University Botanic Garden

Annual Report 2014-2015

CAMBRIDGE UNIVERSITY *Botanic Garden*

UNIVERSITY OF CAMBRIDGE

Director's Report

This year the Garden redeveloped its administrative and visitor support structure, and saw two major building projects through to successful completion.

Last year I reported on the changes we had made to our Curator post, dividing it into an academic Curator and a Head of Estates and Operations. Dr Sam Brockington took up the Curator role, also a University Lectureship, in April 2015, and has made a strong start by rethinking our collections and accessions procedures. He will move on to define our collections strategy in the next year, working to ensure we have a collection that meets current and future demands in plant science research and is fully compliant with the newly agreed Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization, part of the Convention on Biological Diversity. Sam's work is vital to our ability to support and facilitate the enormous breadth of research currently based around the Garden's collection (see pages 14-15 for an overview) and we have clear ambitions to see our role as a major research resource for the global plant sciences community strengthen and grow over the next few years.

Carl Tatterton took up the Head of Estates and Operations role in January 2015, and set to work dealing with a tricky backlog of buildings, maintenance and estates issues. Thanks to his efforts we have now started a project to provide mobility scooter storage, additional bike parking and enhanced paths at the Station Road Gate, have fire alarms in the glasshouses, have a revised Health and Safety policy, have repaired and renovated walls and plasterwork in two of our buildings, have instigated a redecoration programme, and have a contract for window cleaning in the glasshouses. But this is just the list of "small" jobs Carl has tackled. He has also seen our two building projects through to successful completion. The Superintendent's House, a wonderful Victorian property behind the glasshouse range, is an official residence traditionally used by the Garden to house the Director. I prefer to see it serving the Garden's ambitions more directly, and so it has been refurbished, with financial support from the University chest, as a guesthouse for research visitors to the Garden. We opened the house for business in April 2015, and it has been almost fully occupied ever since. It is wonderful to have the opportunity to offer visiting colleagues accommodation on site at affordable prices, especially when those colleagues are students or are visiting from poorer parts of the world. This year also saw the completion of the Geoffrey and Eileen Adams Garden Room, built in our Schools' Garden to provide an indoor learning space for children on organised educational visits. We were delighted to welcome the donor, Mr Chris Adams, and his family to an opening event in June 2015, and to welcome the first school groups to the room when the new term began in September. The room is already proving very popular with school groups, extending our capacity to host such visits through the winter months when the weather is less suitable for outdoor learning.

June 2015 saw the retirement of our long-serving Department Administrator, Brigid Stacey. Brigid had worked for the Garden for over 28 years and had an enormous store of knowledge and experience that many Garden staff relied on. We saw Brigid off in grand style on a lovely summer afternoon, and then set about restructuring our admin and visitor services support. The Visitor Services team were formerly part of the Admin department, but have now moved to form a separate section of the Garden, with their head, Nicci Steele-Williams, joining the Garden's senior management team to provide welcome input on visitor issues. Wendy Godfrey, formerly Deputy Administrator, has stepped into Brigid's shoes and becomes full time Administrator. Wendy has extensive experience of event management and is already bringing a new flair to our regular Garden events, including Apple Day and Twilight at the Garden.

Horticultural developments this year have included development of new plantings in the courtyards around the display glasshouses and a range of new species in the glasshouses themselves. The development of a montane house (warm temperate with foggers) in our back range has allowed the horticulture staff to grow on a greater range of exotic species than ever before, and we are very excited to be able to bring iconic species such as *Amborella trichopoda*, the earliest diverging extant angiosperm, into our displays for teaching and research purposes. Funds from the University's HEIF5 (Higher Education Innovation Fund V) scheme have allowed us to employ an Interpretation Associate, Alison Murray, for 2 years. Alison's role is focused on developing horticultural displays that showcase plant science research across the University, and devising appropriate interpretation materials for the current displays. As part of this project, work has begun to open up the Genetics Garden, which we have renamed "Understanding Plants", to prepare for new spring plantings that will demonstrate how plants tell the time and how plants make branching decisions. We believe that this sort of educational planting scheme will offer our visitors real insight into how the plant science research that the Garden supports can contribute to an improved world for us all.

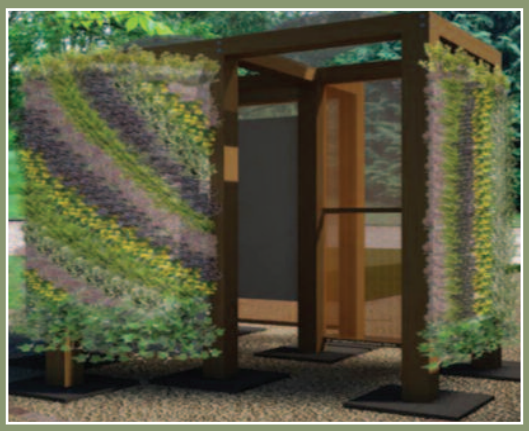
Professor Beverley Glover
Director

The year in pictures...

October 2014's Apple Day attracts over 3,500 visitors, who come to try and buy over 25 varieties of locally-grown heritage apples.

A new engraved plaque acknowledging the dedication and skill of staff past and present is installed on the mill-stone by the Garden Cafe path.

Professor Richard Bateman gives the Annual Lecture on the Bee Orchid in November.



The P2P (Plant to Power) Partnership installs a prototype solar hub at the Garden, an experimental model that explores how to harvest electricity from plants.

As part of an initiative to encourage natural play at the Garden, some of the giant trees develop googly-eyes and seven magical beings take up residence in the New Pinetum.

The Demonstration and Display team extend the very successful Mediterranean Beds.

A 24 hour 'bioblitz', run by the Museum of Zoology, records several new species as present in the Garden in June.

The Education team take delivery of a new Botanic Bike to take learning resources and activities to festivals and outreach events.

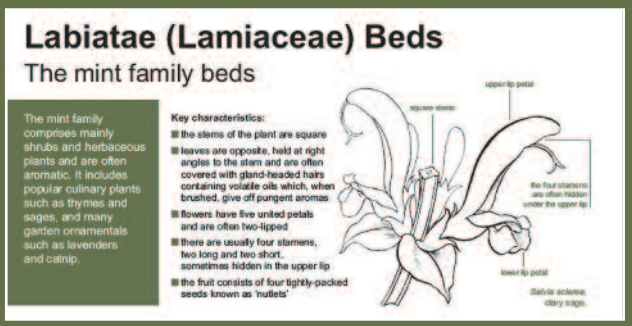
Over 12,000 people came to visit 'Tiny', our titan arum that flowered unexpectedly in July. The Garden opened late on two nights for visitors to enjoy the titan arum at its night-time stinkiest, which attracted international press coverage. Visitors were able to learn all about this remarkable plant's life cycle and many were inspired to share the experience in the classroom, through artwork and on social media.

At the Christmas tea for staff and volunteers, Alan Langley is presented with an RHS Long Service Award by Garden Director, Professor Beverley Glover, in recognition of his 40+ years continuous service to horticulture at the Garden.

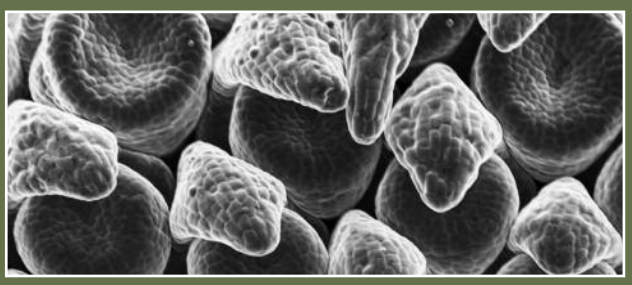
The Orchid Festival runs from February to March 2015 in the Glasshouse Range and focuses on the diversity of orchid pollinators.

A new classroom is completed in the Schools' Garden which will revolutionise the offering for schools. It is named the Geoffrey and Eileen Adams Garden Room, in memory of the parents (pictured above left) of benefactor Chris Adams, who made the transformative donation together with his wife, Sarah.

Dr Sam Brockington takes up the post of Garden Curator in April.



New interpretation boards are installed on the Systematic Beds in August to tell their history and to introduce some key plant families.



The inaugural series of Science on Sunday talks take place from March-August and prove popular.

Horticulture and Estates

STREAM BANK REPAIRS

Horticultural works progressed apace throughout the year, with the regular seasonal tasks enabling us to present the Garden to high horticultural standards to our ever increasing numbers of visitors. In addition to the cyclical tasks of bed clearance and preparation, weeding, edging, watering, propagation, mowing, lawn maintenance, leaf clearance and general cultivation, the horticultural staff were involved in a number of more significant horticultural and arboricultural projects. We were also active in providing support to facilitate a number of new developments, including the Geoffrey and Eileen Adams Garden Room and the Algae Innovation Centre. We continued to provide horticultural facilities and technical support to researchers within the Department of Plant Sciences and the wider University. During the year we also welcomed improvements to elements of our growing facilities which will greatly enhance our ability to cultivate and develop the living collections.

Given our low rainfall, planting opportunities for moisture-loving plants are at a premium. The streamside offers a perfect position for moisture-loving marginals, but in recent years a bamboo, *Yushania anceps,* had developed a dense, spreading mat of moisture-sapping rhizomes. Removal of this dominant species gave scope to extend the streamside plantings, but only after we had repaired the rhizome-damaged stream course with a fresh lining of gault clay. Once the stream was in good repair, and the planting area prepared with our own soil-improving compost, we re-planted the area with a selection of streamside species suited to this habitat. Plants chosen included *Lobelia cardinalis, Hosta tardiana, Rodgersia tabularis* and *Aruncus aeuthusifolius.* These will extend the herbaceous interest throughout the area, providing lush, verdant growth and enhancing this prominent location within the Garden.

In early spring we carried out soil levelling and grass reinstatement work in the opening between the *Magnolia* grove and the Schools' Garden, to allow us to install new picnic benches in the western half of the Garden. These, along with a further group of new picnic benches in the New Pinetum, have proved to be a welcome addition to our well-established offering in the Autumn Colour Area.

The year saw the construction of our new Geoffrey and Eileen Adams Garden Room in the Schools' Garden, and here the horticultural team were instrumental in preparing the site for its construction, undertaking clearance of established shrub and scrub cover, and also in the coppicing of a horse chestnut *(Aesculus hippocastanum).* Upon completion of the building works we undertook further landscaping of the site, which included the clearance and levelling of the adjacent Schools' Garden for future plantings. To improve access we installed a new set of Disability Discrimination Act (DDA) compliant paths. In the Schools' Garden itself, horticultural staff continue to support the Education Department in the delivery of this facility, assisting in the planning of the annual works programme, selection and cultivation of crops, crop rotation, propagation of material and in the general maintenance of the Garden.

