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Royal Botanic Gardens at Kew

The beginning of the third century of its existence finds the Gardens doing more research than ever.

J. R. Sealy

In 1721 George, Prince of Wales and afterwards George II, purchased from the Earl of Arran the house known as Ormonde House, situated about half a mile north of the town of Richmond, Surrey. This house was on the site of an older house or lodge belonging to the erstwhile royal demesne associated with the Palace which Henry VII (1456–1509) built alongside the river at Richmond to replace one that had existed since the time of Edward I (1239–1307). Ormonde House, whose name seems soon to have been changed to Richmond House, became a favorite residence of the Prince and his wife Caroline and continued to be so after they became King and Queen in 1727—Caroline taking particular pleasure (and spending vast sums of money) in improving the garden and pleasure grounds, which extended from the vicinity of the Palace almost to the village of Kew, two miles away to the north.

In 1730, George and Caroline's son Frederick, Prince of Wales, obtained a long lease of Kew House and its grounds. The latter extended southwards from Kew towards Richmond alongside the grounds of Richmond House, the two properties being separated only by Love Lane, the ancient bridle way from Richmond to the horse-ferry across the Thames between Kew and Brentford—an old, and at that time important, town on the north bank of the Thames from which ran the highway to London. Frederick and his wife, Princess Augusta, seem to have been particularly interested in the property and lived much at Kew with their son, the future George III. Frederick died in 1751, but Princess Augusta continued to live at Kew, and in 1759 she obtained the services of William Aiton (who had worked under Philip Miller, the leading gardener of the time) to lay out about nine acres of the grounds as a "physick" or "exotick" garden, which we would now call a botanic garden.

This was the origin of Kew Gardens, the Royal Botanic Gardens at Kew, whose bicentenary is being celebrated this year. In addition to establishing her botanic garden, Princess Augusta employed Sir William Chambers, the famous architect, to design and erect a large hothouse, 114 feet long and the largest in the country, and also a number of buildings—Roman temples and the like—to embellish the grounds, this work being done in the period 1758–62. The hothouse, which became known as the "Great Stove," stood for a century, to be pulled down in 1861, but a number of Chambers' other buildings remain to this day—the Temple of Arethusa (built in 1758), the Temple of Bellona (1760), the Ruined Arch (1761), the Orangery (1761), and the Pagoda (1761–62). The Temple of Aeolus, which stands atop the Mound near Cumberland Gate, was built in 1845 from Chambers' plans after his own building, on the same site, had fallen into decay.

In the formation and development of her "Exotick Garden" Princess Augusta had the guidance and advice of John Stuart, Earl of Bute, who lived at Kew, was a close friend of the royal family, became prime minister soon after George III ascended the throne, and was, in consequence, the best-hated man in England. He was also a keen botanist (his death in 1792 is said to have been caused by a fall when he was endeavoring to collect a rare plant) and had a fine botanical library and herbarium, which were housed in a special building at Kew, from the garden of which he had access to the royal garden. Until Princess Augusta's death in 1772, Bute was virtually director of her botanic garden; in that capacity he served to such good purpose that by 1768, when John Hill published a list of the plants, the collection numbered 3400 species.

In 1760, the year after Princess Augusta inaugurated the botanic garden at Kew, her son succeeded to the throne and took over Richmond House as his country residence. He had the grounds completely remodeled by Launcelot ("Capability") Brown, and in particular he had much of the area south of the house—that is, towards Richmond—laid down to grass, so that he could indulge his fancy for farming. This area no longer forms part of the Royal Gardens, but Queen's Cottage, which was built for George III, remains one of the picturesque features of the gardens.

Sir Joseph Banks' Influence

After his mother's death in 1772, George III purchased the freehold of Kew House and its grounds and so became the owner of the whole of what is now Kew Gardens, though the two halves of the gardens were still separated by Love Lane. And so they remained until 1802, when the King at

