

Western Botanical Gardens: History and Evolution

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ABSTRACT

Dedicated to promoting an understanding of plants and their importance, the modern Western botanical garden addresses this mission through the establishment of educational programs, display and interpretation of collections, and research initiatives. The basic design and roles of the contemporary institution, however, can be traced to ancient Egypt, Persia, Greece, and Rome, where important elements emerged that would evolve over the centuries: the garden as walled and protected sanctuary, the garden as an organized space, and plants as agents of healing. In the Middle Ages, those concepts expanded to become the *hortus conclusus*, the walled monastery gardens where medicinal plants were grown. With intellectual curiosity at its zenith in the Renaissance, plants became subjects to be studied and shared. In the 16th and 17th centuries, botanical gardens in western Europe were teaching laboratories for university students studying medicine, botany, and what is now termed pharmacology. The need to teach students how to distinguish between medicinally active plants and poisonous plants led the first professor of botany in Europe, Francesco Bonafede, to propose the creation of the *Orto botanico* in Padua. Its initial curator was among the first to take plant collecting trips throughout Europe. Not to be

outdone by the Italians, Henry IV of France charged Pierre Richer de Belleval to create a garden next to the university in Montpellier, and thus was born the *Jardin des Plantes*, which was followed by the *Jardin Royal des Plantes Médicinales* in Paris. Unlike the *hortus medicus* of Padua, Montpellier, and Paris, the *hortus* created by Clusius in Leiden was a true *hortus botanicus* that focused on rare plants from various parts of Europe and other continents. British botanists were motivated to create botanical gardens to study plants' medicinal properties, classify species newly arriving from sea voyages, and ultimately exploit their economic potential. With the Royal Botanic Gardens, Kew as the central hub, a network of royal botanical gardens was developed throughout Asia and the Pacific whose primary aim was to refine the production of economically important crops. Early North American botanical gardens differed from their English predecessors by focusing on assisting the less fortunate, discovering and preserving plant biodiversity, and providing refuges from urban crowding. Expanding beyond the interests of earlier institutions, modern botanical gardens focus both on the display and study of diverse collections and on such diverse areas as research into species conservation, educating the public about global climate change, and providing entertaining experiences for all ages.

KEYWORDS: botany; *hortus botanicus*; *hortus conclusus*; *hortus medicus*; paradise; simples

- I. INTRODUCTION
- II. ANCIENT ROOTS
- III. *HORTUS CONCLUSUS*: PRECURSOR OF THE *HORTUS BOTANICUS*
- IV. THE RISE OF BOTANICAL STUDIES
- V. EUROPEAN BOTANICAL GARDENS
 - A. *Orto Botanico of Padua*
 - B. *Jardin des Plantes, Montpellier*
 - C. *Jardin du Roi, Paris*
 - D. *Hortus Botanicus, Leiden*
- VI. BOTANICAL GARDENS IN GREAT BRITAIN
 - A. Early Herbalists
 - B. University of Oxford Botanic Garden
 - C. Royal Botanic Garden Edinburgh
 - D. Chelsea Physic Garden
 - E. Royal Botanic Gardens, Kew
 - F. Joseph Banks and the Royal Botanic Gardens Network
- VII. BOTANICAL GARDENS IN THE UNITED STATES
 - A. John Bartram: Scientist, Nurseryman, and Garden Creator
 - B. The Founding Fathers' Pride in the American Flora
 - C. New York City's Botanical Gardens
 - D. The Missouri Botanical Garden and the Opening of the West
 - E. The Arnold Arboretum and the Rise of American Philanthropy
 - F. Morton, Morris, DuPont, and Huntington: Passionate Garden Creators
 1. The Morton Arboretum
 2. Morris Arboretum of the University of Pennsylvania

3. Longwood Gardens

4. Huntington Botanical Gardens

G. The Chicago Botanic Garden: A Public–Private Partnership

VIII. THE FUTURE OF THE BOTANICAL GARDEN

LITERATURE CITED

I. INTRODUCTION

The modern Western botanical garden is dedicated to promoting an understanding of plants and their importance through the establishment of educational programs, display and interpretation of collections, and research initiatives. Although both form and botanical focus can be traced back to ancient civilizations, the modern botanical garden derives from the *Orto botanico* in Padua (1545), the *Jardin des Plantes* in Montpellier (1593) and Paris (1635), and the *hortus botanicus* in Leiden (1590). While the development of these gardens was framed by the scientific, technological, and religious revolutions brought about by the Renaissance, the demand for their creation was driven by the need to familiarize medical and pharmaceutical students with medicinally active plants. As the number of new plant species introduced domestically and from foreign lands increased exponentially and as the discipline of botany was cleaved from medicine, the more parochial concept of the *hortus medicus* gave rise to the scientifically based botanical garden. In addition to this scientific mission, the British botanical garden network of the 19th century was dedicated to the domestication and improvement of crops with economic potential, a mission that led to the creation of many notable botanical gardens in such Eastern locations as Singapore and Calcutta.

Modern European, British, and North American botanical gardens have expanded their public roles to become important cultural institutions with missions that include plant and ecosystem conservation, formal and informal education programs for a broad range of audiences, coordinated scientific research initiatives that cross continents and oceans, plant display, and popular entertainment (Watson et al., 1993). The objective of this chapter is to briefly describe the history of gardens and then to explore the developments of Western botanical gardens from the 16th century to the present.

II. ANCIENT ROOTS

The development of Western botanical gardens is evolutionary. Its beginnings can be traced to ancient Egypt where the development of the garden served societal functions including ornamental use and the collection of useful plants. In the period of the New Kingdom (16th to 11th century BCE), we first see the garden as symmetrical, walled sanctuary. The Egyptians had no landscaping precedent to emulate, and they created their own in what we now know as formalism. Based on ceramic shards and tomb paintings, typical homes were constructed around an unroofed courtyard filled with trees and in some homes a second courtyard contained more trees, providing shade and fruit, and perhaps a vegetable patch and a vine shading a work area (Wilkinson 1998). A significant contribution of the ancient Egyptians was the recognition of plants as healing agents. A 3,500-year-old papyrus discovered by George Ebers in 1874 reveals that the Egyptians had identified over 800 medicinally active plants that they used in their landscapes (Hales 2000). The pharaohs were horticulturally sophisticated and were continually on the search for new plants. They returned from military campaigns with exotic trees to be grown in the temple gardens. In 1500 BCE, Queen Hatshepsut organized a famous plant expedition to northeastern Africa, the Land of Punt, and returned with living myrrh trees planted in the terraced gardens of her temple at Deir el-Bahri. Her nephew, Thothmes III, carved curious plants brought from Syria upon the walls of the Temple of Amun at Karnak that included iris and squirting cucumber (Janick 2002).

The walled garden reappeared in the ninth century BCE in Persia where the Medes and later the Archaemenians established lush irrigated landscapes in a form that came to be known as *pairidaēza*, “a wall enclosing a garden or orchard,” from which the word paradise is derived. Given its central placement along the trade routes to China, India, and Arabia, Persia was ideally suited for the expropriation of exotic plants and horticultural design that increased after Babylon was captured from Nebuchadnezzar in 583 BCE. The Persian Empire stretched across the known world, its borders expanding to Greece and Egypt in the west and to India in the east.

Based on the ongoing archeological excavation of Cyrus the Great's palace at Pasargadae, the classical Persian garden has been shown to echo those of the earlier Egypt in form: it was designed as an integral component of the overall architecture, protected by four walls, and divided by irrigated rills. A major advancement that the Persians adopted was the use of aqueducts for irrigation (Hobhouse and Haspur

2003). These water channels for irrigation are the antecedent for the four-square garden, and these watercourses formed the principal axis and secondary axes of the main garden at Pasargadae.

After the Islamic takeover of Persia in the seventh century, this garden type became known as the *chahar bagh*, literally a garden of four. In Islamic cosmology, a cross divided the universe into four quarters and a spring that brought forth all life lay in its center, which is strikingly similar to biblical descriptions of the Garden of Eden, which was purported to have four rivers flowing forth from it (Shaw 1943).

The Greeks devoted considerable attention to agriculture and crop plants. Although the botanical writings of Aristotle (384–422 BCE) are lost, those of his most famous student and successor Theophrastus of Eresos (371–286 BCE) survive. Theophrastus eventually became head of the Lyceum, successor to Plato's Academy, and his students (disciples) numbered over 2,000. We know little about the gardens in the Grove of Academe in Athens, but from the many plants contributed by students and correspondents it is clear that they can be considered precursors of the botanical garden. His two famous botanical works, *History of Plants* and *Causes of Plants*, treat such topics as plant classification, propagation, geographic botany, forestry, horticulture, pharmacology, viticulture, plant pests, and flavors and odors. These works are not scientific in the modern sense, but represent descriptive rather than experimental science with brilliant insights. Justly called the Father of Botany, Theophrastus influenced botanical thinking until the Renaissance in Europe.

Interestingly, his works were not as influential as the first-century herbal (*On medical matters*) of Pedanius Dioscorides of Tarsus, a Roman physician who wrote in Greek about the medicinal value of about 600 plants, which remained the standard botanical medical text for 1,500 years under various translation and emendations. The Romans were more interested in practical agriculture than botanical science and were absorbed with horticultural technology. Columella devoted Book 10 of his *World of the Countryside* to a long poem on the merits of gardening and Book 11 to practical gardening advice. According to Pliny the Elder (*Naturalis Historia*, XX), Antonius Castor, who lived in Rome in the first century, had a botanical garden in which he “cultivated vast numbers of plants with the greatest care.”

The classical Roman garden was a private sanctuary built within a courtyard defined by a series of columns and associated entablature. However, within these courtyards, the planted beds surrounded a central pool that included many types of purely ornamental plants. From Pliny the Younger, we know that among these were roses, laurels, boxwoods, acanthus, oleander, iris, hyacinth, marguerite, pansy,

narcissus, anemone, carnation, foxglove, violet, gladiolus, and jasmine (Bazin 1990). As the Roman Empire expanded, the ornamental plants included novel species from foreign lands. In their rural villas, the Romans perfected the use of stone benches, marble statuary, and grottoes in their gardens, but a key feature was water in many forms, from pools to irrigation channels to fountains (Bazin 1990). Roman engineering enabled them to bring water great distances via a sophisticated system of aqueducts.

All these ancient gardens included several key characteristics that we have come to associate with botanical gardens. These include the garden as a walled, protected sanctuary, gardens as organized space, and gardens stressing the cultivation of plants as agents of healing. Finally, gardens were sites for the collection and display of exotic plants from other countries and cultures.

