771 to 1775 and made important contributions to its ornithology. Don Felix de Azara [b. 1746, d. after 1806], who carried on researches in Spanish America from 1781 to 1801; Don Antonio Parra, who published a useful treatise on the natural history of Cuba in Havana, in 1787; Don Joseph C. Mutis, a learned Spanish ecclesiastic and physician, professor of natural history in the

¹ Erlangen, 1788, 2 vols., octavo.

² *Philosophical Transactions*, L, Pt. 2, 1758, p. 859.

University of Santa Fe de Bogota, in Grenada, who carried on a voluminous correspondence with Linnæus and his son from 1763 to 1778,¹ and Joseph Jussieu, botanist to the King of France, who went to the west coast of South America in 1734 as a member of the commission sent by the Royal Academy of Sciences to make observations to determine more accurately the shape and magnitude of the earth. "His curiosity," says Flourens, "held him captive for many years in these regions, so rich and unexplored, where he often joined the labors of the engineer with those of the botanist. To him Europe owes several new plants, the heliotrope, the marvel of Peru, etc., with many curious and then unknown species." Here, also, should be mentioned the eminent French ornithologist, Francois Levaillant [b. 1753, d. 1824], who was a native of America, and the two Mexican naturalists, also native born, Jose A. Alzate [b. in Ozumba 1729, d. in Mexico February 2, 1790], a learned botanist, and Francisco Xavier Clavigero.

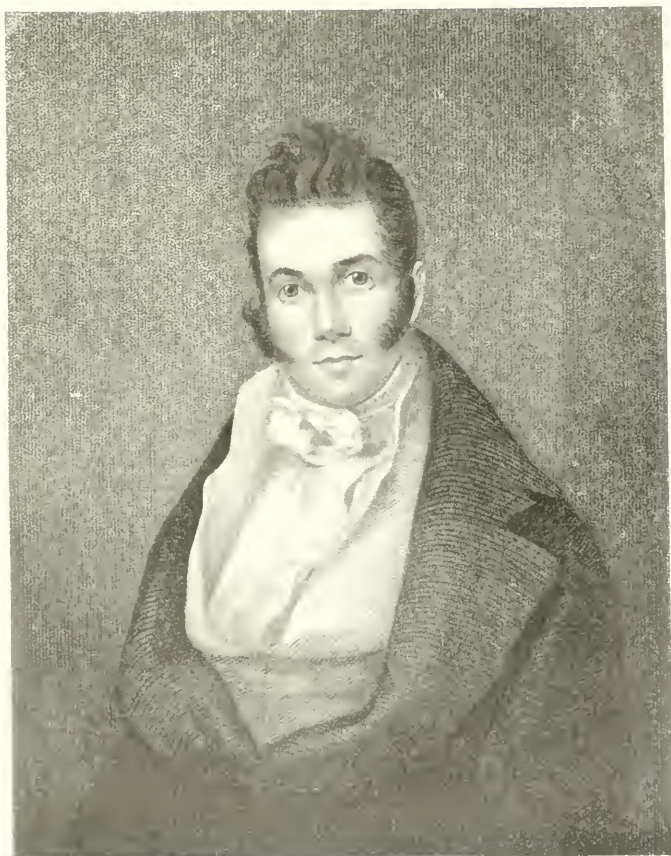
Francisco Xavier Clavigero, the historian of Mexico, was one of the earliest of American archæologists. Born in Vera Cruz September 9, 1731, the son of a Spanish scholar, he was educated at the college of Puebla, entered the Society of Jesus, and was sent out as a missionary among the Indians, with whom he spent thirty-six years. He learned their language, collected their traditions, and examined all their historical records and monuments for the purpose of correcting the misrepresentations of early Spanish writers. When the Society of Jesus was suppressed by Spain, in 1767, Clavigero went to Italy, where he wrote his *Storia Antica del Messico*, printed in 1780-81.