MEDITERRANEAN BEDS – LANDSCAPING

In recent years we have endeavoured to enhance our Mediterranean plantings and landscaping, and this year saw us complete the final phase of these works. Upon clearing the existing, tired plantings, we extended the planting area to include a more diverse range of species from the Mediterranean, which are well suited to our local conditions of low rainfall and shallow soils. Hard landscaping work took the form of the shaping of the beds and introduction of rocky elements, along with the inclusion of a wider, hard surface path, which leads visitors from the north-western corner of the Main Lawn through a relaxed informal planting, more typical of the Mediterranean landscape. Plants typical of the Mediterranean, such as *Lavandula, Rosmarinus* and *Santolina* (cotton lavender) were incorporated into the planting, along with lesser-known species from the region, including *Ballota acetabulolosa* (Greek horehound), *Helichrysum ambiguum, Hermodactylus tuberosa* (widow iris) and *Plantago cynops.* We anticipate that the combination of plants chosen, the informal planting style and the hard landscaping, along with the scent of many of the species selected, will develop into a landscape much more evocative of the Mediterranean, and better reflect the natural habitat of many of the plants grown here.

Our extensive tree collection is constantly under scrutiny for tree health and public safety concerns and in addition to annual remedial works, such as dead wooding and removal of ivy, further significant tree safety works were again carried out. This culminated in the removal of two landmark trees, the *Ailanthus altissima* (tree of heaven) in the eastern part of the Garden, and the *Aesculus hippocastanum* (horse chestnut) adjacent to the Sainsbury Laboratory. In both cases significant safety issues had been identified, which posed a potential hazard. In the case of the *Ailanthus,* the fungus *Pholiota squarrosa* (shaggy pholiota) had been identified in 2013, but only when the tree was felled was the extent of this apparent, with 25% of the trunk and roots affected by decay, serving to confirm that the difficult decision to remove the tree was the correct one. Meanwhile, the *Aesculus* had evident structural weaknesses, and these coupled with the presence of bleeding canker, made it necessary to also remove this tree. While it is regrettable to have to remove such eminent trees, these instances provide an opportunity to plant replacements to ensure a succession of mature trees for future generations. A Cambridge Oak *(Quercus x warburgii)* has been planted as a replacement for the Horse Chestnut. A replacement for the Tree of Heaven will also be chosen, with consideration for its location, ultimate size, climatic factors and collection factors. Further tree works resulted in the clearance of a stand of Lawson cypress *(Chamecyparis lawsoniana)* immediately behind the Scented Garden. When these were first planted in the 1950s it was intended that they would be thinned to encourage strong, healthy growth. Regrettably this thinning never occurred, and with the passage of time the trees had declined significantly, with many having poor foliage and weak growth, a number showing signs of severe dieback as a consequence of dense planting, while others were only standing given the support of neighbouring trees. With

FELLING OF *AILANTHUS ALTISSIMA* (TREE OF HEAVEN)

these trees removed, the replacement planting of *Thuja plicata* planted in 1998 was exposed to provide boundary screening and an evergreen backdrop to the Scented Garden. Looking ahead, in conjunction with the Education Department we intend to develop this new opening as an area in which we can reconnect visitors with nature in a naturalistic planting.

In order to accommodate the construction of the Algae Innovation Centre it was necessary to remove a stretch of Cambridge hedgerow to the west of the Autumn Colour Area. The removal of this section of hedge will permit us to further develop the autumnal plantings of this area. We plan to plant a backbone of autumn shrubs with intermingled herbaceous and bulbous elements, each selected for their seasonal foliage, flowers or stems. Plants which we will introduce to this area for their autumnal interest include *Parthenocissus* species, *Amelanchier lamarckii, Rubus pentalbus* 'Green Carpet', *Euonymus alatus* and swathes of bulbs including *Cyclamen hederifolium, Colchicum autumnale* and *Galanthus reginae-olgae.*

The Experimental Section has continued to provide a valuable service to support plant research both within the University and the wider research community, and this year both the Experimental Glasshouses and Plots were filled to capacity with postgraduate and undergraduate projects. Here we do not only provide space, but offer horticultural support and technical advice to ensure research plants grow to their maximum potential to meet the requirements of researchers. This year we have accommodated a range of research projects, which have involved the cultivation of a diverse range of crops including tomatoes, *Antirrhinums,* rice, potatoes, various *Caryophyllales,* maize, artichokes and broad beans, and the value of this service is becoming ever more apparent. We also provided horticultural support to the P2P Solar Hub team in the selection and cultivation of plants for the green wall elements of this research project, and this has provided not only an interesting project from the perspective of alternative energy, but for us has also provided an insight into vertical gardening. In the Genetics Garden we introduced a new display of an annual wildflower mix developed by Professor Beverley Glover in collaboration with Moles Seeds. The mix was developed to provide a reliable food source to bees, particularly honey and bumble bees, throughout the growing season. The mix, which included species chosen to appeal to bees' vision, included *Borago officinalis* (borage), *Antirrhinum majus* and *Dahlia,* and delivered not only food for insects but also floral interest from early spring through to late autumn.

In the Glasshouses, we held another Orchid Festival to extend interest during February and March, and as previously, this proved popular with visitors. This year we highlighted the relationship between orchids and pollinators. Here, branches draped with species orchids were suspended above the Palm House pool, while a selection of terrestrial *Cypripedium* species (slipper orchids) were displayed to give the appearance of floating above the water's surface of the pool in the Tropical Wetlands House. Large cartoon-like illustrations were hung throughout the Tropical Houses to highlight key orchid

pollinators, such as moths, bees and flies. One of the horticultural highlights of the Festival was the inclusion of *Angraecum sesquipedale.* This species has a nectar spur around 40cm in length, and can subsequently only be pollinated by one insect, the Sphinx moth. Darwin correctly predicted that the pollinator must be a flying insect, and that it would probably be a moth with a long proboscis. It was not, however, until some 50 years later that his theory was proved correct, and the Sphinx moth identified as the specific pollinator. During the summer, visitors were again able to marvel at the Victoria Water Lily, *Amazonia cruziana,* which we had successfully propagated and cultivated, having increased our understanding of the requirements of this species and honed our skills. This year we were delighted to be able to distribute our own successfully pollinated seed to other institutions, including Chatsworth House and Amsterdam Botanic Garden, having initially acquired our seed from the Royal Botanic Garden Edinburgh. We also carried out a small landscaping project in the eastern courtyard of the Glasshouses. A new path of brick pavers was installed to increase the planting area and also to provide better access for visitors. New plantings of species of borderline hardiness have been planted here including *Sonchus acaule* and *Schefflera* species, and we anticipate that these will benefit from the microclimate and thrive in this sheltered location.

During the year we were fortunate to benefit from some infrastructural improvements in our private nursery areas. In the reserve glasshouses we were able to convert one of our smaller temperate houses to a tropical montane house with the introduction of hydrofoggers, which will increase the humidity and maintain a cool temperature. This adaptation will enable us to extend our glasshouse collections to include cloud forest plants such as orchids and basal angiosperms, including *Amborella trichopoda.* This is the only known existing member of the early diverging angiosperm family *Amborellaceae* and is consequently of great interest to scientists keen to understand the evolution of flowering plants. We have also benefitted from infrastructural improvements in the Alpine Yard. Here we installed a new plunge frame for the cultivation of our National Collection of *Fritillaria,* replaced an existing cold frame for the growing of woodland plants and *Galanthus,* and also replaced the skin on the protective canopy. Such improvements will enable us to cultivate, maintain and develop our existing collections in the future.

Sally Petitt
Head of Horticulture

PREPARING FOR THE ORCHID FESTIVAL

Education

CAREERS WITH PLANTS DAY

Schools and Student engagement

The Garden hosted 305 school visits over the last year, an increase of 41 on the previous 12 months. This gave a total of 9410 school children visiting the Garden through our programme - up around 30% on the previous year. Our extended programme of free sixth form student passes to Hills Road and Long Road sixth form colleges has also continued to have good uptake (147 visits), with a focus on those studying biology, applied science, geography, art, or photography.

As part of our long-term goal to deliver more outreach for secondary school age students we ran a session at a Careers Day for secondary school students at RHS Hyde Hall in October 2014. Bronwen Richards and Flis Plent delivered a Crime Scene Investigation workshop which focused on pollen analysis to groups of students from three Essex secondary schools. We have already been invited to present another session for this age group at Hyde Hall next year. We also ran a CPD session for the RHS Campaign for School Gardening on how to set up and run gardening clubs.

Our support with the development of a wildlife garden at Parkside Academy's Coleridge Campus has also continued, with Paul Aston from our horticulture team volunteering his time to assist with planning and planting – including help with site preparing and the sowing of a perennial meadow and planting up a mini bee border. We are planning bulb planting on the site for the autumn of 2015 and hope to further develop our links with the school and their science club and teaching staff over the coming year.

We have been delighted with the delivery of the first phase of the Gatsby Plant Science Education Programme's Student Engagement Project – with our schools officer Bronwen Richards as the project officer. This collaborative project aims to introduce school, college and University students to the interest and excitement of plant sciences. It includes 5 strands to engage and target young people (aged between 14 and 21) with plant science; workshops and lectures on plant science, a Careers with Plants day, a plant science website www.intobiology.org.uk - for independent learning about plant science, a series of Masterclasses for post-16 students exploring food security, and a Creative Arts project for post-16 students exploring issues around plant science.

As part of this programme, 60 Year 9 students from schools in the region attended the first 'Careers with Plants Day' in July, hosted jointly by the Sainsbury Lab and the Botanic Garden. The day included hands-on workshops and tours behind the scenes giving students an insight into a range of plant based careers. Individuals working in industry and at the RHS joined Lab and Garden staff to share their experience and passion for their jobs - a total of over 40 staff and volunteers. The students responded with enthusiasm: "I learnt that there are many, completely different careers to do with plants that I didn't know existed," said one student, while another summed up the day simply as "absolutely awesome". Accompanying staff also got the chance to attend a teachers' workshop focusing on resources they could use at school which utilised and showcased plants. Plans are underway to repeat the success of the day, with a second Careers with Plants Day planned for the Summer of 2016.

In addition to the Careers Day, we have also been working with the events and outreach team from the Sainsbury Lab to expand and enrich the current offer for Cambridge University access and outreach visits. Links between current research at the Sainsbury Laboratory and the Garden's collections and use as a research facility are highlighted to visiting groups with students exploring both the Garden and the Sainsbury Laboratory as part of the same visit.

THE GEOFFREY AND EILEEN ADAMS GARDEN ROOM

GARDENING CLUB AT HANOVER AND PRINCESS COURT

Schools' Garden

It has been a hugely productive year in the Schools' Garden and we are indebted to Alan Langley and Alistair Cochrane of our horticulture staff, and our volunteers, for all their hard work in making the growing year such a success. The four main growing beds were re-assigned to create a more formal crop rotation system and permanent spaces for demonstration. This year we grew a wide range of fruit, vegetables, cut flowers, herbs, hydrophobic plants and a wild flower meadow – using seeds from the national campaign 'Grow Wild'.

This year has also seen the implementation of our education building project, The Geoffrey and Eileen Adams Garden Room, which was funded by a generous donation from Mr Chris Adams. The build began in the early part of 2015 and after some snagging with connections to services and design modifications to the decking to include a balustrade and steps, we formally began using the room for school and family visitors in the Autumn 2015. Landscaping around the new building has now begun, with plans for new planting being drawn up over the winter for implementation in Spring and Summer of 2016.