III. *HORTUS CONCLUSUS*: PRECURSOR OF THE *HORTUS BOTANICUS*

The Greek and Roman civilizations juxtaposed scientific knowledge and folk wisdom, information that stagnated and decayed with the decline and fall of the Roman Empire, leading to what is known as the Dark Ages in the West. However, horticultural information and technology were to survive in monastic gardens in the early medieval period as European culture descended into anti-intellectual theocracies that turned their collective backs on classical knowledge (Arber 1912). The classical documents were preserved by the Arabs, and much was translated by Jewish scholars. In Europe, life increasingly revolved around the church and the clergy and the monastery became central to the cultural fabric of villages and towns.

In the early centuries of the Christian era and in the Middle Ages, monasteries functioned as local health organizations, which meant that the herb garden was an essential part of the whole community's well-being. When barbarian tribes invaded the collapsing Roman Empire from the north and east beginning in 476 CE, monasteries were the primary organizations that preserved medical knowledge (Hales 2000). It was incumbent upon the monks to preserve knowledge of medicinal plants and their uses, not only because they had a much higher degree of literacy, but also because they served as holy agents. The church preached that God had imbued certain plants with healing powers at the time of creation. The common belief was that sin led to illness, and only through the combined forces of confession and the

ingestion of herbs prescribed by the monks could one be healed and absolved of that sin (Giulini 2005).

Continuing the design thread dating back to ancient civilizations, the typical medieval garden was square or rectangular, drawn into four quadrants and, like the earlier *paradeisos*, walled or fenced. Another common design feature was a central fountain or water basin, which for a culture dominated by religion was obviously symbolic of the river described in Genesis 2:10 that “flows out of Eden to water the Garden; and from there it divides and becomes four branches” (Delumeau 2000).

Within the cloister of monasteries and abbeys, there typically would be a *hortus conclusus* or garden of medicinal plants (Delumeau 2000). Of the scant information that is available on the appearance of the monastic garden, one of the best sources is the plan for the Benedictine Monastery at St. Gall, from around 816, which reveals much about the physical layout of monastic life. It included a main cloister, a vegetable garden divided into 18 separate beds, and an orchard used as a burial ground. There was a physic garden where plants with healing “virtues” were grown in 16 rectangular beds (Berrall 1966). The actual choice of plants for each garden was likely based on Emperor Charlemagne’s text from 812, *Capitulare de Villis Imperialibus*. Another well-recognized early monastic garden was Reichenau in Germany whose prior, Walahfrid Strabo (808–849), had been the teacher of Charles the Bold at Aix-la-Chapelle and whose verses extolled the virtues of learning about plants by working daily with them.

The *hortus conclusus* or physic garden was originally intended to treat monks who were ill or declining with age. Typically, decoctions were made from the medicinally active plants (“simples”) within the garden; in other cases, apothecaries were contacted to supply specific medicines (Landsberg 2003). But as important as the physic garden was in this culture, the monks’ knowledge of the use of simples was even more essential. Monasteries were vital storehouses of healing traditions that dated back to ancient times. Typically, one monk (the infirmarer) was assigned the responsibility for growing, harvesting, storing, and preparing herbs for medical use (Hales 2000). Latin translations of *De Material Medica* by Dioscorides and of *Qanun* by the Persian polymath, Abū Alī al-Husayn (980–1037) known in the West as Avicenna, became standard medical texts for use by the monasteries. The monks, however, did not rely exclusively on the classics. Pilgrims and travelers who sought sanctuary at the monasteries often brought with them new plants and new uses (Berrall 1966). Unfortunately, the only mechanism for sharing this knowledge was through handwritten texts, a laborious and expensive process. This widespread transference of knowledge had to await the advent of the *hortus botanicus* and the printed herbal.

IV. THE RISE OF BOTANICAL STUDIES

The discovery of the New World in 1492 by Columbus' voyage sponsored by the Spanish joint sovereigns Ferdinand and Isabella and the opening up of India by the Portuguese by circumnavigating Africa were instigated by the quest for a direct sea route to India. These stupendous events marked the advent of the modern world. The encounter of Columbus and his successors with America initiated a tremendous effect on agriculture and botany of both worlds as new plants were discovered. The Columbian exchange of plants changed the world forever and ignited a new important role for the botanical garden as new plants were collected and studied. Seeds including maize were brought back to Spain from the first voyage of Columbus in 1493 and in the 16th century new plant introductions exploded from explorations. Among the economically important species from the New World were the American agave (*Agave americana*) in 1561, sunflower (*Helianthus annuus*) in 1568, and the potato (*Solanum tuberosum*) in 1590. Early ornamental introductions included the tulip (*Tulipa* sp.) from Turkey in 1562, common lilac (*Syringa vulgaris*) in 1565 from the Balkans, and hyacinth (*Hyacinthus orientalis*) in 1590 from southwest Asia (Cappelletti 1995).

The conquest of the Aztec empire in 1519 by Hernan Cortez encountered an advanced agricultural civilization that mirrored the ancient civilizations of the West. The elaborate royal gardens near Tenochtitlan (now Mexico City), Chapultepec, Iztapalapa, el Peñon, Texcoco, and Huaxtepec contained ornamental, aromatic, and medicinal plants. They were described by Granziera (2003) "as part of a sacred landscape where images of the sun, the mountains and the waters of life stood at the centre of pre-Hispanic religion." The destruction of Aztec civilization by a combination of epidemics, drought, and conquistador rapacity proved to be a tremendous loss for humanity and botanical science.

By the 16th century, a community of scholars had formed whose members were interested in plants for their own sake rather than simply as useful objects. The new field of botany (*res herbaria*) was typically a sideline to the main occupation of scholars, which ranged from physician and apothecary to humanist scholar and cleric, many of whom were united not only by a mutual interest in plants but also by the relationship of their studies to the Protestant Reformation that was sweeping across Europe.

The Renaissance brought with it a rediscovery of the classics of antiquity. New translations were available of Aristotle's works on animals and plants, often from Arabic where this information was preserved, along with new versions of the botanical works of Theophrastus,

Pliny, Dioscorides, Galen, and Avicenna, translated into both modern Latin and vernacular languages that made them more accessible across the polyglot continent. While Luther's reformation was originally based on a repudiation of clerical excesses and a re-emphasis on biblical text, it led also to a reexamination of long-held religious and political assumptions and ignited a passion for questioning and exploration.

The study of plants was entirely consistent with the edicts of the Reformation movement. Martin Luther and Philipp Melanchthon promoted the acquisition of knowledge through reading the classics and through personal observation of the natural world. In condemning universities for their poor instruction in the natural sciences, Luther noted that wise peasants often knew more about plants than did professors (Reeds 1991).

The egalitarian tenets of Protestantism also impacted how people studied plants. All plants, whether medicinal, ornamental, or common weed, were equally valued as subjects for study and illustration. Those engaged in creating the early botanical gardens did so both as devotional acts and as ways of advancing their science. The rise of universities contributed to this expansion of knowledge.

V. EUROPEAN BOTANICAL GARDENS

Each of the botanical gardens created in western Europe in the 16th and early 17th centuries shared a common goal: to serve as teaching laboratories for university students, particularly those studying medicine and what would today be termed pharmacology and botany. Beyond this unifying goal, the individuals instrumental to the creation of the early botanical gardens were driven by different motivations and interests.

A. *Orto Botanico of Padua*

The University of Padua was founded in 1222. An important milestone in the history of botanical gardens came in 1533 with the appointment of Francesco Bonafede to the post of *Lectura simplicium*, which essentially made him the first professor of botany in Europe (Rhodes 1984). Over time, Bonafede became frustrated by the lack of access to living plant specimens with which to instruct his students. How could his pupils learn to properly distinguish between simples (medicinally active plants) and poisonous species, if they never got to see what they looked like?

This frustration motivated Bonafede to apply to the Venetian Senate in 1544 for authorization to create the *Orto dei Semplici*. In June 1545, the

Senate supported his application and passed a decree approving the creation of the garden. But the Venetian government's motivation was more than scientific. The Venetian Republic derived considerable income from trade in plant-based drugs. The collection and display of the plants from which those drugs were derived provided physicians and herbalists with benchmarks for testing, allowing for quality assurances that plants were what they were claimed to be, which in turn provided the Republic with a market advantage over other commercial regions and enabled it to thrive in the herbal industry (Minelli 1995). The first curator or prefect of the garden was Luigi Squalermo, known as Anguillara, who took up this post in August 1546. Trained as a physician, Anguillara became associated with Luca Ghini, first at the latter's private botanical garden and then at the *Orto botanico* in Pisa (which actually predated the *Orto* in Padua, but was moved twice before being settled in its current site in 1591). It was Ghini who first introduced the herbarium sheet as a way to preserve botanical specimens and he served as an excellent mentor to the young Anguillara.

Anguillara took up his new role with a passion. He was one of the first botanists to take plant collecting journeys, venturing into France, Switzerland, the western Balkans, Greece, and Asia Minor, and sending back to his beloved garden many specimens previously unknown in Italy. By 1552, just seven years after its creation, the *Orto botanico* contained specimens of 1,500 taxa of plants, including many species of botanical, agricultural, and horticultural interest (Christopher 1981).

In accordance with the original mandate, Anguillara created an *Orto dei Semplici* that was laid out, in keeping with the tradition dating back to ancient Persia, in a quadripartite design, set within a perfect circle, 84 m in diameter (Fig. 5.1). Within each of the four squares, diverse medicinal plants were displayed and labeled. In the 1549 report to the Venetian Senate from Bernardo Navagero, representative of the church in Rome (and later cardinal), he proclaimed that "those responsible for the Garden had done their job so well, providing precisely the service that was expected of them, that now professors and scholars consider this amenity of great benefit" (Dal Piaz and Bonati 1995).