Clavigero was a man who, in his spirit, was fully abreast of the science of his day, but whose methods of thought and argument were already antiquated.

His monastic training led him to write from the standpoint of a commentator rather than that of an original observer, and his observations upon the animals and plants of Mexico were subordinated in a very unfortunate manner to those of his predecessor, Hernandez. In the *Dissertations*, which make up the fourth volume of his history, he throws aside, in the ardor of his dispute with Buffon and his followers, the trammels of tradition, and places upon record many facts concerning American natural history which had never before been referred to. He here presented a list of the quadrupeds of America, the first ever printed for the entire continent, including 143 species; not systematically arranged, it is true, but perhaps as scientific in its construction as was possible at that time, even had its author been trained in the school of Linnæus.

Clavigero's dissertations are well worthy of the attention of naturalists even of the present day. His essay upon the manner in which the conti-

¹ Smith, *Correspondence of Linnæus*, II, pp. 507-550.



Thomas Say

ment of America was peopled with living forms, shows a remarkable appreciation of the difficulties in the way of the solution of this still unsolved problem. The position taken by its author is not unlike that held by zoogeographers of to-day, in considering it necessary to bridge with land the waters between Asia and Northwestern America, and Africa and South America.¹ In his first Dissertation of the Animals of Mexico he combats the prevailing European views as to the inferiority of the soil and climate of the New World and the degeneracy of its inhabitants, engaging in the same battle in which fought also Harriot, Acosta, and Jefferson.

Clavigero's contributions to archæology and ethnology are extensive and valuable, and we can but admit that at the time of the issue of his *Storia Antica* no work concerning America had been printed in English which was equally valuable.

Although in his formal discussion of the natural history of Mexico he follows closely the nomenclature and arrangement of Hernandez, there are many important original observations inserted. I will instance only the notes on the mechanism of the poison gland and fang of the rattlesnake, the biographies of the possum, the coyote and the tapir, and the Tuza or pouched rat, the mocking bird, the chegoe, and the cochineal insect. Clavigero states that Father Inamma, a Jesuit missionary of California, has made many experiments upon snakes which serve to confirm those made by Mead upon vipers.

To the post-Revolutionary period belongs Doctor Manasseh Cutler, for fifty-one years minister of Ipswich Hamlet, Massachusetts [b. 1743, d. 1823], who in 1785 published *An Account of some of the vegetable Productions, naturally growing in this Part of America*, botanically arranged,² in which he described about 370 species. Cutler was a correspondent of Muhlenberg in Pennsylvania, Swartz and Payshull in Sweden, and Withering and Stokes in England. He left unpublished manuscripts of great value. He was one of the founders of the settlement in Ohio, and at one time a member of Congress. After Cutler, says Tuckerman, there appeared in the Northeastern States nothing of importance until the new school of New England botanists, a school characterized by the names of an Oakes, a Boott, and an Emerson, was founded in 1814, by the publication of Bigelow's *Florula Bostoniensis*.

Thomas Walter [b. in Hampshire, 1740] published in London, in 1787, his *Flora Caroliniana*, a scholarly work describing the plants of a region situate upon the Santee River.³

Doctor Hugh Williamson, of North Carolina [b. 1735, d. 1819], was a prominent member of the American Philosophical Society. He was con-

¹ See similar speculation in George Scot's *Model of the Government of the Province of East New Jersey in America*. Edinburgh, 1685.

² *Memoirs of the American Academy of Sciences*, 1785.

³ Brendel, *American Naturalist*, December, 1879, p. 758.

cerned in some of the earliest astronomical and mathematical work in America; published papers upon comets and climatology, which were favorably received, and secured his election to many foreign societies, and in 1775 printed in the *Philosophical Transactions* his *Experiments and Observations on the Gymnotus Electricus, or Electrical Eel*.

Doctor Caspar Wistar [b. 1761, d. 1818] was one of the early professors of chemistry [1789] and anatomy [1793] in the College of Philadelphia. He was the discoverer of some important points in the structure of the ethmoid bone, a man of eminence as a teacher, and versed in all the sciences of his day.