Our gardening club has now been running again for a full year, with children from our local primary school St Paul's helping with seed sowing, weeding, planting and harvesting in the Schools' Garden at a weekly after school session on Thursdays in term time.

Adult courses, workshops and talks

Adult courses at the Garden continue to be well attended, with 541 adults taking part in the programme this year. We ran 57 adult courses in the reporting period, up from 46 in the previous year, across a range of topics from Plant Science, Botany and Gardening to Botanical illustration, Garden History and Creative Arts. As planned we increased the number of plant science related courses this year, all of which were well attended and well received – topics included: The Biology of Flowers, Chemicals in Plants and Introduction to Plant Genetics. Our evaluation shows that 32% of those attending our adult courses this year were new to our courses programme, and we believe this is in part related to the availability of online booking.

During the University's Science Festival we launched 'Science on Sundays' a new series of bite-sized informal plant science talks at the Garden, which began in March with a talk 'A trick of the light? How petal surfaces attract pollinators", by our Director, Prof Beverley Glover. The free monthly talks continued until August and received excellent feedback from those attending. A second series will launch in March 2016 at the Science Festival and continue again until August.

Community

The community and outreach area of our programme has continued to grow this year with our community officer Sally Lee leading a range of projects and activities with groups from our local community.

Our community gardening project, which began last year, has now become established. Based on the feedback from the activities we piloted last year we have now started a regular Gardening Club which meets at the Hanover and Princess Court Community Centre each Tuesday. We began in March by planting herbs in some new raised beds (built by the City council), for residents to use and care for, followed by planting up hanging baskets, developing planting to support wildlife, sowing wild flower patches with seeds from Grow Wild, and supporting residents with small scale vegetable growing. Now each week we can be found loading up our Botanic Garden cargo bike (which was funded through the UCM Strategic Grant) to carry all the plants and gardening kit we need to run these regular gardening

sessions from the community centre at the flats. To document the progress of this gardening project we also began a blog which can be found via Project Dirt at http://www.projectdirt.com/project/14733/

We have continued to support the Thursday group at St Paul's in leading regular walks and activities for this group of adults with mental or physical health problems. A highlight this year was a birthday party picnic for one of the regular members of the group.

Following a successful pilot of care home outreach visits we have now added regular visits to St George's Care home into our community programme. Once a season we take along plants from the Botanic Garden for the residents to enjoy and run a morning workshop looking, smelling and touching the plants and often doing a plant inspired craft. Sessions during the last year included making paper orchids and using specialist sun-print paper to capture the silhouettes of leaves.

During the summer of 2015 we worked with colleagues from across the University Museums to deliver an art based project called 'Making an Impression' to Young Carers from the charity Centre 33. The project used printing to introduce the children to a range of plants at the Garden and objects across the Museums.

Alongside the regular Cam sight tours which take place at the Garden we have been involved this year in a pilot project called Vocal Eyes. Our community officer and two of the Garden's guides attended a 2 day training session, together with colleagues from other University Museums, about how to describe objects (and in our case plants) to people who are visually impaired. We hope to use this expertise in developing our tours for this group of visitors.

This year we joined with a developing network of community gardening projects to take part in Cambridge's contribution to the Chelsea Fringe, a Chelsea Flower Show spin off festival which is now spreading across the UK and Europe during three weeks around the time of the flower show. We hosted artist Kirsten Lavers for two days during the festival and took our new Botanic cargo bike out on a Jack and the Beanstalk inspired community bean planting day around the city. The response to this type of outreach has been very positive and we hope to explore further links with the community gardening movement in the city over the coming year.

Families

Our monthly family Saturday activities have remained popular drop-ins for families visiting the Garden, and now have a permanent home in our new Garden Room in the Schools' Garden. This will transform our capabilities in this area, with the purpose built space and adjacent toilets providing the perfect setting for this audience. Alongside these regular events, during the summer holidays we also hosted a series of drop-in observational art workshops led by the artist John Wiltshire.

Three new family trails were available in the Garden this year. The first, 'Giants of the Garden', sent children on a mission to visit six trees which had been adorned with giant googly eyes. The eyes were on a Golden Willow, a Giant Redwood, a Hop Hornbeam, a Eucalyptus, a Strangler Fig and the Grafted Beech. At each tree young visitors were challenged to look carefully for specific fallen items to make a magic wand and discover information about the trees – such as how the strangler fig squeezes other trees to death and the story of the grafted beech. In June to tie in with the Bioblitz hosted here at the Garden we introduced the first of a two trail series called 'Find me'. 'Find me' trails will become the default trails we use year round in between the introduction of new and one-off trails. The first challenged our young visitor to spot wildlife that make their homes here in the Garden. The second in this series will be a plant-based Find Me trail which will launch in the autumn of 2015. During the School summer holidays we introduced a re-vamp of an 'Around the World' trail which led our young visitors on a tour of the world via plants. A plant passport was included to collect stamps from stamping stools set out around the Garden.

'Play in the Garden' is another developing area of the family programme and we are beginning to roll out a number of small-scale initiatives to encourage our young visitors to interact with our site through natural play. The first formal output of this project was delivered through a partnership with the local charity Rowan Humberstone, as a series of fairy doors which have been installed in the New Pinetum for our young visitors to discover.

To further support our family audience, a collection of children's picture books based on the natural world is available at Matthew's Library, situated in a corner of the Garden Café. The library was first created in 2008 in memory of Matthew Brett, whose parents, family and friends kindly donated funds for the shelving and the books. Thanks to a further donation from Matthew's family the library was updated in January 2015 with the original bookcase being replaced with a new front-on display unit and the addition of many new books. The old bookcase was donated to the community centre at Hanover and Princess Court. The library is very popular among our younger visitors. Books include Stick Man, The Green Ship, and Christopher Nibbles, and a list for further donations is available via the Botanic Garden website. www.botanic.cam.ac.uk/Education & Outreach/Families in the Garden

Apple Day & Festival of Plants

At Apple Day we led apple themed dressing up sessions, with costumes ranging from Isaac Newton to Snow White, and delivered an apple printing session in the classroom at Brookside with the artist Jane Thewlis. Our contribution to Festival of Plants at the Garden this year was a culinary herb themed selection of activities run from our base in the Schools' Garden. We made apple mint mojitos, sowed herb seeds and made mini herbals using nature printing techniques. The education team also co-ordinated the delivery of a series of plant 'did-you know?' blackboards which were displayed across the Garden for the event.

University Museums, Festivals and Outreach

During Curating Cambridge and the Festival of Ideas we collaborated to deliver public events which connected our collections with those of the University Museums. Our director Beverley Glover was in conversation with Tim Knox, director of the Fitzwilliam Museum, about the challenges of curation, Mary Butcher our basketry tutor gave a talk at the Museum of Archaeology and Anthropology, and this was reciprocated by Imogen Gunn from the Museum talking here to students on our basketry course. Garden historian Dr Twigs Way, who leads our Garden history courses, spoke at the Museum of Classical Archaeology and we had an artist in residence, John Hinton, from the Curating Cambridge Campsite project who wrote and performed a series of songs about our tree collection and the *Victoria cruziana.*

In February we again joined in with the annual evening opening event 'Twilight at the Museums', hosting a torch-led 'Deep dark pollinator hunt' through the orchid display and the rest of the Glasshouse Range. 756 adults and 482 children attended the event which ran from 4.30pm to 8pm.

ONE OF SEVEN FAIRY DOORS TO DISCOVER

THE EDUCATION TEAM GET INTO THE SPIRIT OF APPLE DAY

We also hosted a range of talks, walks and workshops in this year's University Science Festival programme. Christine Bartram, from the University's Herbarium, gave a talk on Women in Botany and Gwenda Kydd led guided walks of the Garden's tree collection discussing the chemical compounds extracted from them. Dr Paolo Bombelli talked about the science behind the P2P (Plants to Power) Solar Hub. The secrets of successful orchid growing were shared by the head of our Glasshouses, Alex Summers, and the world of orchid pollinators by William Foster from the Zoology Museum.

The Garden was host to the Zoology department's Bioblitz in June, which attracted 300 visitors to free pre-booked sessions. During the 24 hour race to record species here at the Garden the education team ran a drop-in session in the Schools' Garden where people could learn techniques for making their gardens more wildlife friendly, have a go at mini beast hunting and snail racing, build homes for garden wildlife and discover ways of monitoring moths and other wildlife who might visit their gardens.

At the Cambridge City Council's Big Weekend in July we joined colleagues from the University's public engagement team to run a stall making miniature gardens, in their Fun Lab marquee on Parker's Piece.

Through funding via the University Museums Opening Door programme we were able to offer a three month internship to a recent Zoology graduate, Megan Wilson, to complete a review of how we currently evaluate the education programme and make recommendations for changes and improvement. As a result we have revamped our evaluation of courses and the schools programme, and are putting in place a range of other evaluation measures to help gain feedback from visitors and the wider community on our programmes. We are hugely grateful to Megan for her hard work and enthusiasm in the time she was with us.

Interpretation

Dr Alison Murray joined us in April 2015 as an interpretation associate, funded by the University's HEIF5 (Higher Education Innovation Fund V) scheme. Alison's role will be to deliver two new living displays in the Garden which will showcase research from the Department of Plant Sciences and the Sainsbury Laboratory. The research projects chosen for the display are Professor Alex Webb's research on circadian rhythm and Professor Ottoline Leyser's research on branching in plants. Both of these new displays will be in the 'Understanding Plants' area of the Garden in 2016.

Conferences

Flis Plent, Sally Lee and Bronwen Richards attended the Bgen Conference in Nov 2014, at which Flis Plent was invited and confirmed as a Director of Bgen. Flis Plent and Bronwen Richards represented the Garden at the BGCI 2015 Education Congress in Missouri, giving presentations on Botanic Gardens at Night and a poster on our trails for Families.

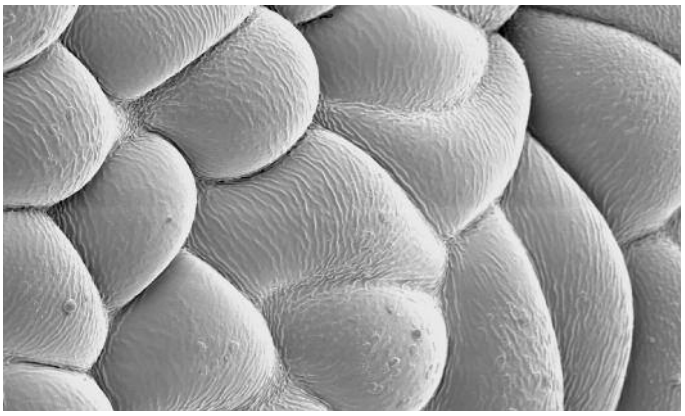
Education volunteers

We began work to recruit some more education volunteers this year, to help with school visits and our growing community and family programme. We have already added a number of new recruits and will continue to seek out suitable candidates to join our team of excellent volunteers who assist us across our programme and at events hosted by the Garden. We thank all our volunteers for their continued support and assistance with the delivery of our programmes.