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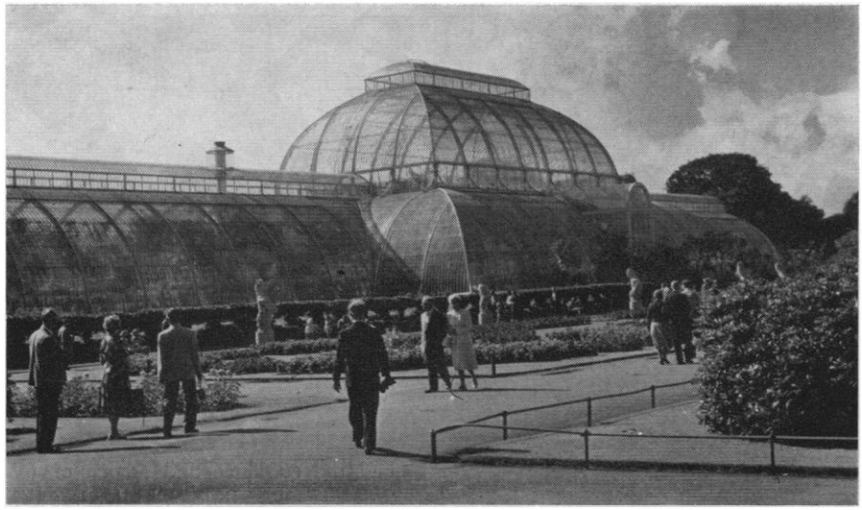

The great Palm House, where many species of palms and tropical trees and plants grow under artificially created tropical conditions.

last obtained powers to close the ancient bridle-way—something he had been trying to do since 1765 (as a substitute he had had a highway built from Richmond to the bridge which spanned the Thames at Kew). Soon after purchasing the Kew estate, George III went to live at Kew House, and Richmond House was razed; it was from this circumstance that the gardens of the two houses took the name Kew Gardens.

In the year prior to his purchase of Kew House, the King had met Mr. (afterwards Sir) Joseph Banks, a wealthy gentleman who was greatly interested in botany and who had accompanied Captain Cook in one of his voyages of exploration round the world. Banks was introduced to the King immediately after his return from this voyage in 1771, and a warm friendship developed between them, fostered no doubt by their mutual interest in horticulture. When, in the following year, the King took over his mother's botanic garden, Banks became his adviser and was, until his death in 1820, virtually (though unofficially) director of the Royal Gardens. In 1778 Banks was elected president of the Royal Society, and in 1781 he received a baronetcy from George III.

Banks possessed a fine herbarium and botanical library and employed a botanist, Daniel Charles Solander, a native of Sweden and a favorite pupil of the great Linnaeus, to look after both. Under Banks' direction no efforts were spared to acquire new plants for the Royal Gardens. Collectors were sent to all parts of the world. Francis Masson was dispatched to the Cape (South Africa) in 1772, and after this not many expeditions left Britain without a collector or gardener from Kew on board.

Banks, and no doubt the King also, was particularly interested in introducing useful plants into one part of the world from another, and this went on side by side with the collecting of new plants for the gardens at Kew. As an example, there is the story of the introduction into the West Indies of the breadfruit (*Artocarpus*), which is native to the South Sea Islands. Everyone nowadays has heard of the mutiny on the *Bounty*, but few know that the voyage of the *Bounty* was undertaken "for the purpose of conveying the breadfruit tree to the West Indies," and still fewer know that on board the ship were two gardeners from Kew, David Nelson and William Brown. Nelson, who had been with Cook on the latter's third voyage, stayed with Bligh after the mutiny but was taken ill after reaching Timor (according to Bligh, "in consequence of a cold caused by imprudently leaving off warm clothing") and subsequently died. Brown sided with the mutineers, and no more was heard of him. After returning to England, Bligh sailed again to get the breadfruit, being accompanied by another Kew man, Christopher Smith, and by another gardener, James Wiles, who was to take charge of the plantations in the West Indies. It is now a matter of history that this voyage was a complete success and that the breadfruit was established as a food plant in the West Indies. What is not generally known is that on his return from the West Indies Bligh brought a number of plants collected there by Smith for the Royal Gardens at Kew. And so it went on, throughout Banks' years at Kew.

In addition to enriching the gardens and introducing economically useful plants into one country from another, Banks initiated policies that stimulated study of the plants themselves. Whenever a new plant flowered at Kew it had to be submitted to Banks' librarian, who wrote a description, and to Banks'

Packing of cocoa plants in a glazed, airtight case for shipment overseas. Many cuttings and specimens are sealed in polyethylene bags and dispatched by air.

artist, Francis Bauer, who made a drawing. Much of this work remains unpublished, but on it was based Aiton's *Hortus Kewensis* (1789), an enumeration of the 5500 species then in cultivation at Kew. This was largely based on the work of Solander and was highly regarded by Banks' contemporaries as a treatise in which the naming of the cultivated plants was put on a firm basis. It was edited by Jonas Dryander, who had become Banks' librarian after Solander's death in 1782. It was Dryander who was largely responsible for the second edition of the work, published in 1813, which contained over 11,000 species; he died, however, in 1810, and the work was finished by Robert Brown, who succeeded him as Banks' librarian.