Doctor James Woodhouse, of Philadelphia [b. 1770, d. 1809], made investigations in chemistry, mineralogy, and vegetable physiology which were considered of importance.

The story of the origin of American scientific societies has been so often told that it need not be repeated here. The only institutions of the kind which were in existence at the end of the period under consideration were the American Philosophical Society, an outgrowth primarily of the American Society for the Advancement of Natural Knowledge, founded in Philadelphia in 1743, and secondarily of Franklin's famous Junto, whose origin dates back to 1727, and the American Academy of Arts and Sciences, founded in 1780.

The relations of the colonial naturalists to the scientific societies of England have not so often been referred to, and it does not seem to be generally known that the early history of the Royal Society of London was intimately connected with the foundation of New England, and that the first proposition for the establishment of a scientific society in America was under consideration early in the seventeenth century. "The great Mr. Boyle," writes Eliot, "Bishop Wilkins, and several other learned men, had proposed to leave England and establish a society for promoting natural knowledge in the new colony, of which Mr. Winthrop, their intimate friend and associate, was appointed governor. Such men were too valuable to lose from Great Britain; and Charles II having taken them under his protection, the society was there established, and obtained the title of the Royal Society of London."¹

For more than a hundred years the Royal Society was the chief resource of naturalists in North America. The three Winthrops, Mitchell, Clayton, Garden, Franklin, Byrd, Rittenhouse, and others were among its fellows, and the *Philosophical Transactions* contained many American papers.

As at an early date the Society of Arts in London began to offer prizes for various industrial successes in the colonies, for instance, for the production of potash and pearlsh, for the culture of silk, and for the culture of hemp, the vine, safflower, olives, logwood, opium, scammony, burilla,

¹John Eliot, *Biographical Dictionary of Eminent Characters in New England*. Boston, 1809.

aloes, sarsaparilla, cinnamon, myrtle wax, the production of saltpeter, cobalt, cochineal, the manufacture of wine, raisins, and olive oil, the collection of gum from the persimmon tree, and the acclimation of silk grass. A medal was given in 1861 to Doctor Jared Eliot, of Connecticut, for the extraction of iron from "black sand."¹ In 1757 we find their secretary endeavoring to establish branch societies in the colonial cities, especially in Charleston, Philadelphia, and New York, and Garden seems to have tried to carry out the enterprise in Charleston. After two years he wrote that the society organized had become "a mere society of drawing, painting, and sculpture."

In a subsequent letter he utters a pitiful plaint. He has often wondered, he says, "that there should be a country abounding with almost every sort of plant, and almost every species of the animal kind, and yet that it should not have pleased God to raise up one botanist."²

The American Academy of Arts and Sciences was founded by the legislature of Massachusetts in 1780, and its first volume of memoirs appeared in 1785.

In 1788 an effort was made by the Chevalier Quesnay de Beaurepaire to found in Richmond, Virginia, the Academy of Arts and Sciences of the United States of America, upon the model of the French Academy. The plan was submitted to the Royal Academy of Sciences in Paris, and received its unqualified indorsement, signed, among others, by Lavoisier. A large subscription was made by the Virginians and a large building erected, but an academy of sciences needs members as well as a president, and the enterprise was soon abandoned.³

In 1799 was organized the Connecticut Academy of Arts and Sciences, which, after publishing one volume of Transactions, went into a state of inactivity from which it did not arouse itself until 1866.

This sketch would not be complete without some reference also to the history of scientific instruction in America during the last century.

The first regular lectures upon a special natural history topic appear to have been upon comparative anatomy. A course upon this topic was delivered at Newport, Rhode Island, in 1754, by Doctor William Hunter, a native of Scotland [b. about 1729], a kinsman of the famous English anatomists, William and John Hunter, and a pupil of Muuro. His course upon comparative anatomy was given in connection with others upon human anatomy and the history of anatomy, the first medical lectures in America.⁴

¹See Dossie, *Memoirs of Agriculture*. London, 1, 1768, pp. 24-26; also Brock in *Richmond Standard*, April 26, 1879, p. 4.