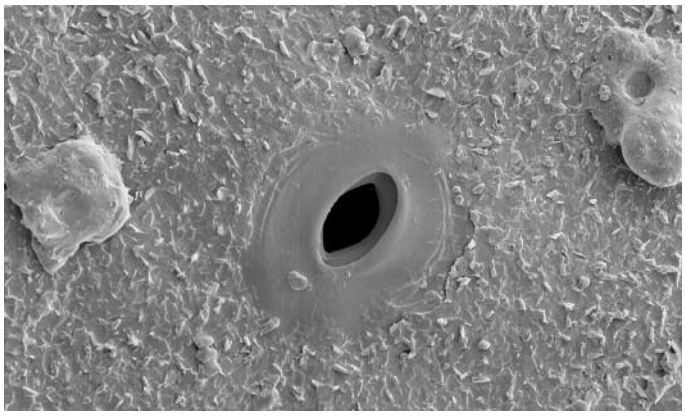
Flis Plent
Head of Education

Flowering of Titan Arum

Following an 11 year wait *Amorphophallus titanum* bloomed in 2015 for the second time in the Garden's history. It was an unexpected event as neither of the two tubers in the collection is at the suggested threshold weight for flowering of 15kg or over. The specimen that flowered had a tuber weighing 12.6 kg with the bud emerging in early July. This bud was confirmed as a developing inflorescence due to the protrusion of the spadix from its tip. Following confirmation of flowering the Glasshouse team notified all other Garden staff and prepared the plant for display.



DISTAL PART OF THE SPATHE



A PORE ON THE SPADIX

An initial measurement was taken of the girth and height of the flowering structure on the 6th July and this was repeated on a daily basis until the inflorescence opened. These data were compared with the measurements recorded in 2004 and with the literature on flowering of *A. titanum* in cultivation to predict the flowering date. The Garden was able to do to this with reasonable accuracy and this allowed publicity and late night opening to be managed accordingly. Throughout the lead up to flowering a public webcam was trained onto the bud. This proved extremely popular and the bandwidth had to be expanded due to viewing traffic.

On the afternoon of Saturday 18th July the bud opened with the purple spathe peeling back from the spadix to reveal tiny flowers in a cavity at the base of the structure. The inflorescence and stalk stood 1.29m, which is short for the species, with the largest recorded inflorescence reaching 3.1m in height. Due to its small stature it was dubbed the 'Tiny Titan', which proved a good tagline for publicity, especially through social media. Publicity grew with articles in the local, national and international press. This was likely aided by previous publicity surrounding the earlier flowering event at Royal Botanic Gardens Edinburgh in June 2015.

The inflorescence is protogynous with the female flowers maturing before the male ones. In the case of *A. titanum* this happens over two nights with the inflorescence functionally female on the first night and male on the second night. Both stages are accompanied by a foul odour, therefore to provide the best opportunity for visiting public the decision was taken to open late on these two evenings. Late night opening (last entry at 10pm, Garden closure at midnight) was managed by the Visitor Services Team and staff volunteered from all Garden sections and from across the University to help staff the event.

The inflorescence was open for five days, with the floral structure collapsing on the Thursday, 23rd July. Over this time period a total of 12,834 visitors were recorded. Late night opening on the weekend of the 18th July saw a large public turnout with queues all the way from the Brookside Gate to the Glasshouse Range. Peak visitor numbers were recorded for the Sunday with 4,426 entries to the Garden. This is the highest daily visitor number ever recorded. The feedback from the public was extremely positive and this was reinforced through the Garden's social media.

Whilst physical measurements of the inflorescence size were taken on a daily basis, a time-lapse of bud development and flowering were produced with help from the University's IT team. A thermal imaging camera was kindly lent to the Garden by Clive Oppenheimer, Professor of Volcanology in the Geography Department. This recorded an image every two minutes and allowed the thermogenesis of the spadix to be recorded and measured. Scanning Electron Microscopy (SEM) images of the spathe and spadix epidermal tissue were taken by Dr Edwige Moyroud, a research fellow working with Professor Glover. This has provided novel data and will be available for future use by the Garden.

The second flowering of *A. titanum* at the Garden matched the successful public engagement that was achieved in 2004, with the added bonus this time of significant engagement through social media. The Garden was able to manage both the publicity and the extra visitors at short notice, and to maximise data recorded both from a botanical and an institutional perspective. The flowering event allowed the Garden to reach a wider audience than ever before through the webcam, publicity and social media. Staff and volunteers provided their time and energy to make the most of this rare event. Let's hope the next flowering does not take another 11 years.

Alex Summers
Glasshouse Supervisor

THERMOGENESIS OF THE SPADIX

A thermal imaging camera was kindly lent to the Garden by Clive Oppenheimer, Professor of Volcanology in the Geography Department. This recorded an image every two minutes and allowed the thermogenesis of the spadix to be recorded and measured.

Research

The diversity of roles the Garden plays in Research, both across the University and more widely, always amazes our visitors and Friends. Pages 16-19 of this Annual Report provide a summary of Research conducted in 2014-2015. As well as our predictable role in providing access to plant collections and offering horticultural support for botanical projects, the Garden also provides underpinning facilities supporting research in Architecture, Biochemistry, Chemical Engineering, Geography and Zoology. We welcome requests for material and resources from colleagues from all academic and research organisations, and are delighted to be able to support such a diversity of projects.

CARYOPHYLLALES – CACTI

CARYOPHYLLALES – BEETROOT

The answers are in the genes

Despite the interesting diversity of research supported by the Garden, it remains the case that our major research focus is on plant science. The ways in which plant science is conducted have changed dramatically over the last few decades, and the Garden now stands poised to be at the forefront of plant science. Put simply, research in the last 25 years focused on understanding how the genes of a single plant species, the model plant *Arabidopsis thaliana*, contributed to the growth, morphology and functions of the plant. Research over the next 25 years will be focused on exploring how the lessons learned from *Arabidopsis* can be applied across the whole plant kingdom, and the primary route to this research will be through the analysis of genes and genomes from an enormous diversity of plant species. The Botanic Garden, with its detailed database of 8000 living species, will be in increasing demand as a resource for plant scientists across the globe.

From cacti to carnivores

Research in the Curator's research group has been focusing on the genomics of extreme adaptation. Sam Brockington's team are studying the Caryophyllales, an order of flowering plants that contain ~6% of all flowering plant species and exhibit extreme life history diversity, including long-lived succulent cacti, the living stones that can resemble tiny pebbles, and a diverse array of carnivorous plants such as *Nepenthes* and the Venus Fly-Trap *Dionaea muscipula*. In collaboration with researchers all over the world the Brockington lab are sequencing >10,000 genes from each of 500 representative species of Caryophyllales. Many of these species are sourced from partner botanic gardens and seed banks such as the Millennium Seed Bank at Wakehurst, and grown by the Cambridge University Botanic Garden. Currently the project is half-way there and a total of 250 species have been sequenced from an extraordinary collection of plants. Having sequenced these genes, the researchers will then leverage recent advances in computational methods to evaluate the extent to which changes in life history and physiology in plants are correlated with changes in the evolutionary rate over the entire genome. They expect these approaches to yield unprecedented insight into the evolution of several genetic pathways of fundamental importance in flowering and crop plants, including pigmentation, discussed below.

Many readers will be familiar with the deep purple and red pigments of beetroot, but be unaware that the humble beetroot in the Caryophyllales is actually representative of a remarkable story in plant evolution, which concerns colour. All flowering plants over the past 150 million years have been coloured in the same way using compounds called anthocyanins, which are derived from the amino acid phenylalanine. The one exception is the Caryophyllales, which are coloured by betalains. Betalains, like the human pigment melanin, are derived from a different building block – the amino acid tyrosine. The

ASH TREE

LINARIA SALZMANNII (left) HAS THE LONGEST NECTAR SPUR IN THE GENUS, WHILE *LINARIA CLEMENTEI* (right) HAS THE SHORTEST

betalain pigments seem to replace all the functions normally performed by anthocyanins, and can produce almost all the same colours and hues with the exception of blue. But why has a completely different colour system arisen in Caryophyllales, and how has the necessary genetic pathway been assembled? The why question is always a hard one for evolutionary biologists, but in this case it may be that the new pigments arose to better protect plants in the harsh and saline environments in which so many of the Caryophyllales now thrive. Alfonso Timoneda, an MSc student in the Brockington lab, and Tao Feng, a visiting scholar from the Wuhan Botanic Gardens in China, are attempting to understand how the gene pathways underlying betalain synthesis have evolved. They have discovered that the betalain pathway has arisen largely through gene duplication, which has given rise to new gene functions capable of synthesising betalains from tyrosine. An exciting challenge ahead is to see whether they can now use the new gene variants to artificially make the betalain pigments in bio-industrial hosts such as yeast. The Botanic Garden has been instrumental in growing up experimental lines of beet in the glasshouses and cultivating an extraordinary range of Caryophyllales, allowing the researchers to track the evolution of the pathway through evolutionary time.

How do different ash genomes resist ash dieback?

Similar genetic and genomic approaches can be applied to a wide range of questions. Ash trees in Britain, Europe and North America are threatened by ash dieback and the emerald ash borer. The laboratory of Richard Buggs at Queen Mary University London is using phylogenomic approaches to find genetic variants in ash species that reduce their susceptibility to these two health problems. They have sequenced the genome of a British ash tree *(Fraxinus excelsior)* with funding from NERC, and post-doc researcher Dr Laura Kelly in the Buggs Lab is now sequencing the genomes of 35 other ash species from around the world, funded by the BBSRC, Defra, NERC, ESRC, Scottish Government and the Forestry Commission. In conjunction with this, they are also screening different ash species for susceptibility to ash dieback and the emerald ash borer. To this end, they have sampled several ash species from the Cambridge University Botanic Garden, including our specimens of *Fraxinus greggii, Fraxinus lanuginose, Fraxinus paxiana, Fraxinus spaethiana,* and *Fraxinus xanthoxyloides.* Using this species diversity, they hope to identify the genes which make different ash more resistant to ash disease, and so identify powerful varieties that could be in the vanguard of re-forestation.

Using genomes to understand species relationships

Our experimental glasshouses and our Mediterranean beds house a collection of toadflax species, *Linaria.* The common toadflax is a frequent garden plant and also a fairly common weed, but the collection the Garden hosts includes a wonderful diversity of flower colours, sizes and nectar spur lengths. These nectar spurs are long tubes which contain the nectar, and they determine which pollinators visit the flower – only insects with the right length of tongue can feed on each individual species. Understanding the evolution of nectar spurs requires an understanding of the relationships between the different *Linaria* species, and Dr Mario Mazuecoa-Fernandez, a post-doc in the Director's research group, has been focusing on understanding these relationships by sequencing a reduced representation of each genome. The results are very exciting – the shortest-spurred and the longest-spurred species appear to be very close relatives, presenting an ideal study system in which to explore the developmental genetics of nectar spur evolution.

These novel approaches to longstanding biological questions are underpinned by two key resources. The first is the availability of affordable genome sequencing to an extent that would have seemed a fantasy only 10 years ago. The second is the availability of living collections of plant species from which to extract DNA and in which to relate gene sequences to plant morphology, function or form. The Cambridge University Botanic Garden is a fantastic resource for researchers from around the world interested in applying these approaches, and we are delighted to see our collection being increasingly used in this powerful way.

