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ESSENTIAL NATURE: BARTRAM'S GARDEN AND NATURAL HISTORY IN PHILADELPHIA, 1790-1825

By

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ABSTRACT

ESSENTIAL NATURE: BARTRAM'S GARDEN AND NATURAL HISTORY IN PHILADELPHIA, 1790-1825

By

Elizabeth S. C. Fairhead

This study tells the story of Bartram's garden in Philadelphia as the gathering place of a community with William Bartram at the center and including Benjamin Smith Barton, Alexander Wilson, James Mease, and Thomas Nuttall. The body of works that make up the heart of the analysis are their publications on the physical sciences and medicine—either books or journal articles published in Philadelphia between 1790 and 1823. By examining these documents and placing them in the context of the lives of the authors and the intellectual environment, this dissertation argues that the projects of the garden were characterized by the search for the essential: the essential characteristics of each individual species, the essential relationships between species, and the essential qualities of life. These explorations, though scientific in content were fundamentally "theological in nature." This study examines the late eighteenth century until the mid-1820s and the intellectual, institutional, and cultural developments in American science that the community at the garden participated in. The garden and its ultimate demise represent the transition from eighteenth century to nineteenth century science and how "naturalists" developed into "scientists" in America.

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Introduction: A Garden of Ideas

On May 18, 1792, at a meeting of the American Philosophical Society in Philadelphia, Benjamin Smith Barton described a plant that he hoped to establish as a unique, unidentified species and therefore be given the privilege of naming. He had studied "a fine specimen" of the plant at Bartram's garden, "which flowered in the beginning of the spring of the year 1791, in the neighbourhood (sic) of Philadelphia. Mr. Bartram and myself carefully examined the plant, in the various stages of its growth, and, together, made the drawings which accompany this letter."[1] This plant, Barton argues, is a species distinct from two similar and previously identified ones. If the scientific community accepts Barton's argument, he proposes to name the plant after Thomas Jefferson, *Jeffersonia Binata*. This letter and its accompanying drawing illustrate the collaborative effort of many naturalists' hands over many years. Collaborations like this were not unusual and this dissertation will explore the scientific efforts and the fruits of those labors: the dissertations, accounts, descriptions and texts produced to document those efforts. The scene set by this account—of a garden filled with exotic and rare plants, of two men working together to make observations of natural specimens and to create a document to share their results and conclusions with the scientific community—will provide the background for this study. The garden where Barton and Bartram worked was owned and cultivated by the Bartram family.

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1. Benjamin Smith Barton, "A Botanical description of the Podophyllum Diphyllum of Linnaeus, in a Letter to Charles Peter Thunberg, M.D. Kinght of the order of Wasa, Professor of Medicine and botany in the University of Upsal, etc.," *Transactions of the American Philosophical Society* 3 (1793): 338.

Bartram's garden and its city

The garden today is a historic landmark and every effort has been made by the museum staff to return the garden to the way it looked during its heyday. Years of neglect and misguided attempts at "improvement" have taken much effort to overcome. Sitting on the Schuylkill River, the garden has three distinct areas. The lowest part of the garden, where the water meets the land gently in a swampy area, is a shady Bald Cypress grove. There the air is cool even on the hottest day and the light barely reaches the ground. The tall, dense Cypress block the sun and their peculiar one-foot tall, mushroom-like growths jutting out from the roots (these growths are called "knees") give this area a kind of fairy-tale feel. The Cypress send up these growths as an adaptation to living in swampy areas. Farther along down stream, the river is met by a rocky barrier. One of these flat rocks has a large, circular, approximately six feet in diameter trench carved into it: a cider press. The river sits below the press, keeping a respectful distance. The unity of nature—the natural stone—and technology—the man-made trench used for creating food stuffs—creates a sense of harmony between the human and non-human elements of the space.

Climbing up to the next level one enters the main part of the garden. With the river below and the house and upper-garden not visible, this part of the garden seems even more extensive than it really is. The land slopes upward away from the river. Well-established trees alternate with open areas of plant beds. Paths perpendicular and parallel to the river criss-cross the garden at right angles. They are paved now. The beds are not manicured, some planting areas are so inconspicuous that they appear almost by surprise. In the shaded areas, ferns and shade plants grow. Birds are everywhere. The trees and

shrubs are filled with song birds out of sight but within hearing, while ground dwellers are more obvious to the garden visitor looking down at the plants. In the center of the middle garden, a small, round pond has been recreated in the spot where a larger, artificial water garden once grew. The water seems "dirty" though this is a conscious effort to maintain the habitat for water plants, insects, and amphibians. Grasses and flowering water plants crowd the space; the pond is small and the plants compete for space near the edge.

A man-made stone wall separates the middle garden from the upper garden. A row of boxwoods, overgrown and ungainly, must have once been a decorative break between these two sections of the garden. Several stairs give the visitor access to the smallest and most densely planted part of the garden. The upper garden is divided into three sections of raised beds: the kitchen garden, the common flower garden, and the new flower garden. The two flower gardens are in bloom nearly all year, a splash of color amidst all the green. The upper garden is adjacent to the stone house that John Bartram originally built and his children and grandchildren made additions to.[2] Near the house is one of several Franklinia trees—the beautiful flowering shrub discovered by the Bartrams and named for Benjamin Franklin. The plant has not been seen in an uncultivated area for two hundred years, but lives on in the garden that the Bartrams and their descendents have maintained. Another namesake plant living close to the house is the Bartram Oak. These named plants give the visitor insight into the projects of the garden and its history.

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2. For a close "reading" of the house see Thomas Slaughter, *The Natures of John and William Bartram*. (New York: Alfred A. Knopf, 1996).

Figure 1. The Garden today: the paths of the garden lead up to the house, built by John Bartram. (photo by author)

In 1807, William Bartram said about the gardens that belonged to his family, "they may with propriety and truth be called the Botanical Academy of Pennsylvania."[3] It had been established fifty years earlier when John Bartram (1699-1777), William's father, had purchased 102 acres of land in 1728. Of this he dedicated approximately twelve to the botanical garden. Because the coastal plain and the piedmont regions literally come together within the space of the garden—a rocky ridge through the garden demarks the transition from one region to the other—a great diversity of plants thrived in a relatively small space in Kingsessing. At its peak, it is estimated that 1400 species were growing in the garden representing various climates and regions. Including common as well as rare and exotic plants, the garden was known throughout the scientific community

3. William Bartram, "Preface to a Catalogue of Trees, Shrubs, and Herbaceous Plants, Indigenous to the United States of America, Cultivated and Disposed of by John Bartram and Son, at their Botanical Garden, Kingsess, near Philadelphia," in *William Bartram: Travels and Other Writings*, ed. Thomas P. Slaughter, 585-587 (New York: Library of America, 1996).

during much of the eighteenth and early nineteenth centuries to be one of the most important botanical collections in the Americas.

It was not a garden designed as a status symbol of its owner, but a working business started as a labor of love of its creator. In his 1787 journal, Manasseh Cutler, the author of the 1725 publication, *An Account of Some of the Vegetable Productions Naturally Growing in this part of America, Botanically Arranged,* makes note of a visit to Bartram's garden; "This is a very ancient garden, and the collection is large indeed, but is made principally from the Middle and Southern States. It is finely situated, as it partakes of every kind of soil, has a fine stream of water, and an artificial pond, where he has a good collection of aquatic plants. There is no situation in which plants or trees are found but that they may be propagated here in one that is similar."[4] Cutler appreciated the combination of good fortune and hard work that was necessary to build a collection like that of the Bartrams.

With no formal education, but self-taught in Latin, John Bartram was knowledgeable in the Linnaean classification system and built the collection mostly with his own efforts. For example, during the period of 1753-55 he made several trips to Catskill Mountains collecting. His knowledge and successes brought him recognition and in 1765 he was named Botanist to the King and received a commission to travel and collect. Through his long-time correspondent, Peter Collinson, British merchant and gardener, Bartram established connections to the British gardening community. The established trade infrastructure in Philadelphia, and those connections to the plant collectors in Britain and Europe allowed John to develop an established collection and

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4. Manasseh Cutler. *Life, Journals, and Correspondence of Rev. Manasseh Cutler.* (Athens, Ohio: Ohio University Press, 1987), 272-274.

business of plants. John Bartram had established the garden as a home and as a business but it became a meeting point during his life-time. He was the center of his own circle of scientists including Benjamin Franklin and David Rittenhouse; he was an original member of the American Philosophical Society.

John's land holdings not dedicated to the botanical garden were working farms and provided income for the Bartram family and their tenants. John had eleven children (two sons by first marriage, nine children by second wife) not all of whom survived infancy. A number of his children went on to establish themselves in business associated with botany and medicine—his sons, Isaac and Moses, were apothecaries in Philadelphia proper. John, Jr. and William followed most closely in their father's footsteps maintaining the family garden and business. The dual purpose of the garden, both as a passion and as a business, worked to increase the reputation of the Bartram family as well as provide income to the family. During the period of this study, the 1790s through 1820s, that income went to support John Bartram Jr. and his family. John Jr. had inherited the garden, house, and family business upon John's death in 1777.

The garden, during this time, was of use not only to gardeners, flower traders, hobbyists but also to scientists. The hobbyists and the scientists sustained the garden as a viable business by working in conjunction, not in conflict. The namers of plants and those who profited from their production and sale had been working together for most of the eighteenth century in England.[5] The Bartrams discovered, collected, raised and made available to the public plants that were unknown to plant enthusiasts in Europe, the

5. Mary Fissell and Roger Cooter, "Exploring Natural Knowledge: Science and the Popular," in ed. Roy Porter, *The Cambridge History of Science, Volume 4: Eighteenth Century Science* (New York: Cambridge University Press, 2003), 154.

colonies and then the new nation. The people who gardened for show provided an outlet to which new discoveries could be marketed.

Figure 2. The rocky ridge that demarcates two regions. (photo by author)

It was in the tradition of the physic garden or the botanic garden. Cutler observed, "every thing is very badly arranged, for they are neither placed ornamentally nor botanically, but seem to be jumbled together in heaps."[6] Plants were arranged in areas defined by "natural growing conditions" rather than any formal classification system.[7] There were no statues or fountains, no long grand staircases. It was, which was not then as obvious as it would seem today, a collection of plants. The expectations for a garden were not exclusively related to plants. Based on contemporary descriptions of the garden, like Cutler's, geometry was not the guiding principle of design. Historically,

6. Manasseh Cutler. *Life, Journals, and Correspondence of Rev. Manasseh Cutler*. (Athens, Ohio: Ohio University Press, 1987), 273.
7. Joel T. Fry, "An international catalogue of North American trees and shrubs: the Bartram broadside, 1783" *Journal of Garden History* 16, no. 1 (January-March 1996): 14.

botanical gardens were level spaces with geometrically delineated spaces for the plants. Though there was a straight line of boxwoods that acted as a break between a majority of the garden space and the upper-garden and house, the overall impression of the space was not one of right angles and level ground. For 200 years gardens all over Europe had been designed with geometric precision. The early colonial gardens in North America followed that pattern for the most part. Beds and paths were laid out at right angles in rows and columns. Gardens were not just for plants, but incorporated statues, terraces, water features (large and small) and small buildings.

Andrew Cunningham, in his essay, "the Culture of Gardens" explains that collections of plants, like the Bartrams', belonged to a different tradition than sculptured, ornamental gardens, "Medicine ('physic') was the occasion for the making of these gardens, but their flourishing stemmed from the fact that they came to be run by people passionate about plants: 'botanists' in the root meaning of the Greek term, plant enthusiasts."[8] Yet, the great botanical gardens of Europe had origins and mandates very different than Bartram's. Bartram's garden was privately owned and not associated with a university or organization like the gardens at Leiden in Holland and Kew in London. Although the garden was the only mid-Atlantic home to some plants, the garden was not a systematic project of empire like Kew and the Jardin des Plantes in Paris.

A botanical garden was more than just a collection of plants, it was a place of learning, a living encyclopedia of natural information. Without printed botanical references, botanical gardens allowed for the study of plants and nature more generally from many regions and multiple continents. Botanical gardens in Europe, including the

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8. Andrew Cunningham, "the culture of gardens" in *Cultures of Natural History,* ed. N. Jardine, F. A. Secord and E.C. Spary (New York: Cambridge University Press, 1996), 48.

one at Padua, attempted to incorporate animals, rocks and stones, as well as plants. This effort was an attempt to capture the whole "great chain of being" in a single space. Bartram's garden participated in the effort to document the great chain of being but was arranged and grown by practical gardeners.

There was a movement in the mid-eighteenth century, led by Lancelot "Capability" Brown, the English landscape designer, that rejected the artificial priorities of geometry and scale. Brown argued that an outdoor space should be designed in such a way that the landscape's inherent "capabilities" are highlighted. (The origin of the nick-name.) He rejected the terraces and geometric patterns for more open, more 'natural' designs. John Bartram had established the garden during the period when Brown was working in England and his garden lacked many of the traditional, "unnatural" elements.[9]

But there was also another important influence on the shape and feel of the space. The Bartrams were Quakers. Although John was disowned by his meeting, he continued to incorporate many Quaker ideals into his life and life-style. (When it came time to educate his son William, he expressed a concern that William's education be practical and not too much of a 'gentleman.') The Bartram estate remained unnamed. The "plain style," so important to the Quakers is evident in the garden that John Bartram established.

Bartram's garden outside Philadelphia attracted many visitors, like Cutler during the eighteenth and nineteenth centuries, including presidents and leading scientists. The garden was a family business, but it was also a resource to the community. The plants were the primary attraction, but they do not explain the whole reason for the visits.

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9. For general garden history see: James and Louise Bush-Brown, *America's Garden Book (*New York: Charles Scribner's Sons, 1979); John Prest, *The Garden of Eden: The Botanic Garden and the Re-Creation of Paradise (*New Haven: Yale University Press, 1981); Christopher Thacker, *The History of Gardens* (Berkeley: University of California Press, 1979).

Other botanical resources in the area were known as either nurseries for the sale of plants or the living trophies of individual collectors. David Landreth established a seed business for vegetables and flowers in 1784. Selling mostly to the Philadelphia area at first, Landreth's business expanded to include customers in many states. From their urban warehouse, the Landreths sold seeds for and introduced new flowers, greenhouse plants, and vegetables to the American market. William Hamilton's estate and gardens, the Woodlands, neighbored the Bartrams. A description of the garden published in 1809 said that "[t]he grounds, which occupy an extent of nearly ten acres, are laid out with uncommon taste; and in the construction of the edifice solidity and elegance are combined." The gardens contained "[f]oreign trees from China, Italy, and Turkey, chosen for their rich foliage, or balmy odours, are diffusely scattered, or mingled with sweet shrubs and plants, bordering the walk and...fragrant path winds round, openings, judiciously exposed, such as the situation of the lands and rivers best admits, diversify the scene."[10] During this time, Hamilton's collection included many "exotics" with a hot house containing 10,000 plants, including bread-fruit tree, coffee from Bengal, Arabia, and the West-Indies, tea, cherimolia from Mexico, Indian god tree, iron tree of China.[11] It was only the Bartrams' collection that included all of the resources that attracted the visitors: the collection of plants, the availability for sale of those plants, and the horticultural and botanical knowledge that allowed for learning not only about how to grow the plants, but also how they lived.

Set in a commercial and intellectual crossroads, the garden owes some of its success to its location: Philadelphia. One of the largest cities in the British Empire before

10. Anonymous, "The Woodlands" *The Port-Folio* 2, no. 6 (Dec 1809): 505 APS Online.
11. Anonymous "The Woodlands" *The Port-Folio* 2, no. 6 (Dec 1809): 507 APS Online.

independence and, at the beginning of this period, the largest city in the new nation, Philadelphia provided fertile ground for the growth of a garden like Bartram's and the community who gathered there. A successful trading center and the seat of the new federal government until 1800, the port combined with profitable mid-Atlantic agriculture meant that Philadelphia was a flourishing urban center. A trade economy meant that exchange, travel, and diversity in all their forms characterized life in the city and its environs. For Philadelphia, the "sea-born commerce played as vital a cultural as an economic role; it enriched not only the pockets but the minds of its citizens."[12] The lively cultural environment manifested in many forms—for example, in 1791, a new 1800 person theater was being built on Chestnut Street. It was the sciences that benefited as much as any other cultural area, though.

Science had been going on in the city for years. Obviously, Benjamin Franklin had been experimenting with electricity. Additionally, James Logan, in the 1730s, had conducted experiments in plant reproduction. And David Rittenhouse had built his famous orrery (a model of the heavens). The American Philosophical Society had been established for several decades and had been promoting and documenting the latest scientific developments, including significant observations of the transit of Venus in 1769. Science in Philadelphia was not the pursuit of only the few, however.

Popular educational opportunities abounded. A lively print culture, with many printers working in the city along with bookshops and libraries, made domestic and international literature available. More diverse collections like the one at the Library

12. Carl and Jessica Bridenbaugh, *Rebels and Gentlemen: Pliladelphia in the Age of Franklin* (New York: Oxford University Press, 1962), 6.

Company established by Benjamin Franklin, along with specialized collections like in the medical library at the Pennsylvania Hospital, were resources to many.

Museums provided access to specimens and visual materials. Opened in the 1780s and expanded in 1794, Charles Willson Peale's museum exchanged, collected, and displayed natural specimens from around the country and all over the world. The infrastructure of trade already in place fueling the economy expanded the public collection at the museum. In addition, the people of Philadelphia could attend lectures and musical concerts at the museum. For those interested in the medical sciences, the Pennsylvania Hospital included the first medical museum.

University of Pennsylvania and its Medical School formed by merging the College of Philadelphia with the University of the State of Pennsylvania. This institutional backing of medicine and scientific interests brought the sciences into a formal setting. By supporting the work of the faculty, the university and medical school fostered the growth and development of scientific pursuits. With the creation of this institution an increasing number of medical degrees were given in the United States (formerly, travel to Europe was necessary for a medical education). The medical school contributed to the diversity of Philadelphia's population by attracting students from other areas of the country.

The people of Philadelphia took advantage of all of these resources and Whitfield Bell argues that Philadelphians saw themselves as a scientific people. They were a consciously scientific culture.[13] Public demand for and interest in technological

13. Whitfield J.Bell, Jr., "The Scientific Environment of Philadelphia, 1775-1790," *Proceedings of the American Philosophical Society* 92, no. 1. (Mar. 8, 1948): 6-14.

improvements encouraged the pursuit of the applied sciences.[14] It was not only that the people of Philadelphia were interested in the sciences, but also that they were a city of "meeters." Informal and named groups met all over the city—some with social and political purposes and some just to socialize. This culture of sharing and exchanging information created networks of knowledge throughout the cultural environment. Because of the many resources and the infrastructure in place, "there was no better place in America in the last quarter of the eighteenth century for the serious pursuit of science than Philadelphia."[15] Bartram's garden was just one of many meeting places for the discussion of and contributions to the international scientific scene.

Figure 3. A meeting place: the shady arbor near the house was a gathering place for visitors. (photo by author)

14. Carl and Jessica Bridenbaugh, *Rebels and Gentlemen: Philadelphia in the Age of Franklin* (New York: Oxford University Press, 1962).
15. Whitfield J.Bell, Jr., "The Scientific Environment of Philadelphia, 1775-1790," *Proceedings of the American Philosophical Society* 92, no. 1. (Mar. 8, 1948): 9.

The people and their works

This study tells the story of Bartram's garden as a gathering point and the community who studied there, but also examines the garden as a representation of the intellectual, cultural and social forces at work at the end of the eighteenth and beginning of the nineteenth centuries. It seems worth clarifying that I focus on those who had a physical presence at the garden. The definition of community, of course, is much broader. The connections extend far beyond those discussed here. For example, the plant mentioned in Barton's letter discussed above was given to Bartram by the French naturalist Andrea Michaux. Although there were many who contributed to the process of learning that went on at the garden, by contributing from afar via letter and package, this study focuses on the men and women who worked, lived and studied together. This community, who produced a number of the most significant scientific works of the period, explored many of the critical issues of the period. Rather than attempt to be exhaustive, I will offer a more intensive analysis by focusing on this single group of people who worked together in a common location during a relatively brief period of time.

Bartram's garden represents the strategies and techniques of scientific inquiry that was conducted during the late eighteenth and early nineteenth century. This dissertation traces the utility of the garden to the scientific community and argues that with the movement away from eighteenth century methods and projects, with the progression of science in America, institutions like Bartram's garden became less central to the accomplishments of the scientific community. Intellectual forces and social developments undermined the utility of the garden and the methods and projects it

represented. The practices of science, as well as the content of the studies, led to shifts in the projects and the fragmentation of what had been a single community. Thus the movement from eighteenth century science to nineteenth century science can be understood as a splitting apart--a "fracturing" of interests. This dissertation explores the causes of that split, especially the intellectual forces.

With the historical setting of the garden in the background, the study will analyze the works of the men and women who worked most closely with William Bartram, especially Benjamin Smith Barton, James Mease, Alexander Wilson, and Thomas Nuttall. In addition, the study discusses the importance of Ann Bartram Carr, Robert Carr, William Hamilton, and Frederick Pursh to the community working at the garden. This study begins in 1791, the year of the publication of Bartram's *Travels,* and ends with Bartram's death in 1823. By framing the study this way, I am not arguing that the later life and death of William Bartram somehow fundamentally altered the state of American science. I am arguing that during the period of the late eighteenth century until the mid-1820s intellectual, institutional, and cultural developments in American science were taking place. Bartram's later life and career coincide with the intellectual shifts that this study will clarify. The story of the garden has significance beyond that of the Bartram family. Bartram's later life makes an interesting story, but also contributes to our understanding of the period.

This period will be examined through the prism of works published in Philadelphia by the people who worked around William during this period—either books or journal articles published in Philadelphia between 1790 and 1823.[16] These mostly

16. A model for this study can be seen in Daniel Walker Howe, *The Unitarian Conscience: Harvard Moral Philosophy, 1805-1861* (Cambridge: Harvard University Press, 1970).

short, specific pieces seem on the surface to be evidence of an obsolete science. But taken as a body, important issues and debates become apparent. I focus on the works of physical science and medicine and consciously leave out works that would today be called ethnography, linguistics, or anthropology.[17] Both Benjamin Smith Barton and William Bartram wrote well-respected materials about native American peoples, but these will not be examined here. Because we do not consider the study of human cultures as part of the same science as the study of plants, because the issues of significance, questions and paradigms are not lumped together in today's studies, I have applied this bit of presentism to my study here. The analyses of works of Natural History concerning humans are important, but differ so fundamentally from the analysis of works about flora and fauna, that this study will take on only the latter.

In their introductory essay to the collection of essays, *Cultures of Natural History,* Nicholas Jardine and Emma Spary discuss different categories of practices of Natural History: material, social, literary, bodily, reproductive. Addressing this distinction, this work focuses on "literary and reproductive" which are the "conventions of genre, representation and persuasion; in natural history and other disciplines these include, along with rational argumentation, the gamut of rhetorical and aesthetic forms of persuasion..." and includes the "...reproductive practices, that is, the means by which skills and

17. Barton himself defines Natural History as ""Unquestionably, a large portion of what relates to the fabric and functions of animals; of what relates to the general analysis of natural objects, whether they be derived from the animal, vegetable, or the mineral kingdoms, or elsewhere; as well as what relates to the uses of those objects in medicine, or the arts; and many other questions of a like nature are all, in strict propriety, subjects of Natural History." Benjamin Smith Barton, "A discourse on some of the Principal Desiderata in Natural History and the best means of promoting the study of Science in the United States" Read before the Linnaean Society, 10 June 1807. (Philadelphia: Denham and Town, 1807), 13.

knowledge are handed on from generation to generation."[18] The work of Natural History is multi-faceted, but this study focuses primarily on the intellection production.

Many of the works examined here remain unknown to the scholarly community. They will be placed into the context of the author's life, into the context of the work going on at the garden, and most significantly into the scientific, literary, artistic, and religious traditions and discussions they fit into. Rather than attempt to make generalizations about the group who worked at the garden, I will demonstrate whether, and in what ways, they were participating in the on-going scientific discussions and debates of their time.

Those discussions and debates were going on on both sides of the Atlantic. The period can be seen as a one of transition. In his 1976 study, *Enlightenment in America,* Henry May, after dividing the Enlightenment into four categories, calls this period the "Didactic Enlightenment."[19] The Didactic Enlightenment was characterized by Scottish, particularly the Common Sense philosophy: belief in scientific progress, intellectual freedom, and republicanism. In the 1790s, May notes, Scottish Enlightenment philosophers were readily available in the United States through booksellers and universities.[20] This dissertation will connect the works of the men and women who worked with Bartram with the major themes and conflicts of this late brand of the Enlightenment. The effort will be made to discuss particular philosophers and care taken not to give in to the temptation to reduce all Scottish thinkers into a single way of thinking.

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18. N. Jardine, F. A. Secord, E.C. Spary, eds. *Cultures of Natural History* (New York: Cambridge University Press, 1996), 8.
19. Henry F. May, *The Enlightenment in America* (New York: Oxford University Press, 1976).
20. Henry F. May, *The Enlightenment in America* (New York: Oxford University Press, 1976), 346.

The transition of what can be referred to in short-hand as eighteenth century to nineteenth-century thought will be examined, here, primarily through the concerns of the sciences. Peter Bowler, in *Evolution: The History of an Idea,* lays out five essential elements that differentiate nineteenth from eighteenth century science: the expansion of the time scale, the concept of a changing universe, the elimination of design and the removal of "teleology," the elimination of miracles, and the inclusion of man within Nature.[21] Though the works completed by the circle of scientists working with William Bartram do not seem to explicitly struggle with all of these issues, I see and therefore will focus on several: the concept of a changing universe, the elimination of design, and the inclusion of man within Nature. Each of these elements will be defined and discussed more fully in the context of the works completed by Bartram's circle.

This dissertation differs from many of the scholarly works about Natural History because it is a look at Natural History not from the perspective of the journey, but from the perspective of the preparation and return.[22] By looking at the environment in which the publications were composed rather than at the environments in which the natural observations were made, new insight is gained into how scientific documents came into being. The group of friends and colleagues who gathered at Bartram's garden created a kind of scientific infrastructure that allowed for explorers to learn how to collect and document the natural phenomena they encountered. My study looks at those documents. This is a story not of heroes or great adventures but the overlooked story of the men and the society that made those heroes and great adventures possible. It is about the

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21. Peter J.Bowler, *Evolution: The History of an Idea* (Los Angeles: University of California Press, 1983).
22. For example, along with the copious scholarship on the Lewis and Clark Expedition, others include: Joseph Ewan, *Rocky Moutain Naturalists* (Denver; University of Denver Press, 1950); Tony Rice, *Voyages of Discovery: Three Centuries of Natural History Exploration* (New York: Clarkson Potter, 1999); Henry Savage, Jr., *Discovering America 1700-1875* (New York: Harper & Row, 1979).

preparation for the journeys and the recording and publication of the adventurers' accomplishments.

Few of the publications that resulted from these explorations were simple reproductions of travel journals. What is known of any journey was filtered through an editing process once the explorers were home and safe. The environment in which the publications were compiled and edited is essential to understanding the final products. Without the constraints of finding food and shelter and maintaining the well being of oneself and a team of explorers, the naturalist is able to really examine the data collected. The personal, professional, and cultural priorities that are reflected in scientific documents are especially manifest not in the field, but where the data was organized and the conclusions were drawn. Though not as dramatic, much of the work of science in the early nineteenth century took place at desks, in studies, and in gardens.