Ironically, Anguillara's primary professional challenge came not from the Republic but from a fellow botanist. In 1561, he published *Semplici*, in which he attempted to clear up nomenclatural confusions by matching each plant described by ancient authors with a known contemporary species. Unfortunately, he corrected some nomenclatural descriptions in *Commentarii in libros sex Pedacii Dioscoridis Anazarbei*, the work of Pietro Andrea Mattioli, the most famous and most cantankerous botanist

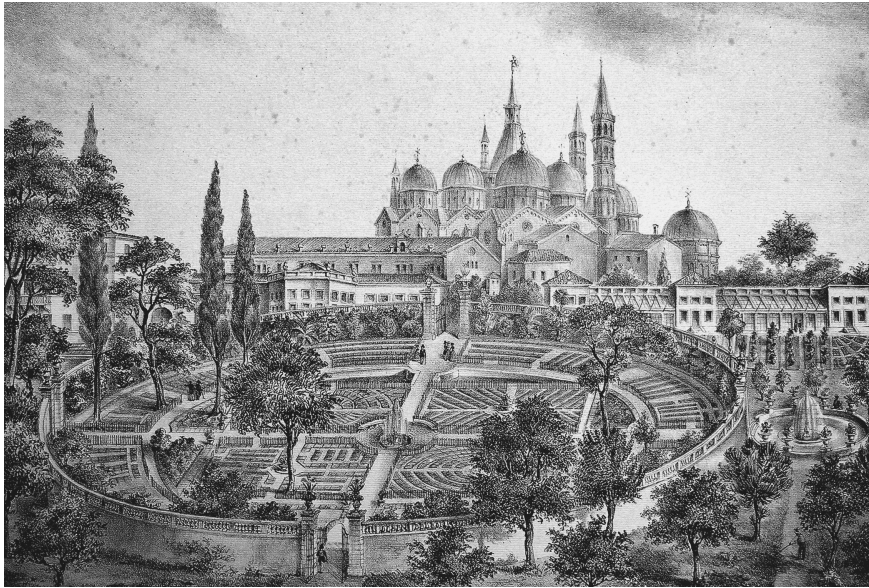


Fig. 5.1. Perspective view of the Botanical Garden of Padua, engraving by Andrea Tosini, 1842. (Used by permission of Library of the Botanical Garden of Padua.)

of the era. The enraged Mattioli published papers highly critical of Anguillara (Egmond 2010). Not one to engage in such public debates, Anguillara withdrew from his post and retired to a quiet life in his hometown of Ferrara (Pavord 2005). On the occasion of Anguillara's death in 1570, Alphonsus Pancius, *medicus* to the Duke of Ferrara, wrote in a letter to Clusius, "He was an uncultured man, but an excellent observer of plants. I admire him much, it happens that a greengrocer may make sensible remarks" (Veendorp and Baas Becking 1938).

Subsequent curators continued his groundbreaking work, collecting and exchanging plants, adding an arboretum, conservatory, and herbarium, expanding scientific research, and creating a more welcoming visitor presence. In 1977, the *Orto botanico* of Padua was declared a UNESCO World Heritage Site, with an inscription reading: "The Botanical Garden of Padua is the original of all botanical gardens throughout the world, and represents the birth of science, of scientific exchanges, and understanding of the relationship between nature and culture. It has made a profound contribution to the development of many modern scientific disciplines, notably botany, medicine, chemistry, ecology, and pharmacy."

B. *Jardin des Plantes, Montpellier*

Like the *Orto botanico* in Padua, the *Jardin des Plantes* in Montpellier was inspired by a great naturalist and teacher, Guillaume Rondelet, and created by a passionate botanical scientist, Pierre Richer de Belleval. The *Jardin des Plantes* also served as a teaching laboratory for the medical and pharmaceutical students of the University of Montpellier, and moved beyond that original goal to adopt a much broader mission of botanical display and research. The history of botany is most indebted to Rondelet for his role as a teacher. At various times, he served as the instructor of nearly all the great botanists of the late 16th century including Matthias de l'Obel (Lobelius), Jean Bauhin, Felix Platter, Leonhardt Fuchs, Conrad Gesner, Laurent Joubert, and Charles de L'Écluse (Clusius) (Mian et al, 2014).

Belleval was a physician, but unlike Rondelet, his early career received significant boosts from two fortuitous events. First, after completing his degree at the University of Avignon, he married the daughter of a deceased *Seigneur de Prades*, who brought to the marriage a considerable dowry. Second, while practicing medicine, he provided great service to the residents of the plague-filled village of Pezenas. In so doing, he caught the attention of the governor of the Languedoc region, Henri de Montmorency, who introduced Belleval to King Henry IV, who appointed him as his personal physician (although he remained in Montpellier and never traveled to Paris).

Recognizing that France needed a botanical garden to rival the one in Padua, in 1595 the King charged Belleval with the task of establishing a garden next to the medical school at the University of Montpellier, and in 1596 the Languedoc legislature ratified the King's order. Belleval gave the new garden his undivided attention. For its basic structure, he divided the *Jardin* into three sections: the King's garden (devoted to medicinal plants and therefore of most utility to the students in the medical school), the Queen's garden (plants from the mountainous sections of the Languedoc), and the King's square (plants of purely botanical or ornamental interest).

From the start, Belleval envisioned the *Jardin des Plantes* as more than a repository of simples. He created what became known as *le monticule* (later, *la Montagne de Richer*), a hillside with stepped beds on either side, in which he placed regional plants aligned to their natural solar orientation and soil requirements. While *la Montagne* still exists, the spiral-walled garden he created to provide shade and trap humidity for plants requiring such conditions was subsequently destroyed. According to Charles Frédéric Martins, director of the garden from 1851 to 1880,

the spiral-walled garden was designed to site plants in conditions similar to their natural habitat by using what Martins called “artificial plant stations.” Because they reflected Belleval’s recognition of the role of microclimates and anticipated the science of plant ecology by more than 400 years, these structures have to be viewed as nothing less than revolutionary (O’Hara 2013a).

Sadly, the emerging science of plants that Belleval was developing was trumped by religious conflict in Montpellier. While Henry IV had been tolerant of the Huguenot population of the region, his successor, Louis XIII, was suspicious of this non-Catholic population and in the summer of 1622 sent forces to subdue his subjects. The citizens of Montpellier resisted and built fortifications around the city including the installation of trenches and cannons in the botanical garden, which was completely destroyed. As Charles Martins wrote in 1871: “Trembling for the safety of his treasures, Belleval carried the most precious specimens into the heart of the town. Nor were his fears groundless, under the direction of the engineer, d’Argencour . . . a bastion was reared in the garden itself, and the blood of the combatants was poured among the devastated parterres” (O’Hara 2013b).

Once the siege ended, and the fortifications dismantled, Belleval immediately set out to rebuild his beloved garden, devoting his entire fortune and remaining strength to its restoration. Within a few years, after repairing or rebuilding the infrastructure and locating lost specimens, the garden slowly returned. In fact, he was able to expand both the total dimensions of the garden and the size of *la Montagne*, but the work exhausted Belleval who was perpetually short of funds.

C. *Jardin du Roi, Paris*

On a visit to the Montpellier garden in 1629, Cardinal Richelieu, the King’s advisor, promised Belleval support from the King. Although that funding never arrived, the *Jardin* in Montpellier did serve as a model for the *Jardin Royal* in Paris. The key driver of the new garden was Guy de la Brosse who, like so many of these early botanists, was a pharmacist and researcher and also served as a physician to the King. Because of his intimacy with the King, de la Brosse was able to petition for support much more effectively than could Belleval. The *Jardin Royal des Plantes Médicinales* was authorized by royal decree in 1624 with de la Brosse as the first *intendant* or director and opened to the public in 1634 (Warner 1956).

From the perspective of collections, the royal garden owed much to the *Jardin des Simples* of Jean Robin and his son, Vespasien. The Robins

were renowned in Paris: the father served as royal botanist to three successive kings, and the son was a well-traveled botanical collector and subsequently director of the medicinal garden started by his father. Jean Robin had a private garden at the western end of the Ile de Notre Dame and in 1586 was put in charge of the gardens of the Louvre. In 1597, he was directed to lay out a *Jardin des Simples* for use by the faculty of medicine at the University of Paris. Most of the species grown in the Robins' garden were eventually transferred to the King's new garden, and Vespasien became its botanical lecturer, living there until his death in 1662 (Warner 1956). Today, the Robins are remembered as the namesake of the genus *Robinia*, the native North American black locust.

After a period of decline following Vespasien's death, the royal garden expanded and over time has become a multifaceted natural history museum with four galleries: the Grand Gallery of Evolution, the Mineralogy Museum, the Paleontology Museum, and the Entomology Museum. In 1795, it expanded again when Bernardin de Saint-Pierre founded a small zoo with animals from the royal menagerie at Versailles.

D. *Hortus Botanicus*, Leiden

During the later stages of the Dutch Revolution against the Spanish in 1574, Prince William of Orange granted a request from the burghers of Leiden to found a university in their beleaguered city. Within 12 years, the burgomasters then agreed to a request from the *curators* or trustees of that university to establish a botanical garden on "the empty place behind the university" (Veendorp and Baas Becking 1938). But it was not until 1594 that the *hortus botanicus* was actually established, and even then only after a considerable challenge in selecting a founding prefect or director. While its establishment was roughly contemporaneous with the *Jardin des Plantes* in Montpellier, the mission and collection development at the *hortus botanicus* in Leiden represented a significant step forward in 16th-century botanical garden development.

Given that the university did not possess a botanical collection and there was no budget to acquire one, in 1591, the curators tried to recruit the physician Bernandus Paladanus from Enkhuizen, Holland, who was an esteemed collector and vendor of *naturalia* in the form of minerals, shells, and rare plants (Egmond 2010). The offer from the curators specified that he was to come "with all his collected curiosities and plants" (Veendorp and Baas Becking 1938). Paladanus flirted with the offer and even sent two designs for the garden based on the layout of the Paduan garden. But after his wife shared a very unflattering review of her visit to Leiden, Paladanus rejected the offer.

After this setback, the wealthy nobleman and plant connoisseur Johan van Hoghelande and his close confidant Princess Marie de Brimeu exerted their considerable influence to get the great botanist Carolus Clusius appointed prefect. Clusius had already had an illustrious botanical career and in his 60s felt that he was too old for such an undertaking. So when van Hoghelande approached him in December 1591 to find out whether he would eventually accept the position that Paladanus had refused, Clusius responded that by no means could he be induced to teach or even to accept responsibility for the new garden (Veendorp and Baas Becking 1938). Fortunately, Van Hoghelande was persistent, and on May 21, 1592, he received a letter in which Clusius stated that he might accept the position *if* he could employ a servant, was given no responsibilities for teaching, and would be assured that the garden would employ a horticulturist who would actually plant the beds.

In 1593, Clusius was appointed prefect of the *hortus* and the well-respected apothecary Dirck Cluyt (or Cluytius) was appointed his second in command. While the familiar quadripartite design may have given the impression of a uniformity of purpose with other botanical institutions, the concept of the *hortus medicus*, so central to the *Orto* in Padua and still a major component in the *jardins* in Montpellier and Paris, was not a driving force in the Dutch *hortus*. This was to become a truly global botanical garden, including rare species from all known parts of the globe, some of which were believed to have medicinal value (Egmond 2010).