²Smith, *Correspondence of Linnæus*, I, p. 477.

³Samuel Mordecai, *Richmond in By-gone Days*. Richmond, 1856. A copy of the original pamphlet of proposals is still preserved in the Virginia State Library.

⁴One of the original tickets to these courses is in the Library of the Surgeon-General's Office in Washington.

The first instruction in botany was given in Philadelphia in 1768 by Kuhn, who began in May of that year a course of lectures upon that subject in connection with his professorship of *materia medica* and botany in the College of Philadelphia. Adam Kuhn [b. in Germantown, Pennsylvania, 1741, d. 1817] was educated in Europe, and had been a favorite pupil of Linnæus. He did not, however, continue his devotion to natural history, though he became an eminent physician. William Bartram, son of John Bartram, was elected to the same professorship in 1782. In 1788 Professor Waterhouse, of Harvard College, read lectures upon natural history to his medical classes, and is said to have subsequently claimed that these were the first public lectures upon natural history given in the United States. This was doubtless an error, for we find that in 1785 a course upon the philosophy of chemistry and natural history was delivered in Philadelphia. "People of every description, men and women, flock to these lectures," writes a contemporary. "They are held at the university three evenings in a week."¹

The first professor of chemistry was Doctor Benjamin Rush, who lectured in the Philadelphia Medical School as early as 1769. Bishop Madison was professor of chemistry and natural philosophy at William and Mary College from 1774 to 1777; Aaron Dexter, of chemistry and *materia medica* at Harvard, 1783 to 1816; John Maclean, at Princeton, 1795-1812, being the first to occupy a separate chair of chemistry. Before the days of chemical professorships, the professor of mathematics seems to have been the chief exponent of science in our institutions of learning.

John Winthrop [b. 1714, d. 1779], for instance, who was Hollis professor of mathematics and natural philosophy at Harvard from 1738 to 1779, was a prominent Fellow of the Royal Society, to whose Transactions he communicated many important papers, chiefly astronomical. We read, however, that Count Rumford imbibed from his lectures his love for physical and chemical research, and from this it may be inferred that he taught as much of chemistry as was known in his day. William Small, professor of mathematics in William and Mary from 1758 to 1762, was a man of similar tastes, though less eminent. He was the intimate friend of Erasmus Darwin. President Jefferson was his pupil, attended his lectures on natural philosophy, and got from time to time his "first views of the expansion of science and of the system of things in which we are placed."

Doctor Samuel Latham Mitchill [b. 1764, d. 1831] was the first man to hold a professorship of natural history, lecturing upon that subject, together with chemistry, in Columbia College in 1792. Doctor Mitchill was eminent as a zoologist, mineralogist, and chemist, and not only published many valuable papers, but in 1798 established the first American scientific journal.

¹ Darlington, Memorials of John Bartram and Humphrey Marshall, p. 535.



Henry R. Schoolcraft

Harvard appears to have had the first separate professorship of natural history, which was filled by William Dandridge Peck, a zoologist and botanist of prominence in his day.

A professorship of botany was established in Columbia College, New York, as early as 1795, at which time Doctor David Hosack [b. in New York, 1769, d. 1835] was the incumbent. Doctor Hosack brought with him from Europe, in 1790, the first cabinet of minerals ever seen in the United States. In its arrangement he was assisted by one of his pupils, Archibald Bruce, who became, in 1806, professor of mineralogy, and who, soon after, in 1810, established the American Journal of Mineralogy.

Doctor Hosack was the founder of the first public botanic garden—this was in New York in 1801; another was founded in Charleston in 1804. These had disappeared forty years ago, and the one at Cambridge, established in 1808, is the only one now in existence.