Natural History during the late eighteenth century focused on a number of major projects and questions. First was the effort to locate "type specimens," or an individual that exhibited the characteristics that identified a species. Explorations and botanical gardens assisted naturalists in their efforts to locate type specimens. These specimens were the backbone of the effort to identify and then classify species. Though interrelated, the process of classification differs from identification. Identification involves determining where the lines between species are drawn, naming and recording unique species. Classification is the system of categories into which individual species are assigned. Bartram and the others worked on both steps of this process. The period is described as amateur generalists looking for new species and the type specimens to illustrate them. Many scholarly studies of Natural History of this period stop at this

point. This study starts at this point and will discuss the significance of the hierarchies and formulas used to make sense out of the seemingly overwhelming number of organisms found in nature.

These two interrelated but separate processes allowed the naturalists to explore larger questions about nature. The process of classification focused not only on the lines between similar species, but took on broader questions such as the difference between plants and animals. By answering questions about classification and identification these scientists were struggling to make sense of the whole of nature. By examining the processes of classifying and identifying organisms, we gain insight into the rules these scientists imagined that nature was playing by.

The effort to identify species fit into the larger process of mapping the flora and fauna of North America (i.e. not only what the species were but also where they grew and thrived). Biogeography was essential to the later nineteenth century projects as part of the struggle to understand the relationship between environment and generation.[23] Biogeography contributed to the struggle to understand the disappearance of species, whether because of extinction or transformation. This troubling phenomenon required reimagining nature and nature's rules. This dissertation will help connect the dots between the end of the eighteenth century project, biogeography, and the developments that would occupy natural scientists throughout the nineteenth century, evolutionary theory.

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23. For a more expanded discussion of biogeography see Susan Delano McKelvey, *Botanical Exploration of the Trans-Mississippi West, 1790-1850* (Jamaica Plain, Massachusetts: Arnold Arboretum of Harvard University, 1955).

A number of the works included in this study focus on botanical processes, especially respiration, reproduction, and movement. These studies were tied to the debates on vitalism or the effort to understand the basis for life. Materialist philosophies brought into question the source of the "life force." Did that force exist within matter itself or was it separate and in some way connected to God? These debates related to where the lines can be drawn in the hierarchy of life, if all living creatures possessed certain qualities of life, were they all equally valuable?

Each of these projects, identification, biogeography, classification, etc, contributed to the effort to make sense of nature. That effort was characterized by the search for the essential: the essential characteristics of each individual species, the essential relationships between species, and the essential qualities of life. These explorations, though scientific in content, I argue, were fundamentally "theological in nature."

Science, scientist, Natural History, and naturalist have to this point been used interchangeably, which leads to a second assertion of this dissertation. The OED defines scientist as "a person with expert knowledge of science; a person using scientific methods." Although the word was not available to the people studied here to describe themselves—the OED dates the origins of the word itself to the 1830s—the term scientist will be used here.[24] The assertion that the people working with William Bartram were scientists is as much a conclusion as a starting point for the arguments that make up this study. The word "science" is even more problematic. Science is understood both as a method and as a subject of study. Science today is not just the study of nature but the study of nature that employs the scientific method. Modern science has come to mean the

24. *Oxford English Dictionary, third edition.* (New York: Oxford University Press, 1989)

highly specialized, institutionally-backed practice of experimentation and data collection with formal peer reviewed publications. Even more strictly conceived, scientific study is the execution of controlled experiments to verify testable hypotheses. One of the challenges of this study is the exploration of these expressions and the assertions they carry for the specialist and the non-specialist. The circle of scientists who worked with William Bartram illustrate a crucial point in not only what scientists studied but how those studies were conducted.

Scholarship

Scholarship on Natural History has stressed the division between natural philosophy and natural history. Natural philosophy is defined as the exploration of theory while natural history is the record of the observable. With its origins in Francis Bacon's divisions of knowledge, natural history belongs to the realm of memory and natural philosophy is driven by reason.[25] The practical companion to this is the difference between a field and a closet naturalist—with the former practicing natural history and the latter natural philosophy. Because this distinction does not apply to the people who worked at Bartram's garden—each of the people studied here gathered and made observations as well as wrote up the results and offered hypotheses for understanding them—these divisions will not be adopted in this study.

Another distinction is offered by Pamela Regis, in her study, *Describing Early America: Bartram, Jefferson, Crevecoeur and the Influence of Natural History*. She employs the categories: "collectors" and "hunters." She defines hunters as those who

25. Richard Yeo, "Classifying the Sciences," in ed. Roy Porter, *The Cambridge History of Science, Volume 4: Eighteenth Century Science* (New York: Cambridge University Press, 2003), 253.

work in the field and collectors as those who sponsor the repositories for the organisms found in the field. This distinction, however, neglects to take into account the role played by Bartram and his garden which acted as a sort of middle step: hunting and collecting, then distributing to the more formal "collectors." The process of bringing examples of nature to the collector was often more complicated than a simple bi-partate categorization can convey.[26]

Natural History and science in early America have been studied from a number of angles and those studies fit within separate bodies of scholarship. This study attempts to bridge the gap between histories of science and the histories of Natural History. Cultural histories attempt to define Natural History, to document the people and works as cultural processes.[27] The distinction between these approaches can be made at the point when the scholar selects which works will be incorporated in the analysis. Natural History is more literary than hard science. Scholars analyze texts based on the authors' use of symbolism or word choice, for example. For these analyses, much scholarship on Natural History has neglected the more scientific works since travel narratives make for more compelling reading, and give a literary scholar much more material to work with. Much non-literary scholarship about Natural History is often like reading Natural History itself: long lists and descriptions of subjects, in this case people and their works of interest, catalogues of people and their works that read just like the catalogues of birds, plants or bugs. A work

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26. Pamela Regis, *Describing Early America: Bartram, Jefferson, Crevecoeur, and the Rhetoric of Natural History* (Philadelphia: University of Pennsylvania Press, 1992).
27. See Joseph Kastner, *A World of Naturalists* (London: John Murray, 1978); Andrew Lewis, "The Curious and the Learned: natural history in the Early American Republic" (dissertation, Yale, 2001); William Martin Smallwood, *Natural History and the American Mind* (New York: Columbia University Press, 1941).

that examines the scientific publications and the intellectual environment in which they were written is still needed.

Histories of science, which examine the naturalists as they contribute to modern interpretations and assertions about nature, examine Natural History as a scientific process. These focus on progression of hypotheses, follow the stepping stones to the "truth" as it is understood at the time of the writing. Much of this body of literature treats early science with a kind of contempt, what I have come to call the "snicker-into-one's-sleeve" scholarship as though to say, "look at how silly these people were." In this study I hope to avoid the tendency to consider any theories or ideas that most closely resemble what is held to be true today as "right" or "smart" and anything contrary to them as not worthy of respect. The accepted concepts and the data available may have led scientists to draw conclusions that are different than those commonly held today. It may be that based on the evidence available and the accepted paradigms, the theories put forth were the most reasonable and or creative then imaginable. In this way, histories of science are lacking. On a related note, this study also touches on the development of scientific institutions in America.[28]

This study explores the scientific hypotheses in the context of the dominant, Western intellectual paradigms, or put another way, the scientific works will be examined

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28. The institutionalization and professionalization of science in America is covered in Stanley M. Guralnick, *Science and the Ante-Bellum American College. Memoirs of the American Philosophical Society,* Vol.109 (Philadelphia: American Philosophical Society, 1975) and George H. Daniels, "The Process of Professionalization in American Science: The Emergent Period, 1820-1860," *Isis* 58, no. 2 (Summer 1967): 150-166. Alexandra Oleson and Sanborn C. Brown, eds. *The Pursuit of knowledge in Early American Republic* (Baltimore: Johns Hopkins University Press, 1976). Histories of individual institutions such as the American Philosophical Society, Academy of Natural Sciences, Philadelphia Society for Promoting Agriculture are available.

within the context of Enlightenment thought.[29] The significance of Enlightenment thought to the course and success of the American Revolution has been studied extensively.[30] But the political aspects of the Enlightenment do not exhaust the influence those schools of thought had on the inhabitants of the North American colonies. A discussion of the bridge between eighteenth and nineteenth century thought in the context of science is still needed.[31]

This study will attempt to fill two gaps in the scholarly literature. The first is in timing. This study falls between John C. Greene's *American Science in the Age of Jefferson* which touches on the beginning of the period discussed here and George Daniels's *American Science in the Age of Jackson*, which briefly discusses the end.[32] The next is analytical. Rather than separate the scientific text and images, this study will take textual and visual evidence as one.[33] Finally, I will challenge the now much out-of-date

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29. Collection of essays on the Scottish Enlightenment in America, especially Andrew Hook, "Philadelphia, Edinburgh and the Scottish Enlightenment" and Deborah Brunton, "The Transfer of Medical Education: Teaching at the Edinburgh and Philadelphia Medical Schools" in *Scotland and America in the Age of the Enlightenment* eds. Richard B. Sher and Jefferey R. Smitten (Princeton: Princeton University Press, 1990); Garry Wills, *Inventing America: Jefferson's Declaration of Independence* (New York: Doubleday and Company, 1978) as Wills argues that the Scottish Enlightenment had significant influence of Jefferson during the writing of the Declaration of Independence, he demonstrates the access to and acceptance of the Scottish enlightenment in North America.
30. See Bernard Bailyn, *Ideological Origins of the American Revolution* (Cambridge: Belknap Press of Harvard University Press, 1967); Gordon Wood, *Creation of the American Republic, 1776-1787* (New York: W. W. Norton & Co., 1969); I. Bernard Cohen, *Science and the Founding Fathers: Science in the Political Thought of Jefferson, Franklin, Adams and Madison* (New York: W.W. Norton & Co., 1995).
31. Studies that explore this same period include: Mark A. Noll, *Princeton and the Republic, 1768-1822: The search for a Christian Enlightenment in the Era of Samuel Stanhope Smith* (Princeton: Princeton University Press, 1989).
32. This study supplements John C. Greene, *American Science in the Age of Jefferson* (Ames: Iowa State University Press, 1984) and George H. Daniels, *American Science in the Age of Jackson* (New York: Columbia University Press, 1968). For an earlier study see Brooke Hindle, *The Pursuit of Science in Revolutionary America, 1735-1789* (Chapel Hill: University of North Carolina Press, 1956).
33. For studies of visual representations of nature see: Ann Shelly Blum, *Picturing Nature: American 19th Century Zoological Illustration* (Princeton: Princeton University Press, 1993); Michael Gaudio, "Swallowing the Evidence: William Bartram and the Limits of the Enlightenment," *Winterthur* 36, no. 1 (Spring 2001): 1-18; Amy R. W. Meyers, ed. *Art and Science in American: Issues of Representation* (San Marino, CA: Huntington Library, 1998); Charlotte M. Porter, *The Eagle's Nest: Natural History and American Ideas, 1812-1842* (Alabama: University of Alabama Press, 1986).

study of the science of this period: Daniel Boorstin's *The Lost World of Thomas Jefferson.*[34] By focusing more on the questions that occupied the scientists, rather than attempting to identify a single answer, I hope to avoid the gross generalizations that Boorstin falls into.

This study will supplement very competent biographies of Alexander Wilson and Thomas Nuttall.[35] The biography of any single individual often neglects the perspective of the interactions within a community. A number of scholars have examined Bartram's *Travels*, this study focuses on Bartram's other, less well-known works.[36] Finally, this research will supplement a number of biographies of William Bartram which neglect the later years of Bartram's life.[37] This work fills in those later years, as well as discusses the relationships William had with scientists and offer an analysis of him out from under the shadow of his more famous father.[38]

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34. Daniel J. Boorstin, *The Lost World of Thomas Jefferson* (Boston: Beacon Hill, 1948).
35. Two good biographies of Alexander Wilson are in print, Robert Cantwell, *Alexander Wilson: Naturalist and Pioneer* (Philadelphia: Lippencott, 1961) and Clark Hunter, *The Life and Letters of Alexander Wilson* (Philadelphia: American Philosophical Society, 1983). A full-length biographical work of Benjamin Smith Barton by Joseph Ewan is being edited and readied for press, for a shorter study see: Jeannette E. Graustein, "The Eminent Benjamin Smith Barton" *The Pennsylvania Magazine of History and Biography* 85 (1961): 423-438. For biographies of Thomas Nuttall, see Jeannette E.Graustein, *Thomas Nuttall, Naturalist: Explorations in America 1808-1841* (Cambridge: Harvard University Press, 1967) and I.M.M. MacPhail, *Thomas Nuttall* (Lisle, Il: Morton Arboretum, 1983).
36. The scholarship on Bartram's *Travels* is discussed more in chapter two. For references see note 49 in chapter 2.
37. The scholarship of this period of Bartram's life is "sketchy" says Joel T. Fry the Curator of Bartram's Garden in email discussion, August 14, 2002.
38 There are a number of studies that deal with both John and William Bartram, see: Ernest Earnest, *John and William Bartram: Botanists and Explorers* (Philadelphia: University of Pennsylvania Press, 1940). Josephine Herbst, *New Green World* (New York: Hastings House, 1954); Thomas Slaughter, *The Natures of John and William Bartram* (New York: Alfred A. Knopf, 1996).

Summary of Chapters

The chapters are arranged chronologically, to tell the story of the garden and the people who worked there. Chapter two, "In search of nature's scheme," examines the years immediately following the publication of the Bartram's *Travels*, 1791-1803. During these years, Bartram established a working and personal relationship with Benjamin Smith Barton and helped to introduce the next generation of Bartrams to Natural History. Benjamin Smith Barton and James Mease were establishing themselves as significant contributors to the scientific and medical community of Philadelphia. The chapter also introduces a number of the basic processes of Natural History and medicine during this period and discusses how those processes were part of the work going on at the garden. Chapter three, Mutable Nature, which focuses on the years of 1803-1808, sees the arrival of Alexander Wilson and Thomas Nuttall at the garden. During this period Barton edited the *Philadelphia Medical and Physical Journal* producing and organizing works on botany, medicine, and zoology and Alexander Wilson began working on the *American Ornithology*. The community at the garden was struggling to make sense of the malleability of species by examining hybrids, species distribution, and the disappearance of species. Chapter four, "the immortal soul of nature," examines the very end of Bartram's career, the years from 1809 to1823. During this time, the United States fought a war and because of the war, the community was separated for many years. The untimely deaths of several of the younger members of the community cut short the list of accomplishments associated with this group. Bartram and his colleagues participated in the debates between vitalists and materialists, while attempting to understand the distinction between humans and animals.

The study concludes with William Bartram's death in 1823. By 1850, the garden was declared bankrupt and the house and the surrounding lands were sold to pay debts. What had once been a central location for the performance of the scientific projects of the new nation no longer had a use to the scientific community. The "old ways" of science were passing out of use and replaced by systems and paradigms more familiar to the ones worked with today. The practice of science was becoming more specialized and professionalized as the eighteenth century projects were reaching their conclusions. The methods and the content of science were shifting. This study does not follow a movement from one point to another so that the beginning is somehow different than the end. Instead, framed to reveal a period of transition, the efforts to bridge and reconcile two ways of thinking are highlighted. Great scientific revolutions attract much attention, but the gradual yet dramatic movement from one perspective to another is a harder story to tell. This is a story of an evolution such as that.

Chapter 2
"In search of nature's scheme"

Sweet flows the Schuylkill's winding tide,
By Bartram's green emblossom'd bowers,
Where nature sports, in all her pride
Of choicest plants, and fruits, and flowers
Alexander Wilson, "A Rural Walk"

Spring at Bartram's garden must have been an extravaganza. Pennsylvania winters are cold and unequivocal; spring comes to the mid-Atlantic relatively early but with a sigh of relief. The collection at Bartram's garden included many flowering trees. The Red Buckeye trees with stalks of tubular red flowers bloomed at the end of April. The bursts of red early in the spring attracted hummingbirds—Barton made note of the red throated honeysucker (hummingbird) at the end of April as well. With May came the tulip trees with their teacup shaped and sized flowers. The month finished with the Mountain Laurel in bloom—a tall shrub covered with bunches of delicate flowers. Each bunch made up of twenty individual flowers making the blossoms look puffy. The garden played host to swallows and martins, and water birds, like herons that ate the insects and other critters living near the water. Many visitors must have enjoyed the garden during this reawakening of nature. But they came to the garden not only for the showy flowers and flowering trees, they came to take advantage of the resources the garden offered. One of the main resources was William Bartram, "Mr. William Bartram has a library within himself," Henry Muhlenberg would write.[39]

39. Henry Muhlenberg to Zaccheus Collins, November 18, 1813, in *Botanical correspondence of Zaccheus Collins of Philadelphia, 1805-1827* (Philadelphia: American Philosophical Society 1958).

William Bartram and his background

Born on April 20, 1739, William (and his twin, Elizabeth) was the fourth (and fifth) child to William's mother, Ann, and seventh (and eighth) to John Bartram. William received a classic education at the Academy of Philadelphia, learning Greek and Latin. In the 1750s, when Bartram was in his teens, he traveled with his father to various parts of New England, helping with the collecting and documenting that supported and enhanced the family's botanical collection. William showed much interest in Natural History throughout his early years but his father believed it was not an option as what we would call a "career path." John Bartram's connections among the Philadelphia professions made a number of other options available, particularly, a physician, or a printer. Instead, in a decision that seems to confuse many of William's biographers (myself included), the young man chose, in 1756, to become an apprentice to a merchant. Upon the completion of his apprenticeship and with the support of his father and his uncle, William went into business in North Carolina. But this business venture was not a success. The failure made him available to accompany his father, in 1765, on a collecting expedition throughout the American south. Rather than return to Philadelphia with his father at that time, William attempted to establish a plantation on the St. John's River in Florida. This was a complete failure, leaving William with few financial resources or options for a future in business.

His knowledge of the South would not go to waste however, because from 1773 to 1777, William, with the sponsorship of John Fothergill, a Quaker merchant and plant enthusiast from London, traveled to the very edges of white settlement for "the discovery

of rare and useful productions of nature, chiefly in the vegetable kingdom."[40] He traveled and collected on a journey that would take him from North Carolina to the Mississippi River through a greater part of Florida and much of the territory in between. Upon the completion of this journey, William returned to Philadelphia, to the home and business of his father and brother.

William's failures in business may explain why John left the house and garden to John, Jr., William's younger brother. And, perhaps it was the failures of his early business adventures that led William to stay so close to home for the rest of his life. Perhaps it was the poor health he struggled with, recurring trouble with his eyes, or the severe leg fracture he suffered in 1786 when he fell from the tree in which he was gathering seeds. Even before his health started to fail and before his accident, he seems to have kept pretty close to home. Elected a member of the American Philosophical Society in 1768 it appears that he did not attend any meetings, ever.[41] He knew that he was not living up to the expectations of society. In a letter written while he was in his 50s he refers to himself as being in the dishonourable status of a bachelor living with his brother. The tone of the letter is not somber though—a little self-deprecation came easily to him. Whatever the reason for his choices to stay, William Bartram lived and worked for the rest of his life at the garden that belonged to his brother and brother's descendents.

In May 1797, playwright William Dunlap makes the following entry in his diary after visiting the garden: "Arrived at the Botanist's garden, we approached an old man who, with a rake in his hand, was breaking the clods of earth in a tulip bed. His hat was

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40. William Bartram, *William Bartram: Travels and Other Writings* ed. Thomas Slaughter (New York: Library of America, 1996), 27.
41. Francis Harper, introduction to *The Travels of William Bartram, Naturalist's Edition* (New Haven: Yale University Press, 1958).

old and flapped over his face, his coarse shirt was seen near his neck, as he wore no cravat or kerchief; his waistcoat and breeches were both of leather, and his shoes were tied with leather strings. We approached and accosted him. He ceased his work, and entered into conversation with the ease and politeness of nature's noblemen. His countenance was expressive of benignity and happiness. This was the botanist, traveller, and philosopher we had come to see."[42] Dunlap describes Bartram as "old" though he was only 58.

The only non-verbal portrait of William was painted by Charles Willson Peale in 1808 when Bartram was 69 years old. It shows a fragile looking older man with thinning white hair, white eyebrows, and blue eyes against a plain background. Bartram is dressed in a dark coat with brass buttons—perhaps an homage to the traveling for which he would become famous. He looks away from the viewer, into the distance with his eyebrows raised slightly, as though he sees something that interests him. Flowers tucked in Bartram's jacket are the only indication of his love for and dedication to Natural History.[43]

When we meet him now, in 1791, these portraits of Bartram are still to come. He is younger, perhaps he still has some darker hair on his head. It is in that year that his literary and scientific masterpiece has finally been published after fourteen years of writing and revisions.[44] Bartram's best-known work, called *The Travels*, describes his

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42. William Dunlap quoted in *William Bartram: Travels and Other Writings* ed. Thomas Slaughter (New York: Library of America, 1996), 604.
43. The flower in Bartram's lapel has attracted some scholarly curiosity, but no consensus has been reached on the species. Portrait owned by Independence National Park.
44. For discussion of the differences between Bartram's first draft and the published version of the *Travels* see Nancy Hoffman's dissertation, "The Construction of William Bartram's Narrative Natural History: A Genetic Text of the Draft Manuscript for "Travels..."" (University of Pennsylvania, 1996).

journey through the American south-east in the 1770s.[45] Consisting of four parts, *The Travels* describes the people, geography, flora, and fauna of the six states Bartram visited. The expedition, much of which Bartram traveled alone or in small groups, spanned a number of years allowing for botanical observations in every season. Bartram's connections opened doors and territory throughout the South; he visited wild areas where his life was at times at risk from animals or the elements as well as the plantations of land holding settlers. *The Travels* is filled with descriptions of both natural and man-made phenomenon throughout the southern region. As he moves from place to place the narrative alternates between broad impressions, "the land is lower and more level and humid,"[46] and specific, minute descriptions of particular species. The effect of this is to tell a story while providing data about individual organisms. The published text included a number of illustrations, all completed by Bartram. They share the technique of the text alternating between broad views, a map of a river basin, and the specific, the head of a rattlesnake. Interspersed in the text are moments of recognition and awe for the wonders of nature.

William Bartram's *Travels* earned him the respect of "curious" and scientific audiences. A contemporary review said that it deserved a "respectable place among those, who have devoted their time and talents to the improvement of natural science." The unusual combination of science and art did not sit well with this reviewer, however. He finds fault with the "rhapsodical effusions" and describes the style to be "disgustingly

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45. The full title of the work is *Travels through North and South Carolina, Georgia, East and West Florida, the Cherokee Country, the Extensive territories of the Musogulges or Creek Confederacy, and the Country of the Chactaws. Containing an account of the soil and natural productions of those regions; together with observations on the manners of the Indians.*
46. *William Bartram: Travels and Other Writings* ed. Thomas Slaughter (New York: Library of America, 1996), 40.

pompous." An example of a rhapsodical effusion appears during a description of a lake: "Ye vigilant and faithful servants of the Most High! Ye who worship the Creator morning, noon and eve, in simplicity of heart! I haste to join the universal anthem. My ear and voice unite with yours, in sincere homage to the great Creator, the universal sovereign." The useful information and facts make the publication worth reading, the reviewer notes, though the "garb in which they appear" may not meet with the approval of the reader.[47] It is possible that Bartram saw this review, for the magazine in which it was published was in Philadelphia.[48] The reviewer is not comfortable with the "poetry" of the work, and believes it detracts from the success of the overall work.

The debate, whether *The Travels* is fundamentally a scientific or artistic accomplishment, continues in modern scholarship.[49] Defined and defended as both a great scientific achievement and significant contribution to development of American Romantic literature, the work refuses to fit neatly into any one category. Berta Grattan Lee argues in the brief essay "William Bartram: Naturalist or "Poet"?" that Bartram is in fact both a scientist and a poet. The literary devices employed by Bartram may diminish

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47. "Impartial review of American publications. Travels through North and South... by William Bartram." *The Universal Asylum and Columbian Magazine* (March and April 1792): 266-267. APS Online.
48. William Bartram, *William Bartram: Travels and Other Writings* ed. Thomas Slaughter (New York: Library of America, 1996), 101.
49. The scholarship on *The Travels* is extensive. Primarily for this reason, this dissertation will not focus on *The Travels*. For analyses of the work see among others: Charles H. Adams, "Reading Ecologically: Language and Play in Bartram's Travels." *Southern Quarterly* 32, no. 4 (1994): 65-74. Douglas, Anderson, "Bartram's Travels and the Politics of Nature." *Early American Literature* 25, no. 1 (1990): 3-17. Larry R. Clarke, "The Quaker Background of William Bartram's View of Nature." *Journal of the History of Ideas* 46 no. 3 (July – Sept. 1985): 435-448. N. Bryllion Fagin, *William Bartram: Interpreter of the American Landscape*. (Baltimore: Johns Hopkins University Press, 1933). Christopher Looby, "The Constitution of Nature: Taxonomy as Politics in Jefferson, Peale and Bartram." *Early American Literature* 22, no. 3 (1987): 252-273. John Seeyle, "Beauty Bare: William Bartram and his Triangulated Wilderness." *Prospects* [Great Britain] 6 (1981): 37-54. Bruce Silver, "William Bartram's and Other Eighteenth-Century Accounts of Nature." *Journal of the History of Ideas* 39, no. 4 (Oct.-Dec. 1978): 597-614. Philip G. Terrie, "Tempests and Alligators: the Ambiguous Wilderness of William Bartram." *North Dakota Quarterly* 59, no. 2 (1991): 17-32.

the pure "truth" of the work, but they do not eliminate the value of the work.[50] This is partly accurate. By posing the question if Bartram is either a naturalist or a poet seems to suggest that they are mutually exclusive categories. The task of a scientist and the task of a poet are inherently different, the question assumes. By not attempting to convey an "objective" truth of his journey, Bartram can no longer be considered a scientist. Pamela Regis, in *Describing Early America: Bartram, Jefferson, Crevecoeur, and the Influence of Natural History*, seconds this: "If a writer is scientific, he cannot truly be said to be romantic. These divisions are modern, imposed from a perspective in which science is looked upon as positivism and art as extra rational."[51] If this distinction is modern, the question remains what is the relationship between science and romance in the late eighteenth century when Bartram was writing? What is nature of scientific pursuit during this period? How do the scientists themselves seem to understand their task? What was the relationship between art and science? Bartram's later works and the works of those who worked around him offer insight into this dichotomy. The upcoming discussions will help clarify that.

Type specimens

Around the time of the publication of the *Travels*, a friendship between Bartram and Benjamin Smith Barton that would last for a life-time started to solidify. William wrote to Barton,

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50. Grattan Berta Lee, "William Bartram: Naturalist or "Poet"?" *Early American Literature* 7, no. 2 (1972): 124-129.
51. Pamela Regis, *Describing Early America: Bartram, Jefferson, Crevecoeur, and the Rhetoric of Natural History* (Philadelphia: University of Pennsylvania Press, 1992), 61.

"I beg leave to offer these observations and specimens to your notice and investigation since I find you have an extraordinary talent and relish for discoveries in every branch of Natural History (particularly with regard to this our Native Country) which I hope you will pursue through life. I am willing nay desirous of contributing all I know for its promotion. I foresee the magnificent structure and would be instrumental for its advancement—Tools and instruments you know, are as necessary as materials in the hands of an Architect. And tho I am comparatively like an old Saw, or Auger, or Ax, worn out, rusty, and cast away as useless, yet even these rejected instruments after being new steeled and repaired may again be preferred to some useful purpose or other."[52]

Barton would make use of Bartram's skills and knowledge over many years of collaboration and friendship.

Barton, born February 10, 1766 in Lancaster, Pennsylvania, was the nephew of the astronomer David Rittenhouse (Barton's mother was Rittenhouse's sister). Formally educated, Barton studied medicine in Edinburgh, Scotland and at Göttingen completing his studies in 1789. Barton's family connections gave him access to the scientific and medical leadership of Europe. Barton carried a letter of introduction from Philadelphia physician, Benjamin Rush, when he moved to Edinburgh: "Mr. Barton is the nephew of the celebrated Mr. Rittenhouse, our great American astronomer, and possesses such abilities, joined with a thirst for knowledge, as render him worthy of that connection."[53] These privileges, along with a secure financial footing (the death of his parents left him

52. William Bartram to Benjamin Smith Barton, March 1791, American Philadelphia Society.
53. Letter reprinted in Jeannette E. Graustien, "The Eminent Benjamin Smith Barton" *The Pennsylvania Magazine of History and Biography* LXXXV (1961): 432.

with an independent income) provided Barton with the basic requirements for the successful pursuit of his scientific interests.