The biography of the man who would become Clusius is significant to an understanding of the garden he would create. He was born Charles de l'Ecluse of noble lineage in Artois, France, in 1526. He studied law at Louvain and Marburg and later medicine at Wittenburg and, like so many notable botanists of his era, eventually found his way to Montpellier to study with the great Guillaume Rondelet, who set him on his life path (Hopper 1991).

In the 16th century, the world of nature—of plants, animals, marine creatures, and minerals—was lifted from the shadows and cast at the center of social and intellectual interest for much of European society. It was a perfect time for someone with Clusius' inclinations and skills to ascend to the top of his profession, despite his lack of a university degree. By the middle of that century, Clusius, Matthias de l'Obel, and Rembert Dodoens formed a triumvirate of botanists working in the southern Netherlands. Known as the "Flemish Fathers of Botany," the three shared rare plant discoveries and knowledge and visited regularly throughout this period. Eventually, the ongoing Dutch Revolution and the splitting of the Netherlands into two separate states led each to leave the region (Egmond 2010).

The Holy Roman Emperor Maximilian II invited the 47-year-old Clusius to found and direct a *hortus medicus* in Vienna. Not only did Clusius develop a renowned medicinal garden in the city, but he also used this time to investigate and catalogue the native flora of Austria and Hungary. This direct study of plants in their native ranges, an approach that was still in its infancy, reflected the significant roles that Clusius, Anguillara, and Belleval played in the establishment of botany as a scientific discipline. Clusius' publications in this period included *Rariorum aliquot stirpium per Hispanias observatarum Historia* (*An Account of Rare Plants Observed in Spain*, 1576), *Rariorum aliquot stirpium per Pannoniam, Austriam et vicinas quasdam provincias observatarum Historia* (*An Account of Rare Plants Observed in Pannonia, Austria and Neighboring Regions*, 1583), and his most renowned work *Rariorum Plantarum Historia* (*An Account of Rare Plants*, 1601).

But why was a man of 67, with a permanent hobble from a horse riding accident, appointed to direct the first true botanical institution in the Netherlands? The answer lies in Clusius' networks. He was fluent in seven languages and a consummate letter writer. Over the course of his long career, he wrote and received thousands of letters, and many of these exchanges included gifts of seeds, plant parts, or dried plants. Clusius employed these networks to familiarize himself with newly discovered plants, as well as to develop the species diversity of the *hortus*. It was Clusius who first introduced the tulip to the Netherlands, a genus that was responsible for the gaining and loss of enormous fortunes in 17th-century Holland.

During its first decade, the collections were largely built upon several contributed private plant collections (each of which had been shaped by its owner's particular passions and fascinations), as well as by seeds and plant propagules sent to the *hortus* from various plant explorers. Despite these disparate collections, the *Index Stirpium* of 1594 clearly shows that Clusius placed specimens based on their morphological and floristic characters. For example, tulips and other bulbous plants were grouped together, as were roses, umbellifers, mints, broad-leafed irises, and narrow-leafed irises. Coming a century and a half before the advent of Linnaean classification, this systematic arrangement of plant species in the *hortus* is further evidence of the importance of Clusius and Cluyt to the emerging science of botany (Tjon Sie Fat 1991).

Leiden's original *hortus* did not survive and the site today is partly occupied by a University of Leiden building. But in the 1930s the garden's administrators were able to construct a two-thirds sized replica of the *Hortus Clusianus*, using the original *Index Stirpium* of 1594 and other historic records. Stepping into this beautifully laid out

reenactment takes one back to an age when intellectual curiosity was at a zenith, learned individuals freely shared their new knowledge and rare plants, and horticultural techniques reached a remarkable level. The great men who created these early botanical gardens formed a cohesive network despite the relatively primitive status of postal systems and roadways.

This network, however, should not be perceived as having sprung up, *de novo*, in the 16th century. Rather, it represented a high water mark along an evolutionary line that traces back to the herbalists Theophrastus, Dioscorides, and Aviceenna, up through the medieval *hortus conclusus*, and then through the global explorations of the 15th and 16th centuries. What they started then crossed the English Channel to fuel a fascination with botany and horticulture in Britain and eventually the American colonies and led to the continued evolution of the modern botanical garden.

VI. BOTANICAL GARDENS IN GREAT BRITAIN

A. Early Herbalists

Three critical but interrelated factors drove the evolution of botanical gardens in Great Britain. The first of these was the increasing reliance on plants as healing agents, which required the identification of the medicinal properties of both common and exotic plants. The second was the vast number of previously unknown species arriving on British shores as trade and exploration became global enterprises. In order to understand their potential uses, they needed to be collected and organized systematically. The third factor was the growing awareness that plants equaled wealth and that the country that controlled production of the most highly valued crops could establish highly lucrative monopolies. Each of these three motivators—medicinal, botanical, and economic—contributed to the rise of the greatest network of botanical gardens the world has yet known.

Interest in botanical gardens arrived later in England than in continental Europe. However, several important physic gardens and herbalists were active prior to the establishment of Britain's first true botanical center. The first herbalist of note was the Reverend William Turner (1510–1568), sometimes called “the Father of English Botany,” who was a controversial and much reviled figure in his times. Banned from England for espousing radical Protestant views, he explored native plants throughout Europe and in 1568 published the results of his

explorations in his *Herbal*, which was noteworthy for debunking many common plant myths of the period. Turner also created physic gardens, first at a site near Kew, and then adjacent to Wells Cathedral, where he served as Dean after his return (Hill 1915).

Building on Turner's botanical efforts, John Gerard (1545–1612) is known primarily for his *Herball, or Generall Historie of Plantes*. Largely uneducated but fiercely ambitious, Gerard rose through the ranks of the London Society of Barber-Surgeons and eventually served as superintendent of the gardens of William Cecil, Lord Burghley in the fashionable London suburb of Holborn. His *Herball* was primarily a translation of Rembert Dodoens' immensely popular herbal, along with citations based on both the garden he curated and unpublished material from his friend, the herbalist Matthias de l'Obel. Despite its shortcomings and inaccuracies, it was the most widely circulated botanical book in English in the 17th century (Smolenaars 2008) and contained the first published illustration of a potato, which Gerard labeled "the Virginia potato." Clusius later correctly identified its country of origin as Peru.

After serving as gardener to various members of the nobility, John Tradescant the elder (ca. 1570–1638) was appointed Royal Gardener to Charles I and created a garden in Lambeth to house the many plant species he collected on extensive travels in Europe and the Middle East. So diverse was this garden that contemporary botanists consider it to be the most important early physic garden in England. His son, who also bore his name, continued his father's collecting travels by venturing to the colony of Virginia, from which he brought back seeds of magnolias, tulip tree, and bald cypress. He also created *Museum Tradescantium*, an extensive catalogue of all of the found objects and species in the garden. The collection of curiosities from the travels of both Tradescants later formed the basis of the Ashmolean Museum, one of the first museums in the Western world (<http://www.ashmolean.org/about/historyandfuture/>).

While both Gerard and the Tradescants focused on botany in their professional pursuits, John Parkinson (1567–1650) was more intent on popularizing horticulture. Trained as an apothecary (and eventually serving as a founding member of the Worshipful Society of Apothecaries), Parkinson came to popular attention with the publication of *Paradisi in Sole Paradisus Terrestris* (1629), a guide to the proper cultivation of plants, which was divided into three sections: the flower garden, the kitchen garden, and the orchard garden. Later, Parkinson published his monumental *Theatrum Botanicum* (1640), a beautifully presented treatise in which he described over 3,800 plants (Arber 1912). Little is known about Parkinson's own garden in Long Acre near Covent Garden, although John Riddell has suggested that it may have been two acres in

size and surrounded by a wall. Four hundred and eighty-four types of plants were grown in the garden (Riddell 1986).

The importance of Gerard, l'Obel, Tradescant, and Parkinson is reflected in the plant genera bearing their names: *Gerardia*, *Lobelia*, *Tradescantia*, and *Parkinsonia*. Regardless of professional training, the four herbalists shared an obsession for collecting, investigating, and writing about ornamental and medicinally active plants. While none were involved in the development of a true botanical garden, their work provided the medical and botanical threads that formed a significant part of the British botanical gardens that followed.

B. University of Oxford Botanic Garden

The first major step in the establishment of a botanical garden network in the British Isles was the creation of the University of Oxford Botanic Garden in 1621. Funded by Sir Henry Danvers, Earl of Danby, who dedicated his fortune to the effort, the garden was “primarily founded for a Nursery of Simples, (so) that a professor of Botanicney (sic) should read there and shew (sic) the use and virtue of them to his auditors” (Anthony Wood, *Antiquities of the University of Oxford* (1796), quoted in Vines and Druse 1914).

The initial work on the garden consisted of raising the ground to prevent flooding and erecting stone walls and the Danby Gate at the terminus of the north–south axis. The garden beds were laid out in a quadripartite design, similar to the early physic gardens on the continent. But the construction exhausted Sir Henry's £5,000 bequest, and no professor of botany was designated until 1669 when Dr. Robert Morrison was appointed by the faculty of medicine. Morrison was responsible both for lecturing on simples in the physic garden and for writing his great catalogue of the garden's plants, *Historia Plantarum Oxoniensium*.

The first curator of plants under Morrison's tenure was Jacob Bobart senior, a dedicated gardener who, due to the garden's poor finances, received no salary for the first seven years. Instead, he supported himself and his family by selling fruit grown within the garden's walls. His son, Jacob junior, succeeded him as curator and Morrison as professor of botany. It was the younger Bobart who compiled the first complete list of garden seeds for exchanges with other gardens, which serves as a progenitor of the modern *Index Seminum*.

One of the most fortuitous developments in the history of the Oxford Botanic Garden was the largesse of William Sherard, a distinguished patron of botanical science. After studying with many of the most notable botanists of his age and traveling extensively in search of novel

species, Sherard in 1726 donated to the garden a unique collection of plants, a herbarium of dried specimens, a library of botanical works, and £5,000 for the construction of a conservatory. He also included an additional £3,000 in his will for the salary of a professor of botany (a position still designated as the Sherardian professorship) and a maintenance endowment for the garden.

C. Royal Botanic Garden Edinburgh

In 1670, the Royal Botanic Garden Edinburgh began quite modestly as the Edinburgh Physic Garden on a 1,600 square foot plot in St. Anne's Yard adjacent to Holyrood Palace. The garden's creators, Dr. Robert Sibbald (later the first Professor of Medicine at Edinburgh University) and Dr. Andrew Balfour, intended the garden as a site for the study of medicinal plants, much like other gardens of this period (www.rbge.org.uk/home) (Daubeney 1850).

