Cambridge
University
Botanic Garden

Annual Report & Accounts

2020–21

Cambridge University Botanic Garden

UNIVERSITY OF CAMBRIDGE

Cambridge University Botanic Garden
Annual Report 2020–2021

Contents

Cambridge University Botanic Garden (CUBG) supports University teaching and research while also being a place of enjoyment and inspiration to visitors of all ages. The Botanic Garden is one of the largest University-owned botanic gardens in the world. Opened to the public in 1846, the 40-acre Garden has an unparalleled living collection of over 8,000 species, including nine National Collections, with glasshouses, experimental plots, lake, herbarium and botanical library.

CUBG also collaborates with national and international researchers from a wide range of partner organisations, including universities, conservation bodies and botanic gardens worldwide, to promote the conservation and scientific understanding of global plant biodiversity.

The Garden offers year-round inspiration for gardeners as well as an exciting introduction to the natural world for families through a programme of family, school and adults' activities and events.

Cover image © Joe Giddens
Design: Paul Oldman (www.smithltd.co.uk)

Director's Report

Professor Beverley Glover
Director CUBG

The 2020-2021 academic year marked the Garden's 175th year on the current site, an event we were keen to celebrate. But it also saw the most difficult year in the Garden's history, as capped visitor numbers reduced our income streams and staff posts were frozen to ensure financial viability. For the second year in a row our core goal, of supporting a globally excellent network of research and teaching around plants while providing stimulating opportunities for educational groups and visitors to engage with our living collection, had to sit alongside a focus on crisis management and finding the route to recovery.

The Botanic Garden has been able to stay open to visitors for all of this last academic year, a real privilege in a time when our partner museums within the University were forced to close. However, it has not been an easy year. Through the autumn, winter and spring, the regular changes of Government advice led us to continually review all of our practices, making changes whenever necessary. Visitor numbers were capped, with the size of the cap varying in response to local conditions. The café continued to operate takeaway only until late summer. The shop opened when it could, and closed when it had to. The continually shifting landscape took its toll on staff stress levels and morale, and we worked hard to maintain a sense of cohesion when many staff were required to return to working from home.

Throughout this difficult year, things have been made harder by staffing shortages. We froze our vacant posts in the summer of 2020, and only released that freeze in summer 2021, when our financial position had begun to recover. For the first year in recent history we had no horticultural trainees on site. In addition, several key staff retired or moved to new roles, leaving us with further vacancies. While these gaps in our staffing have enabled us to bear the loss of income arising from capped visitor numbers, they have made it very hard for the remaining staff to work at the level they are used to. I am grateful to all of the team for their patience and perseverance through an incredibly challenging period. By the end of the academic year things had begun to improve. Visitor numbers have returned to near pre-pandemic levels, and our income streams are recovering as a result.

We have filled our frozen Assistant Director (Audiences and Enterprise) position, and welcomed Paul Pomfret to the Garden in September. Paul will be working closely with me to professionalise our public facing work and enhance income generation to support our research and teaching provision. We took the opportunity to restructure our Horticulture team, and now have a revised system with more opportunity for progression and development. We are recruiting to the remaining vacancies in the team and hope to be fully staffed by the new year. And in an encouraging sign of returning life, our latest batch of trainees began work with us in the first week of September - it is a real joy to be returning to our core values and activities.

Beverley Glover
Director, CUBG

The year in pictures

2020

Glasshouse
Bespoke scaffolding goes up around the Glasshouse Range.

October

Magic & Mayhem
Christmas Elves sprinkle a bit of Magic and Mayhem around the Garden

December

November

Revamping of the Bog Garden

2021

January

Pamianthe peruviana
'The world's most exotic daffodil', *Pamianthe peruviana*, flowers in the reserve glasshouses while they are closed to the public.

February

International media star
A rare Amazonian cactus, *Selenicereus wittii* (Moonflower), flowers in the Glasshouse Range and attracts international attention.

March

Gardener's World
CUBG appears on BBC's *Gardener's World* in a feature about night scented plants.