The first public museum was that founded in Philadelphia, in 1785, by Charles Willson Peale, the bones of a mammoth and a stuffed paddlefish forming its nucleus. This establishment had a useful career of nearly fifty years.

VII.

We have now rehearsed the story of the earliest investigators of American natural history, including two centuries of English endeavor, and nearly three if we take into consideration the earlier explorations of the naturalists of continental Europe. We have seen how, in the course of many generations, the intellectual supremacy of the Western Continent went from the Spaniards and the French and the Dutch to the new people who were to be called Americans, and we have become acquainted with the men who were most thoroughly identified with the scientific endeavors of each successive period of activity.

The achievements of American science during the century which has elapsed since the time when Franklin, Jefferson, Rittenhouse, and Rumford were its chief exponents have been often the subject of presidential addresses like this, and the record is a proud one. During the last fifty years in England, and the last forty in America, discovery has followed discovery with such rapid succession that it is somewhat hard to realize that American science in the colonial period, or even that of Europe at the same time, had any features which are worthy of consideration.

The naturalists whose names I have mentioned were the intellectual ancestors of the naturalists of to-day. Upon the foundations which they laid the superstructure of modern natural history is supported. Without the encyclopedists and explorers there could have been no Ray, no Klein, no Linnæus. Without the systematists of the latter part of the eighteenth century the school of comparative anatomists would never have arisen. Had Cuvier and his disciples never lived there would have been no place for the philosophic biologists of to-day.

The spirit of the early naturalists may be tested by passages in their writings which show how well aware they were of the imperfections of their work. Listen to what John Lawson, the Carolina naturalist, wrote in the year 1700:

The reptiles or smaller insects are too numerous to relate here, this country affording innumerable quantities thereof; as the flying stags with horns, beetles, butterflies, grasshoppers, locusts, and several hundreds of uncouth shapes, which in the summer season are discovered here in Carolina, the description of which requires a large volume, which is not my intent at present; besides, what the mountainous part of this land may hereafter open to our view, time and industry will discover, for we that have settled but a small share of this large province can not imagine, but there will be a great number of discoveries made by those that shall come hereafter into the back part of this land, and make inquiries therein, when, at least, we consider that the westward of Carolina is quite different in soil, air, weather, growth of vegetables, and several animals, too, which we at present are wholly strangers to, and seek for. As to a right knowledge thereof, I say, when another age is come, the ingenious then in being may stand upon the shoulders of those that went before them, adding their own experiments to what was delivered down to them by their predecessors, and then there will be something toward a complete natural history, which, in these days, would be no easy undertaking to any author that writes truly and compendiously as he ought to do.

Herbert Spencer, in his essay on *The Genesis of Science*, lays stress upon the fact that the most advanced sciences have attained to their present power by a slow process of improvement, extending through thousands of years, that science and the positive knowledge of the uncultured can not be separated in nature, and that the one is but a perfected and extended form of the other. "Is not science a growth?" says he. "Has not science its embryology? And must not the neglect of its embryology lead to a misunderstanding of the principles of its evolution and its existing organization?"

It seems to me unfortunate, therefore, that we should allow the value of the labors of our predecessors to be depreciated, or to refer to the naturalists of the last century as belonging to the unscientific or to the archaic period. It has been frequently said by naturalists that there was no science in America until after the beginning of the present century. This is, in one sense, true; in another very false. There were then, it is certain, many men equal in capacity, in culture, in enthusiasm, to the naturalists of to-day, who were giving careful attention to the study of precisely the same phenomena of nature. The misfortune of men of science in the year of 1785 was that they had three generations fewer of scientific predecessors than have we. Can it be doubted that the scientists of some period long distant will look back upon the work of our own time as archaic and crude, and catalogue our books among the "curiosities of scientific literature?"