A 1789 Samuel Jennings's portrait of Barton is of a young man, 23 years old. His hair, eyes, and eyebrows are brown; he wears a black coat and a white shirt with ruffles at the neck and wrists. The dominant feature of the painting is Barton's dramatic head of hair; he is not an attractive man. The air is of a man who works indoors—he is seated, with his head slightly bent over the papers in his hands, looking straight at the viewer. Clouds, blue sky, and a tree form the background. While Barton's chosen field keeps him within, the outdoors are included so the viewer learns that Barton's subjects of study lie there. In his hands is a map. Brandon Brame Fortune explains that this is a map and diagram of ruins of a pyramid discovered near the Ohio River which Barton had visited in 1785. Barton had written a treatise on the ruins and the portrait indicates his pride in that work.[54]

While Barton was living and studying in Edinburgh and Amsterdam he had carried on a formal, respectful correspondence with Bartram. (Barton had written to Bartram to discuss the future publication of *the Travels* and the Bartram botanical discovery, the *Franklinia.*[55]) Upon his return to the United States, throughout the 1790s Barton and Bartram went botanizing along the Schuylkill and in the neighborhood of the house. Barton kept notes of these trips. The boxes of Barton papers in the American Philosophical Society contain dozens of little slips of paper with the date, name of plant and where and with whom it was seen—eighteenth century post-it notes.

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54. Brandon Brame Fortune and Deborah J. Warner, *Franklin and His Friends: Portraying the Man of Science in Eighteenth-Century America* (Washington, D.C.: Smithsonian National Portrait Gallery, 1999). Portrait owned by the American Philosophical Society. Philadelphia, Pennsylvania.
55. Bartram Papers, 1.3, 1.4, 1.5, Historical Society of Pennsylvania.

Results of their work together were seen on May 28, 1792 when Barton published "A Botanical Description of the Podophlum Diphyllum of Linnaeus" with illustrations by Bartram in the *American Philosophical Society Transactions*. This collaborative project begins with a brief history of what is known about two named plants. These plants had been observed and documented but one had never been seen in flower. With the help of Bartram and his garden, Barton had seen one of these plants in flower and with this new data argues that it has been incorrectly identified as a species of the genus Podophyllum: the *Podophyllum Diphyllum*. Barton asserts that in this plant he has identified a new genus, with only one species; he proposes to call the new genus Jeffersonia, with this plant being known as the *Jeffersonia Binata*. The anatomy of the plant and its behavior as it blooms set it apart from the previously identified species.

Barton describes the "generic character" of the plant describing the calyx, corolla, stamina, pistillum, pericarpium and semina. The identification and isolation of essential characteristics, the "generic character" of an organism was an accepted process in Natural History. Georges-Louis Leclerc, comte de Buffon in his 1753 *Histoire Naturelle*, a book that Barton owned and had given to Bartram, says "one proposes to make known the qualities essential to each animal, and one is only able to achieve this by reporting on the resemblances and the principal differences..." [56] While Buffon was specifically speaking about the study of animals, the principle is the same for all Natural History.[57] By looking at the characteristics of a species and comparing them with others, the naturalist identifies those elements without which the plant or animal would not be itself. Those

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56. Joseph Ewan, "One Professor's Chief Joy: A Catalog of Books Belonging to Benjamin Smith Barton," in *Science and Society in Early America: Essays in Honor of Whitfield J. Bell, Jr.*, ed. Randolph Klein, 311-344 (Philadelphia: American Philosophical Society, 1986).
57. Quoted in Alex Potts "Natural order and the call of the wild: the politics of animal picturing." *Oxford Art Journal* 13, no. 1 (1990): 22.

characteristics, which may or may not all appear on any single example of a species combine to create the "type specimen" for that species.

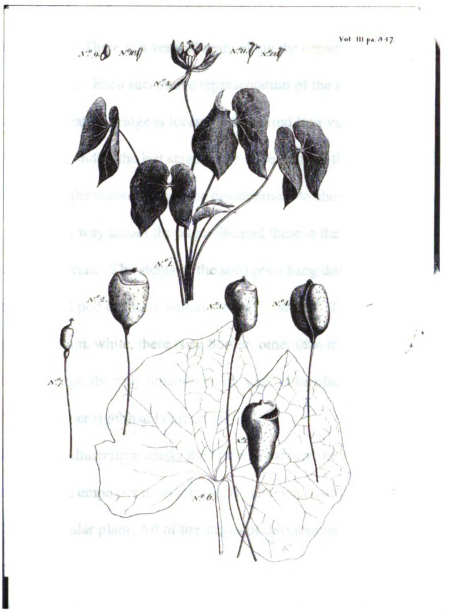

Figure 4. Jeffersonia Binata by William Bartram. (American Philosophical Society)

Bartram's illustration acts as a type specimen for this plant that few have seen in flower. Rather than a single representation this illustration consists of two parts: at the top of the page the whole plant is shown cut off from the ground without any roots with five, two lobed leaves (the "bi" in the binata of the name) and a flower. Four of the

leaves are curled so that the viewer can see the underside of each. Along the top of the top section are four smaller drawings of the reproductive organs of the flower. The lower half of the print shows five stages of the seed pod from fertilization through its opening to disburse the seeds. There is a vertical seam along the capsule, what Barton calls a "longitudinal ridge." Each successive representation of the seed capsule (from left to right) turns it so that this ridge is located first behind (not visible) then on the far left, then in the center, and in the last stage of the development this ridge is invisible again. Bartram has used the chronology of the development to show the seed capsule from all angles; it twists its way across the page. Behind these is the outline of a single leaf, out of scale to show detail. The stems of the seed pods hang down and cover parts of the leaf, the open seed pod is sitting within the leaf's outline. The background of the plate is unornamented, plain, white, there is no border; other than the numbers next to the individual drawings, the only notation on the page is its place in the publication: "vol III pa. 347" in the upper right hand corner.

Bartram's illustration marks the effort to capture the whole plant, throughout its development. The emphasis is on the generic characteristics, as Barton calls them, rather than on one particular plant. All of the stages of development are portrayed, while other characteristics, like the root system, are not included. The superimposition of the seedpods over the outline of the leaf remind the viewer that this is an artificial representation of the plant. With no background, the plant is taken out of its natural context. This "perfected specimen came to be preferred, or standard, because although the image of a single unique specimen might be literally more truthful, it did not and

could not express the larger truth of being characteristic of its species," explains Gil Saunders.[58]

Bartram's garden was an important resource for the data necessary to compose type specimens. As naturalists and collectors struggled to preserve organisms in life-like forms for their herbaria and curiosity cabinets, Bartram was providing living examples of the plants themselves. This process was essential to the project of the garden. The use and incorporation of type specimens in the process of identification were statements in themselves. At this time, it was not universally held to be true that species were real. Many argued that what existed in nature were only multiple individuals of multiple characteristics. The search for type specimens is a statement in the belief in species as reality.

A type specimen is comparable to a "form" as described in the works of Plato. Plato describes two orders: the world of appearances and the intelligible world. The world of appearances is the visible world and the intelligible world is what we know through thinking and knowledge. The forms are the highest level of objects, known only through the power of the dialectic. The visible world, the world experienced through the senses, is a reflection of the forms just as an image in a body of water reflects an object.[59] Though not existing in nature and not perceived with the senses, the form itself is the reality of nature. The effort to identify type specimens and the forms they represented was inherent to the projects of eighteenth-century science.

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58. Gill Saunders. *Picturing Plants: An Analytical History of Botanical Illustration.* (Berkeley: University of California Press, 1995), 22. Alex Potts argues that this process of synthesizing a "perfect" example was not unique to scientific illustrations but a tradition within "classical art theory" in "Natural Order and the Call of the Wild: the politics of animal picturing" *Oxford Art Journal* 13, no. 1 (1990): 22.
59. See Plato's discussion of the four stages of cognition and the allegory of the line in chapter 24 of the Republic. *The Republic of Plato*, trans. Francis MacDonald Cornford, (London: Oxford University Press, 1945).

But the projects of science were not exclusively scientific. Type specimens were the route to a greater understanding of a perfect nature. By creating a type specimen, nature is brought under control, stripped of some of its chaos, elevated to a place where it can be held and observed unchanging. That unchanging place reflects the work of God. The process of identifying a type specimen is a kind of prayer. Belief in type specimens is the belief that God has created nature with a plan, with clearly defined categories into which all individual organisms could fit. The belief in species is a belief in a rational nature. Bartram and Barton believed in species, and believed in the rational God of nature.

James Mease and the Yellow Fever Epidemic of 1793

During those early years of the friendship between Barton and Bartram, tragedy struck Philadelphia. The summer of 1793 was a relatively hot one and in August the first signs of yellow fever were observed by Philadelphia's physicians.[60] Patients with the disease showed an inconsistent variety of symptoms, including body pains, fever, purple discolorations on the skin, bleeding from the mouth and nose, and "black vomit." The disease got its name from the yellow, jaundice of the skin and eyes that often manifested in its victims. The nature of the disease itself makes it difficult to estimate how many people in Philadelphia were infected, but it is possible to say that nearly 5,000 people died in three months, while 17,000 people left the city hoping to escape the contagion.[61]

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60. Susan E. Klepp "How Many Precious Souls are Fled"?: the Magnitude of the 1793 Yellow Fever Epidemic" appendix I in Estes, J. Worth and Billy G. Smith, eds. *A Melancholy Scene of Devastation: The Public Response to the 1793 Philadelphia Yellow Fever Epidemic.* (Philadelphia: Science History Publications, 1997), 178.
61. It is believed today that not everyone infected with the virus showed symptoms. See J. Worth Estes's introduction to *A Melancholy Scene of Devastation: The Public Response to the 1793 Philadelphia Yellow Fever Epidemic.* (Philadelphia: Science History Publications, 1997), 5.

In addition to his work with Barton, Bartram had been working with another young physician who lived near the garden and would play an important role in the yellow fever epidemic. Bartram had read an article on "Observations on the Pea Fly or Beetle, and Fruit Curculio" before the Society for Promoting Agriculture in 1789 which had attracted the attention of this young physician, James Mease. Born on August 11, 1771, Mease was the son of a wealthy merchant, and had had a comfortable childhood. Mease began his studies at the University of the State of Pennsylvania in 1784 when he was 13 years old. He graduated with the first class from Medical Department of the University of Pennsylvania with medical degree in 1792. Inspired to write his dissertation, "An Essay on the Disease produced by the Bite of Mad Dog, or other rabid animal," by a piece in the newspaper that "described in the most erroneous and dreadful manner" the disease, and gave bad remedies, Mease started his medical career with a success.

The education that Mease received in Philadelphia carried on the principles taught in Edinburgh, Scotland. Many of the early professors of medicine in Pennsylvania, including Adam Kuhn, elected professor of the theory and practice of medicine in 1789, and Benjamin Smith Barton, appointed to the chair in 1813, were trained at the University of Edinburgh and classes were modeled on those offered in Scotland. Theories of illness taught in Edinburgh stressed the importance of a balanced nervous system in the health of the human body. (Benjamin Rush even argued that the republican system was good for the health because excessive excitement was avoided through the

more fair political system.[62]) These models encouraged the classification of diseases much like the classification of plants and animals. It was believed that diseases with similar causes could be treated with similar remedies, therefore identifying the essential cause of the disease was crucial to the effective practice of medicine.

A portrait of Mease attributed to Thomas Sully, painted for Mease's son, Pierce, shows a 63 year old man with a receding hair line and a prominent nose. He faces to the right in partial profile not looking directly at the viewer. He is shown not in the robe of a scholar but the plain clothes of a serious man with no ornamentation or identifying additions. The background is plain, emphasizing Mease's head and face, a common sitting for a man who was known for his cerebral contributions to society. But Mease is still young, now, in 1793, only one year after completing his degree. As he did when he selected the topic of his dissertation, Mease served the needs of the people of Philadelphia during the Yellow Fever epidemic.[63]

Both Barton and Mease were practicing physicians during the epidemic. There is evidence that both stayed in the city to treat the sick, were treated for the disease and survived, but neither has left a personal account of the time. Mease himself became very ill, "suspended by a thread over the grave," Benjamin Rush said.[64] Ten years later, in 1803, when the fever struck the city, not as harshly, again, William Bartram would make note of the disease in his weather journal--one of the only non-weather related items included--"Malignant fever present in the city to the great terror of the inhabitants;" "Malignant fever prevails in the city. People alarmed, many families flying into the

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62. Deborah Brunton, "The Transfer of Medical Education: Teaching at the Edinburgh and Philadelphia Medical Schools," in *Scotland and America in the Age of the Enlightenment* eds. Richard B. Sher and Jefferey R. Smitten (Princeton: Princeton University Press, 1990), 249.
63. Portrait owned by American Philosophical Society. Philadelphia, Pennsylvania.
64. William Snow Miller, "James Mease," *Annals of Medical History* 7 (1925): 12.

country. The same terrible fever in Alexandria in Virginia, New York, Harrisbourg on Susquahana very sickly."[65] This entry says two things to me, one that the danger of the fever was felt very deeply, the other is that Bartram saw the presence of the disease as being related to the environmental conditions. It was known that this was exclusively a summer phenomenon. These entries into a scientific journal were scientific in nature. The community at the garden saw the project of identifying the nature of and treatment for the disease as their own. Rather than locating a type specimen, physicians, like Mease and Barton, were struggling to identify what Mease would later refer to as the "seat of the disease."[66]

There was disagreement within the medical community of the city over the origin of the disease, where it "sat" in the body. Without a consensus on that, doctors did not agree about how to treat the disease, i.e. whether to work with nature and the workings of the body or to shock/force them back into health (work against nature). Benjamin Rush, one of Philadelphia's most prestigious and best known physicians, believed in purges and bleedings to force the disease out of the body, while others used gentle medicines that allowed the body to repair itself. (When Mease became ill, he was treated by Rush, proving his confidence in Rush's methods.) The medical community did not agree on whether the disease was contagious. Rush believed yes, while other doctors did not.[67] The public disagreements, and therefore detailed historical record, over these questions reveal that Philadelphia's physicians were struggling to identify the essential characteristics of disease. This record shows that the project of the garden—to identify

65. William Bartram, Diary entry September 19, 1803. American Philosophical Society.
66. James Mease "Cases of the Gradual Loss of Muscular Power, without evident cause." *The Philadelphia Journal of the Medical and Physical Sciences* 2, no. 4 (1821): 322 APS Online.
67. J. H. Powell, *Bring Out Your Dead: The Great Plague of Yellow Fever in Philadelphia in 1793* (Philadelphia: University of Pennsylvania Press, 1949).

the essential characteristics of flora—was being carried out in the larger medical community as they worked to deal with disease.

The city of Philadelphia's efforts to prevent another outbreak of Yellow Fever included the creation of an inspection and quarantine procedure for all ships coming into the port. Governor Mifflin appointed Mease the resident physician of the health office of the port of Philadelphia. This position required that Mease live at State Island, an island set aside by the city. This position would place Mease at the center of a number of public disagreements which established him as a known figure in the scientific and medical communities.[68] He would remain in this position until May 1, 1798.

For those years, while Mease was away from the garden, Barton was working more closely with Bartram to complete the first edition of the *Collections for an essay towards a materia medica of the United States* which was published in 1798. In 1796, Barton had been appointed chair of Materia Medica at University of Pennsylvania. And it was Bartram who encouraged Barton to "attend to and encourage or promote the Analysis of [word indecipherable] American Vegetables of medicinal powers."[69] In the preface of the *Materia Medica*, Barton reveals his personal commitment to this work, by confessing that Americans "are still less acquainted with the properties of our productions [medicinal plants]." This "blank in the history of science" he says he views "with pain."[70] The only thing available on Materia Medica, according to Barton, was published by a German and follows the theory of Signatures (which Barton discounts). This early edition, Barton would continue to modify and update throughout his career, grouped

68. For more on the debates that Mease participated in, see William Snow Miller, "James Mease," *Annals of Medical History* 7 (1925): 6-30.
69. William Bartram to Benjamin Smith Barton, September 1791; American Philosophical Society.
70. Benjamin Smith Barton, *Collections for an Essay towards a Materia Medica of the United States,* first edition (Philadelphia, 1798), iv.

plants by their potential medicinal uses, but contained no illustrations and only the most minimal descriptions of the plants and generalized locations where they could be found. An obvious omission for a Materia Medica, doses and preparation are not really discussed. Though limited, this work demonstrates how medicine and botany were connected at the level of practice as well as theory. Without natural products, doctors had very few weapons in their arsenals. The garden could provide the resources necessary to assist people in their time of need.

With this work Barton contributed to a long tradition of plant collection and documentation. Progressing along a parallel path with botany, the herbal tradition contributed significantly to the development of the knowledge of plants and medicine during this period. These early catalogues of plants included descriptions of the plants, sometimes with basic illustrations and allowed for the layman to have access to health care. It was a slow and cumulative process in which the works of those who came before were carried on and incorporated in new works. The development of herbals moved from copied folk knowledge to the description and utility of newly discovered species, thus moving these works from the purview of the amateur to that of the professional. The Bartrams, including John, Sr. and William's brothers were practicing apothecaries. There is some evidence that William provided some medical care at the garden.[71] The projects of the garden included the development and distribution of medicines.

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71. Mease would note in a later essay that Bartram supplied him with evidence of the effectiveness of geranium maculatum in stopping bleeding. Interesting because Bartram, as a young man, rejected the option of studying medicine, but here seems to be making observations of and perhaps practicing medicine. See "Account of the Efficacy of the external Application of the Geranium Maculatum, in stopping Hemorrhage." *The Philadelphia Medical Museum, Conducted by John Redman Coxe, M.D.* 3, no. 3 (1807): 154. APS Online.

Science and learning

With this and all aspects of the family business, William helped his brother, John, Jr. One visitor to the garden during this period introduces us to some younger members of the family under John and William's care. On January 2, 1799, Hipolito Jose da Costa, the Portuguese envoy to the United States, visited the garden. While he waited to meet John Jr., he sat by the fire with a young woman who he estimates is fifteen years old (she was really 20). This young woman was John, Jr.'s daughter, William's niece, Ann. Da Costa noticed a book about geography sitting close to Ann and they had a discussion about it, and "[w]e then turned to talking about botany, a field in which she was no stranger, for she knew the names of many plants and could apply the system of Linnaeus, about which she could talk with exact, though limited, knowledge." During this same visit he also met twelve-year-old James Howell Bartram, Ann's brother. James and Ann showed their guest some of their drawings—safe to assume that their uncle had been giving them lessons—and da Costa notes that the drawings are "very good."[72]

Ann Bartram had been born at "a quarter after one in the morning" on February 15, 1779.[73] The pictures we have of Ann, who was called Nancy by her family, show us a responsible and serious young woman. Ann seems to have been serious about her work, for she "did not keep a great deal of company but ladies sometimes came to see her."[74] She had taken charge of her father's household when her older sister, Mary, had gotten married in 1794. Later in her life she would be described as having a "the passionate

72. Diary of Hipolito Jose da Costa reprinted in *Pennsylvania Magazine of History and Biography* 78 (1954): 82.
73. Bartram Family Bible, Bartram Family Papers, Historical Society of Pennsylvania.
74. Testimony of Flora Murray, August 30, 1822, John Bartram, Jr. Estate, J. K. Kane Papers, American Philosophical Society. I looked at photocopies in the library of Bartram's Garden.

fondness" for working with plants[75] and was "a considerable botanist and draws well."[76] There is no surviving portrait of Ann, so we do not know what she looked like. John's young family shared the Bartram house with their uncle William.

At this time, William was finishing a project with Benjamin Smith Barton. In April of 1799, Barton's *Fragments of Natural History of Pennsylvania* was published. Though the author of the text is Barton, he acknowledges that much of the material included was provided by "my ingenious and good friend, Mr. William Bartram."[77] Barton, with the help of Bartram and his garden, which he frequented throughout the 1790s, had compiled data on the flora and fauna of Pennsylvania.[78] The common and scientific names of the plants that he had observed, as well as a "progress of vegetation," noting at what point in the year the stages of growth occur, make up a major part of the text. Barton paints a whole picture of the environment of Pennsylvania by creating a table arranged chronologically to show what plants and animals appear contemporaneously and the interactions between the species rather than simply noting single species.

The appendix contains more detailed observations of some of the birds that appear in the tables. These observations include such notes as "I am not quite certain, whether

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75. Alexander Gordon, "Bartram Botanic Garden" *Horticultural Register, and Gardener's Magazine* (Aug 1, 1837): 283, APS online.
76. David Douglas's journal quoted in Jeannette E. Graustein, *Thomas Nuttall, Naturalist: Explorations in America 1808-1841* (Cambridge: Harvard University Press, 1967), 194.
77. Benjamin Smith Barton, "Fragments of a Natural History of Pennsylvania" in *Selected Works by Eighteenth-Century Naturalists and Travellers*. ed. Seir B. Sterling (New York: Arno Press, 1974), 5. (pagination of original document)
78. July 3 1794 makes notes of plant in bloom at Gray's ferry, May 20 and June 13, 1795; Barton makes note of flowers he sees at Bartram's garden; September 11, 1796 BSB notes plant seen in woods near garden, Benjamin Smith Barton Papers, American Philosophical Society.

they are not both the same species; but, I believe, they are different."[79] The process of identification required much more data than just appearance; habits, such as migration, nest building, and favorite foods, help to distinguish the birds. These external characteristics, visible to the naked eye, distinguish one species from another.

Barton is concerned that in past identifications of distinct species the recording naturalist has identified "birds which merely differ in sex, or in age, and in their colouring, for which these animals, at different seasons of the year, are so remarkable."[80] Just as the scientific description of a plant incorporates its whole life, it is not just what the bird looks like at a single moment that identifies the species but the composite of its appearances throughout the year. Any single observation is not enough to identify a unique species. A type specimen is not one that exists in nature, but one that can reflect the changing nature of a single species. Certain organisms could only be classified by a combination of characteristics or what is called "polythetic character combinations." [81] Barton points out, in an effort to differentiate two birds, that they build different kinds of nests. For animals, as well as plants, essential to an identification is not just the physical characteristics but the behaviors that are demonstrated.

The importance of the collection of data through the senses was at the heart of Enlightenment science. In fact, the direct relationship between the senses and truth was a core of Enlightenment epistemology. The process of turning data from the senses into knowledge was of some controversy, however. John Locke, the fount of much of

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79. Benjamin Smith Barton, "Fragments of a Natural History of Pennsylvania" in *Selected Works by Eighteenth-Century Naturalists and Travellers*. ed. Seir B. Sterling (New York: Arno Press, 1974), 18. (pagination of original document)
80. Benjamin Smith Barton, "Fragments of a Natural History of Pennsylvania" in *Selected Works by Eighteenth-Century Naturalists and Travellers*. ed. Seir B. Sterling (New York: Arno Press, 1974), 6. (pagination of original document)
81. Ernst Mayr, *The Growth of Biological Thought: Diversity, Evolution, and Inheritance* (Cambridge, Massachusetts: Harvard University Press, 1982), 190.

Enlightenment thought laid it out this way. Ideas are gained by gathering data through the senses. Inference is the recognition of the connections between ideas and when the agreement or disagreement of ideas is established, knowledge is gained. All knowledge depends on this two step process. Based first on the use of the senses, confirmation of knowledge requires the application of comparison, establishing agreement or disagreement. Since this is the only way to acquire knowledge, Locke argues, there are no innate ideas.

Lockean theory was taught in the universities in Scotland and was responded to in the writings of the Scottish Enlightenment. Disturbed by the path that the skeptics took Locke's theories, Scottish Enlightenment thinkers argued to return certain ideas to humans. In particular, Thomas Reid saw that David Hume had drawn logical conclusions from Locke so Reid attempted to go back to what he saw as the source of skeptical thought to correct the errors in the conception of knowledge.[82] Reid argues that people do have the inherent knowledge that both they and matter exist. Locke, Reid explains, says that judgments of nature come from "comparing ideas and perceiving the agreements and disagreements" but Reid says that judgments do not come from the act of comparison but are "immediately inspired by our constitution."[83] Reid says that operations of the mind that determine the past and present are examples of "simple and original, and therefore inexplicable acts of the mind."[84] "Original acts of the mind" is understood as existing as part of the mind, not acquired through the two-step process of

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82. The ideas of the skeptics and Hume in particular will be discussed more fully in chapter 3.
83. Thomas Reid, Chapter 2, section 7 An Inquiry into the Human Mind on the Principles of Common Sense Flynn, Philip, ed. *Enlightened Scotland: A Study and Selection of Scottish Philosophical Prose from the Eighteenth and Early Nineteenth Centuries*. Edinburgh: Scottish Academic Press, 1992. Page 49
84 Thomas Reid, Chapter 2, section 7 An Inquiry into the Human Mind on the Principles of Common Sense Flynn, Philip, ed. *Enlightened Scotland: A Study and Selection of Scottish Philosophical Prose from the Eighteenth and Early Nineteenth Centuries*. Edinburgh: Scottish Academic Press, 1992. page 43

experience and comparison. The operations that determine past and present are not discovered by reason, Reid says. If certain ideas exist before the process of reason discovers them, then these inherent ideas, or common sense, must be part of human nature. The mind has access, through the hard-wired "common sense," to an understanding of the workings of nature.

All of nature is the work of God, Natural Religion posited. If one has access to the workings of nature through one's own inherent capabilities, then one has access to God through those same capabilities. That knowledge is part of human nature and human nature is the work of God, then by listening to those inherent ideas (common sense) one has access to a higher, unchanging truth. Those ideas, and that truth are the external reality seen in imperfect representations of nature. Observations of nature become ideas in the mind, and then those ideas are filtered through the "common sense" inherent in the mind. This is not only a scientific process, but also provides the scientist with the higher truth of reality. The connection between what is seen, the idea of that observation, and what is reality is firm according to Reid. The scientist's eyes can see the similarities between the organisms, the mind recognizes that this plant has the same shaped leaves as that one, for example, therefore those similarities are a reflection of the higher, unchanging truth that common sense dictates. While Barton and Bartram may not have expressed their philosophy in exactly these words, they were conscious of their belief in the reality of species and dedicated their scientific lives to collecting the observations that gave them access to their truth.

The circle at the garden were establishing important relationships the summer of 1800. Their collaboration on *Fragments of a Natural History of Pennsylvania* seems to

have strengthened the friendship between Barton and Bartram. The affection in the correspondence between them goes beyond the conventional hyperbolic courtesy of the period. "Believe me when I tells the my heart leapt with joy when I saw the lad coming down the Avenue to the House. Thy note relieved me from much anxiety fearing sickness and misfortune, not seeing nor hearing from you so long. Sympathy is the best substitute or representative of an absent friend, Hope's the last resort."[85]

James Mease married Sarah Butler. Butler was the daughter of Pierce Butler, the Senator from South Carolina. It seems safe to assume that they met while the Butler family lived in Philadelphia; the Butlers owned a summer home in Philadelphia. (Pierce Butler accepted the marriage since he would later move to Philadelphia to be close to his daughter and is buried there.) The marriage to the daughter of a prominent Revolutionary war hero and politician convinces me that Mease was a significant figure in the social hierarchy of Philadelphia.