April

The Spring Bingo Family Trail
A return to normality as families were back in the Garden for an Easter trail.

June

Marketing Campaign
CUBG Culture Recovery Fund marketing goes out on buses and advertising hoardings around Cambridge.

Fascination of Plants Day
Professor Beverley Glover gave a Facebook Live talk to celebrate Fascination of Plants Day.

May

July

175th Anniversary
CUBG celebrates 175 years on our current site with a day of celebrations and the planting of a commemorative tree by Cambridge University Vice Chancellor, Professor Stephen Toope, and CUBG Director, Professor Beverley Glover.

August

New meadow-style planting at the Brookside Ticket Office.

September

It's a boy!
One of our *Welwitschia mirabilis* produces reproductive shoots, revealing that it's a male plant.

Research

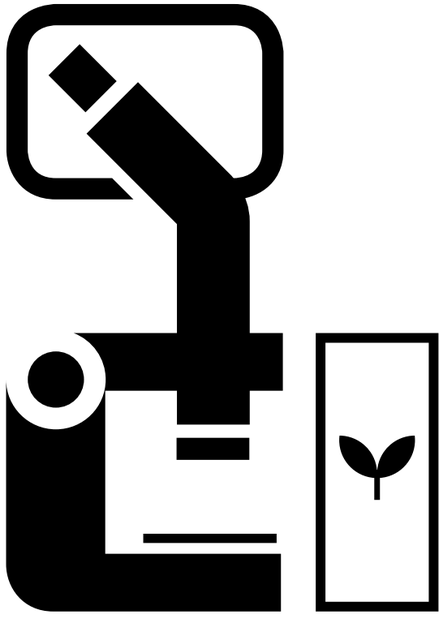
In the 2020-2021 academic year the volume of research supported by the Botanic Garden's living collections dropped, as researchers were less able to access their laboratories and less able to travel to use living material. However it is clear that the range and variety of research requests remains impressive. As well as our primary role in providing access to plant collections and offering horticultural support for botanical projects, the Garden also provides underpinning facilities supporting research in Archaeology, Architecture, Biochemistry, Chemistry, Earth Sciences, Engineering, Geography, Physics and Zoology.

Professor Beverley Glover
Director

Dr Samuel Brockington
Curator

Diverse collections, diverse questions

The launch of our *Living Collections Strategy* in November 2019 formalised our intention to provide the most accessible living collection anywhere in the world, and it is equally important that the collection is diverse. Indeed, the need for a diverse collection is clear from the three very different research projects we have chosen to highlight this year. Each represents an example of a situation where we could not readily have predicted the research request, and can only meet it because of our emphasis on a well curated collection from a wide range of sources.



RNA structure and plant diversity

All plants (and other complex organisms) use DNA to store the genetic information in their bodies. This DNA is transcribed into RNA, which we traditionally think of as a linear strand, and this is then translated into proteins. But researchers at the John Innes Centre, led by Yiliang Ding, have shown that RNA can fold into complex 3 dimensional molecules and that the shapes formed influence how the RNA is translated into protein and therefore how plants grow and develop.

The group has studied these processes in the model plants *Arabidopsis thaliana* and rice, but were intrigued to find out whether the structures they have found are common to all plants. In particular, their studies suggest that different RNA structures might be important at different temperatures, so they hypothesised that plants from different climates might produce different RNA structures.

The team have been testing this hypothesis by sampling widely across the CUBG living collection and analysing genomic sequences and RNA structures. In a first, broad sweep they have sampled material from 120 plants from different habitats and will combine this with information from published sequenced genomes.

This is a classic example of curiosity-driven research taking advantage of our living collection to explore fundamental questions in biology, and we are looking forward with excitement to the results.