In the nearly three and a half centuries since its creation, the garden experienced three moves and considerable changes in focus. Significantly, in 1763, the collections were moved to Leith on the city's outskirts, and the first Regius (royal) Keeper was appointed with funding from the Crown, marking its status as a Royal Botanic Garden. In the 1820s, the Garden moved a final time, to Inverleith, and in 1858, the iconic Palm House was completed on this site. In the 19th century, the garden, like Kew, sent out explorers to bring back new species for its glasshouses. The Inverleith site has gradually expanded over time, and three satellite gardens have been added in Benmore, Dawyck, and Logan, each with unique climatic conditions and collections (www.rbge.org.uk/home).

Royal Botanic Garden Edinburgh may be best known today for its remarkable rock garden, but the Garden is also an international leader in biodiversity conservation and plant evolutionary studies, and more recently in offering distance education.

D. Chelsea Physic Garden

Conceived by the Worshipful Society of Apothecaries of London, the Chelsea Physic Garden was created in 1673 as a training site for apprentices to grow medicinally active plants and study their uses. Originally located on a leased site of Sir Henry Danvers' garden in Chelsea, it was moved to its second and final site in 1722 when Dr. (later Sir) Hans Sloane conveyed the walled garden within the Manor of Chelsea to the Society for £5 a year, requiring only that the Garden

supply the Royal Society, of which he was a principal, with 50 good herbarium samples per year, up to a total of 2,000 plants (Hill 1915). In so doing, Sloane changed the garden's direction so that it should never limit itself strictly to the display and evaluation of medicinally active plants, but rather should serve a broader botanical role.

This mandate to cultivate and display a wide botanical array was given a tremendous lift with the appointment in 1723 of Philip Miller as head gardener. Miller is significant for two reasons: first, he served as a veritable magnet for the collection of plant species from around the globe, many of them first grown in England by him. One of his correspondents was John Bartram, the early Pennsylvania nurseryman who provided Miller with seeds of such North American conifers as *Abies balsamea* and *Pinus rigida*. In addition, Miller was the extremely popular author of *The Gardeners and Florists Dictionary or a Complete System of Horticulture* (1724) and *The Gardeners Dictionary Containing the Methods of Cultivating and Improving the Kitchen Fruit and Flower Garden* (1731). The latter served as a standard horticultural reference for many generations in England, the American colonies, and (in translation) the Netherlands and Germany (Paterson 1986).

Under Miller, the Chelsea Physic Garden enjoyed an era of high visibility and even greater repute. According to botanist Peter Collinson, who visited the Garden in 1764, Miller "raised the reputation of the Chelsea Garden so much that it excels all the gardens of Europe for its amazing variety of plants of all orders and classes and from all climates . . ." (Paterson 1986).

At the end of the 19th century, the trustees of the City Parochial Foundation agreed to take over the running of the Garden from the Society of Apothecaries. In 1983, the Garden became a registered charity and open to the general public for the first time in its history.

E. Royal Botanic Gardens, Kew

Practices established at both the Oxford Botanic Garden and the Chelsea Physic Garden to collect specimens from a wide geographic range provided the basis for the colonial network of botanical gardens and stations that were developed by the British crown and were administered by the Royal Botanic Gardens, Kew. Actually, Kew began as two separate estates—Richmond Lodge and Kew Fields. The former had a somewhat checkered history: it had been a monastic site, then a royal hunting estate that was broken up during the Commonwealth under Cromwell, and finally reclaimed as royal grounds during the Restoration. For much of the latter half of the 17th century, Kew Fields was owned by

the Capel family whose members were famously devoted to gardening (Desmond 1995).

A significant figure in the history of Richmond Gardens was Queen Caroline, spouse of George II. It was Caroline who embraced the nascent English landscape design style that favored sweeping vistas, serpentine lakes, and mannered woodlands in lieu of the strict formality and geometrical patterns of earlier schools. In redesigning Richmond, Caroline employed Charles Bridgeman, one of the greatest practitioners of this approach. Bridgeman served as royal gardener for many years and was the principal designer of many of the major components of the Kew landscape, including the Keeper's Close, Great Oval, Canal Garden, and River Terrace.

In 1731, Frederick, Prince of Wales and son of George II, leased Kew Farm from the Capel family, and five years later married Princess Augusta of Saxe-Gotha. Great garden enthusiasts themselves, Frederick and Augusta were guided by John Stuart, Earl of Bute, on plant acquisitions and landscaping. Devoted to both the advancement of horticultural science and his own political career, Bute was a staunch plant collector, and many of his new acquisitions found their way onto the grounds of Kew. Bute's significance to British horticulture was documented in a note Peter Collinson sent to Carl Linnaeus: "You desire to know our botanical people. The first in rank is the Right Honourable the Earl of Bute" (Desmond 1995).

In the 1740s, Frederick landscaped the area immediately south of the house, planting a multitude of trees and creating the Great Lawn, the Lake with its large island, and the mound on which the Temple of Aeolus now stands. After Frederick's death in 1751, Princess Augusta instructed her head gardener, John Dillman, to "compleat all that part of the Garden at Kew that is not yet finished in the manner proposed by the Plan and to keep all that is now finished" (Desmond 1995). In pursuit of this goal, the Princess was again principally guided by the Earl of Bute.

The groundbreaking for the Physic Garden and Exotic Garden in 1759 were the first steps in the development of Kew into a formal botanical garden. To manage the collections, Augusta then hired as head gardener William Aiton who had trained under Philip Miller, Chelsea's longtime leader.

Upon Augusta's death, George III inherited Kew and Richmond and united the two properties under a single administration. Like previous members of the royal family, George III made a number of physical changes to the site. First, he appointed the highly regarded designer Lancelot "Capability" Brown as Surveyor of His Majesty's Gardens, who further developed the informal landscape, focusing on soft, curved lines

wherever possible. But the most significant step he took was to appoint Sir Joseph Banks to “a kind of superintendence” in 1773. Already a highly regarded botanist and plant collector and cofounder of the London (later Royal) Horticultural Society, Banks led the evolution of Kew from a primary focus on collecting and categorizing plants to becoming a major engine of economic botany.

F. Joseph Banks and the Royal Botanic Gardens Network

The late 18th century was an extraordinary period of exploration for and discovery of plant species new to Europe. With the full support of his King, Joseph Banks sent off plant collectors to such distant points as India, Malacca, the Spice Islands, and Australia. Through the species these explorers brought back and the establishment of outposts in these far-flung locations, Banks envisioned Kew as the central, strong axis of “a network of colonial botanic gardens which would serve as bases for plant hunting and act as experimental gardens for crops, vegetables and fruits which might lead to colonial economic development” (McCracken 1997).

In the realm of economic botany, Kew, with Banks at its helm, served as the confluence of the British East India Company, the British government, and the Royal Society, of which Banks was president. While never sacrificing his primary role as scientist, Banks endeavored to develop a network of colonial botanical centers to domesticate and improve crops with economic potential (McCracken 1997).

But that network was never realized in his lifetime. In 1820, both Banks and George III died, and Kew entered a period of decline. The less forceful garden directors and monarchs that followed failed to share Banks’ vision of how botanical gardens could improve the nation’s dwindling finances. In addition, most of the colonial botanical gardens established under Banks had by this time become private preserves, used primarily to produce vegetables for the governor’s table and flowers for the governor’s wife (McCracken 1997). It took the appointment in 1841 of Sir William Hooker, a highly regarded botanist, as director of Kew to begin the long process of rebuilding both the garden and its network of botanical outposts. Sir William Hooker served as director from 1841 until his death in 1865. He was succeeded by his equally eminent son, Joseph Dalton Hooker, whose directorship lasted from 1865 to 1885. By 1900, economic botany was fully established as an adjunct to imperialism. The 100 or so British colonial botanical gardens around the globe played significant roles in the nation’s dominance in production of spices, coffee, cinchona (quinine bark), rubber, and tea.

Just as the botanical garden network seemed to reach its apex, dark clouds converged at the onset of the 20th century to cause a rapid decline. Reflecting Britain's declining grip on its colonies, many of the colonial gardens passed to municipal control and morphed from research stations into public parks. More generally, as most crops of importance became agriculturally well established, the passion that both the British scientific establishment and the English public had felt for plant exploration and domestication dissipated. Further compounding the problems of the colonial botanical gardens, Kew itself entered another period of decline.

In the nearly 200 years since Banks' passing, the Royal Botanic Gardens, Kew has seen its fortunes continue to fall and rise. Today, it stands as one of the greatest botanical and horticultural institutions in the world, leading significant efforts in plant conservation, systematics research, display and education, and heading up the Millennium Seed Bank Partnership, the largest *ex situ* plant conservation program in the world.

VII. BOTANICAL GARDENS IN THE UNITED STATES

The European settlement of North America provided vast natural resources for the colonial powers to exploit. In addition to the timber, minerals, and agricultural products that were sold domestically or shipped back to Europe, the New World provided a treasure trove of botanical species to be explored. Its founding fathers—from Benjamin Franklin to James Madison—recognized that America's strength lay in its floral diversity, its rich soils, and its agricultural potential. Madison, in fact, positioned himself as an early defender of the environment, stating that humankind could not expect nature to be "made subservient to the use of man" (Wulf 2011).

Much as the discovery of new plant species during the Age of Exploration was a motivating force in the development of European botanical gardens, plant explorations along the Eastern Seaboard and later into the Midwest and Far West inspired both amateur and professional American botanists to found institutions to house their botanical wonders. Beyond simply celebrating the richness of the indigenous flora, these progressive individuals also strove to establish an American scientific identity, based on botany and distinct from British or European traditions.

As Eastern cities were gradually settled in the 19th century and waves of immigrants filled crowded tenements, wealthy merchants and

landowners adopted the Gilded Age notion that the downtrodden could be lifted up in their stations by providing them access to cultural institutions and exposure to nature. Because botanical gardens filled both roles, another motivation underlying their creation was the desire to ensure social stability by providing free access to gardens in urban locations.

Through much of the past two centuries, these three desires—to explore and display native American plant species, to create a truly American scientific identity, and to use wealth for the public good—drove the creation of the majority of botanical gardens in the United States. In the latter part of the 20th century and into this one, new gardens have been created and existing ones modified to address emerging societal needs, including the preservation of biodiversity and issues related to climate change.

A. John Bartram: Scientist, Nurseryman, and Garden Creator

The site of the earliest nursery that also functioned as a display collection of native plants is Bartram's Garden, founded in 1728 by John Bartram (1699–1777). Despite his limited formal education, this devoted Quaker was a botanist, plant collector, nurseryman, and cofounder with Benjamin Franklin of the American Philosophical Society.