During this time, Benjamin Smith Barton, who was teaching at the University of Pennsylvania, was taking his classes to visit Bartram's Garden.[86] In 1801, James Howell Bartram, the nephew who had shown his drawings to the Portuguese envoy, started his studies in medicine with Barton. That he traveled back and forth between the city where Barton was teaching and practicing and the garden is clear from the friends' letters. The younger Bartram acted as a courier between the two friends. Bartram took much interest in "Jemmy's" education, speaking of him in his letters to Barton. He reported on James's progress and recommended his work, saying once "Jemmy has painted a pretty little

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85. William Bartram to Benjamin Smith Barton, April 3, 1800, William Bartram Letter Series I, American Philosophical Society.
86. William Darlington quoted in Francis Harper's introduction to *The Travels of William Bartram, Naturalist's Edition* (New Haven: Yale University Press, 1958), 33.

Hawk."[87] He and the young man read and discussed poetry together sharing their impressions; William would write later: "Remember that line of the Poet, which thee pointed out to me as beautiful."[88] James was trusted with transporting specimens along with the letters between the two naturalists. Barton, over the years requested many specimens and drawings from Bartram. Bartram was able to accommodate Barton with any number of specimens, minus one. For that one, Bartram said he would check with his neighbor, "our friend Hamilton."

William Hamilton, Bartram's neighbor and the owner of the Woodlands, and the Bartrams exchanged specimens and produce for years. Hamilton, who was not a scientist, seems to have been the epitome of what has been called a "virtuoso." The virtuoso is characterized by "his inveterate collecting of coins, shells, and fossils...his passion for new means of studying nature."[89] He fussed over his plants and his greenhouses, his letters to his personal secretary are filled with nagging instructions about watering each and every plant and fixing doors and securing plants.[90]

Barton also worked at the Woodlands, collecting and making observations. He continued to work on his *Collections toward a Materia Medica,* publishing another edition in 1801. This edition is particularly interesting because it was printed by Robert Carr. In fact, this may have been one of the first documents printed by Carr in his newly established business. Robert Carr had come to the United States from Ireland with his family when he was quite young. After completing an apprenticeship with Benjamin

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87. William Bartram to Benjamin Smith Barton April 3, 1800. William Bartram Letter Series I, American Philosophical Society.

88 William Bartram to James Howell Bartram, September 23, 1804, Reprinted as appendix in N. Bryllion Fagin's *William Bartram: Interpreter of the American Landscape.* (Baltimore: Johns Hopkins University Press, 1933), 202.

89. Lewis Perry, Intellectual Life in America: A History (New York: Franklin Watts, 1984), 17.

90. William Hamilton to his private secretary, June 1790, reprinted in *Pennsylvania Magazine of History and Biography* 29: 159.

Franklin Bache, a grandson of Benjamin Franklin, Carr established himself as a source for fine printing in Philadelphia. His business specialized in the techniques necessary for the high quality of scientific texts of the time. Carr's place in the garden would become more permanent in the years to come.

The summer of 1801 was a hard one for William Bartram. He was very ill; he had been plagued with trouble with his eyesight since he fell very ill during his journey to the southern states in the 1770s. On October 25, 1801 Benjamin Smith Barton received a letter signed by William, but the handwriting and the content of the letter indicate that he was not able to write it for himself. James had brought a letter to William in which Barton asked William to complete a drawing. Ann had had to read the letter to her uncle; in his response he says he was "not able to read it therefore got my niece to read it to me."[91] The letter goes on to disappoint Barton because Bartram will not be able to complete any drawings for the near future.

The handwriting of the letter is clearly distinct from that of the signature. The shaky hand that signed the note was not the same who penned it. Did Ann handle any of her uncle's other correspondence? It is clear from the family records that it was William's responsibility to maintain the correspondence for the family business and what remains of his papers shows that he had an active correspondence with friends and colleagues. For at least a brief time, Ann was a crucial part of both the maintenance of the business and the continuation of the scientific pursuits of the period. In his poem, "A Rural Walk," about the Bartrams, Alexander Wilson describes Ann's work with William

91. William Bartram to Benjamin Smith Barton, October 25, 1801, Benjamin Smith Barton papers, American Philosophical Society.

this way, "When science calls, or books invite, /Her eyes the waste of age supply, /Detail their pages with delight, /Her dearest uncle listening by."[92]

Though disease kept Bartram from the projects that he loved, it was another disease that was helping James Mease establish himself as a medical authority in Philadelphia. In 1801, the pamphlet "Observations on the arguments of Prof. Rush, in favour of the inflammatory nature of the disease produced by the Bite of a Mad Dog" was published. This work continued the debates about the essential characteristics of a disease and where one fell in the classification scheme of diseases. The argument referred to in the title is whether the disease, today known as rabies, is one that causes too much excitement in the body or not enough. (Rush believed too much, Mease, not enough.) Mease examines the relative success of various treatments and reads them backwards to argue the nature of the disease, i.e. bleeding or weakening the system does not cure the disease therefore this disease is not about inflammation or "over-excitement."

The theory of diseases, called the "Brunonian System," where the root of disease was thought to be in the nervous system, was taught in Philadelphia and Scotland and was being applied by Mease; "vigor and relaxation are foundation of disease," he says.[93] Medical courses in Philadelphia focused on the "nervous system and its properties of irritability and sensibility, then went on to describe pathological processes as the result of excessive changes in sensibility."[94] This system of classifying diseases was based on

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92. Alexander Wilson, "A Rural Walk" *The Port-Folio* 5, no. 16 (Apr. 27, 1805): 126-127.
93. Reprinted as "Observations on the arguments of the late Prof. Rush, in favour of the inflammatory nature of the disease produced by the Bite of a Mad Dog" in the *American Medical Recorder* 6, no. 1 (January 1823): 3 APS Online.
94. Deborah Brunton, "The Transfer of Medical Education: Teaching at the Edinburgh and Philadelphia Medical Schools." *Scotland and America in the Age of the Enlightenment* Richard B. Sher and Jefferey R. Smitten, eds. (Princeton: Princeton University Press, 1990), 249.

certain assumptions about the significance of the characteristics of the disease. The seat of the disease was seen as the nervous system, therefore the definition of and treatment for an illness must address the imbalance in the nervous system. Classification systems were employed by physicians as a shortcut to methods of healing. If two diseases were classified together, then a remedy for one would act as a remedy for another. This pamphlet about rabies reenacts the arguments that took place during the Yellow Fever epidemic. (Although about Yellow Fever, Mease and Rush had agreed.) Diseases were identified and classified using the same methods as flora and fauna. The methods of medicine reflected the same belief in an organized, classifiable Nature as the methods of Natural History. (The disagreement between Mease and Rush about the correct treatment for rabies did not diminish their respect for each other. Mease would be one of the last to visit with Rush as he was dying in April 1813.)

On January 1, 1802, William Bartram began keeping a weather diary in which he notes the appearance of plants and their flowers and migrating birds. The diary starts with a day worth remembering: a day in January that was as "serene and warm as in the month of May."[95] Bartram would keep his weather journal for nearly twenty years. During the summer of 1802, the regulars at the garden were working separately. Barton's status as a professor at the University of Pennsylvania did not prohibit him from going out in the field and doing his own collecting. He traveled to Virginia from July through September where he traveled by foot, collecting and observing plants, natural springs, stones, and talking with doctors about diseases.[96] During that same year, Mease, recently elected to the American Philosophical Society, was continuing his service to the

95. The original diary was given by Ann B. Carr to Thomas Meehan. I looked at a microfilm copy in the American Philosophical Society.
96. Benjamin Smith Barton, 1802 Journal, I looked at the photocopy in the Library of Congress.

community. He established the Company for the Improvement of the Vine. Mease owned his own small vineyard and worked with his own plants. This short-lived organization was ultimately not very successful.[97] He also spent the year editing the first American edition of the *Domestic Encyclopedia*, originally published in London by A. F. M. Willich, MD. The illustrated encyclopedia includes entries on farm machinery, milling, grinding, farm animals, transportation, and architecture, among others. He edited the entries for what he considered to be of greatest utility to an American reader.

The Elements of Botany and systems of classification

In February of 1803, Benjamin Smith Barton published a text book, *Elements of Botany,* for use in his classes in Botany and Natural History at the University of Pennsylvania. Like the *Fragments of a Natural History* and the article on the *Jeffersonia*, Barton collaborated with Bartram to complete this project. In the preface, Barton thanks Bartram for his help, "The greater number of the plates, by which the work is illustrated have been engraved from the original drawings of Mr. William Bartram, of Kingsessing, in the vicinity of Philadelphia. While I thus publicly return my thanks to this ingenious naturalist, for his kind liberality in enriching my work, I sincerely rejoice to have an opportunity of declaring, how much of my happiness, in the study of natural history has been owing to my acquaintance with him..."[98] Acknowledgement of their friendship and professional partnership is preserved with the text.

Barton's text makes every effort to explain and describe with a neutral voice. The reading is at times, pretty dull going. Barton seems disturbed by the Linnaeus's reference

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97. Simon Baatz, *"Venerate the Plough": A History of the Philadelphia Society for Promoting Agriculture, 1785-1985* (Philadelphia: Philadelphia Society for Promoting Agriculture, 1985), 17.
98. Benjamin Smith Barton, *Elements of Botany* (Philadelphia: printed for the author, 1803), 1: xi.

to the calyx as the "conjugal bed" saying that this "poetical language seems ill adapted to the grave dignity of science."[99] Yet Barton is not always successful in keeping his own "poetical language" in check. His description of seed encasements is a striking example: "The final object or ultimate end of the Great Creator of the Universe, in forming buds, must now, be sufficiently obvious. They are the protecting domes, the cradles, of tender embryons, which, in due time, are to burst from their enclosures, expose themselves to the light of day, and spread eternal beauties over this earth."[100] Though Barton attempted to maintain a clinical tone, the beauty of nature was too much for him at times. The striking difference between the two styles, one cold and the other warm, makes me wonder if Bartram (whose "rhapsodical effusions" were already well known) was not more involved in the writing of the *Elements* than Barton gave him credit for.

The textbook has three sections: plant anatomy, plant functions, and a description of the Linnaean classification system. By the middle of the eighteenth century, European naturalists attempting to document the vast number of newly identified species required a workable system to organize them. Carl Linnaeus's sexual system, published in the *Systema Naturae* (1735), placed plants into categories based on the number, shape, and arrangement of pistils and stamen—the reproductive organs. The classes were based on the number of stamen (male parts); each class was then subdivided into orders (based on female organs), genera and species.[101] It was an artificial system, that is, one based on arbitrarily identified characteristics of the organisms being classified. Though arbitrary, a major advantage of the system was that it was fairly easy to learn. Inherent in the

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99. Benjamin Smith Barton, *Elements of Botany* (Philadelphia: printed for the author, 1803), 1: 124.
100. Benjamin Smith Barton, *Elements of Botany* (Philadelphia: printed for the author, 1803), 1: 101.
101. A very useful description of the system appears as an appendix, "Linnaean Classification, Nomenclature, and Method," by William Stearn to *The Compleat Naturalist; a life of Linnaeus* by Wilfred Blunt (New York: Viking Press, 1971), 248.

Linnaean naming system were the separate processes of identifying and classifying or as William Stearn explains, Linnaeus's "major contribution to science was to separate these designatory and diagnostic functions by using for a time two sets of names concurrently."

The need for an easily understood system did not lead to the universal acceptance of Linnaeus's system, however. Benjamin Smith Barton wrote, "I think, it is a matter of much more consequence to ascertain the place of our genus in some *natural system* of vegetables. I would not wish you to think, from this observation, that I undervalue the sexual method of Linnaeus. This is so far from being the case, that I am an implicit believer in the doctrine which asserts the existence of sexes in vegetables, and the necessity of an intercourse between them for the purpose of perpetuating the species. I, moreover, greatly admire the system of your countryman. In most respects, it is preferable to the method of Tournefort, or of any other botanist. But, still, I cannot help wishing that the day may arrive, and, if the physicians of Europe continue to cultivate botany as some of them have done, it will arrive, when the sexual arrangement shall give way to a more natural method, one in which the order, or assemblage, of nature will be pursued more rigorously than it has been by Linnaeus."[102] Barton gave only his qualified support for the Linnaean method.

Bartram wrote of the Linnaean system, "[n]ot withstanding the excellent system invented and established by Linnaeus; and the industry and labours of that celebrated naturalist in correcting and reforming Botany, there still remains much confusion and error, particularly in regard to the vegetables of America, arising from a disagreement betwixt European and American Botanists... I must observe, that in my opinion that

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102. Benjamin Smith Barton, "A Botanical description of the Podophyllum Diphyllum of Linnaeus, in a Letter to Charles Peter Thunberg, M.D. Knight of the order of Wasa, Professor of Medicine and botany in the University of Upsal, etc." *Transactions of the American Philosophical Society* 3 (1793): 339-340.

most valuable part of Linnaeus's botanical work, namely the Synomymal for the Spec. Plantarium is the cause of not a little confusion..."[103] The acceptance of the Linnaean system was neither universal nor unquestioned. While recognizing the merits, Bartram saw Linnaeus's system as the source of confusion.

That confusion came in part from the very nature of attempting to shape categories around the vastness and diversity of the flora of many continents. Identification of distinct species and classification share the process of determining the "essential characteristics" of a plant. The processes differ, though. The question of identification is: which parts of the organism most clearly distinguish it from other species? The question of classification is: which shared characteristics of organisms allow for logical grouping? Classification schemes demand a certain logic or what Ernst Mayr calls "top-down versus bottom-up methodology." Top-down classification schemes start with the largest categories first and eliminate options by dichotomies using yes/no questions. Bottom-up classification starts with a body of individuals and groups them by like characteristics. Like the processes of inductive and deductive reasoning, top-down and bottom-up methodologies start in different places. One is based on pre-conceived, weighted (by functional importance) ideas about life, the other is based on the data itself.

The Linnaean system is a "top-down" or deductive methodology. Linnaeus says in the *Philosophia Botanica*: "The 'character,' or the definition of the genus, is threefold: the factious, the essential, and the natural." Linnaeus goes on to explain that the "generic character is the same as the definition of the genus...The essential definition attributes to the genus to which it applies a characteristic which is very particularly restricted to it, and

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103. William Bartram to Henry Muhlenberg, Sept 8, 1792; Muhlenberg Correspondence, 21, Historical Society of Pennsylvania.

which is special. The essential definition distinguishes, by means of a unique idea, each genus from its neighbors in the same natural order."[104] The process of classification makes use of the same essential characteristics as the process of identification, but sorts the characteristics differently. (not unlike "lumping" and "splitting")

An example of determining the appropriate characteristics to base a system of classification on can be seen in the *Elements* when Barton argues that classification cannot be based on leaves. The leaves of the same species of plant vary considerably because of environmental factors (soil, climate and elevation).[105] The shapes and placement of the leaves of any individual species are too variable to constitute an essential characteristic of classification, Barton says. In this he disagrees with Linnaeus. Rather than looking at leaves, Barton argues, in "the study of plants, it is a matter of essential importance to attend to the structure of the bulb, or bulbous root. These bulbs frequently afford excellent marks for distinguishing one species of plant from another of the same genus."[106] Without looking at this part of the plant, making the distinction between one species and another is not valid. Plate II is dedicated to illustrating root systems of various plants. With several figures showing the same plant at different stages of development, the root and bulb's consistency in the life of each plant is reinforced. The accompanying drawings are not simply illustration, they help to argue Barton's points.

Intimately related to the belief in type specimens and the reality of species, the belief that a system of classification reflects some universal reality was in dispute.

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104. Linnaeus quoted in Ernst Mayr, *The Growth of Biological Thought: Diversity, Evolution, and Inheritance* (Cambridge, Massachusetts: Harvard University Press, 1982), 176.
105. Benjamin Smith Barton, *Elements of Botany* (Philadelphia: printed for the author, 1803), 1: 44.
106. Benjamin Smith Barton, *Elements of Botany* (Philadelphia: printed for the author, 1803), 1: 12.

Buffon says, "...since in nature only individuals exist, while genera, orders, and classes only exist in our imagination." [107] Barton, however, did believe in the reality of a classification system, writing that botanists are "in search of nature's scheme."[108] In the *Elements,* Barton describes and comments on fifteen alternative systems of classification that date back to the mid-sixteenth century. Each system places the weight of the classification on a different parts of the plant. For example, Boerhaave's Method makes the first division between herbs and trees, then where they grow, and finally the number of seeds and how they are enclosed. By providing the alternatives to Linnaeus's system, Barton is commenting on the utility of that system, while simultaneously emphasizing the need for some method of classification.

A system of classification was needed not only because there were an overwhelming number of species that needed to be documented, but also because taxonomy was necessary in understanding the laws of nature and nature's God. The patterns seen in flora and fauna were in fact evidence of a divine intelligence. Type specimens and classification systems provide us with insight into the scientific projects of the garden and the era. They also reveal how science and religion were intertwined more intimately than simply the definition of Natural Religion or the belief that all of nature is a reflection of God's intelligence would convey. How scientists conceived of the finite representations of nature and the acceptance of an infinite truth were inseparable. The true nature of nature was being discovered by examining one plant or one bird at a time.

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107. John Lyon and Phillip R. Sloan, eds. *From Natural History to the History of Nature: Readings from Buffon and His Critics* (Notre Dame: University of Notre Dame Press, 1981), 115
108. Benjamin Smith Barton, *Elements of Botany* (Philadelphia: printed for the author, 1803), 1: 46.

Chapter 3

Mutable Nature

Where'er I view this vast design,
On earth, air, ocean, field,or flood,
All, all proclaim the truth divine,
That God is bountiful and good.
Alexander Wilson, "A Rural Walk"

Fall is a beautiful time in the mid-Atlantic region. The days continue to be warm but the cool nights bring about the dramatic changes that made American trees desirable all over Europe. The garden was host to the dramatic Scarlet Maple with its bright red leaves and full round shape. Adding some novelty to the garden, Witch Hazel, which flowers in the fall with blossoms that look like they have been shredded and seem misplaced on land—looking much more like something from under the sea. The yellow-bellied woodpecker and the snow bird spent some time in Pennsylvania during these months. While the ducks and teals pass through on their annual migrations.

Winter was not completely silent in either plant or animal activity in the garden. Though the deciduous trees lose their leaves, the evergreens continue to provide color. Ground ivy, an evergreen, creeping shrub, grows along the ground under the trees that had provided it shade in the summer. The grey bark of the Silver Maple splits and peels vertically revealing reddish trunk underneath. The contrast of the silver on red gives the tree a visual appeal in the slumbering garden. Some birds over-winter in Pennsylvania, and perhaps the Carolina-Pigeon made an appearance in the garden as it moved through the area.

In January 1803 with the garden "white with hoarfrost," Nancy seems to have been working on something called the "Kalendar" for Benjamin Smith Barton. Her

uncle, William, in a letter to Barton writes, "[m]y niece Nancy requests the favour to keep the Kalendar one week longer in order to make some amendment she thinks it requires before its presentment and promises to send it by James next Sunday."[109] At the end of part one of the *Elements of Botany*, Barton notes: "I have, also, collected materials for a much more complete [Calendarium Florae], which it is my intention to publish, on some future occasion."[110] The Bartrams, specifically Ann, were helping Barton with another project. Barton's much more complete work does not seem to have been produced. Barton's many promises of work that never appeared assure me that it was not Ann who failed to complete the project. The projects of the garden were proceeding, though.

Alexander Wilson

The spring of 1803 brought a new friend and colleague to the garden. In March, Bartram received a letter from the new teacher at the Union School in Gray's Ferry, about a mile from the garden. Alexander Wilson shared an interest in birds with the Bartrams and seems already familiar with Ann's interests and talents: "This Bird I take to be the female Yellow Rump. I suppos'd it on first sight to be some other. If Miss Bartram thinks it worth drawing it is at her service." Though the earliest of the surviving letters, this one was clearly one of many. His appreciation of Bartram is growing quickly at this time. A clear morning in March with frost that warmed to a pleasant day and "great numbers of Ducks in Schuylkill from the south," Wilson wrote in the same letter to Bartram, "I have this moment rec'd yours, which like all the letters you have honoured

109. William Bartram to Benjamin Smith Barton, January 23, 1803, Barton letters series I, American Philosophical Society.
110. Benjamin Smith Barton, *Elements of Botany* (Philadelphia: printed for the author, 1803), 1: 302.

me with are to me as valuable as Bank Notes to a Miser."[111] Bartram and Wilson would exchange many letters over the next ten years—many of which indicate that Bartram, Wilson, and Nancy were teaching and learning about ornithology from each other.

Alexander Wilson was born in Paisley, Scotland on July 6, 1766. After an abbreviated education at a country grammar school, he worked as a weaver and a peddler. At the age of 28, he was imprisoned for what has been interpreted as political persecution; Wilson had written a poem that criticized manufacturers and defended the rights of laborers.[112] After this was resolved, Wilson left Scotland and arrived in the United States on July 14, 1794. He settled near Philadelphia where he taught school at Milestown.

Two portraits of Wilson, one textual and one visual, give us a sense of his appearance and character. Wilson is remembered as "very particular on the subject of the linen he wore, and the white cravat and ruffles were as important to him as a fine ladies' dress is to her. [H]is dress was that of other gentlemen of the period. Wilson was almost a pure type of the bilious temperament, which you are aware is one best fitted for constant exertion either mental or physical. He could bear great fatigue without flinching. His height was five feet and eleven inches. When preparing for one of his expeditions he was in the habit of taking a walk every morning, increasing the distance daily and when he could make twenty miles without much fatigue, he started on his journey."[113] Wilson was said to have been poised and well-spoken.[114]

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111. Alexander Wilson to William Bartram March 4, 1803, in *The Life and Letters of Alexander Wilson,* ed. Clark Hunter (Philadelphia: American Philosophical Society, 1983), 202.
112. The early life of Wilson is researched thoroughly in Robert Cantwell, *Alexander Wilson: Naturalist and Pioneer* (Philadelphia: Lippencott, 1961).
113. Franklin L. Burns, "Miss Lawson's recollections of ornithologists," *Auk* 34, no. 3 (July 1917): 278.

A painted portrait of Wilson, attributed to Thomas Sully, shows Wilson in his forties. Handsome and young, the painting gives no hint of the illness that would take Wilson's life when he was only 48. Sitting slightly profile, Wilson's head and shoulders only are visible against a background that is lighter around the face and grows darker around the shoulders. Wilson's thin features, dark hair, high forehead and sideburns are not as noticeable as his brown eyes. They are deep and expressive, attracting the viewers' attention immediately. (I was a little disappointed to see a number of Sully's other portraits whose subjects had those same deep eyes; an artist's technique rather than a distinguishing characteristic of the sitter?) As though to confirm the textual description, Wilson is shown wearing an elaborate tie and collar.[115]

Advising the younger generation

Wilson, Ann, and William worked in the garden that was coming to life with spring. By the river in the mornings and evenings, one would notice the sound of the male bull frog beginning in April. Sturgeon were seen in the Schuylkill jumping from the water. In May, glow worms could be seen in the grass in the evenings. That spring of 1803, from April through June, Meriwether Lewis was in Philadelphia preparing for famed "Corps of Discovery" expedition. Lewis was sent to Philadelphia by Thomas Jefferson to take advantage of the many scientific resources there. During the 1790s Thomas Jefferson had lived across the river from the Bartram's garden and continued to corresponded with both Barton and Bartram. When the time came to give the leader of

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114. Thomas Crichton, *Biographical Sketches of the late Alexander Wilson, Author of Poems and American Ornithology* (Paisley [Scotland]: J. Neilson, 1819) refered to in Robert Cantwell, *Alexander Wilson: Naturalist and Pioneer* (Philadelphia: Lippencott, 1961).
115. Portrait owned by American Philosophical Society, Philadelphia, Pennsylvania.

his team of explorers a crash course in Natural History, Jefferson arranged for Lewis to study surveying with Andrew Ellicott, medicine with Benjamin Rush and Natural History with Benjamin Smith Barton. Barton introduced Lewis to methods of identification and preservation; Lewis would carry Barton's *Elements of Botany* with him on the expedition. The textbook that had partially resulted from Barton's work at the garden would travel to the Pacific.

In June, William Bartram and James Mease collaborated on an article called, "Account of the Species, Hybrids, and other Varieties of the Vine of North America" published in *The Medical Repository*. Mease had requested that Bartram contribute to his work with the "Company for the Improvement of the Vine." He has published the article earlier than he had originally planned, he writes in the introduction, because he wants to "give an opportunity of comparing the living vines with the botanical description during the present season, and to diffuse the knowledge of the erroneous and perplexing arrangement of Linnaeus and Walter on this subject." [116] The classification of different species and varieties of grape was the subject of some disagreement.

The effort of the article is to determine what is a species and what is a hybrid. A hybrid is the offspring of heterogeneous parents. Not exclusive to the vegetable kingdom, these new creations had occupied Bartram for some time. Earlier Bartram had written to Barton acknowledging receipt of a preserved black squirrel. He had noticed that it is a different color than he has ever seen before, and hypothesized that squirrels mate and produce blends of colors; "I believe they intermarry and produce varieties as

116. James Mease, "Account of the Species, Hybrids, and other Varieties of the Vine of North America," *The Medical Repository*, (1803): 19-24.

mankind do."[117] Hybrids were common knowledge among horticulturalists and agriculturalists, but for the pressing questions of a botanist, hybrids raised serious questions. The formation of a hybrid, either natural or man-made complicate the identification and classification processes. If one believes that type specimens reflect a higher reality, then what is one to make of a hybrid? Often, the offspring display characteristics unique enough for it to be considered a new species, but does that mean that the higher reality one sees in nature can be altered? The possibility of malleable species was troubling not so much in themselves but for their implications. Bartram's observations of grapes contributed to a more serious conversation about the permanence of species.

Bartram continued to keep his weather journal. On August 23 1803, Bartram made a remarkable entry in his journal: he has seen the Aurora borealis. Extremely rare on the east coast of the United States as far south as Philadelphia it must have been an awesome sight. That same fall, William started to make note of numeric temperatures in his weather diary rather than a qualitative description: rather than "cool and pleasant" a temperature is noted in a number of entries. The addition of a thermometer to the garden adds the element of quantification to the observations made at the garden.

The following spring, Barton received word from the garden to send James home, for a member of the family had died. John, James's brother, had died around 11 o'clock on March 6 from some cause related to alcohol. He was not quite 23 years old. Bartram asks Barton to keep an eye on his beloved nephew when he is gone.[118] How could he

117. William Bartram to Benjamin Smith Barton, January 11, 1793, William Bartram letter series I, American Philosophical Society.
118. William Bartram to Benjamin Smith Barton , March 7, 1804, William Bartram letter series I, American Philosophical Society.

know that he would outlive both of the younger men? Bartram's relationship with his nephews was paternal and caring. James left Philadelphia later that same year to serving as a ship's surgeon on a voyage that would take him to the Cape of Good Hope and Batavia

On a hazy, cloudy day at the garden in September, Bartram penned a letter to his nephew James. Bartram seems particularly worried about James drinking. Perhaps because James's father, John, Jr. was known to have been a bit of a drinker or even more fresh in his mind, the recent loss of James's brother John to "ardent spirits." It is interesting to note that the letter was written while John, Jr., James's father, was still alive. Offering the guidance of a father, Bartram reminds his nephew to observe religious tolerance, respect for authority, and "[b]e charitable, and always be foremost to administer relief to the poor and distressed."[119] He tells him to "guard the honour of women." I believe he is warning his nephew not to take advantage of prostitutes, when he says "never join in the low witty remarks of the ill bred coxcomb to turn into ridicule of the sex some natural foibles..." He notes that the women were more than likely no longer in their "happy state of inosence" because of some "unprincipled rake." Bartram despises the taking advantage of the weak. He repeats this concern in other works, especially in descriptions of how people abuse animals. Bartram's affection for his nephew and their bond is clear. The advice he gives the younger makes not only his feelings obvious, but also his impressions of the weaknesses of human nature.