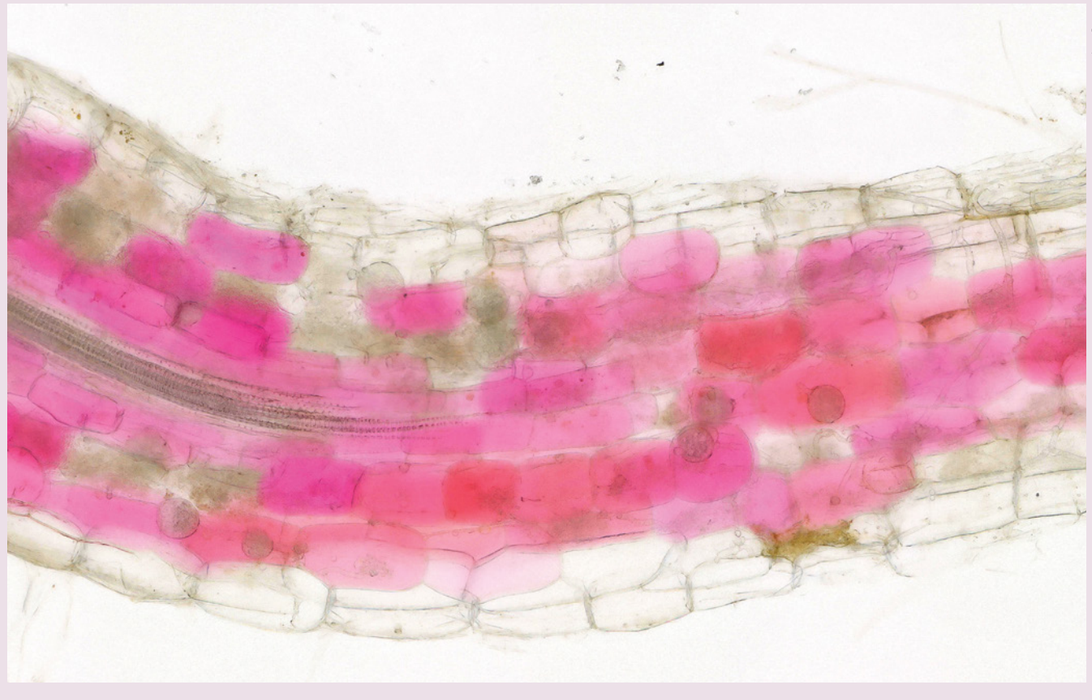


Image by Temur Yunosov/Alfonso Timoneda

Blushing plants reveal when fungi are growing in their roots

Almost all crop plants form mutually beneficial associations with a particular type of fungus in the soil. This relationship greatly expands the plant's root surface area and boosts the plant's ability to take up nutrients that are vital for growth. The more nutrients plants obtain naturally, the less artificial fertilisers are needed. Understanding this natural process, as the first step towards potentially enhancing it, is an ongoing project for many research groups in Cambridge. This year the Curator, Dr Sam Brockington, worked with colleagues in the Sainsbury Lab here in the Botanic Garden to explore this association in a new way[1].

The project was based on Sam's interest in the evolution of the bright red pigments called betalains found in beetroots and other members of the *Caryophyllales* growing in our living collection. In this project the team used betalains to visually track soil fungi as they colonised plant roots in a living plant. To achieve their results, the researchers engineered two model plant species - a legume and a tobacco plant - so that they would produce the highly visible betalain pigments when the beneficial fungi were present in their roots. The plants were then grown in a transparent structure so that the root system was visible, and images of the roots could be taken without disturbing the plants. The work has the potential to transform our understanding of how roots and fungi get together, and was made possible by the isolation of betalain-producing genes from the plants in our living collection.

[1] Timoneda et al 2021 *PLOS Biology*.