In 1781, George III purchased the freehold of Dutch House, now known as Kew Palace, a large mansion situated close to Kew House, and both houses were used by the royal family until 1802, when Kew House was pulled down. About this time the King began building a new palace a short distance away—an extraordinary piece of architecture somewhat on the lines of a Norman castle, which excited derision among intelligent people and of which only the walls had been erected at the time of the death of King George in January 1820. It was demolished in 1829.

The Australian House, specially constructed of aluminum and glass, a recent addition to the Royal Gardens. In it are housed plants from the arid areas of Australia.

The herbarium, in which are housed millions of plant specimens. Botanists and students from all over the world come here to study.

Under Public Control

Banks outlived his royal master by six months. His herbarium, library, and botanical drawings all went to the British Museum, and the Royal Gardens were left without the support of a botanist. William Townsend Aiton, who had succeeded his father in 1793 as "Gardener to His Majesty," carried on the Kew tradition so far as he could; collectors were sent out from Kew at intervals, and drawings of interesting plants were made. It is clear, however, that the gardens were not maintained so well under George IV and William IV as they had been during the reign of George III, and by 1837, when Victoria became Queen, complaints about the conditions at Kew had reached such a pitch that the Treasury appointed a committee, comprising John Lindley (secretary of the Horticultural Society and one of the leading botanists of the day), Joseph Paxton (gardener to the Duke of Devonshire), and Mr. Wilson (gardener to the Earl of Surrey), to examine and re-

port on the Gardens. Nothing was done, however, until 1840, when it became known that the Earl of Surrey, who in his capacity of Lord Steward had charge of the royal estates, was proposing to use the greenhouses for growing fruit and to disperse the botanical collections. Pressure was at once brought to bear on Parliament, and, as a result, the botanic garden, now some 14 acres in extent, was placed under public control, the remaining part of the Gardens—the so-called "pleasure grounds"—remaining the property of the crown.

In 1841 Sir William Jackson Hooker, then Regius professor of botany at Glasgow University, was appointed director of the Botanic Gardens at Kew. He brought with him his splendid herbarium and library, and, incidentally, his own botanical artist, and from that time onward the history of Kew has been a story of steady expansion and development, from both the horticultural and the botanical standpoint.

More and more ground was taken from the pleasure grounds into the botanic garden until all had been absorbed; more and larger greenhouses were erected [for example, the Palm House, built in 1844–48, and the Temperate House (1860–99)]; and the collection of plants increased in size until it now includes about 25,000 species. Collections in the herbarium and library have likewise grown steadily. In the years 1853 to 1855 Kew received the herbarium and library of a Dr. Broomfield and those belonging to George Bentham—a wealthy gentleman and one of the leading botanists of the time, who settled and worked at Kew—and to these, in 1866, were added Sir William Hooker's herbarium and 1000 volumes from his library. Today, the library alone fills to overflowing the space which once housed the whole of the original herbarium and library, while the modern herbarium can no longer be contained in the three large wings which house it, and construction of a new building is under consideration.

During the period since 1841, the botanists working at Kew have contributed greatly to the progress of botanical science, as evidenced by their publications. These include the *Botanical Magazine* and Hooker's *Icones Plantarum,* both produced at Kew since 1841; Bentham and Hooker's *Genera Plantarum;* the *Index Kewensis*; the *Index Londinensis*; the colonial floras, such as the *Flora Capensis, Flora of Tropical Africa, Flora of British India,* and *Flora Australiensis*; the *Kew Bulletin,* and such works as Hooker and Baker's *Synopsis Filicum,* Baker's handbooks of the Amaryllideae and the Irideae, and so on. And all through this long period Kew has continued to play an important part in introducing economically useful plants into one country from another [to give but two examples, *Cinchona* (the source of quinine) to India from South America and rubber, to Malaya from Brazil]; it has continued to encourage collecting and to send collectors to all parts of the world; and it has never ceased to train gardeners for posts in Britain and throughout the world. In these respects the tradition at Kew has continued unbroken from its earliest days.

Banana plants (foreground) and cocoa plants (background) in the quarantine house of the Royal Botanic Gardens. Plants and cuttings, free of disease, are shipped from Kew to agricultural stations throughout the world.