While Bartram was writing to James, Wilson was away from Philadelphia. He, his nephew, Duncan, and a young man from Kingsessing named Isaac Leech walked

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119. William Bartram to Dr. James Bartram, September 23, 1804, Reprinted as an appendix in N. Bryllion Fagin, *William Bartram: Interpreter of the American Landscape.* (Baltimore: Johns Hopkins University Press, 1933), 201.

from Philadelphia to Niagara Falls. The 1,200 mile journey would provide the subject for Wilson's poem "the Foresters." Wilson was also planning a number of other projects. Earlier that year, after working with the Bartrams to improve his drawing skills and identification techniques, Wilson had started conversations with the engraver, Alexander Lawson, about the prospect of doing a bird book. These were the first steps he would take toward his major contribution to the Natural History of the United States. He was exploring his options for compiling and illustrating an ornithology of American birds.

The following year, 1805, started with a publication from an unexpected source. William Hamilton, of the Woodlands, published in the *The Philadelphia Medical Museum* an account of the Agave Americana that had flowered in his collection during the summer of 1804. In the account, Hamilton documents the growth of the agave over a two month period and notes that the plant remained in flower for forty days. Hamilton had shared his greenhouse with the Bartrams, but how well he took care of the plants is up for debate. He defensively asked his secretary to get in touch with the Bartrams after their plants have been returned to them. He told his secretary that Bartram "should be reminded that [the plants] were sent too late to me, being absolutely dead when they came to ye Woodlands." Sending back dead plants didn't stop Hamilton from expecting something in return though, "remind him of his promise to give a few of his East & West India seedlings."[120]

It is unexpected that Hamilton would publish in a scientific journal because he was not a scientist, or even an amateur naturalist. He was a plant collector participating

120. William Hamilton to his private secretary, June 1790, reprinted in *Pennsylvania Magazine of History and Biography* 29 (1905): 159. William Hamilton seems to have seen Bartram as one of the people provided for his service. He sent Bartram a note asking if he (Bartram) could remember the name of the person he (Hamilton) had met a few days before. Bartram Family Papers, 4.44, Historical Society of Pennsylvania.

in what has been called curious culture. Curious culture "involved wonder and admiration at whatever was rare or outstanding, whether in size, shape, skill of workmanship, or in any other respect. Such rarities formed the curiosities whose unusual and outstanding qualities curiosi admired and wondered at."[121] For Hamilton, Bartram's garden was a resource for the rarities that would reflect well on him. Remember Bartram's grapes? Hamilton learned of them and is anxious to see the "white grape which you called Blands grape." His interest isn't scientific, though. He wants to impress his guests--"if it is ripe and you can spare them, you will oblige me by sending as many as will fill a plate and if the fruit good, it would serve as an interesting part of our dessert at dinner today for Mr. And Mrs. Merry whom I expect will be here. (Mr. and Mrs. Merry were the British Ambassador and his wife.)[122] Contributing to the scientific projects of the time was not all the garden was good for.

In the Spring of 1805, Ann and William collaborated on a short piece that appeared in the *Philadelphia Medical and Physical Journal,* Benjamin Smith Barton's journal begun a year earlier. Short-lived—published for only four years—it provided the medical and scientific community in Philadelphia with observations, accounts, and theories of many topics. "Description of an American Species of Certhia, or Creeper" included a textual description by Bartram and an illustration by Ann. Ann had continued to study William; Wilson refers to her as William's "amiable pupil." Wilson's letters indicate his own support for her undertakings; he had sent her drawing paper and wrote, "Nobody, I am sure, rejoices more in her acquisition of the beautiful accomplishments of

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121. Katie Whitaker, "The culture of curiosity," in *Cultures of Natural History,* eds N. Jardine, F. A. Secord, E.C. Spary (New York: Cambridge University Press, 1996). For a discussion of English attitudes about flowers and trees see chapter five of Keith Vivian Thomas, *Man and the natural world : a history of the modern sensibility.* (New York : Pantheon Books, 1983).
122. William Hamilton to William Bartram, Bartram Family Papers, 4, Historical Society of Pennsylvania.

drawing than myself. I hope she will persevere."[123] In her illustration of the Creeper, a tree sitting on a ground cluttered with growth is rooted in the lower left corner, curves slightly to the right, before it curves back to the left and out of the picture. The bird sits on the trunk of the tree farthest to the right. The composition of the drawing is very elegant. The curve of the branch over the head of the bird echoes the curve of the bird's head and its relatively long, curved beak. This echoing is repeated in the truck of the tree and the curve of the bird's back. The composition is weighted to the left, leaving nearly the entire right side of the drawing blank giving the bird room to escape if danger comes. The written description says that the length of the bird is five inches, so the scale of the drawing is deceptive. Relative to the tree, which looks old and established, the bird looks quite large. The tail of the bird tucks under it showing how the animal would use its tail to balance while climbing. Ann's drawing, with its distorted scale and positioning of the bird indicates the belief that habits, like this bird's climbing, are important in identifying a species.

123. Alexander Wilson to William Bartram, March 31, 1804, in *The Life and Letters of Alexander Wilson,* ed. Clark Hunter (Philadelphia: American Philosophical Society, 1983), 211.

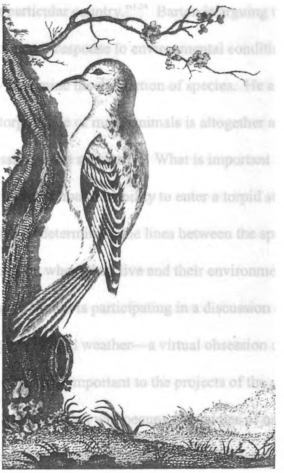

Figure 5. Ann Bartram's illustration to "Description of an American Species of Certhia, or Creeper."

Barton had talked about animal behavior in his *Fragments of a Natural History of Pennsylvania*. There he discusses the variability of behaviors, important because behavior is a crucial element in identification. The relationship between identification and behavior was a serious question. If a particular species behaves differently under different circumstances, is that enough to classify the animal as a distinct species? About migration—a behavior very important to bird's survival—Barton says, "the migration of birds is not 'determinate instinct' but an act of volition, or will. Hence, the seasons and other circumstances will greatly regulate the arrival of birds in, and their flight or

removal from, a particular country."[124] Barton is arguing that because the migration patterns are a voluntary response to environmental conditions, this is not a legitimate characteristic to determine the distinction of species. He also points out that "[w]e are certain that the torpid state of many animals is altogether an accidental circumstance; that is, it is not necessary to the species"[125] What is important is not that the individual animal could survive without the ability to enter a torpid state, but that this behavior should not be used in determining the lines between the species. Some of the same species, depending on where they live and their environments, differ in their hibernation habits, Barton says. Barton is participating in a discussion of whether certain birds hibernate or migrate in cold weather—a virtual obsession during the period.[126]

Though obviously important to the projects of the garden, these observations foreshadow the questions that will occupy the studies of naturalists for much of the latter parts of the nineteenth century. Barton is here making note of environmental effects on animal behavior or what modern biologists refer to as "proximate causes" of changes in behavior. This is an important stepping stone to the recognition that changes in behavior might lead to what is called "evolutionary causes" for the change in the genetic programs over long periods of time. Without this first recognition of the relationship between environment and behavior, the concept of natural selection would not be possible.

By early November the garden had fallen quiet, the night insects had stopped their noises, and the deciduous trees had lost their leaves. One might see a falcon as it passed

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124. Benjamin Smith Barton, "Fragments of a Natural History of Pennsylvania" in *Selected Works by Eighteenth-Century Naturalists and Travellers*. ed. Seir B. Sterling (New York: Arno Press, 1974), 9. (pagination of original document)
125. Benjamin Smith Barton, "Fragments of a Natural History of Pennsylvania" in *Selected Works by Eighteenth-Century Naturalists and Travellers*. ed. Seir B. Sterling (New York: Arno Press, 1974), 13. (pagination of original document)
126. see Andrew Lewis's dissertation "The Curious and the Learned: natural history in the Early American Republic" (Yale, 2001).

through Pennsylvania on its migration from north to south. By late 1805, James has returned to Philadelphia from his journey. Ann and William continue to work together, but William's health seems to have been poor. He has excused himself from at least one social function for the reasons of poor health. Either feeling poorly, or not wanting to participate in the function for some other reason, we know that Ann was there with him. In December, Barton must also have been bothered by illness, since on a cold and clear day with a wind from the northwest, Barton predicted his own early death.

This prediction was made in the dedication of the *Philadelphia Medical and Physical Journal* to "the Students of Medicine in the University of Pennsylvania." In his dedication he puts into words the transitional state Natural History was finding itself, "[b]y enlarging the stock of useful facts; by walking in the rose-spread paths of Truth, with Nature as your guide, you will prepare the way for those more permanent systems, which Providence has given man the ability to found: systems not liable to be affected by a few slender facts; not liable to be dissolved by the discovery of a new species of animal, of vegetable, or of mineral." "Rose-spread paths of truth" aside for the moment, it is interesting to note that Barton is sensitive both to the need for systems of classification and the fragility of them. He senses the instability of the paradigms in which scientific observations have been organized, but has faith. He makes here an argument that the perfection of nature, "the rose-spread paths of Truth," can handle the incorporation of all new knowledge and discoveries. While it may seem on the surface that the greater truths are being called into question, he has faith that nature and nature's God are secure.[127]

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127. Benjamin Smith Barton, "To the Students of Medicine in the University of Pennsylvania." *The Philadelphia Medical and Physical Journal. Collected and Arranged by Benjamin Smith Barton* 2 (1806): iii. APS Online.

On April 1, 1806, a day that saw "a slight shower of rain early this morning," Alexander Wilson resigned as the teacher at Union School in Gray's Ferry. He took a position with Bradford and Inskeep editing *Rees's Cyclopedia* and worked closely with the printer, Robert Carr. This publication would provide Wilson with skills, connections, and resources to begin working on the *American Ornithology* full time.[128] Carr and Alexander Lawson were also working on James Mease's *Geological Account of the United States* that would be published early in 1807. This encyclopedic project included a handful of engravings by Lawson (one of a buffalo hunt in which the buffalo look much more like African water buffalo than American bison.) Mease acknowledges Barton and Bartram, the "human resources" of the garden, as sources of information. This team of naturalists, engraver, and printer worked well together publishing some of the most important works of the period.

Barton's fossils

In March 1806, Barton published the first of two installments of a letter on "Facts, Observations, and Conjectures, relative to the Elephantine Bones (of different species), that are found in various parts of North-America." Barton's letter was addressed to "Mr. G. Cuvier." George Cuvier, a French scholar working at the National Museum of Natural History in Paris, had published on the fossils of jaw bones of Mammoth and the living Indian elephant in 1798. By sending his findings to Europe, Barton was participating in one of the most controversial scientific arguments of the period. Cuvier, Lamarck, and Buffon were only a handful of the significant minds attempting to make sense of whether

128. The success of the *Rees Cyclopedia* was in part due to its fine quality; one review said, "*Rees cyclopedia* is well-printed by Mr. Carr, good quality paper, illustration of good quality, well edited, informative." *Port-Folio* 4, no. 18 (October 31, 1807): 280.

species of animals that once existed could disappear altogether and why. Fossils and bones of non-living species had been discovered all over the world. The most famous set of bones found to date in North America had been excavated on a farm in the Hudson River Valley by Charles Willson Peale in 1801. The nearly complete specimen had been put on display in Philadelphia in December of 1801.[129]

Barton starts the 1806 section of his letter with a discussion of a set of remains found in Wythe, Virginia, including a description of the conditions in which the bones and remains were found. These are important because those conditions have allowed for the preservation of some soft tissues. The primary discovery of this particular animal is the stomach and its contents. Barton asserts that this species was herbivorous; apparently this had been one of those persistent issues that had been dividing the scientific community for some time. Since behaviors, including diet, are essential to determining distinct species, the findings of the stomach contents is significant. If the bones and remains are from a distinct species, then it can be confirmed that that species is different than similar ones now living. This, Barton says, is not the same species as ones that are now living.

He then goes on to clarify his own belief about extinction: "[w]e shall never, perhaps, be certain at what period the *species* of the Mammoth ceased to exist in America. We may, however, I think, confidently assert, that several centuries have elapsed since this vast animal was a common inhabitant of the forests or marshes of this

129. See "Exhuming the Mastodon" by Charles Willson Peale for Peale's visual representation of the expedition.

continent."[130] Though the particulars shifted over time, the debate about extinction and malleability of species had been and would be raging for years. Barton would say in another publication, "I speak of animals as *extinct*. In doing this, I adopt the language of the first naturalist of the age. No naturalist, no philosopher; no one tolerably acquainted with the history of nature's works and operations, will subscribe to the puerile opinion, that Nature does not permit any of her species of animals, or of vegetables to perish."[131] Only a person who is really not paying attention would think species do not become extinct, Barton is saying.

Why send this letter to Cuvier? Cuvier had been focusing his work on establishing the difference between extinct and living species, so he had a proven interest in the topic. Barton also wanted to send one of the molars found in North America to help in Cuvier's projects. Barton agreed with Cuvier about extinction in general but disagreed on some of Cuvier's specific assertions. Cuvier hypothesized that "revolutions," often taking the form of floods and wiping out any number of species, had occurred in the long history of the earth. Barton, in his letter, suggests data that undermines the hypothesis of "revolutions." The bones and tusks (defenses Barton calls them) were found in the earth in a vertical position, as though the animal were standing when it was buried; "Thus, allowing the fact to be correctly stated, no one will imagine, that the skeletons, to which these bones belonged were conveyed to the morass in which they are found by a deluge,

130. Benjamin Smith Barton, "Additional Facts and Observations, relative to the Extinct Species of American Elephants. In a letter from the Editor to Mons. Cuvier, of Paris," The Philadelphia Medical and Physical Journal. Collected and Arranged by Benjamin Smith Barton 1 March 1806): 28.
131. Benjamin Smith Barton, "A discourse on some of the Principal Desiderata in Natural History and the best means of promoting the study of Science in the United States" Read before the Linnaean Society, 10 June 1807 (Philadelphia: Denham and Town, 1807), 20.

or by any other violent convulsion of nature."[132] These bones weren't swept to their final resting place and buried by a flood—the animal walked to that place and sunk into the swamp.

The question remains: where do the species go? If they are not destroyed in a flood or other catastrophe, why don't they exist anymore? One suggestion was that species changed over time. The mechanism for change like this had been seen over short periods in the development of hybrids. Cuvier did not believe that organisms evolved over time, however. He believed species were immutable. Each species is precisely made of interdependent parts, said Cuvier, any change would have the result of disrupting the organism. Based on this conception, Cuvier developed a system for classifying species based on four categories or types. Within each category the species were alike enough in their anatomy that they could be seen as related. There was, according to Cuvier, no evidence any species from different categories could have a common ancestor.

Another significant figure in the debates of the period was Jean-Baptiste Lamarck who had recently (1802) published the beginnings of that would become the *Philosophie zoologique* (1809) in which he laid out his theory of organic development. Lamarck did believe that species were mutable. He posited that change occurred as a "nervous fluid" worked within the body of an organism. In the most oft used parts of a body, the fluid carved paths and ultimately generated new structures. Over generations, new, more complex forms developed by the power of the nervous fluid. Lamarck's system for variation of species partly related to organisms responding to their environments, but differed from the notion of natural selection in that common descent was not a part.

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132. Benjamin Smith Barton, "Additional Facts and Observations, relative to the Extinct Species of American Elephants. In a letter from the Editor to Mons. Cuvier, of Paris," The Philadelphia Medical and Physical Journal. Collected and Arranged by Benjamin Smith Barton 1 March 1806): 172-73.

Lamarck argued that simple organisms are spontaneously formed. Over time, and with the power of the nervous fluid, species become more complex, therefore, the more complex a species, the longer it has existed. Each group of species originates with a different instance of spontaneous generation.[133] These differing conceptions of the origins of species and their relationships to one another were occupying the minds of many of Europe's scientists.

Barton was also struggling to make sense of malleable species and extinction and his belief in type specimens. In 1799, Barton had published in the *American Philosophical Society Transactions*, "Some Account of an American Species of Dipus, or Jerboa." In it Barton had asserted that "the number of mammalia that are common to the old and the new world is much smaller than naturalists have supposed, and that America possesses many species of these and other animals, as well as of vegetables, which ever have been peculiar to herself. Everything, in my opinion, favors the idea, that with respect to many of the living existences, there has been a separate creation in the old and in the new world."[134] With the acceptance of separate creations as an explanation for the differences between species, Barton allows for a continued belief in the reality of species. Species that started out different could not be expected to be anything but different. For Barton, it was possible to reconcile the problem of similar, yet distinct species with his faith in the permanence of nature and nature's God.

The theory of separate creations also directly responds to the theories of Georges-Louis Leclerc, comte de Buffon who was Lamarck's teacher. According to Buffon, all

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133. Peter J. Bowler, *Evolution: The History of an Idea* (Los Angeles: University of California Press, 1983), pages 83-88.
134. Benjamin Smith Barton, "Some account of an American Species of Dipus, or Jerboa," *American Philosophical Society Transactions* 4 (1799): 118.

matter is made up of parts that are identical. Each individual is created through a process like nutrition and growth. The mixture of seminal liquids sparks the growth of a new individual, which is created by each of the parts of the body molding the organic matter, let's call it clay, into the shape the body needs to complete itself. So the clay is added until each part is made and grows to be full sized. Buffon argues that "so long as there subsists individuals the species will ever be new; they are the same at present as they were three thousand years ago, and will perpetually exist, by the powers they are endowed with, unless annihilated by the will of the Almighty Creator."[135] His point is that as long as there is a species, then there will continue to be that species and that off-spring are always identical to their parents. As individual organisms responded to new environments, say from traveling to new places, they "degenerated" into the variations that were mistaken for distinct species. If an individual is taken out of the environment, it will revert to the original type.[136] So, according to Buffon, organisms are in fact constant, though their environments may temporarily alter their immediate appearance.

What was particularly disturbing to American naturalists was Buffon's assertion that degeneration had occurred at a faster rate on North America. Animals in Europe were less degenerated than those found in the new world. This, of course, rubbed American naturalists the wrong way. Barton would say in a lecture on natural knowledge, "Of all the countries of the earth there is none, perhaps, which exhibits scenes of greater magnitude, sublimity, and grandeur than America."[137] Buffon's

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135. John Lyon and Phillip R. Sloan, eds., *From Natural History to the History of Nature: Readings from Buffon and His Critics* (Notre Dame: University of Notre Dame Press, 1981).
136. Peter J.Bowler, *Evolution: The History of an Idea* (Los Angeles: University of California Press, 1983).
137. Benjamin Smith Barton, Lecture, Benjamin Smith Barton II Misc. Papers, American Philosophical Society

theories were both offensive and incorrect according to Barton. The interdependent questions of malleability and extinction that took up so much of the attention of naturalists during this period would lack a nearly universally accepted theory to explain them for another generation.

Why did it matter that certain species might or might not become extinct or whether species were malleable? Inherent in the projects of the garden, to identify and classify was the search for the laws of nature. The conception of knowledge that underlay the projects, the belief that what is observed reflects a higher truth, suggested that species remain constant. The truth, or the laws, of nature that species reflect remains constant, so to disrupt the equation of observation to reality would be extraordinarily problematic. Those laws reflected the unchanging immutable order of nature and the God that nature reflected, according to the eighteenth century paradigms.

The danger of rejecting the fundamental acceptance of a static universe had already been seen with the arguments of the skeptics. The debate between the Scottish Enlightenment and the Skeptics was: can one make the leap from the data presented to the senses—the shape of the leaves—and the existence of an unseeable truth—particular species? The skeptics questioned this connection and argued that it was not possible to make that leap. We can no longer be sure that what we see represents some kind of higher reality. David Hume argued that if there are no inherent ideas then we have no tool for determining the reality of our experiences. Without the inherent ability to judge truth, all knowledge remains in a state of uncertainty (hence the name, skeptic). For skeptics the connection between experience and Truth is broken.

The search for the essential was a search for the infinite. If we can be sure of nothing then we can not be sure of the existence of God. The rejection of fixed species led down a similar path. Without fixed species it became much harder to accept a fixed, unchanging truth that reflected the nature of God. The challenge for this period of transition and the scientists working within it was to reconcile a belief in God with the evidence that animals became extinct. Without a belief in some higher truths then a person is left with no certainty, no moral compass. The intellectual process of throwing away the construct of species led to a very dangerous, amoral place. Believing in type specimens was a rejection of skepticism—it was a belief in Truth.

The processes of evolution and extinction, though recognized, had to be reconciled with the faith in these constants. There is evidence that Barton believed in a teleological nature—nature that has been and is created toward an ultimate purpose. He writes in another work "But who will seriously believe, that Nature has exerted so much care and skill in the construction of the beautiful petals of flowers, merely to form a palace for insects, whilst they are aiding in a work, which, in innumerable instances, is fully accomplished without the least of insectile aid?"[138] His argument in this case, about the petals of flowers, depends on the assumption that the petals have been designed for a particular purpose. The source for a purpose in Nature is God. By holding a teleological view of nature, the scientist is able to reconcile extinction with the laws of nature. Extinction occurs because it is the intention of a plan. The teleological view of nature, so crucial to the eighteenth century conception of nature, did not survive into the nineteenth century. To believe in both divine purpose and extinction is to hold the middle ground between eighteenth and nineteenth century sciences.

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138. Benjamin Smith Barton, *Elements of Botany* (Philadelphia: printed for the author, 1803), 1: 139-140.

Barton published his part in this debate in two parts stretching over 1806 and 1807. The others at the garden continued their own work. James Mease traveled to Georgia and published a short piece on the alligator Mease's trip retraced some of the steps that Bartram had taken in the 1770s. In his article, he describes what the alligators eat and their interactions with the human populations of the area. Mease injured and captured a large alligator and describes the battle he fought to keep the animal in captivity. The alligator "twisted of the handle [of a boat hook] in an instant, though more than one inch and a half in diameter."[139] Without specifically mentioning Bartram's name, the testimony in the article goes a long way to adding credit to the seemingly hyperbolic descriptions found in *the Travels*. Bartram's reviewer's criticism of "rhapsodical effusions" rings with less authority. This article was one of a number by Mease who over the years would work to preserve the garden and the reputations of its inhabitants. This year also saw an important addition to Mease's family: his son, Butler Mease was born. The young man would later change his name to Pierce Butler as a condition of his inheriting significant wealth and property from his maternal grandfather. Butler would go on to marry Fanny Kemble, and become infamous in the anti-slavery movement. But that is years to come and another story.

The garden was struggling because of the Napoleonic Wars Embargo. Ann would say in later years that the garden business was not quite the same after this extended interruption in the trade with Europe. In addition, competition among Philadelphia plant and seed growers was intensifying. With the limiting of the international market because of the embargo, the increased number of nurseries in the Philadelphia area, for example,

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139. James Mease, "Observations of the American Alligator" *The Philadelphia Medical Museum, Conducted by John Redman Coxe, M.D.* 3, no. 3 (1807): 146.

David Landreth and his very successful and well-known seed business, put pressure on the Bartram family's business.[140] In 1807, the Bartrams issued a thirty-three page catalogue of plants in garden. In it, the Bartrams made available for sale species that "have been lately discovered" that were not yet established within the scientific community (i.e. did not have accepted names). William and his brother hoped that by releasing these plants to the public, along with descriptions, the scientific community could work together to establish names; the catalogue is a scientific project as well as a commercial one. The dual nature of the garden, that of a "botanical academy" and a working business, is obvious at this point.

Ironically, in the early months of 1807, Thomas Jefferson was making arrangements with Bernard M'Mahon, the Philadelphia horticulturalist and nurseryman, and with William Hamilton to grow plants from seeds gathered by Meriwether Lewis on the Corps of Discovery expedition. M'Mahon's *American Gardener's Calendar* had been published in1806, and would prove popular enough to support eleven editions. Jefferson wrote directly to William Hamilton asking him to look after the plants at the Woodlands, "it is with great pleasure that, at the request of Governor Lewis, I send you the seeds now enclosed, being a part of the Botanical fruits of his journey across the continent."[141] In April, 1807, Lewis himself returned to Philadelphia to work with the community of scientists to document the scientific discoveries from the expedition. The live plants along with the preserved specimens were returned to the very place where Lewis learned his collecting techniques.

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140. Pennsylvania Horticultural Society, *From Seed to Flower, Philadelphia 1681-1876, A Horticultural Point of View* (Philadelphia: The Pennsylvania Horticultural Society, 1976), 69.
141. Thomas Jefferson to William Hamilton, quoted in Rodney H. True. "Some Neglected Botanical Results of the Lewis and Clark Expedition" *Proceedings of the American Philosophical Society* 67, 1 (1928): 8.

The summer of 1807 was a busy one for Barton. He was getting established as a home owner and head of the family.[142] Throughout the summer Barton had visited and made observations at the garden. He employed Frederick Pursh, who had been the gardener at the Woodlands to do some collecting for him. Pursh, who had started working at the Woodlands in 1803, was familiar to the community at the garden. Barton employed Pursh to travel west of Philadelphia then on to the south through Maryland, Virginia and North Carolina. Pursh's journal from this collecting trip became the property of Barton. After his return, Pursh worked with Barton and Lewis over the summer on compiling the records of Lewis's expedition. Their work together seems to have soured however. It is unclear the nature of the arrangements made between Lewis, Barton and Pursh. But it is known that Lewis was looking for assistance in identifying the plants that were collected on the expedition and that although Barton was the leading scholar and employer of Pursh, it was Pursh, not Barton, who ended up in possession of Lewis's specimens.

142. Barton purchased Venetian blinds for his front parlor windows in July. *Pennsylvania Magazine of History and Biography* 27 (1903): 54.

Figure 6. The garden in summer. (photo by author)

While in Philadelphia, Lewis also worked with Wilson and Alexander Lawson to create illustrations of some of the sixty-six birds that the corps had discovered in the west.[143] Lewis, in their time together, made an impression on Wilson and would lead him in 1810 to play an unexpected part in the history of the expedition. Meanwhile, Wilson was hard at work on his own major project. He sent to Bartram a proof sheet from the *American Ornithology*, apparently Bartram's confirmation was necessary before plates could be made. On a cloudy day in May, Wilson asked for Ann's help preparing the plates. He also suggested that "Mary" might help. Mary Leech, a fifteen year old former student at the Union School lived with her family on land rented from John, Jr. The Leech family had lived on the Bartram land since1796 and would stay until at least 1810.[144] Wilson was friends with the family, it was Mary's brother, Isaac, who had

143. Arthur F.W. Hughes, *The American Biologist Through Four Centuries* (Springfield, Ill: Charles C. Thomas, 1982).
144. William Brooke Fetters, *Six Columbiana County, Ohio Pioneer Families, Family William Fetters and Mary B. Leech Ancestors and Descendents. Maximillian Leech of Blockly and Kingsessing, a supplement.*

traveled with Wilson on his trip to Niagara Falls. One can imagine, Ann, nearly old enough to be Mary's mother, and Mary working to paint the plates of the first ornithology of the United States with the confidence of their friend.

Biogeography

On June 10, a cool, pleasant day in Philadelphia, Barton addressed the Philadelphia Linnean (sic) Society. Barton who had been working to get the organization established had been elected the first president and presented the first anniversary oration called "*A Discourse on some of the Principal Desiderata in Natural History, and on the best Means of promoting the Study of this Science, in the United-States.*" (The oration was published with a preface dated August 12 1807.) More specific than his dedication to his students from a few years earlier, Barton lays out the future of the study of natural history as he sees it. Barton starts with the call for a system of classification that will bring it "regularity and beauty" to Natural History.