Professor Beverley Glover, Director and
Dr Samuel Brockington, Curator

Research supported and facilitated

The Botanic Garden maintains and makes accessible the living plant collection of the University of Cambridge. Research and teaching is supported through the plant collections of over 8000 species, the Experimental Section which provides supported glasshouse and open ground research plots, and through use of the 40-acre landscape. In addition to home-grown research the Garden supports a wide range of projects throughout the University of Cambridge and collaborates with a great many external partners.

Cambridge University Botanic Garden

Professor Beverley Glover, Director:
Research programme focussed on the evolution and development of flowers, plant/pollinator interactions, and plant surface properties. Material maintained at CUBG, analysed in the experimental plots, or accessed from living collection, for projects including:

- Stamen evolution in *Solanum,* with Dr Sandy Knapp (The Natural History Museum) and Gwen Davis (PhD student).
- The relationship of floral morphology to pollination success in *Vicia faba,* with Dr Jane Thomas (National Institute of Agricultural Botany) and Emily Bailes (PhD student).
- Molecular evolution of key developmental pathways in plants, with Dr Sam Brockington (Curator, CUBG) and Dr Chiara Airoldi (post-doc).
- Evolution of floral form and pollinator type in Antirrhineae, with Cecilia Martinez (PhD student).
- Development and evolution of insect-mimicking petal spots in *Gorteria diffusa,* with Dr Paula Rudall (RBG Kew), Dr Allan Ellis (Stellenbosch University) and Greg Mellers (PhD student).
- Development, function and evolution of iridescence in plants, with Dr Paula Rudall (RBG Kew), Professor Richard Bateman (RBG Kew), Professor Ulli Steiner (Adolphe Merkele Institute, Switzerland), Professor Jeremy Baumberg (Department of Physics, University of Cambridge), Dr Silvia Vignolini (Department of Chemistry, University of Cambridge) and Dr Edwige Moyroud (post-doc).
- Evolution of epidermal cell morphology, with Lin Taylor (PhD student).
- The effect of plant viral infection on pollinator attraction, with Dr John Carr (Department of Plant Sciences, University of Cambridge), Dr Alex Murphy (post-doc), and Sanjie Jiang (PhD student).
- Evolution and development of nectar spurs in *Linaria,* with Dr Mario Fernandez-Mazuecos (post-doc).
- Interactions between petal surface and pollinator claw morphology, with Dr Walter Federle (Department of Zoology, University of Cambridge) and Jonathan Pattrick (PhD student).
- Petal epidermal cell morphology and the association with insect pollinators in *Nicotiana,* with Gabriela Doria (PhD student).
- Provision of liverworts, mosses, ferns, lycophytes and cycads for undergraduate teaching.

Dr Sam Brockington, Curator (from April 2015):
Research programme focussed on the evolutionary genomics of the order Caryophyllales, using material grown in the experimental glasshouses, and across the living collections:

- Sequencing transcriptomes in Caryophyllales is being done in collaboration with Stephen Smith (University of Michigan) and Michael Moore (Oberlin College, Ohio).
- Reconstituting the betalain pathway in heterologous host systems with Alfonso Timoneda (MSc student).
- Understanding how Caryophyllales switch from betalain pigments to anthocyanins with Tao Feng (Visiting Scientist, Wuhan Botanic Gardens).
- Developing curation strategies for endangered plants in the CUBG living collections with Pangiotis Spiliotis (Royal Botanic Gardens, Edinburgh).

In collaboration with Tim Pankhurst, Plantlife Fenland Officer based at CUBG:
Maintaining collection of fen plants for conservation including:

- Comparative anatomical examination of *Dryopteris cristata* (Crested buckler fern).
- Testing viability of *Viola persicifolia* (Fen violet) seeds from Wicken Fen.
- Regenerative strategies and reintroduction stock for *Liparis loeselii* (Fen orchid) and *Dactylorhiza incarnata* ssp. *ochroleuca* (Yellow early marsh-orchid), with Pete Atkinson (Plant Records Officer) and Pete Michna (Experimental Supervisor)

Department of Plant Sciences, Cambridge

Professor Sir David Baulcombe, FRS
(RNA Silencing and Disease Resistance Group)
Use of experimental glasshouses to propagate the progeny of *Solanum lycopersicum x S. pennelli* hybrids through to the F4 generation, to investigate transgressive segregation in hybrid plant populations. Transgressive segregation results in plants that have heritable properties that are outside the range of the parents, and this work aims to understand the molecular biology of this important trait so that it can be harnessed more efficiently for crop improvement. Also growing *Zea mays* for analysis of inheritance of key traits.

Dr John Carr (Plant Virology Group)
Use of experimental glasshouses to grow tomatoes *(Solanum lycopersicum)* and common bean *(Phaseolus vulgaris)* for a variety of projects concerned with the effect of virus infection on plant fitness, plant interaction with herbivores and plant interaction with pollinators. Most notably the glasshouses are used to maintain tomatoes with a colony of bumblebees to explore how different tomato genotypes attract pollinators. The Experimental Supervisor, Pete Michna, also provides valuable support in finding and identifying various aphid species.

Dr David Coomes (Forest Ecology and Conservation Group)
Using plants in the tropical display house for a project concerned with the emission of isoprene by plants. Some plants emit vast quantities of this small organic compound into the atmosphere (up to 5% of carbon fixed) whilst others emit none at all. The explanation for its production, and why species differ so much in the quantities produced, remain poorly understood. Growing *Eucalyptus* plants in chambers in the Botanic Garden greenhouses, we found that isoprene production was very closely influenced by temperature, but that simulated herbivory (i.e. creating holes in leaves with a paper hole punch!) had absolutely no effect. This supports the hypothesis that isoprene is produced at high temperatures to protect cell membranes.

Professor Howard Griffiths (Plant Physiological Ecology Group)
Maintaining collections of succulent plants for analysis of those with Crassulacean acid metabolism. The diversity and evolution of epiphytic bromeliads from the neotropics are being investigated. The compromise between water use and carbon gain is also being used to infer evolutionary origins and biomass production potential in succulents and grasses. In grasses, many savanna species have evolved the C4 pathway to enhance productivity, and the selection pressures leading to changes in leaf vein anatomy and metabolic partitioning are being investigated. These processes led to the development of highly productive crops such as sugar cane, sorghum and maize. *Agave tequilensis, Aechmea, Guzmania* (Bromeliacease); *Jatropha, Kalanchoe, Mesembryanthemum* and rice plants are all maintained at the Botanic Garden. Various moss species are also used from the collection in the Garden and cultured in shade for analysis of moss metabolism.

Dr David Hanke (Plant Growth Substances Group)
High quality tubers of *Solanum tuberosum,* cvs Majestic, Desiree, Maris Piper, Estima and Mayan Gold are grown and harvested for Luke Browning (PhD student) working with David Hanke on an industry funded project to develop diagnostic tests for tuber dormancy.

Wheat plants are also grown for Farhat Nazir (PhD student) to study the control of seed dormancy by hormones in relation to pre-harvest sprouting.

Professor Julian Hibberd (Molecular Physiology Group)
Rice, millet and wheat are grown for anatomical analysis, RNA isolation and deep sequencing as part of a project to understand the genetic differences between the more common C3 photosynthesis and the more efficient C4 photosynthesis.

Dr Uta Paszkowski (Cereal Symbiosis Group)

The mutually beneficial arbuscular mycorrhizal (AM) symbiosis is the most widespread plant-fungal association between roots of terrestrial plants and fungi of the Glomeromycota, in which the fungus receives photosynthates from the plant and enhances its mineral, particularly phosphate, nutrition.

This research focuses on the identification and characterization of molecular mechanisms underlying the development and functioning of AM symbioses in the crop plants maize and rice. Maize and rice lines are grown in the Botanic Garden's research glasshouses and experimental plots for genetic characterization and seed amplification.

Professor Alison Smith and Dr Matt Davey (Plant Metabolism Group)
The Botanic Garden has provided space in a frost-free horticultural polytunnel for an algae growth facility co-funded by the INTERREG NW Europe strategic initiative 'EnAlgae' (www.enalgae.eu), and run in partnership with InCrops. The facility is part of a network of pilot plants across NW Europe, where different algal species are being grown to establish what role algae can play in the development of a low carbon economy. The facility showcases a 6m long photobioreactor with patented low energy design by Steve Skill, EnAlgae collaborator. The reactor has a capacity of 300L, and will be used to test the growth of a variety of algal strains that are commercially promising, as well as for outreach activities to industry and schools. A new Algal Innovation Centre glasshouse facility is being constructed on site, to allow expansion of the programme.

Dr Edmund Tanner (Tropical Ecology Group)
Growing tree seedlings under shade for studies of forest dynamics.

University of Cambridge

Dr Siobhan Braybrook (Sainsbury Laboratory)
Use of the living collection for a project exploring the diversity of leaf epidermal cell shapes found in plants.

Dr John Laurie (Sainsbury Laboratory)
Sampling *Gnetum gnemon* from the living collection to analyse how ovules develop and improve understanding of the evolution of embryo development in seed plants.

Dr Sebastian Schornak (Sainsbury Laboratory)
Plants engage with fungi to improve access to nutrients such as phosphate. We have sampled liverwort species from the Botanic Garden *(Lunularia cruciata* and *Pellia endiviifolia)* and stained them to detect fungal structures. We found that *Pellia endiviifolia* harbours fungal structures. Comparing early land plant symbiosis with the root symbiosis of higher plants will allow us to highlight evolutionary aspects of symbiosis establishment in different parts of plants.

Professor Paul Dupree (Department of Biochemistry)
Use of the experimental glasshouses to grow rice plants as part of a study to understand plant cell wall growth and mechanics. Supply of *Drimys winteri* from the collection for cellular research.

Dr Ruth Reef (Department of Geography)
Use of the experimental plots to explore the effects of varying carbon dioxide concentration on the growth and diversity of salt marsh plants.

Professor Nick Davies (Department of Zoology)
Use of the landscape to study how distance from cover influences feeding behaviour of blue tits and great tits under threat from attack by sparrowhawks. Studies of Dunnocks in the Garden over several decades, monitoring nests and breeding behaviour.

Dr Ian Wilson (Department of Chemical Engineering)
Understanding the mechanical behaviour of pitcher plant fluid.
A paper about this work was published as Collett, C.H., Ardon, A., Bauer, U., Chapman, G., Chaudan, E., Hallmark, H., Pratt, L., Torres-Perez, M.D., Wilson, D.I. (2015) A portable extensional rheometer for measuring the viscoelasticity of pitcher plant and other sticky liquids in the field, Plant Methods, 11:16

David Russell (Department of Pharmacology)
Samples of *Amorpha fruticosa* for isolation of potential anti-cancer compounds.

Dr Maximillian Bock (Department of Architecture)
Investigating Bamboo as a viable alternative to current building materials to help meet carbon dioxide emission targets and lead architects and engineers to a greener and more sustainable future. Cultivation of common and rarer bamboo species at the Botanic Garden for structural analysis. Work as part of the Eco-House Initiative to explore how best to minimise rotting of timber piles.