For much of his adult life, Bartram supported himself with subscriptions from English plant enthusiasts for boxes of American plant specimens and seeds. Throughout this period, Bartram maintained a close correspondence with Peter Collinson, a wealthy London cloth merchant and fellow Quaker with a keen interest in botany, who helped Bartram find patrons among members of the royalty and nursery industry who shared a passion for American plants. Among these supporters were Philip Miller and Sir Hans Sloane, both of whom attained fame in association with the Chelsea Physic Garden (Wulf 2009).

While this business suffered periodic setbacks and never yielded the profits that he envisioned, Bartram is credited with the introduction of 150–200 new American plant species to Europe. Alone and later in partnership with his son William, John also undertook a number of explorations to discover the botanical wonders in this largely uncharted land, traversing the East Coast from Maine to Florida.

John chronicled his early investigations along Lake Ontario in *Observations on the Inhabitants, Climate, Soil, Rivers, Productions, Animals, and Other Matters Worthy of Notice*, made by Mr. John Bartram in his Travels from Pennsylvania to Onondaga, Oswego, and the Lake Ontario, in Canada. Later, on a 1765 exploration throughout the South, John and

William Bartram spotted the Franklin tree (*Franklinia alatamaha*) in a small grove along the Altamaha River in southern Georgia. William Bartram brought seed back to the garden in 1777 and named it in honor of his father's close friend. The species has not been reported in the wild since 1803.

In 1765, John Bartram was named Botanist to the King in recognition of all of the species he introduced to Britain. Four years later, John's broad scientific achievements led to his election to the Royal Academy of Science in Stockholm. In a frequently quoted statement, the great Swedish botanist and taxonomist Carl Linnaeus (1707–1778) praised John calling him “the greatest natural botanist in the world” (Wulf 2009).

By the time of the senior Bartram's death in 1777, Bartram's Garden contained the largest collection of North American species that had been gathered to date, including *Cladrastis kentukea* that had been discovered in 1796 in central Tennessee by the French plant explorer Andre Michaux, and a Bartram oak, *Quercus* × *heterophylla*, a rare but naturally occurring hybrid of red and willow oak. These were catalogued in the Bartrams' popular 1783 broadside *Catalogue of American Trees, Shrubs and Herbacious (sic) Plants*. The extensive collection of named plants and the catalogue describing those plants allow us to call Bartram's Garden one of the first North American botanical institutions. However, neither John nor sons William or John, Jr. (who together assumed ownership upon their father's death in 1777) promoted their site primarily as a botanical garden. Rather, through three generations of Bartrams, it was first and foremost a horticultural business, specializing in the native flora of the continent.

B. The Founding Fathers' Pride in the American Flora

Each of the first four American presidents were themselves farmers: Washington at Mt. Vernon; Adams on his farm, Peacefield, in Massachusetts; Jefferson at Monticello; and Madison at Montpelier. So while England was creating its network of royal botanical gardens and France had the *Jardin Royal des Plantes Médicinales* in Paris, America's early leaders recognized the need for a botanical institution that would reflect its status as a democracy, not a monarchy, in its capital city of Washington, DC. The concept of a botanical garden for all the citizens of the nation was first presented in 1796 by President Washington who suggested several sites, including one adjacent to the president's house. In a letter to the Commissioners of the District of Columbia, Washington wrote: “Conceiving (if there be space sufficient to afford it) that a Botanical Garden would be a good appendage to the institution of a

university, part of this square might be applied to that purpose. If inadequate, and that square, designed in the Plan by Majr. L'Enfant for a Marine Hospital, is susceptible of that institution and a Botanical Garden also, ground there might be appropriated to this use. If neither will admit of it, I see no solid objection against commencing this work within the President's square . . ." (Fallen 2007).

The notion of a botanical garden located in the young nation's capital and free and open to all can be contrasted with such institutions as the Chelsea Physic Garden that only opened to the general public in the 1980s or the Royal Botanic Gardens at Kew and Edinburgh that were traditionally dedicated to research and collections, not public access.

In 1816, the cause for a national botanical garden was taken up by the citizen founders of the Columbian Institute for the Promotion of Arts and Sciences who made establishing a garden one of the organization's primary goals. The garden would serve "to collect, cultivate and distribute the various vegetable productions of this and other countries . . ." (quoted in Fallen 2007). The Institute's goal also reflected the tremendous curiosity then prevalent regarding the natural world, particularly the biological treasures of the newly formed nation. After considerable lobbying, Congress approved a bill on May 8, 1820, granting the Institute "a tract of public land in the City of Washington, not exceeding five acres" for the purpose of establishing a botanical garden (Fallen 2007). An 1824 broadside lists more than 100 plant species that were then on display in the Columbian Institute. Many of these species had been solicited from foreign governments or were brought back by naval officers after deployments in foreign lands.

Unfortunately, dwindling interest doomed the Columbian Institute, and in 1837 Congress failed to provide ongoing support. But interest renewed in 1842 when the U.S. Exploring Expedition to the Pacific islands returned with 1,600 plant specimens representing 500 species. To house the collection, a temporary greenhouse was constructed behind the U.S. Patent Office. In 1850 when the Patent Office was enlarged, Congress allocated \$5,000 to relocate the greenhouse to the foot of the Capitol, and the United States Botanic Garden was officially named in 1856.

Many changes have taken place at the botanical garden in the nearly two centuries since its creation. Remaining true to its goal of demonstrating "the aesthetic, cultural, economic, therapeutic and ecological importance of plants to the well-being of humankind," the 21st-century U.S. Botanic Garden is focused on educating the public about sustainability and protecting the environment (www.usbg.gov).

C. New York City's Botanical Gardens

Although little known today, Dr. David Hosack (1765–1835) played a seminal role in the rise of the botanical garden in New York City. While serving as a professor of botany at Columbia College, Hosack made a considerable personal investment in the development of the Elgin Garden to house a collection of medicinally active indigenous plants from which drugs could be extracted. Given the undeveloped state of the pharmaceutical industry in 1801, Hosack's creation of the Elgin Garden was a significant step.

After failing to convince his college to finance the project, he sought help from the New York Legislature, but the support never materialized. In frustration, he published a pamphlet extolling the virtues of the garden and condemning the legislative inaction, which he circulated among horticultural associates from Boston to Philadelphia (Mickulas 2007), further alienating potential supporters. In 1811, Hosack was forced to sell the property to the State in a final bid to have it maintained as a botanical garden, but neither the state nor Columbia College ever appropriated adequate support, and by 1814 the Garden started on a decline from which it never recovered (Brown 1908; Mickulas 2007).

In the aftermath of the War of 1812 and the English trade embargo, which left the United States in a financially stressed position, neither the State nor City of New York was prepared to support a botanical garden. If a botanical institution were to be established in the city, it would need a hero of even greater influence and power than Dr. Hosack.

That hero came in the person of Dr. Nathaniel Lord Britton who, along with his wife Elizabeth and key members of New York society, triumphed in the chartering of the New York Botanical Garden (NYBG) in 1891. The Brittons were both noted botanists, and Nathaniel held a professorship at Columbia College. In 1888 they honeymooned in England, and upon visiting the Royal Botanic Gardens, Kew, Elizabeth was reputed to have asked, "Why couldn't we have something like this in New York?" (Mickulas 2007).

But more than scientific curiosity was behind her question. While New York had risen in both its financial and cultural status, it was still overshadowed by London, a position that the New York elite felt acutely. Two other factors played into the Brittons' drive to create this new garden. The first was the Gilded Age belief that the lives of impoverished urban dwellers could be uplifted by providing them with parks and green spaces, a belief that resonated with both the wealthy industrialists and religious leadership of the city and helped the garden's supporters in raising funds. The second was Nathaniel Britton's belief that the

establishment of a major botanical institution in New York was necessary to foster scientific independence from the Old World and particularly England. In this, he was supported by two nascent organizations: the Horticultural Society of New York and the Torrey Botanical Club. The latter was formed by Columbia professor John Torrey in the 1860s to share botanical discoveries and included Nathaniel Britton among its members. The Horticultural Society, in contrast, was a conglomeration of florists, nurserymen, estate gardeners, and estate owners. J.P. Morgan and others among the wealthy elite joined the group and participated in its annual exhibitions and competitions (Mickulas 2007).

The genesis of the New York Botanical Garden exemplifies several of the motivating forces that drove the development of such institutions in the 19th century: engagement of the upper classes in providing cultural centers for the masses, establishment of research centers where distinctly American science could be pursued, and botanical gardens as “arks” where North American and global flora could be displayed.

This loose alliance of botanical societies, privileged amateurs, religious leaders, and the New York news media all pressed the New York State Legislature to establish a true botanical garden in the city. Among the key players in this effort were two judges, Charles P. Daly and Addison Brown, both of whom were members of the Torrey Club. Brown co-authored with Nathaniel Britton *An Illustrated Flora of the Northern United States, Canada, and the British Possessions*. Finally, on April 28, 1891, the Legislature approved the articles of incorporation for the New York Botanical Garden, and a 250-acre parcel of city parkland north of the Harlem River was selected as its future site. Calvert Vaux provided the garden’s first schematic plan, and the Olmsted Brothers firm laid out the system of road and pathways.

Nathaniel Britton was installed as the new garden’s first director and quickly set about establishing a scientific research program for which he needed to raise \$250,000 in private donations by 1898. When he succeeded, the city matched those funds with an additional \$500,000 “for the construction of a fireproof botanical museum, laboratories, and horticultural houses” (Mickulas 2007). With these challenges behind him, Britton identified sponsors to support botanical expeditions in North America, Puerto Rico, and the Caribbean.

While their visit to Kew may have motivated the Brittons to develop a world-class botanical garden in New York City, the two institutions each reflect their periods of origin and their national priorities. Kew, under Joseph Banks, had a fundamental interest in the promotion of economic botany and viewed both plant exploration and the creation of satellite botanical gardens around the globe as ways to identify and then

propagate economically valuable species. These satellite gardens were as Donald McCracken notes “as much a part of British imperialism as were the fleets of the Royal Navy or the soldiers of the Queen” (McCracken 1997).

In contrast, the parties who contributed to the development of the New York Botanical Garden were democrats who desired to create a beacon of American scientific achievement for the betterment of man and the world. In so doing, they wished to enhance New York’s reputation as an urban center of science and culture. Today, NYBG continues to carry out its three-part mission of conducting basic and applied plant science research around the world, maintaining diverse and high-quality horticultural collections, and using its site as a venue for teaching the public about plant biology, horticulture, and the natural world.