One of the projects that Barton sees as most significant for the advance of science is a "geographical view of vegetables." By this he means "an arrangement of vegetables according to the extent of country which they occupy from north to south, and from east to west; as well as according to their altitude above the level of the sea."[145] Alexander von Humboldt had published his *Essai sur la geographie des plantes* on plant distribution in 1807 (which Barton owned) based in part on his journey to the Americas in 1804. Humboldt had visited Philadelphia in that year; Charles Willson Peale had painted his portrait for his collection in the Natural History Museum. The community around the

145. Benjamin Smith Barton, "A discourse on some of the Principal Desiderata in Natural History and the best means of promoting the study of Science in the United States" Read before the Linnaean Society, 10 June 1807 (Philadelphia: Denham and Town, 1807), 42.

garden was well aware of Humboldt's visit and his work. Wilson had sent to Bartram an account of the visit.[146] Humboldt argued that the process of mapping species and understanding their relationships to each other was a far more significant project than simply identifying and classifying. He said the goal of the biogeography was to "investigate the confluence and interweaving of all physical forces."[147] Humboldt argued that through this gathering, documenting and synthesizing of data, the forces, the conflicts and the balance of nature could be better understood.

Barton had been working on explicit biogeography projects for some time. In his 1792 article "An Inquiry into the Question, whether the Apis Mellifica, or True Hone Bee, is a native of America" Barton compiled accounts and linguistic evidence that argues that the honey bee is not native. Here, he uses history to make an assertion about species distribution.[148] In his discussion of the elephantine bones, Barton points out that the distribution of this species was wide and asserts that Asia is the origin of many of the species in North America. The project of biogeography was tied to the effort to trace origins and whether living species are descendents or not. Barton, along with the broader scientific community, struggled to figure out which current species is most like an extinct one.

Barton, in his presentation before the Linnaean Society, offers an example of the process and implications of the study of biogeography: "Thus, from a mere attention to the vegetables of the north-eastern parts of Asia and north-western parts of America, we

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146. Alexander Wilson to William Bartram, August 16, 1804, in *The Life and Letters of Alexander Wilson,* ed. Clark Hunter (Philadelphia: American Philosophical Society, 1983), 219.
147. Alexander von Humboldt quoted in Michael Dettelbach, "Humboldtian science" in N. Jardine, F. A. Secord, E.C. Spary, eds. *Cultures of Natural History* (New York: Cambridge University Press, 1996), 290.
148. Interestingly, Barton points out that in several Native languages there are no words for honey or wax. From this he concludes that wax-making honey bees were unknown to the native peoples. If they were unknown he goes on to argue, they must not have been there, not much gets past those folks.

should conclude, that these two continents had once been united to each other: for many of the vegetables of these regions of the old and new world are *specifically* the same...".[149] The debates over malleability of species and extinction gain much from the geographic data. Barton had argued that species that differ differ because they have origins in separate creations. The species that are similar are, in fact, the same and have the same origin. There is no contradiction in imagining that animals and plants moved from one location to another.

The project of a biogeography was part of the effort to understand the "changeableness" of the universe along with malleability of species and extinction. But, the project of biogeography complicates the concepts of the type specimen. While the process of identifying the type specimen removed the subject from nature and viewed the specimen out of its context, biogeography put the plants and animals back into their native spaces, required that a specimen be viewed within its context. The techniques and strategies of eighteenth century projects were colliding with the demands of nineteenth century projects. The process of viewing organisms in their context was essential to finding solutions to the questions of malleability of species and extinction (nineteenth century projects), but undermined the technique of collecting type specimens (eighteenth century projects).

Throughout the fall of 1807, Wilson applied himself to his project. He went to New York and Albany, collecting data and looking for subscribers. In October the *American Ornithology* got one of its most prestigious subscribers: Thomas Jefferson. Jefferson wrote that he was "satisfied it will give us valuable new matter as well as

149. Emphasis is Barton's. Benjamin Smith Barton, "A discourse on some of the Principal Desiderata in Natural History and the best means of promoting the study of Science in the United States" Read before the Linnaean Society, 10 June 1807 (Philadelphia: Denham and Town, 1807).

correct the errors of what we possessed before."[150] Advertisements for the publication appeared in a number of major newspapers around the country. The publication will be a benefit to the individual, the ads explain, the pursuit of natural history provides access to the workings of the God of nature. Moreover, the publication will be an important part of the national project. Wilson's *Ornithology* will "rescue this part of American history, from the obscurity in which the mistakes, the prejudices, and circumscribed situation of foreigners have involved it," and "additional motives for self-congratulation and love of country, are the great designs of this publication."[151] Only an American would have the access and exposure to the live specimens necessary to make an accurate study, Wilson argues in the advertisements. Jefferson responds that to correct the errors is most important. The *Ornithology* will be a part of the American project of creating a system that corrects the errors of the past dominated by the work of Europeans.

Life continued at the garden as in the past. The household account books of 1808 show a significant purchase of building supplies during this period. Was John making repairs to the house or outbuildings? Construction is always disruptive. Late summer, after many of the birds had stopped their songs of spring but the Ka-te-did-it had started its "cheerful chattering," Wilson visited the garden and participated in a rather gruesome experiment.[152] He caught a daddy long legs and he, with Ann and William looking on, systematically pulled all of the legs off. This did not seem to be the spontaneous cruel entertainment of a sultry afternoon since they brought the spider inside and carefully laid

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150. Thomas Jefferson to Alexander Wilson, October 9,1807, in *The Life and Letters of Alexander Wilson,* ed. Clark Hunter (Philadelphia: American Philosophical Society, 1983), 266.
151. Advertisment reprinted in in *The Life and Letters of Alexander Wilson,* ed. Clark Hunter (Philadelphia: American Philosophical Society, 1983), 267-272.
152. Benjamin Smith Barton, "Fragments of a Natural History of Pennsylvania" in *Selected Works by Eighteenth-Century Naturalists and Travellers*. ed. Seir B. Sterling (New York: Arno Press, 1974), 6. (pagination of original document)

each leg on a piece of paper. They noticed that the legs continued to move after being severed from the body and would continue to respond to touch. Wilson notes that these "convulsive motions, if they may be so called seemed to originate in the joints and what is very singular each leg before its final cessation seemed to suffer expiring agonies starting about more violent than ever for a second or two, after which no attempts with the finger could restore it." Wilson's poetic nature seems disturbed by their observations—"expiring agonies," for goodness sake. [153]

Thomas Nuttall

That same summer, Thomas Jefferson made arrangements with Charles Willson Peale for his grandson to study Natural History and botany in Philadelphia. The plan that Jefferson laid out was for his grandson, Thomas Jefferson Randolph, to live with the Peales and study with Caspar Wistar and Benjamin Smith Barton.[154] Jefferson hoped that the gardens in Philadelphia would be an especially valuable resource for his grandson's education. Jefferson's grandson was not the only student to start studying with Barton that summer. A new friend had arrived at the garden: Thomas Nuttall. Over the next years, Nuttall would work regularly at the garden, so often in fact that he "had a room expressly reserved for him at [Bartram's] house, called Nuttall's room, which he occupied occasionally for a whole week."[155]

153. Alexander Wilson's notes, in *The Life and Letters of Alexander Wilson,* ed. Clark Hunter (Philadelphia: American Philosophical Society, 1983), 272-273.
154. Thomas Jefferson to Charles Willson Peale, in *Pennsylvania Magazine of History and Biography* 28 (1904): 314.
155. "Biographical notice of the Late Thomas Nuttall" *Proceedings of the American Philosophical Society* 7 (1859-1861): 301.

Nuttall had arrived in the United States from England and met Benjamin Smith Barton soon after his arrival. Thomas Nuttall, born on January 5, 1786 in Yorkshire, England, was the first of three children of Margaret Hardacre and James Nuttall. His father died in 1798 when Thomas was 12. He received a formal education until he was 14, then was apprenticed as a printer. Without the consent of his family, he left for the United States and landed in Philadelphia on 23 April 1808.[156] It was said about Nuttall: "He was described as stout and stooping, moving like an Indian, and morbidly unsociable, except with the very rare individuals who struck a sympathetic chord."[157] A mid-nineteenth century biographical notice describes him as having a fair complexion "sometimes very pale from hard labor and want of exercise. His height was above the middle; his person stout, with a slight stoop; and his walk peculiar and mincing, resembling that of an Indian." [158]

An unattributed and undated portrait of Nuttall shows a seated man around 35 years old with a receding hair line of short curly hair against a dark, plain background. He is very trim, dressed in a black coat and white shirt, collar and tie. Grey eyes look squarely at the viewer. He is not smiling exactly but there is a slight upturn to his mouth and no contraction of the eyebrows. If not happy, he is calm and content. There is no indication of Nuttall's scholarly pursuits. Since Nuttall was only 22 when we meet him, the portrait gives us the idea that the years to come will be good ones for him. He started

156. Jeannette E. Graustein, *Thomas Nuttall, Naturalist: Explorations in America 1808-1841* (Cambridge: Harvard University Press, 1967).
157. M. L. Ferald, "Some Early Botanists of the American Philosophical Society" *American Philosophical Society Proceedings* 86 (1943): 63.
158. "Biographical notice of the Late Thomas Nuttall" *Proceedings of the American Philosophical Society* 7 (1859-1861): 306.

studying botany soon after his arrival in Philadelphia and would work with Barton for a number of years.[159]

The American Ornithology

That June, as Wilson traveled to New England searching for specimens and subscriptions, volume one of *American Ornithology* was published. The first volume includes 38 drawings of 34 birds on nine plates. The introduction says the work is "intended to comprehend a description and representation of every species of our native birds, from the shores of the St. Lawrence to the mouth of the Mississippi, and from the Atlantic Ocean to the interior of Louisiana."[160] Wilson says about the birds he portrays that he will become "their faithful biographer." It is not for idle curiosity this work, the introduction promises, it is a "study thus tending to multiply our enjoyments at so cheap a rate, and to lead us, by such pleasing gradations, to the contemplation and worship of the Great First Cause, the Father and Preserver of all." These pursuits "can neither be idle nor useless, but is worthy of rational beings, and doubtless agreeable to the Deity."[161]

Looking at a couple of the plates can give a reflection of the work as a whole. The first plate starts the collection off so beautifully. Three birds are posed on a single unattached tree branch—two smaller birds (Goldfinch and Baltimore bird) at the top and bottom with the larger Blue Jay in the center. The two smaller birds face to the left, with

159. Portrait owned by the Fogg Museum, Harvard University.
160. Alexander Wilson, *American Ornithology* (Philadelphia: Porter and Coates, 1878), 1: 1.
161. Alexander Wilson, *American Ornithology* (Philadelphia: Porter and Coates, 1878), 1: 2.

the larger one facing right. The space is balanced and orderly. Wilson's first plate sets the tone for the work. Here, nature is tidy and ordered with "regularity and beauty."[162]

Figure 7. Plate one of volume one of the *American Ornithology*.

The ninth plate shows four woodpeckers on a single page with very little white space shown. The birds' tails are tucked into the open spaces on the page. They sit, three vertically and one horizontally. Broken bark on the tree branch alerts the viewer to the birds' primary food source. Each of the birds shares the red and black coloring giving the plate a visual consistency that is very decorative. The result is not just decorative; the viewer is able to compare the four species, a grouping technique that is not often used in

162. Barton uses this expression to compliment a classification system. Benjamin Smith Barton, "A discourse on some of the Principal Desiderata in Natural History and the best means of promoting the study of Science in the United States" Read before the Linnaean Society, 10 June 1807. (Philadelphia: Denham and Town, 1807).

this ornithology. Balance and order turn these birds into the type specimens that they are meant to be.

Figure 8. Plate nine of volume one of the *American Ornithology*.

The plates were created in a process of many hands. Wilson started by drawing the birds as he wished them to be portrayed including important details of each animal and its placement on the page. Then the engraver, Alexander Lawson, created copper plate engravings of the drawings, by cutting lines in the plate to make the outline and the shading. To make a print, the whole plate was inked with black ink, then wiped clean, leaving ink only in the etched lines, with deeper indentations making darker lines. Wilson acknowledges the significance of the partnership between artist and engraver in

the introduction when he says, "[e]very person who is acquainted with the extreme accuracy of eminent engravers, must likewise be sensible of the advantage of having the imperfections of the pencil corrected by the excellence of the graver."[163] The last step is for the colorist—for the first volume there were a number—to hand paint each element of the drawing.

A number of Wilson's drawings are preserved in the library of the Academy of Natural Sciences. By comparing the original sketch with the finished plate, one gets a better impression of the collaboration between the artist and the engraver. Wilson's sketch of the Great American Shrike (volume one, plate five) shows the bird perched on a piece of a tree branch, facing to the right, with its wings closed and the tail drooping slightly. The Shrike in the finished plate is exactly the same size and sits on the same branch. A quick glance would say that the engraving has replicated the drawing exactly. But a closer look reveals the slight differences which contribute to changing the attitude of the bird on the page. In Lawson's engraving, the bird's head thrusts forward slightly more, the line of the neck and chest is straighter as though the bird is reaching toward something. Wilson's bird is more relaxed, with gently curved lines forming the neck and chest. The tail in the engraving is higher and the neck is more stretched out giving the bird a more elongated air. The effect is that Lawson's bird, the one that appears in the printed volumes, seems more aggressive. Wilson's plates have been criticized for seeming to lack life because the birds are stretched into unnatural positions. Perhaps this criticism is not fair to Wilson since the resulting plate clearly reflects the work of two artists, not just one.

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163. Alexander Wilson, *American Ornithology*, (Philadelphia: Porter and Coates, 1878), 1: 8.

Work on the next volumes of the *Ornithology* continued for Wilson. In December he was off again, heading south this time. His travels took him to Washington, DC, Virginia, North Carolina, South Carolina, and Georgia. On December 18, 1808, Wilson visited the White House. William Bartram had introduced Wilson to Thomas Jefferson by letter in 1805 when Wilson sent to Jefferson a drawing of two birds. Jefferson carried on intermittent correspondence over the years with both Wilson and Bartram. In fact earlier that year, Bartram had sent to Jefferson seeds for a "silk tree" (a native of Persia, he explains by letter). Jefferson replied that "he salutes Mr. Bartram with friendship and respect" and will "cherish with care at Monticello" this plant.[164] Wilson strongly supported the president, he had said in 1805 that "the re-appointment and continuance of our beloved Jefferson to superintend our national executive, is one of those distinguished Blessings whose beneficent effects extend to Posterity; and whose value our hearts may feel, but can never express."[165] Wilson was more than just a political supporter, he brought the latest news from the garden Jefferson knew and respected.

The projects of the garden and their contributors found the support of figures like Jefferson extremely valuable. Those projects were characterized by the struggle to reconcile changing notions of Nature while staying active in the vibrant debates of the period. The work of the Bartrams, Barton, Wilson, and Nuttall was challenged by shifting paradigms.

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164. Thomas Jefferson to William Bartram, November 23, 1808, American Memory Collection, Library of Congress. http://memory.loc.gov/ammem/collections/jefferson_papers/
165. Alexander Wilson to William Bartram, March 4, 1805, in *The Life and Letters of Alexander Wilson*, ed. Clark Hunter (Philadelphia: American Philosophical Society, 1983), 231-232.

Chapter 4
"the immortal soul of nature"

Thus twines the honeysuckle sweet
Around some trunk decay'd and bare,
Thus angels on the pious wait,
To banish each distressing care.
Alexander Wilson, "A Rural Walk"

Summer brings heat and plenty of insects to the garden, but also songbirds which are attracted to the Sassafras trees. Rice Buntings visited in August, for example. The monotony of late summer with the hot days, warm nights, and plenty of weeds in the flower beds, would be broken by the Carolina Allspice with its lovely scent that continued to bloom late into the summer. The crops in the working parts of the Bartram land would start to be harvested. Many of the plants that had bloomed in spring would be making seeds. The bounty of spring is present even in the most stifling heat.

On March 4, 1809 Ann Bartram married Robert Carr at the garden. Today, a pale brown silk dress with short sleeves and an empire waist is hanging in the closet of one of the upper bedrooms at the Bartram house (and museum). Family legend has it that this is Ann's wedding dress. The archeologists and material culture experts who have been enlisted in the debate say that the material, style and dating of the fabric are appropriate for it to be Ann's.[166] Attending her wedding were John Bartram, Jr., her father, her sister, Mary and her sister's husband, Nathan Jones and her uncle, William, along with the tenants and servants of the farm. It must have been a happy day. Her marriage to a non-Quaker meant that she was disowned by the meeting, so I like to imagine that she loved

166. Kate Sahmel, Conservations Report, Winterthur Museum, Division of Conservation Textile Laboratory. March 31, 2005.

him, that she got something in exchange for what she lost.[167] Ann and Robert would have no children of their own, though Ann helped to raise Carr's son from his first marriage, who was what we would call a pre-schooler when his father remarried. The boy, John Bartram Carr, grew up at the garden and would go on to produce a minor work in Natural History, as short journal piece entitled "The Diary of a Naturalist" in 1831. Around the time of her wedding, there is a noticeable change in the language of the Bartram family account books. Until 1809, Ann was referred to by her childhood name, Nancy. After 1809, Ann becomes "Ann."

Wilson and "The Foresters"

Alexander Wilson missed Ann's wedding, not returning to Philadelphia until late March. In fact, the day after the wedding, he wrote to Bartram detailing his trip to the areas that Bartram must have remembered from his own journey to the South. The expedition has been tiring, Wilson confesses in his letter, but successful. He made a discovery of a distinct species in a most grisly way, he tells Bartram. He had "presided at a singular feast" at which a dead horse was cleaned by 237 carrion crows, 38 vultures, and five or six dogs; he jokes that he "left the eating part entirely to the others." The significance is that he has discovered a species "very distinct" from the well-known turkey vulture. It was during this same trip that Wilson attempted to trap a woodpecker in his room in Wilmington, North Carolina. The bird did significant damage to the

167. Merril D. Smith, "The Bartram Women: Farm Wives, Artists, Botanists, and Entrepreneurs," *Bartram Broadside of the John Bartram Association* (Winter 2001): 6.

interior space and nearly escaped his captivity through a wall.[168] Wilson returned soon after this letter was written and incorporated his observations into the *Ornithology*.

Starting in June 1809 (until March 1810) Alexander Wilson's "The Foresters" was published serially in *Port-Folio*. The poem tells of Wilson's journey by foot to Niagara Falls in the fall of 1803. He had traveled with his cousin, Duncan and "young Leech," making note of flora, fauna, and local people along the way. Wilson had been writing poetry for years. In Scotland, he had won local poetry contests and was known in his community for his verse. He had published very little since he arrived in the United States, but of this work Wilson said, "I have bestowed more pains upon this than I ever did upon any former poem."[169]

Wilson believed in enlisting the arts, especially poetry, in the cause of advancing the development of America. This work goes hand in hand with the *American Ornithology* in his efforts to glorify his adopted country. He sets the mood of the poem by opening with his conviction that he is performing a duty to his country. He joins with others around this time in asking if the beauties of the arts are exclusive to Europe, "To Europe's shores renowned in deathless song,/ Must all the honours of the bard belong?/And rural Poetry's enchanting strain/ Be only heard beyond th' Atlantic main?" He will do what he can to save the glories of America from obscurity by writing a poem about her nature because nature is silent until a human speaks for it, "Yet Nature's

168. Alexander Wilson to William Bartram, March 5, 1809, in *The Life and Letters of Alexander Wilson*, ed. Clark Hunter (Philadelphia: American Philosophical Society, 1983), 307-9.
169. Alexander Wilson to William Duncan, February 20, 1805, in *The Life and Letters of Alexander Wilson*, ed. Clark Hunter (Philadelphia: American Philosophical Society, 1983), 231.

charms that bloom so lovely here,/Unhailed arrive, unheeded disappear."[170] Wilson's stated goal is to draw attention to the beauties of nature through the beauty of poetry.

The poem is attributed to the "Author of the American Ornithology." This attribution signals that this was to be read in connection with the author's scientific accomplishments. Throughout the work, footnotes explain in prose either what could not fit in verse, or what Wilson wanted to draw attention to. The distinct voice of the footnotes, the voice of an accomplished scientist, acts to ground the reader in the realism of the poem; the "bard" is not describing some fictive, fanciful place, but one that is real, with real place names and census data. Scientific names of birds appear in this voice reinforcing the veracity of the poem, as well making it accessible not only to the highly educated but also to all who read its lines.

Many of the Scottish Enlightenment thinkers argued that aesthetic production was important to the development of the mind and morals. Wilson's poetry is written not just for the pleasure of a few, but for the good of the many. Intended to appeal to the "common sense" of everyone, the poetry is accessible and clear. The epistemology of the Scottish Enlightenment, that all are endowed with the ability to know through their senses and conscience the higher authority of God, also argued that all have a knowledge of beauty. Wilson's poetry complemented his Natural History in his social projects. Science and art are working hand and hand.

Wilson enlisted the aid of moments of sublime experience in his effort to make the beauties of North America truly known to all. When he and the travelers first see the Falls they are filled with awe, "All hearts confess an awful joy serene,/And, humbly, bow

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170. Alexander Wilson, "The Foresters; A Poem: Descriptive of a Pedestrian Journey to the Falls of Niagara, In the Autumn of 1803," *Port-Folio* 1, no. 6 (June 1809): 538. APS Online.

before the glorious scene./ Such were our raptures, such the holy awe/That swell'd our hearts, at all we heard and saw."[171] Through this sublime imagery, Wilson puts to use the poetic theories of Anthony Ashley Cooper, Third Earl of Shaftesbury, and other thinkers of the Scottish Enlightenment. These sublime moments of heightened awareness of beauty inspire a person to virtue, Shaftesbury argued.[172] The Falls themselves inspire awe, and the poem about the Falls is the way to promote higher values in all. Virtue and Beauty are inseparable, argued many of the Scottish philosophers. A person's sense of beauty is inherent in human nature and accessing that sense promotes virtue. If all can know beauty, and beauty is a path to virtue, then all can benefit from the work of art that depicts nature's beauties. The projects of the garden, with their roots in the European debates of the period, were not limited to those of a strictly scientific nature.

In part because the definition of what is scientific was different. Beauty provided access not only to virtue, but to truth, some argued. That truth could be of a scientific nature. Incorporating concepts of the Romantics, *Naturphilosophen* had advocates in England and in Europe.[173] This belief stated that living things reflected ideal patterns. Not unlike the Platonic ideals seen in the quest for type specimens, visible nature reflected perfect nature. Acquiring scientific knowledge was not limited to the scientific process, but included the exploration of higher truths accessed through the emotions. Idealism, at the heart of the Romantic movement, argued that the ideals or the truths of nature, were seen not through direct access of the senses but through the experience of

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171. Alexander Wilson, "The Foresters; A Poem: Descriptive of a Pedestrian Journey to the Falls of Niagara, In the Autumn of 1803," *Port-Folio* 2, no. 6 (March 1810): 184. APS Online.
172. William Charvat, *The origins of American Critical Thought, 1810-1835* (Philadelphia: University of Pennsylvania Press, 1936).
173. For a more complete discussion of naturphilosophen and the Philosophical Naturalists in Britain, see Philip F. Rehbock, *The Philosophical Naturalists: Themes in early Nineteenth-Century British Biology.* (Madison: University of Wisconsin Press, 1983).

one's emotions. Virtue was an ideal, but so were the laws of nature. Through his poetry, Wilson was participating in a transatlantic scientific discussion.

Naturalists and history

While Wilson's poem about Niagara Falls was appearing in print, Thomas Nuttall was making his way there, collecting and making observations for Barton. They would correspond along the way, exchanging letters of introduction for specimens and observations.[174] Barton was, through his own connections and resources, promoting the collection of botanical information of North America. Mease also spent the summer applying his scientific knowledge to improving the community. In July 1809, the organization for which Mease had become secretary, Pennsylvania Society For Improving the Breed of Cattle, held a two-day cattle exhibition. Though the organization got off to a strong start, this one would prove to be another short-lived experiment for Mease.[175]

Throughout the fall, while the *Franklinia* was in bloom at the garden, Wilson, now back in Philadelphia, worked with Bartram on the *American Ornithology*. In November during a visit to the garden, Wilson and Bartram must have talked about Wilson's upcoming trip because the next day he wrote to Bartram inviting him to join him.[176] Bartram would not go with Wilson on any of his journeys but Wilson had another idea for Bartram to be of assistance to him. In addition to all of the natural

174. Jennette E. Graustein, *Thomas Nuttall Naturalist: Explorations in America 1808-1841* (Harvard University Press, 1967).
175. Simon Baatz, *"Venerate the Plough": A History of the Philadelphia Society for Promoting Agriculture, 1785-1985* (Philadelphia: Philadelphia Society for Promoting Agriculture, 1985), 17.
176. Alexander Wilson to William Bartram in Hunter, November 11, 1809, in *The Life and Letters of Alexander Wilson,* ed. Clark Hunter (Philadelphia: American Philosophical Society, 1983), 319-320.

knowledge he could share, his reputation was a key to Wilson's success. Wilson made the suggestion, "your favourable opinion of my work (if such you have) would, if publicly known, be of infinite service to me, and procure me many friends."[177] This time the resource that Wilson sought at the garden was Bartram's good word.

In January 1810, Volume two of the *American Ornithology* was published. This volume differed from the first in the number of birds per plate. The average number of figures per plate in the first volume was four while in the second that average raises to nearly six. The density of information on each page reflects the constraints of time and money more than an artistic decision. Wilson's successes in collecting data and some of his failures in securing subscribers could be seen in these plates.

The year ended on a sad note at the garden. In December, William's brother, Moses, died at the age of 78. Moses was an apothecary, contributing his knowledge of botany to the medical community of Philadelphia. He had dabbled in some horticultural work when he was younger, publishing a short piece on the results of his experiments with silk worms in the *Transactions of the American Philosophical Society* in 1771. William Bartram's generation was starting to pass.

In January 1810, the community at the garden was involved in another tragedy. On October 18, 1809, Meriwether Lewis had died in Natchez Trace. The circumstances of his death were mysterious; Lewis died of a gun shot wound, but it was unclear if it had been self-inflicted. Wilson, who was traveling west through Pittsburgh and south to Louisville, Kentucky and on to Tennessee and Mississippi to collect for and market the *Ornithology*, decided to visit the location of Lewis's death and make an investigation.

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177. Alexander Wilson to William Bartram, August 4, 1809, in *The Life and Letters of Alexander Wilson,* ed. Clark Hunter (Philadelphia: American Philosophical Society, 1983), 316.

The official record of the Lewis and Clark's expedition was still not complete at the time of Lewis's death, so as Wilson started his journey, William Clark traveled to Philadelphia to arrange for the publication of the journals from the expedition. Clark and Barton met to make arrangements for Barton's assistance with the identification of the flora and fauna observed during the expedition.

Because of the timing of the visit with Clark, it seems unlikely that Nuttall's next trip was not at least partly inspired by it. Leaving Philadelphia in the early morning of April 12, 1810, Barton arranged with Nuttall to head west, following much the same path as the Lewis and Clark expedition, but other opportunities would present themselves along the way. Under the constraints and dangers of western travel, Nuttall diverged from Barton's original plan and traveled west with the John Jacob Astor company. Much like for Nuttall's previous trips, Barton had helped prepare Nuttall for the trip by lending him supplies and materials for collecting and would provide guidance along the way.

While Nuttall was away, Barton sent a letter to Thomas Jefferson about some drawings of bones of the Asiatic mammoth he had recently received from a correspondent in St. Petersburg. Jefferson had been interested in the fossils and bones found around the country for years and had even published a piece in 1797 in the *American Philosophical Society Transactions* on bones that had been found in Virginia. In this letter, Barton continues his argument that the mammoth bones found in North America are from a distinct species and that neither the North American nor the Asiatic mammoth is now living. What is especially interesting is that he addresses the concern that with the acceptance of the possibility of extinction comes the rejection of a perfection in nature; "There is something awful in the consideration of this subject; and

yet this very subject is admirably calculated to display to us the wisdom, as well as power, of him who formed all things. The harmony of nature is not, in the smallest degree, disturbed by the total destruction of what many have deemed necessary integral parts of a common whole."[178] The God of Nature has removed the species from the earth, Barton says. The possibility of a malleable nature does not eliminate the participation of an all powerful God. Barton struggles to work at the point of convergence of these two scientific paradigms. It is also interesting to note that this exchange of bones from Europe to America mirrors Barton's sending the molar to Cuvier in 1806. The international exchange of data and results went both directions across the Atlantic. The publication of that data reflects the method of "peer review" so essential to modern scientific methods.