External collaborations

Rachel Fosberry (Oxford Archaeology East)
Archaeobotany is the study of plant remains from archaeological sites through the identification of preserved plant remains and the interpretation of these findings within specific contexts and time periods. Preservation is variable and ancient plant remains can be difficult to identify. Use of the Botanic Garden collection to develop a reference collection for the recognition of the seeds and vegetative parts of different species.

Dr Nancy Harrison and Dr Julie Mackenzie (Anglia Ruskin University in collaboration with the Centre for Ecology and Hydrology)
Blue tits and great tits breeding in CUBG and in woodlands have been studied over 10 years, in association with the detailed temperature and rainfall records made available by CUBG.

The project involves monitoring breeding birds and some ringing of adult birds. A pilot study began in spring 2013 using stable isotope techniques to study blue tit and great tit nestling diet in urban environments (CUBG and Cherry Hinton Hall) compared to woodland (Monks Wood, Cambridgeshire). Initial results suggest that urban birds eat prey higher up the food chain (mainly spiders) compared with woodland birds (mainly caterpillars).

Dr Tim Pankhurst (PlantLife)
The Fen Orchid, *Liparis loeselii,* is the principal focus of a collaboration between Plantlife and CUBG, also involving RBG Kew, Norfolk Wildlife Trust, Butterfly Conservation and Natural England. We have been trying to understand better the reproductive strategy of this European protected species. This has involved a programme of seed-baiting to a) locate and identify the symbiotic fungus that it relies upon for germination, b) assess the suitability of potential reintroduction sites, and c) develop an ex-situ population, both for study and as stock for reintroduction. This year we have also collected from the wild a small number of growing specimens to test our ability to grow and propagate fen orchid at the Garden.

Dr Peter Stroh (Botanical Society of the British Isles)
I am a BSBI Scientific Officer based at Cory Lodge and working on a Vascular Plant Red Data List for England that will, when complete, give an assessment of extinction threat for all native and archaeophyte taxa found in England. During the course of the year, I have also been involved with CUBG staff in the introduction of the extinct endemic *Bromus interruptus* (Interrupted Brome) using seed from plants that were previously established in the Botanic Garden from the last known wild population. Seed sown at the introduction site in Whittlesford, Cambridgeshire, have germinated and monitoring with CUBG staff will continue throughout the winter and spring.

Jonathan Shanklin (Cambridge Natural History Society)
Survey of naturally occurring plants in CUBG as part of research for a "Natural History of Cambridge" and to contribute towards the BSBI Atlas 2020.

Kevin Hand
Monitoring populations of bats in CUBG for a long term study of population trends.

William Armstrong (Northumberland University
Material of *Widdrintonia nodiflora* supplied for analysis of xylem as a water filter.

Dr Richard Buggs (Queen Mary University London)
Material supplied from five different species of *Fraxinus* for genome sequencing and analysis as part of a project to explore resistance to the pathogen causing ash dieback.

Ros Smith (Duchy College, Cornwall)
Chenopodium quinoa and *Tulipa* "Captain Fryatt" material supplied for projects involving plant virus infection.

Alex Prendergast (Natural England)
Material of *Cirsium tuberosum* supplied for research into morphology of wild populations.

Dr Fred Rumsey (Natural History Museum)
Seed of *Bromus interruptus* supplied for reintroduction programme.

Plant Material provided to other Gardens

Botanischer Garten Der Universitat Bonn
Hyacinthoides sp.

The Magic of Life Butterfly House
Passiflora jussieui

Royal Botanic Gardens Kew
Hermannia flammea, Hermannia pinnata, Macleania cordifolia

King's College, Cambridge
Various plant material

Hortus Botanicus Leiden
Rhododendron taxifolium, Rhododendron rarum, Rhododendron gracilentum, Aristolochia cathcartii

Myddleton House
Syringa protolaciniata

University Della Calabria
Malus pumila "Flower of Kent"

U3A Botany Group
Various plant material

Wimpole Hall
Cirsium tuberosum

RHS Wisley
Various plant material

Warsaw Botanic Garden
Fritillaria crassifolia, F. affinis

Plant material accessioned

During the period 1st October 2014 to 30th September 2015 the Garden accessioned 943 plants, of which 308 were of wild origin. An accession of note was the collection of 20 wild collected plants of the Fen Orchid *(Liparis loesellii),* a very rare orchid found only in three sites in the East of England. These plants were collected as part of a conservation program to propagate the plants for possible reintroduction work. 65 new seed lots were added to the seed bank.

Publications by Botanic Garden staff and associates

- Chandler, C., Wilts, B., Vignolini, S., Brodie, J., Steiner, U., Rudall, P., Glover, B.J., Gregory, T. & Walker, R. (2015) Structural colour in *Chondrus crispus. Journal of the Royal Society Interface* 5, 11645.
- Giorio, C., Moyroud, E., Glover, B.J., Skelton, P. & Kalberer, M. (2015) Direct surface analysis coupled to high-resolution mass spectrometry reveals heterogeneous composition of the cuticle of *Hibiscus trionum* petals. *Analytical Chemistry* 87, 9900-9907.
- Bailes, E., Pattrick, J., Ollerton, J. & Glover, B.J. (2015) How can an understanding of plant-pollinator interactions contribute to global food security? *Current Opinion in Plant Biology* 26, 72-79.
- Vignolini, S., Moyroud, E., Hingant, T., Banks, H., Rudall, P., Steiner, U. & Glover, B.J. (2015) Is floral iridescence a biologically-relevant cue in plant-pollinator-signalling? *New Phytologist* doi: 10.1111/nph.13178.
- Vignolini, S., Moyroud, E., Hingant, T., Banks, H., Rudall, P., Steiner, U. & Glover, B.J. (2015) The flower of *Hibiscus trionum* is both visibly and measurably iridescent. *New Phytologist* doi: 10.1111/nph.12958.
- Glover, B.J. (2014) Understanding flowers and flowering: an integrated approach. 2nd edition. Oxford University Press, 292 pages.
- Wilts, B., Whitney, H., Glover, B.J., Steiner, U. & Vignolini, S. (2014) Natural helicoidal structures: morphology, self-assembly and optical properties. *Materials Today* 1: 177-185.
- Dumanli, A., Kamita, G., Landman, J., van der Kooij, H., Glover, B.J., Baumberg, J. Steiner, U., Vignolini, S.(2014) Controlled, Bio-inspired Self-Assembly of Cellulose-Based Chiral Reflectors. *Advanced Optical Materials* 2; 646-650.
- Glover, B.J., Airoldi, C., Brockington, S., Fernández-Mazuecos, M., Martínez-Pérez, C., Mellers, G., Moyroud, E. & Taylor, L. (2015) How have advances in comparative floral development influenced our understanding of floral evolution? *International Journal of Plant Sciences* 176, 307-323.
- Bennett, T., Brockington, S.F., Rothfels, C., Graham, S., Stevenson, D., Kutchan, T., Rolf, M., Thomas, P., Wong, G., Leyser, O., Glover, B.J. & Harrison, C.J. (2014) Paralagous radiations of PIN proteins with multiple origins of non-canonical PIN structure. *Molecular Biology and Evolution* 31; 2042-2060.
- Ellis, A., Brockington, S., de Jager, M., Mellers, G., Walker, R. & Glover, B.J. (2014) Floral trait variation and integration as a function of sexual deception in *Gorteria diffusa. Philosophical Transactions of the Royal Society Series* 369; 20130563.
- Brockington, S.F., Moyroud, E., Sayou, C., Monniaux, M., Nanao, M.H., Thevenone, Chahtan, H., Warthmann, N., Melkonian, M., Yong, Z., Wong, G.K.S., Weigel, D., Dumas, R. & Parcy, F. (2015) Response to Comment on "A promiscuous intermediate underlies the evolution of LEAFY DNA binding specificity" *Science* 347(62222), 621
- Yang, Y., Moore, M.J., Brockington, S.F., Soltis, D.E., Wong, G.K.S., Carpenter, E.J., Zhang, Y., Chen, L., Yan, Z., Xie, Y., Sage, R.F., Covshoff, S., Hibberd, J.M., Nelson, M.N. & Smith, S.A. (2015) Dissecting molecular evolution in the highly diverse plant clade Caryophyllales using transcriptome sequencing. *Molecular Biology and Evolution* doi:10.1093/molbev/msv081
- Brockington, S.F., Yang, Y., Gandia-Herrero, F., Covshoff, S., Sage, R.F., Hibberd, J.M., Wong, G.K.S., Moore, M.J. & Smith, S.A. (2015) Lineage-specific gene radiations underly the evolution of novel betalain pigmentation in Caryophyllales. *New Phytologist* 207(4): 1170-1180

Funding

This has been a promising year where the Garden continued to encourage new Friends and visitors to engage in a range of interesting and exciting activities. Events such as Apple Day, the summer music evenings, and the flowering of the Titan Arum, all helped to increase much needed revenue to support the operational costs of a growing Garden.

Focus again for the Garden was on Visitor experience, education, science and research. From University funds a new Curator was appointed, along with a new Estates Manager - both vital roles at the Garden as we develop our collections for national and international audiences and improve our estate. In addition, and funded from trading revenues, the Visitor Service section welcomed a new member of the team, recruited to ease staffing pressures and enhance the Visitor experience.

During the year the Garden was grateful to receive a number of legacies, earmarked largely to form part of the new 'Research Fund' - the income of which is intended to forward Science and Research at the Garden.

In addition, the Garden was awarded £900k over three years from The Monument Trust, to 'develop and interpret the heritage systematic beds', a large and exciting project that will physically engage visitors with the science of taxonomy.

Perennial, the Gardeners' Benevolent Society, generously funded the salary of an additional trainee who participated in the Garden's one year horticultural trainee scheme. The scheme now offers seven places to those wishing to pursue a career in horticulture by gaining practical horticultural experience and developing a high level of diverse plantsmanship, whist receiving a salary.

In memory gifts, donations and Gift Aid all helped to fund the completion of The Geoffrey and Eileen Adams Garden Room (now open for school children), the relandscaping of both the Subtropical Courtyard and the Mediterranean Beds, and interpretation of the Systematic Beds. We are very grateful for these various gifts.