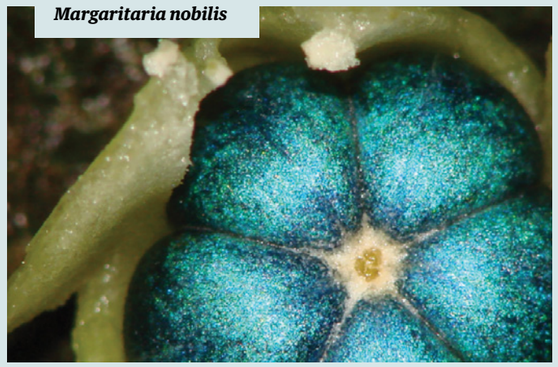
A common shrub with an unusually honest approach to signalling

The Director, Beverley Glover, has been interested for a long time in the way that structures, rather than chemical pigments, can produce colours. In fruits this "structural colour" can make the fruit very brightly coloured and attractive to animals, but since the structures are usually dry cell walls, the fruit has no nutritional value. This is the case with the shiny blue fruits of *Pollia* and the metallic blue/green fruits of *Margaritaria nobilis*, both to be found in our living collection. However, this year Beverley published work in collaboration with teams in the Chemistry department at Cambridge and in Yale in which the Botanic Garden's collection of *Viburnum* revealed a new sort of structural colour[1]. *Viburnum tinus* is a commonly grown shrub with blue berries. These were thought to be coloured purely by chemicals. However, careful analysis of the structure of the fruits and their optical properties revealed that the metallic blue appearance of the fruits is produced by globular lipid inclusions arranged in a disordered multilayer structure. This structure is embedded in the cell walls of the fruit and sits over a dark layer of blue anthocyanin pigments. The presence of such large, organized lipid aggregates in the cell wall enhances the colour signal of the fruit. And because the colour is stronger the more lipid is present, and lipid is a highly calorific food source for birds, in this case the structural colour is serving as an honest signal of nutritional content.

[1] Middleton et al. 2020 *Current Biology*.

Viburnum tinus

Margaritaria nobilis



Horticulture

2020–2021 will be a memorable year for the horticultural team for varied reasons. It was the first year in living memory in which we had no trainee horticultural technicians. We also said farewell to several members of the team. Disruptions aside, the horticultural team were able to maintain the Garden and in addition deliver a range of planned and unexpected projects, worthy of note in even the most ordinary of years.

Sally Petitt
Head of Horticulture

Tree collections

The care of our tree collections is one of our primary roles, ensuring that our trees are both healthy and safe, and also that we continue to provide a succession of planting to ensure future generations may enjoy a maturing tree scape.

Occasionally we have to undertake radical tree works to ensure that we can either retain trees into the future, or to remove mature specimens as a result of damage or failure. One such specimen identified as requiring intervention was the long-established clump of *Pterocarya fraxinifolia* (Caucasian wingnut) at the end of Lynch Walk. Here reduction of the tall, slender, brittle stems which carried a heavy leaf load removed the potential risk of serious damage to both the tree and visitors. Although the work seemed dramatic it has ensured we can retain this arboricultural feature into the future, and increased light levels will allow us to encourage the development of strong new suckers to reach maturity in the future.

In the area between the Terrace Garden and Middle Walk we were forced to remove two mature trees. *Cedrus atlantica* 'Glauca' had suffered from significant branch loss in summer 2020, and its structural integrity was impacted such that it was no longer considered safe, while a neighbouring *Eucalyptus parvifolia* had been considerably weakened by southern bracket fungus (*Ganoderma australe)*, and had also suffered limb loss. The removal of these two species opened up a large area, adjacent to a well-worn access route from the Main Lawn to the Middle Walk. The Landscape & Machinery and Trees & Shrubs Sections took the opportunity to review this wider landscape. Having felled the trees and ground out the stumps, the ground was levelled and grass seed sown to create a new lawn. A Cambridge oak (*Quercus warburgii)* was transplanted here, which will mature to complement the existing oak planting in this area. We then fell back on a long-standing plan to excavate the well-worn path and install a wider, hard-wearing gravel path in its place. The route of the path has been lined with *Galanthus* 'S. Arnott' (snowdrop 'S. Arnott') to extend the season of interest here.