Is it not incumbent upon workers in science to keep green the memory of those whose traditions they have inherited? That it is, I do most steadfastly believe, and with this purpose I have taken advantage of the

tercentenary of American biology to read this review of the work of the men of old.

Monuments are not often erected to men of science. More enduring, however, than monuments are those living and self-perpetuating memorials, the plants and animals which bear the names of the masters who knew them and loved them. Well have the Agassizs remarked that "there is a world of meaning hidden under our zoological and botanical nomenclature, known only to those who are intimately acquainted with the annals of scientific life in its social as well as its professional aspect."¹

I hope I am not at this day entirely alone in my appreciation of the extreme appropriateness of this time-honored custom, although I know that many of our too matter-of-fact naturalists are disposed to abandon it, and that it is losing much of its former significance. In fact, in these days of unstable nomenclature, such tributes are often very evanescent. It seems fortunate that the names of some of the most honored of the early naturalists are perpetuated in well-established generic and specific combinations.²

When I see the *Linnaea borealis*, I am always reminded of the sage of Upsala, as he is represented in the famous Amsterdam painting, clad in Lapland fur, and holding a spray of that graceful arctic plant. *Magnolia* and *Wistaria* call up the venerable professors of botany at Montpellier and Philadelphia. *Tradescantia virginica* reminds me of John Tradescant and the Ashmolean Museum, whose beginnings were gathered by him in Virginia. The cape jessamine (*Gardenia*), the spring beauty (*Claytonia*), the partridge berry (*Mitchella*), the iron weed (*Vernonia*), the *Quercus bartramii* (= *Q. heterophylla*), the *Scarus catesbyi*, *Thalictrum* and *Asclepias cornuti*, *Macrurus fabricii*, *Didelphys* and *Canis azarae*, *Chauliodus sloanei*, *Alutera schaffii*, *Stema forsteri*, *Stolephorus mitchilli*, *Malacanthus plumieri*, *Salix cutleri*, and *Pinus banksiana*, the *Kalmia*, the *Jeffersonia*, the *Hernandia*, the *Comptonia*, the *Sarracenia*, the *Gaultheria*, the *Kuhnia*, the *Ellisia*, the *Coldenia*, the *Robinia*, the *Banisteria*, the *Plumieria*, the *Collinsonia*, the *Bartramia*, all bear the names of men associated with the beginnings of natural history in America.

Yet, pleasant as it is to recall in such manner the achievements of the

¹ Seaside Studies in Natural History, p. 25.

² The genus *Harriotta* has been dedicated by Goode and Bean to the memory of Thomas Harriot. It is intended to embrace a long-rostrated eliomaroid fish from deep water off the Atlantic coast of North America. The description is not yet published. Harriot's Isle, named for Harriot by the early explorers, and shown upon Vaughan's map, in Smith's General History of Virginia, has entirely disappeared. It was situate on the north side of Albemarle Sound, about midway between Roanoke Island and the mouth of Chowan River. Whether it has been swept away by the tides, or has become a part of the mainland, it is difficult to say. The latter supposition seems the most probable, and since it is in all likelihood Reeds Point which now occupies its former location, the propriety is suggested of calling this little cape Harriots Point, in memory of the explorer.

fathers of natural history, let us not do them the injustice to suppose that posthumous fame was the object for which they worked. Like Sir Thomas Browne, they believed that "the world was made to be inhabited by beasts, but to be studied by man." Let us emulate their works and let us share with them the admonitions of the *Religio Medici*.

"The wisdom of God," says Browne, "receives small honor from those vulgar heads that rudely stray about, and with a gross rusticity admire His works; those highly magnify Him whose judicious inquiry into His acts, and deliberate research into His creatures, return the duty of a devout and learned admiration. Therefore," he continues—

Search while thou wilt and let thy reason go
To ransom truth, even to the abyse below,
Rally the scattered causes, and that line
Which nature twists be able to untwine.
It is thy Maker's will, for unto none
But unto reason can He e'er be known.



PIETRO ANGELO SECCHI.