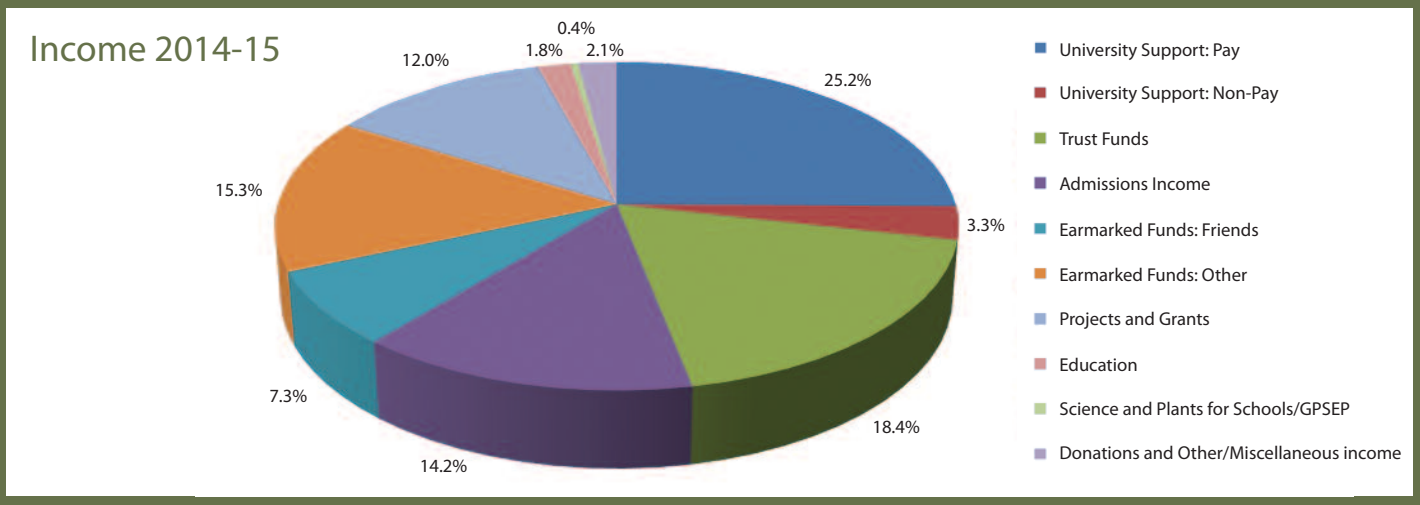
Importantly, Volunteers continued to play a crucial role at the Garden, bringing a diverse range of skills, experience and passion, helping to make the Botanic Garden the special place it is today.

INCOME		**£k**	**£k**
Funding Source	**Details**	**2014-15**	**2013-14**
University Support	Pay	694.1	658.0
	Non Pay	89.8	51.0
	Non Recurrent	0.0	3.0
Trust Funds	The Cory Fund	493.3	475.4
	Other Trust Funds	14.5	12.1
Admissions Income	Gate takings (to include tours,guidebooks etc)	391.2	351.6
Earmarked Funds	Friends (to include income for events, activities)	203.7 See breakdown below	179.8
	Other Specific Donations and Trade (to include Trading events)	420.1	157.9
Projects Grants/Funding		330.9 See breakdown below	208.4
Education Running Costs, Courses and Events		48.4	45.7
Science and Plants for Schools/GPSEP ***		11.3	159.5
Donations – General (to include Gift Aid)		51.1	109.2
Other/Miscellaneous income		5.9	3.7
Total Income		**2,754.4****	**2,415.3****

Breakdown of Income (Friends: Earmarked Funds)		
Friends of the Botanic Garden – Subscriptions	195.3	169.1
Friends of the Botanic Garden – Outreach programme	7.0	9.0
Friends General Donation and 25 Fund	1.5	0.2
Other	0.0	1.5
Total	**203.7****	**179.8****
Breakdown of Income (Project Grants/ Funding)		
Monument Trust	300.0	0.0
Perennial – Funding towards Trainee Programme	19.8	0.0
Garden Room – Classroom for Schools (Funded by a Specific 'Giving in Memory' Donation and Specific Garden Reserves)	0.0	150.0
Community Art Project - % for Art	0.2	0.2
Voicing the Garden (Funded by Heritage Lottery Fund Wildlife Travel, CUBGA and Garden reserves)	0.0	0.5
Connecting Collections (Funded by University of Cambridge Museums)	5.0	5.0
Pergola Project (Funded through a Specific Donation, Gift Aid and Garden Reserves)	0.0	3.0
Interpretation (HEIF5 Funded)	0.1	49.7
Mill Stone Plaque (Funded from CUBGA* and Garden Reserves)	0.8	0.0
Global Food Security Project	5.0	0.0
Total	**330.9**	**208.4**

Expenditure		£k	£k
Expenditure Type	**Funding Source**	**2014-15**	**2013-14**
Pay	University Support	627.2	658.1
	Trust Funds	468.9	449.4
	Admission and Tours	315.2	294.5
	Earmarked Funds: Friends	65.2	52.2
	Earmarked Funds: Other	41.2	26.9
	Specific Project Grants/Funding	27.9 see detail below	0.0
	Education Courses and Events	14.8	0.0
	Science and Plants for Schools/GPSEP ***	11.3	125.7
		1,571.7	1,606.8**
Non Pay	University Support	139.1	54.6
	Trust Funds	13.5	30.1
	Admission and Tours	35.8	147.6
	Earmarked Funds: Friends	23.8	25.8
	Earmarked Funds: Other	132.3	-13.4
	Specific Project Grants/Funding	324.3 See detail below	30.3
	Education	40.0	34.8
	Science and Plants for Schools-GPSEP ***	2.9	138.0
	Donations – General	0.0	42.6
	Others/Miscellaneous	0.0	2.0
		711.7	492.4**
Total Expenditure		**2,283.4**	**2,099.2**

Breakdown of Expenditure (Specific Project Grants/Funding)		
Perennial – Funding towards Trainee Programme	19.1	0.0
The Geoffrey and Eileen Adams Garden Room – Schools Room	310.2	10.0
Community Art Project - % for Art	0.1	4.9
Voicing the Garden	0.0	11.5
Connecting Collections – University of Cambridge Museums	4.0	0.5
Pergola Project	0.9	3.0
Interpretation (HEIF5 Funded)	9.3	
Mill Stone (funded by CUBGA* and from Garden Reserves)	1.5	0.4
Subtropical Courtyard Project (funded from donations)	0.9	0.0
Mediterranean Bed Project (funded from donations)	2.2	0.0
Systematic Beds Interpretation Project (funded by the Friends and from a specific donation)	4.1	0.0
Total	**352.2****	**30.3****
Total Income less Total Expenditure:	**471.0**	**316.1**
Less: Earmarked funds held for future planned expenditure	-414.0	-248.0
Funds reinvested by Cory and Trust Fund Managers	-1.0	-1.0
FUNDS REMAINING FOR DISCRETIONARY USE	**56.0**	**67.2**



* Cambridge University Botanic Garden Association – CUBGA
** Calculations include minor rounding errors
*** Gatsby Plant Science Education Programme

The Gatsby Plant Science Education Programme

- 2014-2017: Gatsby Charitable Foundation: £1,500,000 to support *Science and Plants for Schools, a Student Engagement Programme,* and the *Gatsby Plants Summer School* (held by the Director with Professor Ottoline Leyser, Director of the Sainsbury Laboratory Cambridge University).

Syndicate and Cory Managers

Four meetings of the Botanic Garden Syndicate were held during the year under the Chairmanship of Dame Fiona Reynolds. Syndicate members were Professor Paul Brakefield, Dr David Coomes, Professor Nick Davies, Dr Laurie Friday, Dr Ian Furner, Mr Donald Hearn, Professor Nick Jardine, Professor Ottoline Leyser and Dr Mike Rands. The Secretary was the Garden's Director, Professor Beverley Glover. The Syndicate were pleased for the opportunity to meet the Botanic Garden staff in advance of their July meeting.

The Cory Managers met four times during the year under the Chairmanship of Professor Alison Smith (Acting Head of the Department of Plant Sciences) and in the absence for one academical year on research leave of Professor Sir David Baulcombe. Managers for the year were Mr Michael Allen, Professor Howard Griffiths and Dr Alan Munro with Mr Jonathan Appleton as the representative of the Director of Finance.

Botanic Garden Staff – October 2014 to September 2015

Director
- Professor Beverley Glover

Curation
- Curator: Sam Brockington (from April 2015)
- Plant Records Officer: Pete Atkinson
- Plant Records Assistant: Mar Millan
- Cory Library Manager: Jenny Sargent

Administration
- Administrator: Brigid Stacey (to June 2015), Wendy Godfrey (from July 2015)
- Deputy Administrator: Wendy Godfrey (to June 2015)
- Finance Officer: Rachel Agnew
- Deputy Finance Officer: Anouska Arthur
- Finance Administrator: Elaine Dalton
- Assistant Administrators: Richenda Whitehead and Caty Cooke
- Education Administrator: Emma Daintrey
- Friends Administrator: Sacha Watson (from April 2015)
- PA to Director: Jane Adams

Visitor Services
- Head of Visitor Services: Nicci Steele-Williams
- Deputy Head of Visitor Services & Team Leader (Tuesday-Thursday): Laura Welford
- Team Leader (Friday-Monday): David Evans
- Visitor Services Assistants: Andrew Bryant, Jennifer Hills (to October 2014), Amanda Wilkins, Lucinda Fudge, Hannah Winter, Susan Baker, Sam Kuper, Andrew Cameron, Kate Smith, Greg Smith (to December 2014), Alison Watkins (from April 2015), James Oliver (from April 2015)

Development
- Development Officer: Juliet Day
- Interpretation Associate: Alison Murray (from March 2015)

Education
- Head of Education: Flis Plent
- Education Officer: Sally Lee
- Schools Education Officer: Bronwen Richards

Estates
- Head of Estates and Operations Manager: Carl Tatterton (from January 2015)
- Estates Manager: Philip Starling

Horticulture
- Head of Horticulture: Sally Petitt
- Alpine & Woodland Section: Supervisor – Helen Seal (to March 2015), Paul Aston (from June 2015); Assistant – Simon Wallis
- Demonstration & Display: Supervisor - Peter Kerley; Assistant – Paul Aston (to June 2015), David Austrin (from September 2015)
- Experimental Area: Supervisor - Pete Michna; Assistant – Sally Hughes
- Glasshouse Section: Supervisor - Alex Summers; Assistant – Alan Langley
- Landscape & Machinery: Supervisor - Adrian Holmes; Assistant – Alistair Cochrane
- Systematics Section: Supervisor – John Kapor; Assistant – Julie Clos
- Trees & Shrubs Section: Supervisor – Mark Crouch; Assistant – Ian Barker
- Trainee Horticultural Technicians: From September 2014 to August 2015: Cathy Hawes, Sean McDill, Sam Peczek, Seth Ratcliffe, William Renwick, Imogen Velouria, Giulio Veronese. From September 2015: Adam Bullen-Cutting, Emma Lainchbury, Kathryn Bray, Martine Borge, Owen Harlow, Paul O'Connor, Richard Choksey.