While NYBG quickly attained its status as *the* botanical garden of the City of New York, Brooklyn also aspired to include a garden among its cultural institutions. In response to pressure from constituents in Brooklyn, the New York State Legislature approved a bill in 1897 to establish a botanical garden. Much like the mythical phoenix rising from burning ashes, the Brooklyn Botanic Garden (BBG) was created on a former ash dump in the northeast corner of a plot purchased for park development in 1864. The original 39 acres of the Brooklyn Botanic Garden opened in 1910 (<http://www.nycgovparks.org/parks/brooklynbotanicgarden/history>).

From its conception, BBG has focused on exceptional horticultural collections, scientific discovery, and service to the citizens of Brooklyn. The botanical garden’s first 20 years were particularly rich in the development of new gardens. From 1911, when the Native Flora Garden was laid out, to 1928 and the dedication of the Cranford Rose Garden, six major collections were added, as well as a laboratory and conservatory. Just four years after the garden’s dedication, the Children’s Garden opened, marking the birth of the children’s garden movement in public gardens.

In recent decades, the now 54-acre garden has continued to innovate, creating unique outreach programs such as Project GreenBridge and Greenest Block in Brooklyn and conducting extensive botanical research through the New York Metropolitan Flora project. Along with the Queens Botanical Garden—which emphasizes sustainable practices and serving ethnically diverse populations—New York now has major botanical institutions in three of its five boroughs. Together, these institutions have completed the dream of Nathaniel and Elizabeth Britton for their city to become a center of botanical research, display, and educational programming.

D. The Missouri Botanical Garden and the Opening of the West

The Missouri Botanical Garden has the distinction of being the earliest botanical garden in North America that has continued to operate on the original site. It was also the first botanical institution located away from the Eastern Seaboard, on the edge of the Western frontier. Ironically, it took an Englishman, Henry Shaw, not a trained botanist, to free botany from its East Coast mantle.

Henry Shaw was born in Sheffield, England, in 1800, the son of an ironware manufacturer. His early training provided no clues of the botanical passion he would develop in later life. Like many young men of his class, he studied the classics and French before joining the family business. In 1818, he and his father took a business trip to Canada, New York City, and New Orleans. From this bayou city, Henry decided to strike out on his own and to travel up the Mississippi to the French settlement of St. Louis (Colligan 2009). Once established in St. Louis, Shaw set up a dry goods store that sold provisions to settlers, trappers, and fortune hunters heading west. This business became such a success that by 1840 Henry Shaw liquidated his inventory and retired, a wealthy gentleman.

Shaw then had the means, leisure time, and interests to travel extensively in Europe and the Middle East. In 1851, while visiting Chatsworth, the Duke of Devonshire's country estate, Shaw was struck with the notion of creating a botanical garden in his adopted city. But Shaw was a businessman, not a botanist. To succeed in turning his St. Louis estate into one of the world's leading botanical institutions, he would need the assistance of professionals. Wisely, he sought advice from Sir Joseph Hooker, then the director of Kew, who introduced Shaw to Dr. George Engelmann, a German-born St. Louis physician known for his botanical knowledge. Through Engelmann, Shaw also established contact with Asa Gray, the eminent Harvard botanist. Relying on their counsel, Shaw made considerable progress from 1851 to 1859 on the development of the collections that would serve as the backbone of the garden.

Engelmann made collecting trips to the Rocky Mountains, the Southwest, and northern Mexico, and purchased at Shaw's behest the 60,000-specimen Bernhardt herbarium. Based on the advice of Hooker and Engelmann, Shaw determined that his nascent garden would be more than a repository of living plants, but would also be an important center of plant research. To that end, he built a botanical museum and library and hired the garden's first botanical curator. So closely associated was Shaw with his institution that for many decades it was known locally as Shaw's Garden.

On March 14, 1859, the Missouri Legislature passed an act officially establishing the botanical garden, which opened to the public 3 months later. Shaw later established a namesake School of Botany at Washington University and endowed a professorship of botany in honor of his longtime friend Engelmann. The first director of the Missouri Botanical Garden, Dr. William Trelease, was appointed to the professorship, a tradition that has continued to the present time (Colligan 2009).

In September 1943, the *Missouri Botanical Garden Bulletin* published a transcript of Shaw's 1880 handwritten *Guide to the Missouri Botanical Gardens, St. Louis*, which offers a very interesting glimpse of Shaw's understanding of what constitutes a botanical garden: "A botanical garden is defined as a garden devoted to the culture of a collection of plants with reference to the science of botany. The legitimate object of such gardens is to collect and cultivate all the species and varieties of plants that can be cultivated in the given climate. . . . Botanical gardens, in their dedication to scientific purposes, and in the economical uses to which they are destined to be applied, may be regarded as the most important institutions of a civilized country." In addition to the importance he places on the scientific role of botanical gardens, Shaw also recognized that in a rapidly expanding city like St. Louis a botanical garden could be a highly prized natural refuge, "Of all the public resorts, a scientific garden, when properly kept, will be found to be not only one of the most delightful mediums for intellectual gratification and amusement, but also one of the greatest of temporal blessings that can be enjoyed by a people."

Of the many achievements of the Missouri Botanical Garden in the more than 150 years since its inception, three stand out. The first was the appointment in 1889 of the eminent botanist William Trelease to the directorship. It was under Trelease's leadership that the global research program of the garden was established. The second was the groundbreaking in 1959 for the Climatron to replace the aging Palm House. Based on the geodesic dome design of Buckminster Fuller, the conservatory represented the beginning of the modern era for the botanical garden and spurred a huge resurgence of attendance. The third was the appointment in 1971 of Dr. Peter Raven as its Director (later President), which ushered in a period of greatly expanded scientific research, facility construction, and garden development. For decades, Dr. Raven has been a leading advocate for conserving our dwindling global biodiversity, and the Missouri Botanical Garden has been a model of conservation research, botanical libraries, and garden design and programming for public gardens.

E. The Arnold Arboretum and the Rise of American Philanthropy

An arboretum is a type of botanical garden dedicated to the display and study of trees and shrubs. The Arnold Arboretum in the Boston suburb of Jamaica Plain was established through the use of a bequest of the wealthy whaling merchant James Arnold to Harvard College in 1872. Arnold called for the establishment of a trust to be administered by three prominent Bostonians—George B. Emerson, John J. Dixwell, and Francis E. Parker—and “to be by them applied for the promotion of Agriculture, or Horticultural improvements . . .” (Hay 1995). This vaguely worded bequest did not specifically mention the establishment of an arboretum, but the trustees, and especially Emerson, were intent that the funds be used in this manner.

Founded in 1807 on a seven-acre plot at the corners of Garden and Linnaean streets, the Botanic Garden of Harvard University predated the Arnold Arboretum by 65 years (<http://arboretum.harvard.edu/about/our-history>). It is significant for its development from 1847 to 1872 under the directorship of Asa Gray, who added a library, lecture rooms, greenhouses, and outdoor gardens laid out in concentric circles and arranged systematically. Coming as this did at the dawn of the public garden era in the United States, Gray’s transformation of the garden became a model for the botanical institutions that followed. His directorship ended just as the arboretum in Jamaica Plain was being established, but the garden hung on until 1947 when the collections and buildings were removed to make way for married student housing (Hedrick 1988).

Rather than objecting to the addition of an arboretum, Gray embraced the notion of creating a living museum of woody plants to complement (and be located adjacent to) the botanical garden, but neither the university nor the trustees of the Arnold estate supported his choice of location and chose instead the former estate of Benjamin Bussey six miles from campus (Sponberg 1990). Not only was this 137-acre estate better able to accommodate a major arboretum, but siting the Arnold Arboretum there was a fitting tribute to Bussey who, in addition to his commercial trading and lumber interests, had a passion for horticultural development (Hay 1995).

The lengthy negotiations between the Arnold trustees and Harvard administrators resulted in an agreement that called for “the establishment and support of an arboretum, to be known as the Arnold Arboretum, which shall contain, as far as is practicable, all the trees (and) shrubs . . . either indigenous or exotic, which can be raised in the open air” (Sponberg 1990). The agreement was significant because it also

established the precedent of directing large estate gifts to the philanthropic development of cultural institutions.

Today, the name Charles Sprague Sargent is well known among those who study botany or horticulture. But when Asa Gray suggested that his friend be named the first director of the Arnold, it seemed an odd choice. Sargent had graduated near the bottom of his Harvard class and, upon his discharge from the Union Army, spent 3 years drifting around Europe before settling in Brookline to manage his father's estate. While supervising that estate, Sargent honed his skills in arboriculture, botany, and landscape design and formed valuable friendships with Gray, the great landscape designer Andrew Jackson Downing, and the noted historian Francis Parkman (Sponberg 1990).

In 1872, Sargent was appointed director of the Harvard Botanic Garden and Professor of Horticulture at the Bussey Institution of Harvard. The following year, his appointment was extended to also include the directorship of the Arnold Arboretum, and he devoted the rest of his life to building up that institution. In this, he was further assisted by Gray, who recommended his appointment as surveyor of American forest resources, a posting that provided Sargent the freedom to explore forested regions, to establish a network of like-minded correspondents across the country, and to gather specimens of native woody species for the burgeoning arboretum (Sponberg 1990).

In this period, Sargent also formed an equally important relationship with Frederick Law Olmsted, the father of landscape architecture. Olmsted had already won (with his partner Calvert Vaux) the competition to design Central Park and was developing the network of Boston parks that would come to be known as the Emerald Necklace. In consultation with Sargent, Olmsted designed the Arnold to be a central jewel in that necklace, with meandering pathways, sweeping vistas, and collections of woody plants based on the then generally accepted classification system of Bentham and Hooker.

Sargent's other achievements are legion: he established professional relationships with plant collectors in Japan, China, and Mongolia, which resulted in the Arnold serving as the first site for many species new to North America; he authored *Catalogue of the Forest Trees of North America* and the 12-volume *Silva of North America*; and he was a member of the National Forest Commission created by President Grover Cleveland that advised on the creation of 21 million acres of national forest reserves.

F. Morton, Morris, DuPont, and Huntington: Passionate Garden Creators

The influence and expertise of the Brittons served as the impetus that led to the establishment of a great scientific and cultural institution in New York City, but funding and support for the project came from a broad but loose coalition of private wealth, horticultural societies, and government. In different parts of the United States, other gardens began to emerge that were the products of individuals of great wealth who had the time, influence, and passion to transform their estates into great public institutions.