The Task Today

Today the Royal Botanic Gardens at Kew are, first and foremost, a scientific institution, whose main task is the study of plants, with special reference to their classification and naming. The establishment comprises four departments. First, the herbarium and library, where the botanical work is carried out with the aid of the largest collection of dried specimens (over six million) in the world and the matchless botanical library of over 55,000 volumes; second, the Jodrell Laboratory, which is concerned with microscopical investigation into plant structure, especially in relation to plant taxonomy, and also with plant physiology; third, the three Museums of Economic Botany, where plant products are stored, studied, and displayed to the public; and lastly, the gardens proper. These are open to the

public, for whom they form a greatly appreciated pleasure ground, though their primary function is the growing of as large a collection of plants as possible for scientific study. The gardens cover some 300 acres along the south bank of the Thames between Kew and Richmond, the western half corresponding to part of the garden of Richmond House, and the eastern half, to the grounds of Kew House. The site is flat, and such elevations and depressions as now exist are all man-made; the poor and shallow soil overlies river gravel, and atmospheric pollution is high, discouraging the growth of many conifers. Despite these disadvantages, deciduous trees and shrubs grow splendidly. The extensive collection of these trees and shrubs is arranged for the most part according to plant families. Through skillful landscaping the grounds present a diversified aspect, and the monotony which one might expect to find where so many trees and shrubs are grown on a flat terrain has been avoided through the construction of such features as long grassy vistas, winding paths, and curved borders; the artificial lake and the pond; and buildings such as the greenhouses (notably the Palm House and the Temperate House) and the Pagoda. Another device which helps to make the gardens attractive to visitors is the bold planting of a single genus, which provides a great display of color at some period of the year. Thus, in early spring, drifts of daffodils and crocuses and groups of blossoming Japanese cherries are special features; shortly afterwards a large group of *Malus floribunda* comes into bloom. In May, Kew is visited by thousands of people who come to see the great sheets of bluebells which carpet the woodland. Different varieties of lilac are planted together to provide a mass of color, as are varieties of azalea, while the planting of rhododendrons, known as "rhododendron dell," is a special attraction, and so too in their season are the iris and rose gardens. In addition to the trees and shrubs, a vast collection of herbaceous plants is grown out-of-doors, in the herbaceous ground, the rock garden, and the aquatic garden. And finally, the five acres of greenhouses hold a large collection of plants which do not thrive out-of-doors at Kew and for which temperatures ranging from those of cool temperate zones to those of the hottest tropics are provided.

The beginning of the third century of its existence sees the Royal Gardens bigger and better equipped than at any previous time in its history, and it has never been more active in both the horticultural and the botanical spheres. There need be no doubt that the Kew tradition will be worthily maintained in the future and that Kew will continue to be a mecca for botanists and horticulturists alike.

The Earth's Mantle

Its nature may be directly discovered by drilling in ocean basins where the overlying crust is thin.

Gordon G. Lill and Arthur E. Maxwell

There are several ways to determine the nature of the earth's mantle, but in the last analysis only the direct method will be satisfactory. We must drill down to the mantle and bring up as much sample as possible for examination. We then will know what the mantle is like, at least at that one particular spot.

In February of 1957, the American Miscellaneous Society (AMSOC), an esoteric organization with branches throughout the United States and in some foreign countries, was approached by Walter Munk of the Scripps Institution of Oceanography, who represented, as well, Harry Hess of Princeton University. Munk's proposition was that the society should undertake the promotion of a deep drilling project designed to bore through the earth's crust and bring up a sample of the mantle. The matter was argued from the patio of Munk's home, onto the campus of the Scripps Institution of Oceanography, and into the dinner hour and beyond at the home of Roger Revelle. The outcome was inevitable. The proposal was reasonable, the idea was exciting, and there were plenty of excellent scientific reasons for undertaking the work.

With funds granted by the National Science Foundation, the AMSOC Committee of the National Academy of Sciences–National Research Council was organized to place the project on a firm scientific basis. The committee is composed of the following members: Gordon G. Lill (chairman), Willard Bascom (executive secretary), George Colchagoff, Maurice Ewing, William B. Heroy, Harry Hess, Harry Ladd, A. E. Maxwell, John Mecom, Walter Munk, Roger R. Revelle, William Rubey, J. I. Tracey, and Leonard Wilson.

The pros and cons of the project were argued again at a special meeting of the Division of Earth Sciences of the National Academy of Sciences–National Research Council in late April of 1958. The arguments presented against the project were as follows: (i) The cost will be so great that funds will be drained from other worth-while work in the earth sciences. (ii) One hole will not suffice. Since the mantle is not homogeneous, it will be necessary to drill many holes to determine its nature. In this case, drilling costs will become prohibitive. (iii) It is known from geochemical experiments that a phase change occurs in the physical nature of rocks under the conditions of pressure and temperature which must exist in the region of the Mohorovicic Discontinuity. (iv) It is known from laboratory experiments that the mantle is composed of peridotite, eclogite, or dunite. (v) The publicity given large projects is bad for science.

So far as we can remember, these were the major arguments against the

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