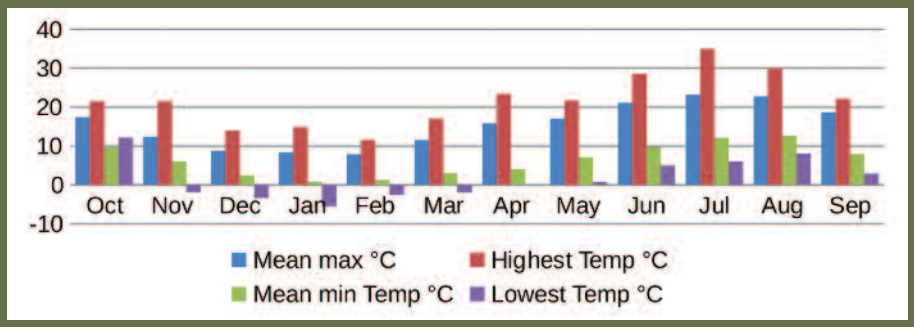
Botanic Garden staff activities

The following members of staff have contributed to external organisations and groups in connection with their posts:
- Professor Beverley Glover: fellow of Queens' College; trustee of the Royal Botanic Garden Edinburgh; member of the Council of the European Society for Evolutionary Developmental Biology; member of the Botanical Society of America; member of the British Society for Developmental Biology; Fellow of the Linnean Society; member of the Linnean Society's Education Committee; Patron of the Cambridgeshire Gardens Trust; Vice-President of the Cambridgeshire Beekeepers' Association; Associate Editor for Naturwissenschaften; member of the Advisory Board of New Phytologist; member of the Editorial Board of Current Opinion in Plant Biology; member of the Natural Environment Research Committee's Peer Review College; serves on the Royal Society's Small Grants Panel; gave invited lectures at the University of Nottingham and to the Friends of the St Andrews University Botanic Garden; gave a lecture at the Cambridge International Science Summer School and the Cambridge Alumni Festival; gave invited talks at the Rank Prize Symposium on Iridescence in Grasmere and at the European Society for Experimental Biology meeting in Lausanne.
- Dr Samuel Brockington: member of the European Society for Evolutionary Developmental Biology; member of the Botanical Society of America; Fellow of the Linnean Society; gave an invited talk at the Symposium for Biology, Genomics and Evolution of the Complex Thalloids at the Royal Botanic Gardens, Edinburgh; gave a plenary talk at the International Meeting of Caryophyllales 2015 in Botanic Garden and Botanical Museum at Berlin-Dahlem.
- Daniel Jenkins continued as a member of the UK Biology Education Research Group.
- Ginny Page continued to serve on the UK Plant Sciences Federation Executive Committee.
- Sally Petitt continued on the Advisory Committee of the Chelsea Physic Garden and as Trustee of the Merlin Trust.
- Alex Summers continued as a member of the RHS Tender Ornamental Plant Committee.
- Simon Wallis continued as a member of the RHS Joint Rock Garden Plant Committee.

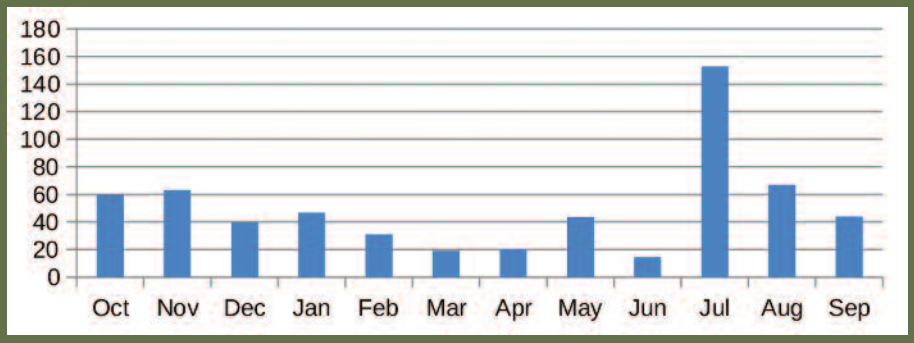
The Cambridge Certificate in Practical Horticulture and Plantsmanship
- Congratulations to Cathy Hawes, Sean McDill, Sam Peczek, Seth Ratcliffe, William Renwick, Imogen Velouria and Giulio Veronese on their successful completion and award of the certificate.

Weather

Monthly Temperatures



Rainfall (mm)



This past academic year of weather has been mixed; a cool winter with some snow, a dry spring, a wet summer with fluctuating temperatures and a mild, wet autumn.

October was mild with highs of 21.5°C and only one very light ground frost at -1.2°C. The rainfall was 59.7mm with a particularly heavy shower on the 12th in which we had 20.3mm of rain. November was an extraordinarily warm month with a maximum of 21.5°C on the 1st. It was also slightly wetter than average, with 63mm of rain and localised flooding in some areas of the Garden. December was drier than average with mixed weather. The rainfall was recorded at 39.7mm, of which 15.3mm fell on the 27th. This fell as sleet and rain and, along with some hard frosts, was our first taste of wintery weather. We had 8 air frosts and 20 ground frosts reaching -8.8°C on the grass thermometer.

January was a fairly average month, with the last weeks having some severe frosts, wintery weather and a storm on the 28th with thunder and hail. There were 13 air frosts and 22 ground frosts, the hardest on the 23rd where we recorded -5.5°C in the air and -9.8°C on the ground. We had 4 snow days and two days when the snow lay on the ground, although it was very shallow and melted quickly. February was another unremarkable month with maximums between 11.5°C and 3.4°C, minimums between 6.2°C and -2.6°C and rainfall measuring 31.0mm. Snow fell on 3 days in the first week of February, and lay on the ground for 2 days. The heaviest snowfall measured 3.8cm. This made for some beautiful scenery and everyone enjoyed the Winter Garden and snowdrops under the snowfall. In March we had less rain than average with 19.1mm falling. As well as being dry, it was persistently windy and we had several instances of high winds recording over 40mph. There were 14 ground frosts and 5 light air frosts throughout the month.

April was a warm, dry month with only 20.4mm of measurable rain falling over ten days. This made the ground dry out and sometimes crack in places. There were 10 ground frosts, the coldest being -3.2°C, however no air frosts were recorded. We also had some warm days and the highest maximum recorded was on the 16th at 23.4°C. May was mild and had an average amount of rain, measuring 43.4mm over16 days. There were two significant occurrences of gale force winds on the 5th and 6th of May when gusts reached over 40mph, and there was a squall on the 19th with some thunder and hail. Our last ground frost of the spring came on the 21st, reading a measly -0.1°C and our highest maximum was read on the 11th with 21.7 °C. June was a fine, dry month that had very little rain. We measured 14.5mm over 10 days, the largest recording being only 3.1mm on the 4th. Our highest maximum temperature reading was on the 30th with 28.6°C and the lowest minimum was 4.9°C on the 7th, with the highest min, 14.2°C on the 13th.

In July, we had 152.8mm of measurable rain that fell over 14 days, and 3 instances where the rainfall measured reached double figures: 11.3mm was recorded on the 3rd, 31.2mm on the 24th and a whopping 87.1mm was recorded on the 16th that mostly fell overnight in an isolated thunder and hail storm. We had one other instance of thunder on the 4th. The hottest day of the year was recorded in July at 35.0°C on the 1st. This is very close to the Garden's own record high for July of 35.6°C! However, the temperatures fluctuated a lot and we recorded a maximum of only 17.1°C on the 26th. We had a slightly wetter than average August with 66.9mm of measurable rainfall over 16 days. We had our highest minimum recording of the year with 18.4°C on the 21st of the month. Our highest maximum on the 22nd was 29.9°C and the lowest maximum was 19.2°C on the 18th. September was a slightly cooler than average month with some days reaching only 15.1°C as a maximum and 2.9°C as a minimum. We had 13 days of measurable rain totalling at 43.9mm and on the 17th 20.4mm was recorded.

Sally Hughes Experimental Assistant

Thank You

Gifts, donations and support received in Annual Report period 1 October 2014 – 30 September 2015

In Memory Gifts
- The family of Kate Gross, £500
- Family and friends of Stephen Day, for the Schools' Garden, £2,525
- Family of Matthew Brett, for Matthew's Library, £250

Legacy Giving
- (Katherine) Monica Beck, a residual legacy payment, £3,869
- Dr (Patricia) Bronwen Loder, a legacy of £10,000

Individual Gifts and Donations
We would like to thank all those Friends of Cambridge University Botanic Garden who continue to make significant gifts over and above the annual renewal subscription.

Grants, Trusts and Societies
- The Monument Trust, a grant payable over three years to support Understanding Plant Diversity, a project to reinvigorate the research, teaching and public engagement value of the Systematic Beds, £900,000
- Perennial, for the employment of an additional horticultural trainee, £19,770
- CUBGA, towards renovating the millstone dedicated to Garden staff, £800
- Connecting Collection grant from the University of Cambridge Museums to support education and outreach, £5,000
- Cambridge Global Food Security grant towards developing a new display exploring wild crop plant diversity, £5,000

Corporate and other support
- CambPlants, for Festival of Plants, £1000
- Sainsbury Laboratory Cambridge University, for Festival of Plants, £1000

Donors to the Cory Library
- Mrs P Altham
- A. Crespi & Mila Abreu
- Tom Johnson
- Peter Kerley
- Meredith Lloyd-Evans
- William McCoy
- Gina Murrell
- Polish Dendrology Society
- Prof. Zhirayr Vardanyan

Corporate Friends

AAAS Science International
Abbey College
Alertmen.com Ltd
Bellerbys College
Birketts LLP
Bromium UK Ltd
Brookgate Development Management Ltd
Cambridge Assessment
Cambridge Centre for Sixth Form Studies
Cambridge Crystallographic Data Centre
Cambridge Education Group
Cambridge Institute for Sustainability Leadership
Cambridge Silicon Radio Ltd
Cambridge University Department of Chemistry
Cambridge University Department of Pharmacology
Cambridge University Office of External Affairs and Communications
Cambridge University Press
Cambustion Ltd
Cantab Asset Management
Cantab Capital Partners LLP
Carter Jonas
Churchill College
Clare Hall University of Cambridge
Collabora Ltd
Costello Medical Consulting Ltd
Deloitte LLP
Department of Chemical Engineering & Biotechnology
eLife Sciences Publications Ltd
Eversheds LLP
Fauna & Flora International
Geant
Hills Road 6th Form College
Historic England & The English Heritage Trust
Hoare Lead
Hope Residential Nursing Home
Inivata Ltd
Irwin Mitchell LLP
John Lewis Cambridge
KPMG
Lynfields Management Ltd
Marks and Clerk LLP
Marshall Sports & Social Club
Microsoft Research Ltd
Mills and Reeve LLP
Momo Group Ltd
Mott MacDonald Ltd
Mander Porman Woodward Ltd
MRC-CBU (University of Cambridge)
Nash Matthews LLP
Natural England
NetNames Brand Protection Ltd
NHS Cambridgeshire and Peterborough CCG
NIAB
Open University
Pembroke College University of Cambridge
Peters Elsworthy and Moore
Ramboll UK Ltd
Real VNC Ltd
Royal Albert Homes
Samsung Cambridge Solution Centre Social Club
Saunders Boston Ltd Savills (UK) Ltd
Siemens Industry Software Ltd
Sony Computer Entertainment Europe Ltd
St Marys School
Stephen Perse Foundation
Stone King LLP
Strutt and Parker
Thales E-Security Ltd
The Leys School
The New School of English
Towry
Transversal Corporation Ltd
Trustonic
Tucker Gardner
Twigkit Ltd
WSP I P B

Thank you to all our volunteers who gave us a total of 2,291 hours of their time

… and thank you to everyone who visited the Garden
- Visitor numbers through ticket offices (including Friends, groups and paying visitors) 257,758
- Adult Education course participants 541
- Educational visit participants 9,410

Front cover image: Howard Rice
Titan Arum: Howard Rice
Titan Arum thermal images: Dr Clive Oppenheimer
Other photos: CUBG staff

The paper used in this publication has been sourced from sustainable sources.

www.botanic.cam.ac.uk