1. The Morton Arboretum. The Morton Arboretum near Chicago was created by the son of the founder of the Arbor Day holiday, Julius Sterling Morton, who inherited his father's love of trees and a keen sense of business. An astute businessman, Joy Morton founded the Morton Salt Company in 1885, which shortly became the leading salt producer in the United States and Canada.

After making his fortune, Joy Morton decided to pursue his passion for trees and horticulture by transforming his Thornhill estate into an arboretum. Just as that earlier industrialist, Henry Shaw, had turned to the eminent Harvard botanist Asa Gray for guidance, Joy Morton sought the assistance of Charles Sargent, the Arnold Arboretum's first director. Sargent recommended the European gardens worth visiting, the professional staff to hire, and the facilities to construct, including a library and herbarium. He even advised on the tree collections and edited the arboretum's statement of purpose (<http://www.mortonarb.org>).

Between 1921 when the arboretum was established and 1934 when Morton died, the arboretum grew to 735 acres with established plantings and nurseries, an extensive system of roads and paths, a dedicated staff, and a landscape plan to guide the future. The now 1,700-acre Morton Arboretum is dedicated to preserving endangered woody species from around the world through the collection and display of taxa hardy to the Chicago area, through research focused on understanding the relationship between trees and their environments, and the breeding of trees resistant to various biological pressures.

2. Morris Arboretum of the University of Pennsylvania. Like Henry Shaw and Joy Morton, John Morris amassed a sizable fortune through his business enterprises, particularly I.P. Morris & Co., a prominent iron works. John and his sister, Lydia, came from a distinguished

Philadelphia Quaker family that provided both children with a strong education and equally strong convictions about the need to protect open space and to promote the creation of places of horticultural beauty (Morris Arboretum 2001).

In 1887, John and Lydia Morris purchased a 26-acre tract in the Chestnut Hill section of Philadelphia, and between then and 1910, added an additional 86.7 acres to the estate they called Compton, which they envisioned becoming a public garden that would benefit both individuals and plant science.

Despite their passion for horticulture, neither John nor Lydia was professionally trained, so they too turned to Charles Sargent for advice on developing their collections. One of the plant explorers who gathered exotic species for Compton was Ernest ("Chinese") Wilson, whom Sargent also employed at the Arnold Arboretum.

The landscape development of Compton echoed the eclectic tastes of the Victorian era and the Morris' extensive travels in Europe and Asia. Early on, they developed a Japanese garden, a rose garden, a fernery, and a true arboretum, but they recognized that for their estate to be a botanical institution the collections must be properly documented and labeled and that educational and research programs needed to be added (Morris Arboretum 2001).

John Morris died in 1915, leaving the estate to his sister with the stipulation that it be a place "where young men and possibly young women may be taught practical gardening and horticulture . . ." In 1924, almost 200 years after the creation of Bartram's Garden, Philadelphia's first botanical garden, Lydia approached the administration of the University of Pennsylvania, offering to bequeath Compton and \$4,000,000 to the university "for use in education and botanical research as the Morris Botanical Garden, School, and Museum." Today, the Morris Arboretum of the University of Pennsylvania is a leading center for tree display and research and the current executive director, Paul Meyer, continues Ernest Wilson's legacy by leading several plant collecting trips to China and other parts of Asia (Morris Arboretum 2001).

3. Longwood Gardens. Pierre S. DuPont was born into a family that had become wealthy manufacturing gunpowder while displaying a long-held love of creating gardens. Pierre's own interest in gardens intersected with those of Samuel and Joshua Pierce who, in the mid-19th century, had created a 15-acre arboretum, known as Pierce's Park, on a section of land that had been held by the family since 1700. But by the early 20th century, the Pierce heirs lost interest in Pierce's Park, and it

changed hands several times, deteriorating further with each transaction.

In 1906, 36-year-old Pierre DuPont purchased the Pierce property, renaming it Longwood and developing it first as a pleasure garden. Pierre would dazzle family and friends with elaborate fountain shows, dancing nymphs, and enormous picnics on the lawn. By 1921, the iconic conservatories were opened, and by the mid-1930s Longwood had grown from the original 202 acres to 926 acres (www.longwoodgardens.org/history).

The formal transition from private estate to public garden occurred in 1946, when the U.S. government granted the Longwood Foundation permission to operate Longwood Gardens as a nonprofit organization. Today, Longwood Gardens holds the mantle as America's premier display garden with close to a million annual visitors.

4. Huntington Botanical Gardens. Henry Huntington was born in 1850 in upstate New York, but in his 20s made his way across the country to San Francisco to work for his uncle, Collis P. Huntington, one of the owners of the Central Pacific Railroad. In 1902, Henry moved his offices to Los Angeles where he eventually gained business interests in electric train lines, water, energy, and land development.

A refined individual, Huntington retired at age 60 and devoted himself to the development of his art and rare book collection and the landscaping of his 600-acre ranch. In the latter pursuit, he depended heavily on his grounds superintendent, William Hertrich, who was instrumental in developing the plant collections. In 1919, Henry and his wife Arabella signed an indenture transferring their property and collections to a nonprofit educational trust. Henry's main collections have evolved into the three components of the Huntington: library, art collections, and botanical gardens. For all three components, the Huntington's mission is to "encourage research and promote education in the arts, humanities, and botanical sciences through the growth and preservation of its collections" (<http://www.huntington.org/WebAssets/Templates/content.aspx?id=14552>). The Huntington also supports research through its Research Scholars program and offers a wide variety of educational programs throughout the year.

G. The Chicago Botanic Garden: A Public-Private Partnership

Unlike U.S. public gardens created in the 19th and early 20th centuries, the Chicago Botanic Garden (CBG) grew out of the dedicated efforts of the Chicago Horticultural Society, a group that started by hosting flower

shows in the 1880s and took the national stage by hosting the World's Columbian Exposition Chrysanthemum Show in 1893. After a period of inactivity, the Society set as its goal the creation of a botanical garden and coordinated a public-private partnership between the Horticultural Society and the Forest Preserve of Cook County that in 1965 resulted in the groundbreaking for the Chicago Botanic Garden, which opened to the public in 1972.

In its relatively short period of existence, the CBG has become a nationally prominent public garden with magnificent plant collections displayed on nine islands, scientific research programs focused on climate change, plant conservation and habitat restoration, and a number of urban agriculture, youth education, and horticultural therapy programs that collectively address the needs of individuals whose circumstances, histories, or personal impairments have limited their life options. In so doing, CBG has moved from the traditional role of botanical gardens as plant museums to taking on significant social roles in their communities and the world.

VIII. THE FUTURE OF THE BOTANICAL GARDEN

Would Anguillara or Clusius recognize the contemporary botanical garden? Like the *Orto botanico* in Padua or *hortus botanicus* in Leiden, modern public gardens are built around plant collections, although they no longer focus primarily on medicinal plants. But unlike those 16th-century botanical gardens whose collections were typically organized along known taxonomic or ecological lines, many gardens today have collections that have either a geographic or thematic basis.

In the 21st century, botanical institutions are changing in ways that distinguish them not just from their Renaissance predecessors but also from the organizational priorities of gardens from a hundred years ago. Given the current critical loss of biological diversity, many gardens have shifted their research and collections to focus on propagating and preserving rare species, restoring degraded habitats, and reintroducing extirpated species. While much of this work is conducted in sites nearby or at the gardens (*ex situ*), other efforts are focused on species loss in Africa, Central or South America, and Asia.

Large numbers of the plants first displayed in the early botanical gardens came from voyages of exploration undertaken by colonial powers. However, exploitation of the natural resources of other nations is no longer acceptable and treaties such as CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) and

the Global Strategy for Plant Conservation (GSPC) ensure that trade in specimens of wild animals and plants does not threaten their survival. Contemporary plant collectors primarily bring back seeds of desired species. If the seeds are viable and germinate, rigorous protocols are followed to ensure that the species will not become invasive if introduced into the landscape. Problems associated with non-native invasive species have become much more pronounced in recent years, partly as a consequence of the nursery and landscape trades introducing and promoting species with strongly invasive tendencies and partly due to unintentional movement of plant propagules through increased global trade. Many public gardens now have policies on the nondisplay of known invasive species, based on the priorities laid out in the *International Agenda for Botanic Gardens in Conservation* (Botanic Gardens Conservation International 2012). Target 11 of the agenda stipulates that “all botanic gardens carry out invasive species risk assessments of their collections and management practices.”

Initiatives such as those addressing the need to preserve biodiversity, to take steps to mitigate global climate change, and to produce our food more sustainably would have been entirely unknown to the architects of the earliest European gardens. But these topics are increasingly serving as the bases of the educational programs offered by contemporary botanical gardens. Such programs are intended to serve the educational needs of all ages, from young children to post-retirees, and are offered both inside and outside the gardens.

While botanical gardens are still built around plant collections, many are finding that the plants themselves are not enough to attract the size or diversity of audiences that they need to survive. More and more, gardens are embracing entertainment options to attract young professionals, families, and members of specific ethnic groups. These entertainment approaches and display functions vary from outdoor sculpture exhibits to concert series, themed festivals (chili peppers, pumpkins), cooking demonstrations, model trains, holiday light shows, and antique car rallies.

But what of members of the public who cannot afford to attend a special event at a garden, or even access transportation to travel to the garden? Addressing the needs of underserved audiences and the communities in which such individuals live presents botanical gardens with one of their greatest challenges and greatest opportunities. Botanical gardens are expanding beyond the more homogenous audiences they have traditionally served. To reach more diverse audiences, gardens provide free entry passes, translate signage into prevailing languages, or hold events of special appeal to members of a target group. But even the

most effective in-reach efforts will only succeed with a small percent of the underserved population. Outreach programs, on the other hand, can touch the lives of those most resistant to the appeal of a botanical garden.

Social justice programs sponsored by public gardens generally fall into one of the four categories: community gardening and nutrition, job training and life skills, neighborhood rehabilitation, and plant science and biology education. Often, a single program will achieve more than one of these objectives, for example, a community gardening program for teens in which the participants also learn about team building, marketing, and plant science. The most effective programs involve partnerships between the botanical garden and community or governmental organizations, schools, or religious groups. Through such programs, botanical gardens demonstrate that they are serving the needs of *all* people, not just the scientific and noble elite to which 16th-century gardens catered.

All life depends on plants: they feed us, clothe us, provide us with shelter and medicine, and beautify and enrich our lives. Through their research, programs, and display, modern botanical gardens are vital centers that preserve existing flora, create hardier forms of crops and ornamentals, and educate audiences on ways to create a sustainable future.

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