Upon his return at the end of the summer, Wilson continued to work on the *Ornithology* as he had in the past, referring questions to Bartram, compiling data and making portraits of the birds. There was one change in Wilson's routine; while he was away, he had started writing directly to Sarah Miller; it was a blossoming relationship for him. Alexander Lawson, the engraver working with Wilson on the *Ornithology* had introduced him to the Millers. In October, Wilson's account of his trip to Kentucky and Tennessee was published in *Port-Folio*. Wilson had written a long letter to Alexander Lawson about visiting the site of Meriwether Lewis's death in Natchez, Mississippi in the previous May and it was a version of that letter that appeared in *Port-Folio*. Wilson would be one of the only people to visit the site of Lewis's death and it was Wilson who erected a small fence around the grave to protect and preserve it.

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178. Benjamin Smith Barton to Thomas Jefferson, July 13, 1810, in *Port-Folio* 4, no. 4 (October 1810): 343.

The circle of scientists working around the garden played important parts in keeping the work of Natural History alive after the end of the glamorous journeys. Wilson's work on documenting the circumstances of Lewis's death has helped us understand the man who led one of the greatest exploring expeditions of the nineteenth century. Barton also contributed to the effort to remember the men behind the science. In 1806, in his *Philadelphia Medical and Physical Journal*, he published accounts, tributes, and memorandums on the lives of five naturalists.[179] Barton used his position of editor of a journal to document the accomplishments of European and American naturalists and their contributions to the knowledge of North American Natural History. By documenting the lives of the men and making them a part of our national history, the circle working with Bartram made sure these men were not forgotten. Much of modern scholarship demands that we view the works of natural description through the lens of the biases and personalities of the people who made the observations. Our scholarship of science today owes much to the work of the Bartram circle.

James Mease also contributed work to record and preserve the accomplishments of Americans. *A Picture of Philadelphia,* with descriptions of many aspects of life in Philadelphia, was published around this time. Mease describes the scientific institutions, including the Philadelphia Linnaean Society with its committee structure, and the purpose of the organization. The Society solicited submissions of unknown plants, animals or minerals from throughout the United States. These discoveries will prove "extensively valuable in the arts and manufactures," Mease argues. Another institution working to forward science in Philadelphia was Charles Willson Peale's museum. Mease's

179. These are: John Banister, Dr. Thomas Walmsey, William Vernon and Dr. David Krieg, and Mr. John Clayton.

description quantifies the space by listing its measurements and lists a number of the animals on display—a short catalogue of sorts. This was not Mease's only effort as a preservationist. On January 20, 1812, James Mease wrote a letter to the governor of Pennsylvania arranging for the original charter of Charles II— "Grant of King Charles II to William Penn, 4th March 1680"—which John R. Coates had brought from England, to be deposited "among the archives of the state."[180] He would also exchange letters with Thomas Jefferson about the physical location of the composition of the Declaration of Independence. The work of the Bartram circle included preserving history as well as preserving plants.

At the garden, John, Jr. had started to shift the responsibilities of the property to his children. Legal arrangements were made for James and Robert Carr to take over a section of the property (a piece of profitable meadow land, to be specific). William witnessed this legal document. I imagine the whole family together making arrangements for the future. During that summer, Wilson lived with the Bartrams and the Carrs at the garden. He worked on the fourth volume of the *Ornithology* and traveled short distances from Philadelphia collecting data for the unfinished volumes. Wilson worked tirelessly on his project. In September, during one of his stays in Philadelphia, Volume four of *American Ornithology* was published.[181] Volume three had been published earlier that year and Wilson spent the fall and winter hard at work coloring plates for Volume five, which would be published in February.

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180. James Mease to Simon Snyder, January 20, 1812, in *Pennsylvania Magazine of History and Biography* 73 (1949): 423.

181. An interesting aside, this is one of the first publications to experiment with printing in color. Colored ink was used to print from the copper plates (rather than exclusively black). This innovation was discussed by James Green, in paper presented, "Hand Coloring vs. Color Printing in Early Nineteenth-Century Natural History Color-Plate Books" at 'Curious in our way' conference, Saturday, November 20, 2004.

Vitalism

Barton continued to teach Botany at the University of Pennsylvania. To aid his teaching, the second edition of *Elements of Botany* was published. This edition, with few changes from the first, provided a vehicle for Barton to emphasize his own interests: the function of the leaves, "[a] subject more pleasing than any of those which I have hitherto touched upon, now presents itself to my view. I am to inquire into the uses of the leaves in vegetable economy."[182] Throughout the *Elements*, Barton refers to and acknowledges the scientists who conducted experiments to determine the role and significance of various botanical processes. Barton had been performing experiments on plants for some time. Early in his career he experimented with the stimulant effects of Camphor on plants ("Hints relative to the Stimulant Effects of Camphor upon Vegetables") with the results published in the *Transactions of the American Philosophical Society*. His experiment was replicable—to place cuttings of the same plant in two pots, one with camphor and one without. The hypothesis he is testing is that camphor, which is a known stimulant to animals will also act as a stimulant to plants. This he found to be true. This information has utility; perhaps camphor could be added to fertilizer to aid in plant growth or used by florists to extend the life of cut flowers. In the *Elements* he refers to experiments that were "so frequently repeated...that I cannot imagine, that I have been deceived in my observation."[183] Barton is referring to the process of repeatable experiments, inherent in our modern definition of science.

182. Benjamin Smith Barton, *Elements of Botany* (Philadelphia: printed for the author, 1803), 1: 51.
183. Benjamin Smith Barton, *Elements of Botany* (Philadelphia: printed for the author, 1803), 1: 58.

That Barton would consider it possible that a stimulant known to work on animals would have similar effects on plants indicates his recognition that the processes of life are analogous in the animal and vegetable kingdoms. The analogy is especially obvious when one observes the movement of plants. For anyone interested in plant life, the movement of leaves toward the light and their circulatory systems were obvious. But what role in the life of the plant did these behaviors and structures provide? Barton rejects the hypotheses that the leaves are perspiratory, excretory, or digestive organs. He presents the possibility that the circulation and respiration that are known to take place in plants has the function of nourishing the plant with oxygen, like the circulatory system of an animal brings oxygen to its tissues. What he calls, "vital air" that is "necessary to the maintenance of animal life" may also have the same function in the life of plants. Barton was participating in a scientific discussion that had been going on transatlanticly for a number of years. The most significant recent discovery was that of Joseph Priestly who in 1772 had discovered that plants release the very gas that keeps animals alive.

The functions of the leaf and the mechanisms for performing those functions make up the subject matter of Plate VI of the *Elements of Botany*. This plate (not drawn by Bartram) includes two figures, separated evenly by a straight horizontal line through the center of the page. The top figure shows a glass container within which is hanging a single leaf. Beside the container stands a representation of a candle—the whole candle is not shown, the candle itself is not important, only the idea of a light source. A shadow of the container lies on the surface opposite the light source, this light is strong, the shadow indicates. The description explains that this leaf of a vine has been placed in a glass vessel filled with water. When the light is positioned close to the vessel, the leaf will

move so that it "presents its upper surface to the light."[184] The figures on the lower half of the page illustrate the same process, altering the conditions of the experiment only slightly. The experiments prove that it is the upper surface of the leaf that benefits from exposure to light and that plants have the power of movement necessary to survive.

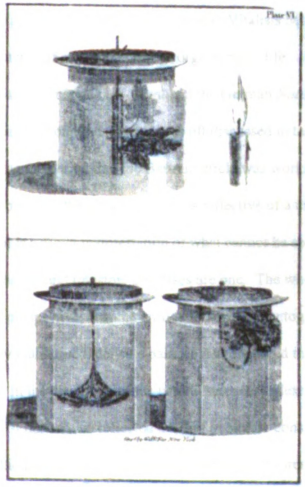

Figure 9. Plate VI of the *Elements of Botany*.

Beyond an academic interest in the processes of plant life, the questions of plant functions have their origin in a larger debate that had been raging at the conceptual level

184. Benjamin Smith Barton, *Elements of Botany* (Philadelphia: printed for the author, 1803), 2: 21.

for a hundred years or more. Barton and the circle at the garden were struggling to make sense of the very source of life, or echoing the debates between "vitalists" and the "materialists." The crucial question is: does the power of life originate in matter alone or is there some other, non-organic, power at work? Very simply, materialists believed that matter itself holds all the properties of life. Movement and energy come directly from matter and there is nothing real other than what is material. Vitalists believed that there is a life force, something outside of matter that brings organisms to life.

A central tenet of the Romantic movement and the German *Naturphilosophie*, vitalism had many advocates among the arts and was oft discussed in the intellectual and artistic communities during the period that the Bartram circle was working. The philosophical naturalists believed that all of nature was reflective of a unified whole. Because what can be seen is a direct manifestation of what cannot be seen, the artist or scientist knows that the visible and invisible universes are one. The wholeness of Nature, according to this perspective, was the unification or coming together of opposites. This constantly maintained, delicate balance demonstrated that the universe itself was a living being. In the discipline of the natural sciences, Alexander von Humboldt's descriptions of nature also reflected a belief in Nature consistent with the Romantic perspective which saw nature as a constant balancing of forces. The oneness of nature meant that organisms shared fundamental characteristics. One of those characteristics was the life force. The vitality of nature came from this life force. Materialists saw nature in a more mechanical way. Matter itself was the source of movement within each organism. While important to artists, what difference did it make to scientists?

These debates related to the debates about origins of organisms. While the debates about extinction and malleability of species stressed the question: where do species, in the abstract, come from? This debate asked: when and how does the life of a particular organism begin? The significance goes beyond the strict parameters of science. By questioning the origin of life, one is forced to ask: where was God in the equation of life? If matter is wholly mechanical, is there still room for God in nature?[185] Barton's scientific text, one used in an academic environment and including discussions of repeatable experiments, was saturated with the metaphysical debates of the period.

War of 1812

In June of 1812, after years of building tension, the United States declared war on Great Britain. The effects of these tensions had been felt at the garden for years, but with the declaration of war came significant changes. Thomas Nuttall who was still a British citizen when war between his home and adopted countries broke out had not returned to Philadelphia from his journey west. Instead, he left the United States for England directly; he stayed in England for the war's duration. The war also called Robert Carr away from the garden. Carr hoped to serve in the army, so he petitioned for a commission. The signatories of his request reveal a snapshot of the community that gathered at the garden: "We the subscribers do certify to the honourable the secretary of War that we are well acquainted with Robert Carr the above applicant that he holds a respectable station in society and sustains a fair and unblemished reputation and that his

185. For more on the debate between vitalism and materialism see Nicholas Jardine, "*Naturphilosophie* and the kingdoms of nature," in *Cultures of Natural History*, eds. N. Jardine, F. A. Secord, E.C. Spary (New York: Cambridge University Press, 1996) and Shirley A. Roe, "The Life Sciences," *The Cambridge History of Science, Volume 4: Eighteenth Century Science*, ed. Roy Porter (New York: Cambridge University Press, 2003).

connexions (sic) are highly respectable." This testimony is signed by William Bartram, James Mease, Benjamin Say, Alexander Wilson and Dr. Benjamin Smith Barton.[186] While the war took some away, another was coming to stay. While Carr and Nuttall were away, Wilson lived at the garden between his collecting trips.

That fall the garden said good-bye to another of its residents. Ann's father, John, Jr. died on November 16, 1812. His three children, Mary, James and Ann, and their spouses inherited the Bartram estate. After John's brothers, William and Isaac Bartram, completed an inventory of the property in December, the Bartram estate was divided between the three families, with Ann and Robert Carr maintaining the house and garden, James and his wife living in one of the tenant houses, and Mary and her husband Nathan Jones taking over another portion of the property.[187] James and Robert had agreed a few years earlier to occupy, maintain, and profit from the farm jointly. But all was not easy between the three families; Robert Carr and Nathan Jones were not the best of friends and their disagreements about how the estate was to be run led to family troubles over many years. Accusations of mismanagement of land would send the brothers-in-law to court looking for a financial settlement. For now though, the war kept Carr away from his family and the garden they loved.

Throughout 1813 Robert wrote letters home. There is anecdotal evidence that Ann valued the letters she received from her husband very much. Bartram wrote to Carr, "Mrs. A. Carr my esteemed Niece continues in tolerable good health and spirits,

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186. Carr letter book, Robert Carr Papers, Historical Society of Pennsylvania.
187. Joel T. Fry, "Bartram family history" in "Phase I Archaeological Survey of the Proposed Wetland Restoration Site: Historic Bartram's Garden." 2 vols. bound as one. MS report prepared for the John Bartram Association, (October 18, 1996): 2: 131.

especially at receiving Letters from you."[188] This brief acknowledgement could be interpreted in two ways: Bartram hopes Carr will feel guilty for not writing more often, or Ann genuinely appreciates the correspondence from her husband. The latter seems more consistent with Bartram's character. He was again looking out for the welfare of his beloved children. Carr's duties with the military fell in the category of "support," and his letters indicate that he was anxious for something more glamorous to do than make sure the bread was baked properly. He sought the help of the garden community to make something happen, "wrote to Mr. A. Wilson requesting him to apply to Colonel Pike to have me transferred to 15th regiment as it is ascertained the 15th will be ordered to the lines immediately." It is uncertain if Wilson was able to pull the appropriate strings but by September Carr was marching with four companies of the 16th regiment toward Albany. [189] Prospects for his business at home were not as promising. The printing business, overseen by his brother while Carr served, failed during his absence.

For Wilson, 1813 was overwhelming with the requirements of completing the last volumes of the *Ornithology*. He wrote to Bartram to say that all his colorists had left him. He continued to color his own plates for the printed volumes as well as travel to collect and observe for the upcoming one. On August 13, Wilson returned to Philadelphia from Cape May where he had been collecting. He settled in with his friend, William Jones—the brother-in-law of Sarah Miller, the woman Wilson hoped to marry. But the stress of work and exhaustion were taking their toll. It got bad enough that he wrote a hasty will and on August 23, 1813, Wilson died of dysentery. The next day, his body was buried in the graveyard of Gloria Dei Church. The day was hot and the mourners grew

188. William Bartram to Robert Carr, November 5, 1813 Gilbert Collection College of Physicians, Philadelphia, PA. Photocopy viewed in collection in Library of Bartram's Garden.
189. Carr letter book, Robert Carr Papers, Historical Society of Pennsylvania.

tired as the funeral procession followed Wilson to his grave.[190] Wilson's will reveals the strength of his commitment to Sarah; after making arrangements to settle his obligations, Wilson left all of his possessions to her. The final volume of the *American Ornithology* which had gone to press earlier in the summer appeared after Wilson's death. His friend and champion George Ord oversaw its production.

Port-Folio magazine published a warm obituary of Wilson in September saying that Wilson was "equally useful, eminent, and beloved."[191] Wilson had succeeded at at least one of the goals he had set for himself—he was considered the faithful biographer of the feathered tribe. The obituary states that the *American Ornithology* was successful in part because he "seemed to have a peculiar aptitude for cultivating an acquaintance with these children of the forest."[192] Oddly, the obituary refers to Wilson's friendship with the "late William Bartram." Bartram would not die for another decade, but it seems he had been enough out of public view for the writer to have mistaken him for dead.

Though not nearly as personal, another blow hit the community at the garden that year. Frederick Pursh's *Flora Americae Septentrionalis: Or, A Systematic Arrangement and Description of the Plants of North America* was published in London. This publication included many of the plant discoveries of the Lewis and Clark expedition. It was frustrating for many, not least of whom Barton, to realize they had been scooped by a German publishing in England. The plants brought back by the "Corps of Discovery" should have been introduced by an American in an American publication. The business relationship between Pursh and Barton at the time of the publication is disputed. Did

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190. In a letter from William Bartram to Robert Carr, Bartram indicates that Carr's brother attended the funeral. Is it safe to assume that Bartram and Ann attended as well? William Bartram to Robert Carr, November 5, 1813, College of the Physicians of Philadelphia.
191. "C." "Obituary Notice-Alexander Wilson," *Port-Folio* 2, no. 3 (September 1813): 346. APS Online.
192. "C." "Obituary Notice-Alexander Wilson," *Port-Folio* 2, no. 3 (September 1813): 349. APS Online.

Pursh "steal" the credit for these discoveries? Perhaps, but, that, is also a story for another time.

In April 1814, a review of *American Ornithology* appeared in *Annals of Medicine, Natural History, Agriculture.*[193] The review lays out some of the problems with the naming conventions and classification systems of ornithology to date and the technical difficulties in preserving specimens. It also compliments Wilson for overcoming these "disadvantages" inherent in the current state of the field of ornithology. His work, the review states "excels all that precedes it," and the "delineations of Wilson are done in such a masterly style that the bird is at once recognized."[194] But the illustrations of the species included are more than simple delineations. With the combination of textual and visual descriptions, the volumes of the *Ornithology* come alive as a work of art. It is the very art of the *Ornithology* that makes it such an effective scientific tool. The liveliness of the images makes them ready tools for the aspiring ornithologist. When the subjects come alive in the representation, they make better models for comparison to the living specimens. Since the scientific process of identification depends on accurate comparisons, successful artistic expression makes for a more useful tool.

If, as it has been argued and with which I agree, art is defined as the creative expression of self then the *American Ornithology* is as much an artistic project as a scientific one.[195] The expression of this precision is not separate from the artist; Wilson arranged the birds as he saw them; he wrote about them in the first person. His

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193. "American Ornithology; or the Natural History of the Birds of the United States: illustrated with plates, engraved and coloured from original drawings taken from Nature," *Annals of Medicine, Natural History, Agriculture* (April 1814): 574-579. APS Online.
194. "American Ornithology; or the Natural History of the Birds of the United States: illustrated with plates, engraved and coloured from original drawings taken from Nature," *Annals of Medicine, Natural History, Agriculture* (April 1814): 577. APS Online.
195. S. Peter Dance makes this argument in *The art of natural history : animal illustrators and their work* (Woodstock, N.Y. : Overlook Press, 1978).

descriptions of the birds are about his own experiences with them. His personality is present throughout the work. Barton's *Elements* is not artistic by this definition, Barton remains in the background, rarely surfacing. The process of removing oneself from the act of science, remaining neutral, would become an ideal in scientific study. But for this group, that ideal was not established and the differences seen in Wilson's and Barton's works illustrate that.

For the remainder of the war years, life at the garden progressed quietly. Even visits home for the holidays were not enough to reconcile Carr with his experiences with the Army. He even wrote home "intimating my thoughts of resigning."[196] He did not resign, but he was able to work closer to home. For the winter of 1814, Carr worked as recruiter for the Army in Philadelphia. While he was away, Ann and William looked after his son. Young John Carr had been learning to read and would develop skills for and a love of botany and horticulture that would occupy his adult life. Barton continued to visit the garden and add notes to his collection of observations. During this time, James Mease was also serving in the war effort working as a hospital surgeon. On February 5, 1814, the city of Philadelphia celebrated the victories of the war in a general illumination of the city. This must have been visible from the part of the garden that touches the Schuylkill—the city is still visible from the garden. With the city lit up, it must have been

196. Carr letter book, Robert Carr Papers, Historical Society of Pennsylvania.

beautiful.

Figure 10. The Philadelphia skyline from Bartram's garden. (photo by author)

Natural Progress

As the war drew to a close the family and friends of the Bartrams started to gather again at the garden. On Sunday February 12, 1815, Carr received the news that the peace had been concluded at Ghent in December. He left for home the same day.[197] He would be formally "disbanded" in May. Thomas Nuttall returned to the United States from England but left Philadelphia soon afterward for a trip to the South to collect specimens and meet with southern naturalists. He would not leave without visiting with Bartram however. He must have consulted with Bartram about his journey, because he retraced Bartram's steps through Georgia.

For some time, Barton had not been in the best of health. In the preface to the revised edition of the *Elements* he mentions a number of times that he is sick while he is

197. Carr letter book, Robert Carr Papers, Historical Society of Pennsylvania.

writing. He decided to travel to England in hopes that the journey and sea air would improve his health. He returned to the United States in November via New York, but the trip was not effective. On December 19, 1815, Barton died of pulmonary tuberculosis at his home in Philadelphia. Thomas Nuttall would not have the opportunity to say good bye to Barton since he did not return from his collecting trip until February 1816.

A major development in Nuttall's career would come in 1817 with the beginning of the publication of the *Journal of The Academy of Natural Sciences of Philadelphia.* The Academy had been established in early 1812 "for the encouragement and cultivation of the sciences, and the advancement of useful learning."[198] With only 20 members in 1814, the Academy sponsored a lecture series on "Botany for the use of the Ladies of Philadelphia." As much as a fund raisers as anything else, this was followed by a series on chemistry in the fall of 1815. The organization grew slowly as it built a collection of specimens, sponsored expeditions and opened a public museum in 1828. Nuttall would work on the publication committee of the *Journal* and do some of his most important work with the Academy.

The establishment of the Academy signifies an important milestone in the institutionalization and professionalization of science in America. It has been argued that institutionalization is the inevitable result of a group's recognition that the knowledge they hold in common is somehow outside of the norm. Once this awareness is raised, formal relationships and protocols to build and protect that knowledge form.[199]

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198. "History of the Academy," The Academy of Natural Sciences. http://www.acnatsci.org/learn/history.html visited May 9, 2005.

199. It is the second of four stages in the development of the profession laid out by George Daniels—Preemption, institutionalization, legitimation, attainment of professional autonomy—in "The Process of Professionalization in American Science: The Emergent Period, 1820-1860" *Isis* 58, no. 2 (Summer 1967): 150-166.

This process, combined with factors external to science, including the building of physical and political infrastructures, led to the rapid development of organizations in all fields.[200] This institution, without any consciousness on the part of its members, marked the end of the usefulness of institutions like the garden. The more formal membership and fund raising allowed the work of many to be pooled rather than the work of few to be displayed. The more formal organizations allowed for the work to take on a life of its own, rather than be dependent on a single individual or a single family. The structures of teaching and learning, of the pursuit of knowledge that had been in place in the early years of the garden were shifting. The development of scientific institutions led to a shift in the modern perception of where science takes place or the "location of science." The garden had been an accepted location of science where knowledge circulated rather than observed a strict hierarchical flow.[201] But with the development of institutions like the Academy, the legitimate work of science moved to laboratories, universities, people with PhDs and formal funding.

A visitor to the garden in September 3, 1817 gives us a picture of what was happening there. "In the afternoon we rode to Bartram's garden, now in the possession of a Mr. Carr who married old Bartram's daughter. This is a beautiful spot, and rather better kept than formerly. As a nursery of young plants, it is rising in consequence. Mr. Carr informed me that he had 6000 plants in pot for sale. His forcing beds are fine, and enable him to take the first cucumbers to town, for which he obtained 50 cents each for

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200. Alexandra Oleson, "Introduction: To Build a New Intellectual Order," in *The Pursuit of knowledge in Early American Republic,* eds. Alexandra Oleson and Sanborn C. Brown (Baltimore: Johns Hopkins University Press, 1976).
201. Mary Fissell and Roger Cooter, "Exploring Natural Knowledge: Science and the Popular," in *The Cambridge History of Science, Volume 4: Eighteenth Century Science,* ed. Roy Porter (New York: Cambridge University Press, 2003).

the first 50 and 25 cents for the first hundred. In addition to this, he is now building a large greenhouse."[202] Carr was working to expand the business of the garden and make it more appealing to casual visitors.

Working partly in the more formal world of the Academy and partly in the informal classroom of the garden, Thomas Nuttall published *The Genera of North American Plants, and Catalogue of the Species to the Year 1817*, funding the printing of the text himself. Nuttall introduces his text with an explanation of his methodology: "In this interesting and now prevailing view of the subject, a reduction of heterogeneous materials to their natural types, has led the way to the construction of genera better according with the plan of nature." By "reduction of heterogeneous materials to their natural types," Nuttall is referring to the process laid out by Buffon and Cuvier called comparative anatomy. Though more concerned with the anatomy of animals, Buffon and Cuvier's theories were equally applicable to plants. Cuvier's *Lessons in Comparative Anatomy* had been published in 1805; Buffon discussed the process in 1753: "The result of this process of comparison will not only be a distinct knowledge of each [organism], but also a general knowledge of all [organisms]."[203] Documenting similarities of species through the process of comparison would lead to a more "natural system" of classification, it was argued.

A new natural system had been the subject of Correa da Serra's botany lectures in Philadelphia in 1815 when he presented Antoine Laurent de Jussieu's "Natural System of

202. Samuel Breck, "The Diary of Samuel Breck, 1814-1822," ed. Nicholas B. Wainwright, *Pennsylvania Magazine of History and Biography* 102 (October 1978): 491.
203. Georges-Louis Leclerc, comte de Buffon, *Histoire Naturell*, 1753 quoted in Alex Potts, "Natural order and the call of the wild: the politics of animal picturing," *Oxford Art Journal* 13, no. 1 (1990): 22.

Plant Classification."[204] Nuttall had published a brief botanical piece earlier that included both the Linnaean classification and the "Natural Order of Jussieu." But Nuttall worried about moving away from Linnaean system. He was afraid of "revolutionary" change, but argued that the classification system must be based on "the great plan of natural affinities" and goes on to call such a system "sublime and extensive."[205] Tapping into imagery of the sublime, Nuttall makes every effort to keep natural religion alive in botany. The belief that there is such a thing as a natural system shows continued faith in a higher order. Though some of the eighteenth century conventions, like the Linnaean system, were falling out of favor, the more fundamental faith in nature's reflection of a higher reality held fast. Nuttall wrote, "Can we deny the perception of a prevailing affinity throughout the vegetable kingdom, and carp at the anomalous character of a few individuals?" The "prevailing affinity" that Nuttall mentions is his bow to the type specimens that defined the identification process of the previous generations.

Sadness struck the garden on April 18, 1818. James Howell Bartram died at the age of 31. It was not a lovely spring day but one with a "cool wind high, blustering from NW." Bartram notes in his weather diary, "NB died this morning Dr. James Bartram of Kingsess, grandson of the celebrated John Bartram the Botanist and Naturalist." This small note speaks volumes. Bartram made no note of other family milestones and no mention of his own illness. James's death must have touched the old man deeply. Little is known about the circumstances of James's death. James's widow, Mary Ann, would be looked after by Robert Carr until she remarried.

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204. Thomas Nuttall, *The Genera of North American Plants, Facsimile of the 1818 edition*, ed. Joseph Ewan (New York: Hafner Publishing Company, 1971), vii.
205. Thomas Nuttall, *The Genera of North American Plants, Facsimile of the 1818 edition*, ed. Joseph Ewan (New York: Hafner Publishing Company, 1971), vi.

With James gone and the failure of his printing business during the war, Robert Carr took over full-time responsibility for the garden. He recognized that the dedication to the garden of his wife and her family made it necessary to settle in for the time being. Carr would write "the advanced age of our uncle, Mr. W. B., who resides with us and who could not bear the thought of parting with the garden, forbids the idea of selling during his life."[206] Carr began to participate more in the projects of the garden. In June 1819, he published "Observations on tea shrubs" as letter to Constantine Rafinesque in the *Western Monitor*. Rafinesque, a naturalist, trained in France, but working in the United States, had visited the garden in 1802 before taking a position at the Transylvania University in Lexington, Kentucky.