In February we sadly lost another mature specimen, this time on our eastern boundary. A mature *Pinus nigra* (Austrian pine), which served as a magnificent backdrop to the Winter Garden, fell unexpectedly overnight. Damage, which extended to the eastern end of the Winter Garden, was quickly cleared, though losses here included *Thuja plicata* (western red cedar) hedge, *Prunus* 'Omoi-No-Mama' (Japanese apricot 'Omoi-No-Mama'), *Sorbus aucuparia* 'Beissneri' (mountain ash 'Beissneri') and *Viburnum tinus* (laurustinus) in the north-eastern corner of the winter Garden. The hedge was replaced and a new opening into the Winter Garden incorporated directly from the East Walk. New plantings included *Sycopsis sinensis*, *Anemanthele lessoniana* (pheasant's tail grass) and the bamboo *Fargesia robusta*. A young specimen of *Quercus rubra* (red oak) was planted in the eastern boundary as a replacement for the *Pinus nigra*, and we hope that this will mature in our conditions to provide a fine backdrop to the Winter Garden's landscape in years to come.

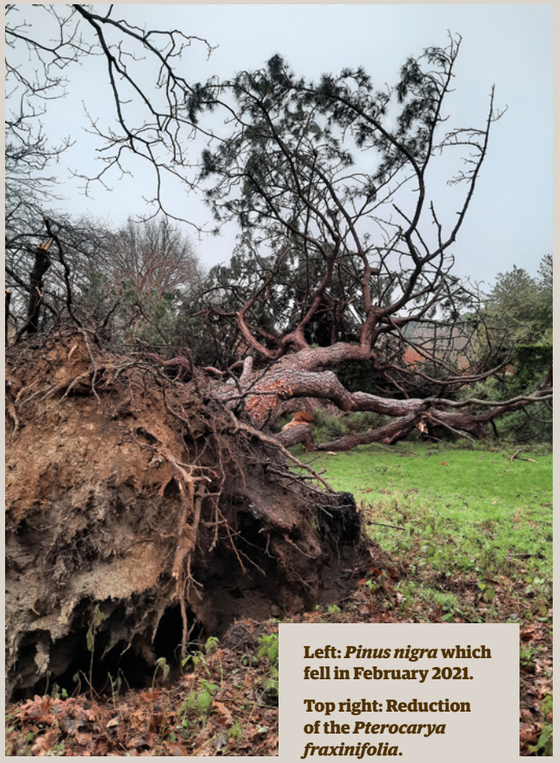
While it is always a shame to lose mature specimens, it does provide an opportunity to continue to develop the tree collection, and this year we took the opportunity to plant out approximately 70 young trees in our grounds. It can be challenging to find suitable locations for new trees, especially with the considerations of space, competition, suitability to our local conditions, and their value to the collection. Amongst the species planted were a black oak (*Quercus velutina*) and a large-leaved rowan (*Sorbus megalocarpa*) in the Autumn Garden, and several conifers in the New Pinetum, including *Araucaria araucana* (monkey puzzle), *Cupressus bakeri* (Siskiyou cypress) and *Callitris oblonga* (pygmy cypress pine). The Trees and Shrubs team will continue to nurture these specimens to establishment to ensure their longevity. Such successional planting is key to ensuring future generations can enjoy the mature plantings just as our visitors do today.

70

New young trees planted

including:
Black oak (*Quercus velutina*)
Large-leaved rowan (*Sorbus megalocarpa*)
Monkey puzzle (*Araucaria araucana)*
Siskiyou cypress (*Cupressus bakeri)*
Pygmy cypress pine (*Callitris oblonga*)

Above: Arboricultural contractors dismantling the *Eucalyptus parvifolia*, with assistance on the ground from our Trees and Shrubs team.



Left: *Pinus nigra* which fell in February 2021.

Top right: Reduction of the *Pterocarya fraxinifolia*.

Above: Preparations for a new path from the main lawn to Middle Walk.

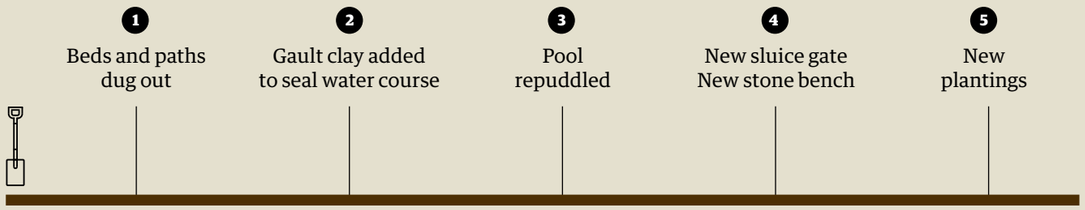
Below: New path March 2021.

Left: Puddling the pool in the Bog Garden

Right: New plantings.

Renovation of the Bog Garden landscape

Sitting in the shelter of banks constructed from the spoil excavated when the Lake was formed in the 1850s, the Bog Garden provides an intimate landscape. Here we have historically grown a range of marginal plants which thrive in the damp conditions provided along the edges of a shallow pool, fed from the stream. Plantings were becoming tired, and in some cases were being overwhelmed by pernicious weeds, such as field bindweed (*Convolvulus arvensis)*. During winter 2019-2020 the Alpine and Woodland Section cleared the plantings and left the area fallow to ease eradication of these weeds. In autumn 2020, we determined to reinstate the landscape and plantings for the benefit of our returning post-Covid visitors. Working around an established clump of *Osmunda regalis* (royal fern), and with assistance from the Landscape and Machinery Section, the existing pools, beds and paths were dug out and reinstated over winter. Staff re-puddled the pool with gault clay to provide a sealed water course, and installed a new sluice gate to help retain water in the pool and ensure the adjacent beds remain moist. Old soil was removed from existing beds and replaced, and the paths were re-laid. The last stage of the redevelopment was to introduce new plantings which will thrive in these conditions. Plantings include *Rheum palmatum* (Chinese rhubarb), *Gunnera tinctoria* (giant rhubarb), *Darmera peltata* (umbrella plant) and *Primula florindae* (Tibetan cowslip). We anticipate that these will mature to produce lush combinations, which visitors can admire from a newly installed stone bench repositioned in this quiet corner of the Garden.



In August we introduced a new staff structure, and in September we were pleased to welcome a new cohort of trainee horticultural technicians.

Flowering first

The flowers of many members of the cactus family (*Cactaceae*) create quite an impact, but the flowering of one member of this family generated interest both near and far during the year when it provided us with the first recorded flowering of this species in the United Kingdom.

Donated by Bonn Botanic Garden, the moonflower (*Selenicereus wittii)* was introduced to our collection in 2015. *S. wittii* is a Brazilian plant, which grows above the waterline of floodplain rainforests in the Amazon Basin. In cultivation it is something of a rarity, listed as growing in only 13 botanic gardens globally, and this is the only known example of it in the United Kingdom.

It is an unusual epiphytic cactus, which climbs its way up host plants using adapted stems, which look like large, flattened pads whose roots enable the plant to climb into the forest canopy. As the common name suggests it is a night flowering species which produces a sweet scent to attract only two known hawkmoth pollinators, whose long proboscis (or tongue) allows them to reach the nectary at the base of a long floral tube.

Since 2015 our plant of *S. wittii* has slowly advanced up the trunk of *Pachira aquatica* (water chestnut tree). Although unusual in habit, it held limited appeal until the Glasshouse staff noticed a flower bud developing in November 2020, about 3.5m up the climbing stem. From this point interest in this species rapidly grew and its flowering in February provided not only an opportunity for us to revel in the horticultural glory associated with the first UK flowering, but also to study the morphology, anatomy and biochemistry of this species. The installation of a webcam allowed us to share this night time spectacle, along with conservation and plant diversity stories, with a fascinated on-line audience.

Since flowering, the stem of *S. wittii* has continued to advance up the trunk of the tree, and we will keep our eyes open for signs of fattening flower buds during the coming year.

Selenicereus wittii

A new addition to the Garden, carved by chainsaw from the felled *Cedrus atlantica* 'Glauca'.

Learning

CreativeNature

School visits

101
Educational visits

2,529
Students

1,535
Primary school children

Summer term 2021 was busy for the Learning Team, with 70% of school visits in this reporting period visiting the Garden between May and July.