Hoping to defend the Bartram family's role in the introduction of tea in the Philadelphia area, Carr lays out a brief history of the plant in Pennsylvania. At the conclusion of the letter appears the brief confirmation, "I have read the above statement of Robert Carr, and believe it to be correct"; this is signed William Bartram. Perhaps Bartram oversaw the writing of the article, perhaps the observations were really his, but he was getting too old to work on publications of this kind. This would be one of the only botanical publications by Carr and it was observed by contemporaries that he had little knowledge of scientific botany—he was remembered for his pleasant personality. David Douglas would say that Carr "has but a modest share of knowledge [of botany]. This deficiency, however, is made up by his pleasing manner."[207] Put those two

206. Robert Carr quoted in Merril D. Smith, "The Bartram Women: Farm Wives, Artists, Botanists, and Entrepreneurs," *Bartram Broadside of the John Bartram Association* (Winter 2001): 7.
207. David Douglas quoted in Jennette E. Graustein, *Thomas Nuttall Naturalist: Explorations in America 1808-1841* (Harvard University Press, 1967), 194.

observations together and perhaps you can imagine that Carr was helping Bartram more than the other way around.

After the completion of his service during the war, Mease returned to his service to the improvement of American agriculture. Numerous publications over the next few years built a significant body of work.[208] Mease's efforts to apply botanical and medical knowledge to agriculture and benefit the nation reinforce scholarly arguments that the science of this period was defined by its contributions to the developing nation. John Greene argues that in the context of nationhood science "meant two things: as the example par excellence of useful knowledge, science must be cultivated to promote the interests, prosperity, and power of the rising American nation; and as the supreme example of the powers of the human mind, the successes of science challenged Americans to prove to the world that republican institutions were as favorable to intellectual achievement as they were to liberty."[209] Mease's 1818 assessment of British malt liquors (he had published on the subject in 1807 as well) exemplifies Greene's argument. The substitution of ingredients in British malt liquors made them useless for their medicinal properties, while American malt liquors were made with only the best ingredients. Mease wrote "the improvement in the manufacture of porter and ale, particularly the last, has been great; and they ought to be solely used by all those whose health require them."[210] Drink American, he seems to be saying. By using only

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208. See James Mease, "On the Adulteration of British Malt Liquors," *The American Medical Recorder* 1, no. 1 (January 1818): 29-35; "On the Cultivation of the Vine in the United States," *The Philadelphia Register and National Recorder* 1, no. 21 (May 22, 1819): 341-343 and 2, no. 2 (July 10, 1819): 17-20; "Remarks on the late Cattle Procession in Philadelphia, with Directions how to effectually promote the Breed of Cattle," *The National Recorder* 5, no. 12 (March 24, 1821): 186-190. All found at APS Online.
209. John C. Greene, *American Science in the Age of Jefferson* (Ames: Iowa State University Press, 1984).
210. James Mease, "On the Adulteration of British Malt Liquors," *The American Medical Recorder* 1, no. 1 (January 1818): 35.

American products in the practice of medicine, citizens will support the agriculture of the new nation. It is through the promotion of agriculture (he had recently been elected secretary of Philadelphia Society for Promoting Agriculture) that Mease saw true independence for the citizens of the United States. Like Thomas Jefferson, he argued that the farmer possessed "that independent spirit, that honest demeanor, that unsuspicious frankness, and that unaffected patriotism..."[211] The resources of the garden, through one of the members of its community, contributed to the development of the new nation.

Value of Life

The processes of reproduction in plant life had been of interest to the community at the garden for many years. Barton had discussed it in detail in his *Elements* and Nuttall contributed to this discussion in1822 when he published "Thoughts on the proximate cause of fecundation in vegetables" in the *Philadelphia Journal of the Medical and Physical Sciences*. In this article, Nuttall is grappling with the question of the mechanics by which plants become "impregnated." In the process of external impregnation, the seed becomes impregnated after it leaves the parent plant. How does this occur? Nuttall argues that pollen is able to find its way without the assistance of insects. This is an anticipation of the discovery of what would be called "Brownian movement" after Robert Brown whose experiments in 1827 led to observations of the movement of pollen in water. (Brown's experiments were performed ironically on an American plant named for William Clark.) It is the movement of the pollen that allows for reproduction without direct contact. Brown concluded that movement existed within

211. James Mease, "The Preface" of the *Domestic Encyclopedia*, quoted in Don Yoder, "Domestic Encyclopedia," *Pennsylvania Folklife* 14, no. 3 (1965): 16.

pollen. It is this very same movement that Nuttall attempts to describe in his article. The pressing scientific discussions of their day were a transatlantic conversation.

The movement of pollen, along with the more obvious movement of leaves provided fodder for the debate between vitalists and materialists—the debate about the sources of life. Nuttall's arguments about the movement within tiny particles weighs in on this debate. He calls the process of fecundation "active and recondite."[212] The source of life is within tiny particles, too small to see with the naked eye. The power to create life is barely visible. This realization begs the question: what effect does this realization have on the perception of the value of life? With the source of life being identified in such seemingly insignificant powder, the value of each life, no matter how puny, becomes huge.

Bartram continued to keep his weather journal and one can observe the aging process as the handwriting becomes weak in places. Bartram was weak at this point but still accepting and charming visitors. Alexander Lawson's daughters, who were young around this time would later write, "When a child I saw Mr. Bartram. He was a very charming old gentleman and he gave me a very double yellow rose, a great rarity at that time, and every summer we made more than one excursion to the garden."[213] The garden still allowed Bartram, though now getting quite old, to be a resource; this time he provided happy and unique memories for the children of a colleague.

Though the country was suffering from an economic depression, the garden must have been a lively place during the early 1820s, Ann, Robert, and their son John continued to run the family seed and plant business. For the younger generation at the

212. Thomas Nuttall, "Thought on the proximate cause of Fecundation in Vegetables," *Philadelphia Journal of the Medical and Physical Sciences* 4, no. 8 (1822): 257. APS Online.
213. Franklin L. Burns, "Miss Lawson's recollections of ornithologists," *Auk* 34, no. 3 (July 1917): 277.

garden, steps were being taken toward advancement: Robert Carr became a justice of the peace for Kingsessing in 1821 and in 1822, Thomas Nuttall accepted the position to take over responsibility of the botanic garden at Harvard University. The Carrs and a staff of workers who helped to maintain the garden started spring work in the garden in March though the weather was still unpredictable at that time of the year in Pennsylvania. The trees in the collection had gotten quite large and dramatic.

In addition to the many people working the beds and hothouses, pets and working animals lived at the garden. "Anecdotes of an American Crow," published earlier by William Bartram, describes one of the more active animal residents. In this piece, Bartram says he is speaking of one crow, named Tom, rather than giving a species biography—"since I am convinced, that these birds differ as widely as men do from each other, in point of talents and acquirements."[214] The crow's actions, including stealing Bartram's glasses and hiding them under some leaves, and teasing an old dog, "exhibited incontestable demonstrations of a regular combination of ideas, premeditation, reflection, and contrivance."[215] This animal showed characteristics thought to belong only to humans.

For Bartram, a project of the garden was to better understand the distinction between the animal kingdom and humans. As part of their study of nature, the community at the garden considered what both people and animals were capable of. Bartram had corresponded with Barton on this issue and wondered why people are so resistant to the possibility of animals having reason. Bartram argues that "men have put

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214. William Bartram, "Anecdotes of an American Crow," in *William Bartram: Travels and other Writings*, ed. Thomas Slaughter (New York: Library of America, 1996), 573.
215. William Bartram, "Anecdotes of an American Crow," in *William Bartram: Travels and other Writings*, ed. Thomas Slaughter (New York: Library of America, 1996), 576.

invention to the rack" in trying to establish that animals do not possess reason." He wonders, "What are they afraid of, that the Spirits of Animals will rise up in judgment against them for killing and eating them?"[216] Wilson's work echoes Bartram's sentiment in his description of how the mother partridge fools a predator by pretending it is injured and leading the threat away from her young. "This well-known maneuver, which nine times in ten is successful, is honourable to the feelings and judgement of the bird, but a severe satire on man. The affectionate mother, as if sensible of the avaricious cruelty of his nature, tempts him with larger prize, to save her more helpless offspring; and pays him, as avarice and cruelty ought always to be paid, with mortification and disappointment." [217] Bartram and Wilson agree that reason is not exclusive to humans.

It is not only that animals have reason, it is that man is often 'no better than an animal.' How can we hold ourselves above animals, Bartram argues, when man is the most "cruel and hypocritical" of all?[218] Bartram's assessment of the difference between people and animals is not always complimentary toward people: "It evidently appears, that the Animal creation are endowed with the same passions and affections we are, and that the affections operate after the same manners; It is too true I fear, that the Malicious Order abound and predominate in Man. Not only in their actions among one another but toward the *Animal creation.*[219] Bartram had abhorred the use of force of the strong over the weak all his life.

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216. William Bartram to Benjamin Smith Barton, December 23, 1792, Benjamin Smith Barton Papers, American Philosophical Society.
217. Alexander Wilson, "The Partridge," *American Ornithology*, Volume six.
218. Bartram's sentiments anticipate the growth of humane convictions. The founding of the SPCA in England is only a few years away in 1824, followed by the American Society in 1866.
219. Emphasis is Bartram's. William Bartram to Benjamin Smith Barton, Bartram Papers, 1.9, Historical Society of Pennsylvania.

While offering insight into an astute observer of nature, Bartram's opinions about animals also provide us with another layer of the debate between vitalists and materialists. Bartram was unequivocal in where he stood in this debate, "We say this Divine Intelligence penetrates and animates the Universe. This is the Immortal soul of nature, of living moving beings, of vegetables and in the Elements." The difference between animals and people is too indistinct for the source of life not to be in all living things. God is greater than people are capable of demonstrating, "I can not believe, I cannot be so impious...to desire or imagine that Man who is guilty of more mischief and wickedness than all the other animals together in this world should be exclusively endowed with knowledge of the creator..." Though their talents and achievements differ, who can say that one is more impressive than another? In an undated essay, or draft of a letter, Bartram admits that no animal could "weave a piece of Brocade, make a compleat Ship, a watch or Clock," but counters that with the observation that no man could make a spider web or a honey comb.[220] The similarities between people and animals demonstrate that they share fundamental characteristics. Reflecting the Romantic notion that all of nature is reflective of a life force, Bartram clearly adheres to the vitalist perspective.

Not only do animals possess and use reason, but they have access to God, Bartram argues. In fact, man is closest to God when he is closest to his animal instincts. Bartram says, "Thus it appears I think that we act most rationally and virtuously when our actions seem to operate from simple instinct or approach nearest to the *Animal Creation*."[221]

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220. These undated notes bear a strong resemblance to arguments that appear in the introduction to the *Travels*: "We admire the mechanism of a watch, and the fabric of a piece of brocade, as being the production of art..." 19. William Bartram, Bartram Family papers, 1.72, Historical Society of Pennsylvania.

221. (emphasis Bartram's) Undated notes by William Bartram, Bartram Family papers, 1.72, Historical Society of Pennsylvania.

Value and spirit, "the immortal soul of nature" are found in all living things. Bartram's Quaker belief that the "light of God is within all" must have influenced his perception of animals. This light, that is argued to be in all humans, is actually in all living things, Bartram seems to be saying. Living beings are not simply proof of God's power, as Natural Theology had been arguing, but are capsules of God's divinity. This acceptance of the universality of life's value, like the patterns and similarities that contributed to the development of classification systems, illustrate the faith in a higher order. Both require a belief in a reality that cannot be seen. The reality of life, the order and source of life is seen in the finite examples perceivable by the senses. The truth of life is something taken on faith.

Bartram had this faith. Each in their own way, each of the scientists working at the garden demonstrated their faith through their scientific work. Barton, Wilson and his much loved nephew James would express this no more; they had been gone for years. The time for the next generation, of both people and ideas, was coming. On July 22, 1823, when the kitchen garden would have been ripe with melons and squashes and the wild potato in flower, William Bartram died at the age of 84 "under a pear tree that grew at the south corner of the house"[222] The accounts of his death vary some as to the immediate cause and location, but one thing is consistent. Bartram died in the garden where he spent the majority of his life. The location of Bartram's grave is unknown. Later that year, Nuttall returned to the garden for a visit, perhaps to give his condolences to the family. His companion at this time reported that the garden was in a "deplorable

222. "On a visit recently to Bartram's garden Mr. Carr pointed out the spot where the old man died." Thomas Loraine McKenney to Dolley Payne Todd Madison, 28 July 1835, in The Dolley Madison Digital Edition, ed. Holly C. Shulman (Charlottesville: University of Virginia Press, 2004): http://rotunda.upress.virginia.edu/dmde/DPM0826 (viewed February 7, 2005).

state." Robert Carr admitted that after Bartram's death, his "present property barely produc[es] a decent livelihood."[223] The garden mourned.

223. Robert Carr to Major General Jacob Brown quoted in Joel T. Fry, "John Bartram Carr, The Unknown Bartram," *Bartram Broadside of the John Bartram Association* (Fall 1994): 4.

Chapter 5
Epilogue and Conclusion: Seeds from the garden

But while remembrance' power remains,
There rosy bowers shall bliss my view,
Sweet shades of peace! On foreign plains,
I'll sigh and shed a tear for you.
Alexander Wilson, "A Rural Walk"

Epilogue

After Bartram's death, what was left of the community at the garden disbursed. Nuttall had left Philadelphia just before Bartram died, to work at Harvard University maintaining the new botanic garden there. Not satisfied to settle in an academic position, Nuttall would continue to travel and collect throughout North America. Due to family obligations, he eventually returned to England to spend the end of his life pursuing the less adventurous side of botany. James Mease continued his work with the Society for Promoting Agriculture, and efforts to preserve the history of the young country. He continued to publish until close to his death in Philadelphia on May 14, 1846.

John B. Carr, Robert's son, died in June, 1839, of pulmonary consumption; he was 34 years old. His "Diary of a Naturalist" bares a remarkable resemblance to the weather diary kept by his Uncle William. The notations are of similar format and language choice. The herbarium specimens from the Bartram family collection that he prepared in the early 1830s would perhaps be the last type specimens to leave the garden.[224]

In May 1829, Mease wrote a brief history of the garden that would appear in the *Gardener's Magazine*. His short description was sent to the editor as a correction to a list

224. "Today, 63 of Carr's specimens survive in the Darlington Herbarium preserved at West Chester University." Joel T. Fry, "John Bartram Carr, The Unknown Bartram" *Bartram Broadside of the John Bartram Association* (Fall 1994): 4.

of botanic gardens in Philadelphia that had appeared in an earlier issue. Mease's description defends the garden's significance and says that Robert Carr is running it with "great zeal and success."[225] This says two things, one is that the garden has already started to drop off the "radar screen" of at least some of the gardening community by 1829, and that Mease's connection and loyalty to the family continued after William's death. A committee of the Pennsylvania Horticultural Society visited the garden in 1830 and "found the estate to be in most excellent order."[226]

After William's death, Ann and Robert attempted to maintain the house and expand the garden and nursery business. The expanded garden included 1400 native plant species and as many as ten glass houses filled with exotic plants. The Bartram garden continued to supply plants to notable customers. For example, Thomas Say, working at the community at New Harmony, ordered fruit trees from the Carrs. There were now two very different possible directions for the garden to go in, one toward the intellectual, scientific or the other toward the culture of curiosity. In the mid 1840s, Ann and Robert chose to try to accommodate the desires of the curious, turning the garden into a "pleasure park" complete with entertainers, ice cream vendors and steamboat rides. It was not enough, though, for the garden to survive as a viable business.

The garden and the plants were sold at public auction in the summer of 1847. After a few years of a sort of transitional ownership, the garden finally went fully into the hands of Andrew Eastwick, an inventor and railroad entrepreneur. Eastwick would preserve the garden as a "curiosity" on his private estate until it became part of the public

225. James Mease, "Bartram's botanic garden on the Schuylkill, near Philadelphia," *Gardener's Magazine, Loudon* 7 (December 1831): 665.
226. John. W. Harshberger, "Bartram Arboretum and Park," *Gardeners Magazine* 32 (October 1920): 80.

park system in Philadelphia. The Woodlands, too, would be turned to another use. The garden would become a cemetery, though some of the original paths are still in the park.

By the time of Ann's death in 1858 (she is buried at the Woodlands), the nature of nature study had changed. She was a victim of these changes. What must her last years have been like? Did she pine for the days gone by? Or was she relieved to have the burdens of her family, burdens she did not choose for herself, lifted from her shoulders? Was she excited to see the greater interest in science? Was she frustrated by the exclusion of women from the scientific processes?

The garden had succeeded partly because it was held together by the intellect, personality and reputation of a single person. William may not have been a successful business man, but his presence leant success to his family's business. Equally importantly his personality—his willingness or preference to stay out of the limelight—made him a beacon for students, colleagues, and peers. His self-deprecation played and important part in the development of the younger men who worked with him. He seems always willing to assist with a project, but spent little or no time on self-aggrandizement.

After his death, the family reputation passed to Ann. There is little doubt that she was an accomplished naturalist, but she was a woman. One reason the garden could not survive is that its leading scholar, Ann, was "caught between two almost mutually exclusive stereotypes: as scientists they were atypical women; as women they were unusual scientists." Ann shared these disadvantages.[227] By the mid-nineteenth-century texts on Botany for ladies were available. They were infused with decorative illustrations and poetry. As the sciences became more specialized and professional the legitimacy of

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227. Margaret W. Rossiter, *Women Scientists in America: Struggles and Strategies to 1940* (Baltimore: Johns Hopkins University Press, 1982), xv

these texts published especially for ladies became undermined. The association of women and Botany took on a form that undermined the legitimacy of as a resource.

The institutionalization of the sciences in the academy and the establishment of science as a profession forever changed the way that science was conducted. The physical arrangement of the garden and Bartram's willingness and openness to teach may have in the end undermined the success of the garden as an institution of learning. The lack of an atmosphere of authority, with a clear hierarchy between teacher and student, meant that the garden may not have been considered a place of learning from authorities once institutions with these features were available.[228] As was true for the conduct of science, gardening was becoming more institutionalized. The Pennsylvania Horticultural Society was founded in 1827. (Interestingly, Ann Bartram Carr was not a member.) Written resources about plants became more readily available, so the necessity of living reference guides decreased.

The business of the garden could not survive the multiple challenges it faced. The economic depression of the early 1820s must have had an effect on the profitability of the garden. With soup kitchens in Philadelphia distributing soup at a rate of a pint per person per day it seems unlikely that the seed business was not affected.[229] The market for American plants was changing; David Landreth's nursery grew and by 1824 had expanded to thirty acres in two locations. (The two locations allowed for some control of cross-pollination.) John Lyon in England, in 1811, had offered American plants for sale to the English market for the first time.

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228. For a discussion of authority and space see Dorinda Outram, "New spaces in natural history," in *Cultures of Natural History*, eds. N. Jardine, F. A. Secord, E.C. Spary (New York: Cambridge University Press, 1996).
229. For more on the economic crisis of this period see Samuel Rezneck, "The Depression of 1819-1822, A Social History," *The American Historical Review* 39, no. 1 (October 1933): 28-47.

The work of the men and women who worked at the garden was within a few years of their deaths overshadowed. Amos Eaton's *Manual of Botany for the Northern States, a field guide* would go into its eighth edition in 1840 and John Torrey's *Flora of the Northern and Middle Sections of the United States Or A Systematic Arrangement and Description of All the Plants Hitherto Discovered in the United States North of Virginia"* would displace the work of Barton and Nuttall. In 1827 the huge first volume of John James Audubon's *The Birds of America* was published. Wilson's *American Ornithology* was dwarfed in comparison and soon forgotten.

Conclusion

Bartram's garden was a living resource for the scientific communities of Philadelphia and beyond. Many documents written by residents, neighbors, and visitors owe their existence to the plants, animals, and humans who lived and grew in the garden. Some of the data for these documents was gathered during traveling expeditions, and some was gathered within those several acres along the Schuylkill. The scientific accomplishments of the Lewis and Clark expedition, for example, depended in some part on the community in Philadelphia. Without their assistance in preparing for and documenting the discoveries of the expedition, the achievements may have been lost. By providing such necessary elements as institutional backing and peer review of findings, the established scientific community at the desks and in the gardens of Philadelphia contributed materials and support for the expeditions to far reaching places. The environment in which the final reports were composed was as important to the results of the journey as the observations themselves. The resources of Philadelphia, including the garden, shaped the nature of the historical record.

Institutions like the garden were important to the scientific process. A community gathered there around the turn of the nineteenth century. But by the mid-nineteenth century, the garden as a focal point came to an end. The obvious explanation for the dissolution of the community discussed here is that the members died. But why did another, similar community not take its place? The garden itself had particular utility to the effort to document nature through its collection of plants, the geographic situation on the migration routes of many birds, and mostly in the encyclopedic knowledge of its primary intellect, William Bartram. But knowledge accumulates and is passed on and collections grow, so why did the garden cease to have the use it once did?

What had been a single community was during this period starting to split apart. The gardeners who had helped support the garden through their enthusiasm and commerce took their patronage elsewhere. The curious turned their interests away from North America and focused its interests on more exotic locales. The artists who had worked hand in hand with the scientists came under new expectations for their practice. Objectivity came to be valued in ways previously unknown. The artist's creativity and self-expression in the representations of nature came to be avoided within the performance of science. The scientists who used the garden as a reference guide were moving into more institutionalized environments. The casual resource of the garden no longer suited their needs.

With the shift in emphasis to more formal settings, the utility of the garden to the projects of science diminished. The search for the type specimen, the effort to identify similarities between species, whether plant, animal or disease, could no longer be carried out by single individuals. Searching for type specimens and new species of organisms

continued to occupy scientists, but the sheer quantity of known species alone made it more and more rare for one person to be able to master more than one class. The emphasis for the scientist stopped being Nature per se and started to move toward a specialty like mycology or embryology. In addition, the greater dependence on controlled experiments using increasingly sophisticated technology took the work of science out of settings like the garden. Though the circle at the garden was conducting some experiments, the rules of scientific processes were becoming more strict. The very definition of science was shifting and it is not a coincidence that during this period "naturalists" became "scientists."

Words develop because the need to name something becomes evident. Scientist as a word entered the English lexicon just at the end of this study. These men and women were examples of the phenomenon that needed to be named. Contrary to the common description of eighteenth-century scientists as amateurs, playing at science without resources or backing, these people were professional (paid for their scientific work), peer-reviewed, conducting repeatable experiments. By expanding the view of a resource and what is scientific discourse, it becomes clear that they were not playing at science but practicing science.

In modern biology the essence of an organism cannot be seen. The true identity is the genotype not the phenotype. All characteristics, those that cannot be seen as well as those that can, are considered essential to an individual organism. Only the features and behaviors that could be observed with the naked eye were considered essential to Bartram's circle. The categories (species) were developed based on data that was available to the naked eye. The acceptance of information and conclusions drawn from

data we can not see marked a significant shift in the sciences. With this shift, the naturalist, who makes observations of living organisms is no longer doing the science. The naturalist and the nature writer become the amateurs, before this shift in conception of species the person who studied the visible characteristics was the scientist.

The strategies and techniques of the science of the period are represented in the documents published for both specialized and general audiences. They show us that the period was characterized by the effort to reconcile fundamentally changing notions of nature. The eighteenth-century notion that nature reflects unchanging laws designed toward an ultimate purpose was shifting toward a theory of impermanence in nature that changes according to the needs of the environment. We also see a search for an understanding of life much greater than the particular processes of plants. Inextricably linked to one of the major philosophical and artistic debates of the period, the conclusions drawn about specific plant or animal functions contributed to an understanding of the whole universe of nature.

Modern classification of plants reflects our acceptance of evolution as the process of life, the "creation myth" of choice. Plants are divided into categories that include those with and without vascular systems and plants with and without a seed encasement. It has been recognized through modern research that these are the fundamental stepping stones from the least to the most complex forms of plant life. Though not universally true, generally, the more complex plants are the newer plants and therefore the system of classification mirrors the belief in the evolution and development of more complex life forms. The classification schemes of the late eighteenth century were equally illustrative. Though still in use, the Linnaean classification scheme was falling out of favor. A more

"natural" method was demanded. This demand actually confirmed the belief in a reality of nature that is ordered. They believed in a universe that was created for a purpose by an all-powerful God. Their belief in type specimens and clearly delineated species reflected that. The criteria for establishing the divisions between species reflect the scientists' perceptions of the rules nature plays by.

The accepted epistemology of the period, the Common Sense philosophy, argued that people can know that what they see is real. The connection between the data collected by the senses and a higher truth was firmly accepted. Though questioned, especially by the skeptics, the possibility of an understanding of the human mind that could not recognize truth was not tolerable. The basic processes of Natural History, identifying type specimens and developing classification systems, were dependent on the scientists' conception of the capabilities of the mind and the human connection to a perfect reality. That perfect reality was the higher order which was also God.

Intellectual developments of the nineteenth century opened new doors that allowed relativism into the understanding of nature. Once the senses were no longer the path to knowledge of the infinite, then science and religion were no longer linked the way they had been. With that break, the connection between human understanding of nature and that of a higher order was lost. With this loss comes the modern split between the realms of theology and science. Natural phenomena and metaphysical conclusions could no longer be understood during the same process with the same techniques. The questions fall into two types rather than one. It is not that the belief in fixed absolutes disappeared in the mid-nineteenth century, it is that the belief in fixed absolutes and the understanding

of how nature works could no longer be reconciled. What had once been a single belief fractured into those held by different people.

During the late eighteenth and early nineteenth century, the Enlightenment had started to fade in significance on the American intellectual scene. Enlightenment thought did not disappear however, it evolved and certain aspects of the thought were carried on in new forms. The Romantic movement did not undermine the Enlightenment but allowed certain aspects, like the concept of species and the idealism of the *Naturphilosophie*, to continue. Romanticism included the quest for primordial or ideal types. The concept of the ideal being reflected in nature connects the eighteenth-century scientists and their Romantic offspring. Romanticism was not the adversary to the Enlightenment but the last gasps of an old world view. The Enlightenment ideals lost their stronghold in the sciences and resurfaced incorporated in the philosophy that seemed to oppose all the Enlightenment stood for.

The reconciliation of eighteenth and nineteenth century views of nature required a compromise between the concepts of an unchanging and a changing universe. One solution to that seeming contradiction was the idea of teleology. A universe that is engineered toward goals allows for change and perfection to coexist. Natural laws of change and adaptation can be reconciled with a concept of nature in which God plays an active part. Modern debates about creationism and Darwinism seem to have brought the debate full circle. How can the universe be governed by the laws of random adaptation and still have a place for God. One solution that has been offered is the concept of intelligent design. But the scientific community has rejected intelligent design as a possible driving mechanism to nature. Is it because scientists refuse to believe in God?

No. The modern debate is as much about method as it is about God. The community who worked with Bartram and their works offer insight into the modern debate. One of the central debates at the end of the eighteenth century centered around the demand for a natural system of classification. The Linnaean system with its top-down methodology was not satisfactory for reflecting the complex arrangements of nature. A natural system utilizing bottom-up thinking was the only acceptable method for organizing the unending discoveries of nature. The rejection of intelligent design seems to reflect this same debate. Modern Creationists want to figure out a way to put God back into the developments of nature. They start with a concept (God in nature) and mold the theories around it (intelligent design). Scientists, however, insist that any hypothesis must come from the data itself. Deductive and inductive reasoning are struggling again. The resistance to the conclusion that God must be somehow involved in the creation and workings of nature is less than the resistance to the method of getting there. The methods of science can not be reconciled with the methods of theology. The origins of the split between these two methodologies goes back farther in time than the end of the eighteenth century, but that period highlights the division in its modern form.

The division between science and religion, so controversial today, was at the heart of the shifts that were occurring at the beginning of the nineteenth century. The garden fell victim these shifts. The intellectual, spiritual and cultural needs of the scientific community could not make use of a botanical garden like Bartram's. The garden is being restored today. Through careful research and archeology the old beds and paths are being rediscovered. School children visit to learn about the horticulture and the lives of

botanists of the past. The uses are new and different, nonetheless, the garden is of use once again.

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