Further & Higher Education visits

45
Higher education Visits

Educational Outreach

12
Home education visits

264
Children

642
Free educational passes

In response to fewer educational visits to the Garden we looked for outreach opportunities to work with schools

Primary & Secondary Schools

Overall we had a total of 101 educational visits (2,529 students) across this reporting period. The majority of school children visiting are from Primary Schools (1,535); Secondary Schools account for 544 of the students; we had 152 sixth form students attend on school trips; and the remainder were Early Years and Home Schooling groups. There are several factors that have contributed to educational visits remaining below “normal” levels, the main one being the national school closures in November and again between January and March, during which time we had no educational visits. Once schools reopened, bookings were initially slow as schools readjusted and assessed whether or not they wanted to run trips under covid restrictions. When schools returned to the Garden, we restricted it to one school each day, as we wanted to be sensitive to the anxieties that some members of the public had, and to allow visitors time to adjust to seeing larger groups in the Garden.

Undergraduates

45 higher education visits took place during this reporting period.

Master's Projects

In addition, we supported five undergraduate students from the University of Cambridge’s Department of Zoology with their final year projects and two Master’s projects with students from Anglia Ruskin University. Examples of these projects include monitoring bat winter activity in the Garden and assessing the suitability of waterbodies in the Garden for amphibian populations.

Horticultural College Visits

We have also had seven visits from horticultural colleges in this reporting period.

Nature Garden

We worked with a local Secondary School, Coleridge Community College, to help them develop their nature garden. This involved members of the Learning Team attending their gardening club at school as well as three on site sessions to provide inspiration and support that they could take back to school.

Grow a Row

In collaboration with Cambridge Sustainable Food we supported their Grow a Row project by recruiting schools to get involved. We provided schools with packs to grow vegetables, including seeds, compost, pots and resources to explain how to grow and look after their vegetables. In total four schools were involved, one Secondary and three Primary. In addition to the packs we did site visits to advise on how to get the most out of their school allotment and were available to answer questions when they arose. The aim of the project was for students to grow enough food for themselves and to have enough spare to donate to local Food hubs where it would be distributed to families struggling to afford food.

Home Education Groups

An interesting area of development in our schools programme this year has been the increase in home education groups seeking to use the Garden as a space to learn - we have had 12 home education trips in this reporting period including a total of 264 children. We will continue to examine and develop this provision.

Free Pass Scheme

We have seen a reduction in the uptake of our free pass scheme for students studying relevant subjects at local sixth forms and Anglia Ruskin University. During this reporting period 642 passes were issued, which is a substantial decrease on the 913 passes issued in the previous reporting period. We think the main reason for this is that students were learning from home for a large portion of the last academic year.

Adult Learning Programme

Our Adult Learning programme has continued to thrive online. We continued to reach a much wider audience across the UK and internationally with our online courses, and in response to requests from participants and the popularity of these courses, we intend to continue with an online programme alongside in-person courses at the Garden.

Science on Sundays Lecture Programme

245
Viewers

The Science on Sundays series of talks continued as an online offering. During the last reporting period these were delivered on the website as pre-recorded talks. Following the success of our interactive online courses, we decided to trial delivering the Science on Sundays talks as interactive webinars using Zoom. Five talks were presented this way to a total audience of 245 people. We recorded the talks and they will be edited and included on the website.

Online activities for families

As well as in-Garden trails and activities for families, four new downloadable family activities were added to the website at the end of 2020 and start of 2021 when in-person activities were more restricted. These included ‘Dandelion Art’, ‘Snowdrop pop-up’, ‘Grow your own poached eggs’ and ‘Pinecone owl’.

Family Learning Trails

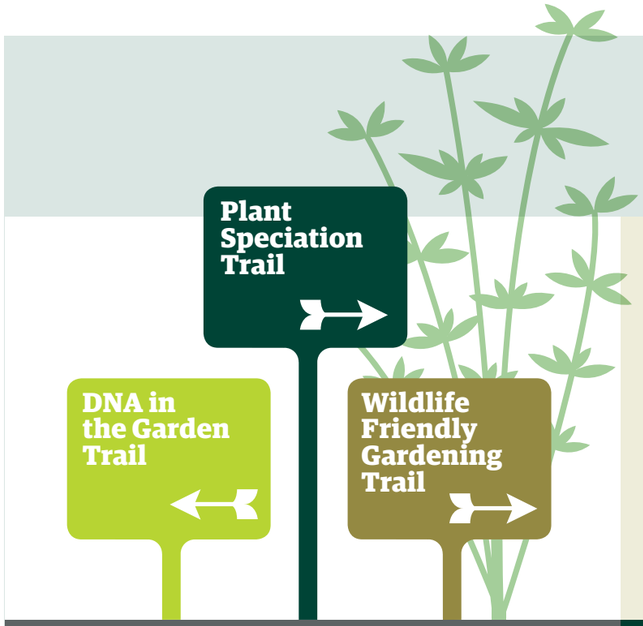
2,000
people completed the Easter Trail

Autumn Animals
Easter Trail
Summer Mystery History Trail

As restrictions have eased, it has been wonderful welcoming families back to activities in the Garden. We have delivered three self-led family trails during the reporting period. These included Autumn Animals in September and October 2021, where children were encouraged to collect fallen autumn treasures in the Garden to embellish cards depicting garden wildlife. We were also able to offer our Easter Trail which this year was Spring Bingo, where participants completing a line were rewarded with a choice of a chocolate egg or a packet of “poached egg flower” seeds. More than 2,000 people completed this trail and we were pleased to see that about a quarter of children chose seeds over chocolate. We will continue to look at garden-related prizes for future trails.

Our Summer Trail, the Mystery History Trail, has been one of our most popular to date; 7,000 trail booklets were picked up from ticket desks. Whilst we don’t have exact numbers for trails prior to this year’s Easter trail, we would not normally need to print more than 4,000 booklets.

Learning



Interpretation and Adult Trails

We have added to the Garden's interpretation and adult trail offering this year, with three new trails now available at the ticket desks and on the website.

These are Wildlife Friendly Gardening, Plant Speciation and DNA in the Garden. The DNA in the Garden trail was created in collaboration with EMBL-EBI (the European Bioinformatics Institute) and launched in summer 2021 alongside an interactive digital game exploring plants that have had a key role in the development of genome sequencing and other genetic technologies.

New interpretation boards
A new interpretation panel focussing on John Stevens Henslow and his role in the Garden was erected as part of our 175th Birthday celebrations. New interpretation boards have also been installed at the Fen Display.

UCM Collaborations

50
Volunteers

BioBlitz Weekend
The aim of the event is to count as many species present in the Garden over a 24 hour period as possible. In addition to recording wildlife spotted in the Garden, we also offered 33 nature walks and workshops including bat walks, owl pellet dissections, pond dipping and general natural history. The event was supported by over 50 volunteers and many interesting species were identified. One of the highlights of the weekend was only the second British record of the gall mite *Aceria brachytarsus* on Walnut, subsequently also spotted on Walnut trees in Downing and Jesus Colleges. The Five-banded Weevil-wasp *Cerceris quadrifasciata* was spotted again in the Garden, which is exciting as this is quite a rare find for Britain and it seems to be one of the Garden's specialities.

Other UCM collaborations during this period have included our contribution to *Twilight* in February 2021. For this year's digital event, we created an activity sheet to make a "Night-blooming water lily".

We also worked with the UCM to host an event for Centre 33 Young Carers, a project in collaboration with Eden Explorers. The workshop combined music and nature to inspire a love for the natural world.

Fitzwilliam Museum collaboration
In summer 2021 we provided a venue and material for a Fitzwilliam Museum event that was part of their *Scent* exhibition for blind and partially sighted individuals. We also collaborated on the Inspire Project, a teacher CPD (Continuing Professional Development) project aimed at including more nature within their teaching. Our session was entitled *Trees* and we used the Garden's much loved Cambridge Oak as the inspiration for our offering. Resources from these sessions were included with our online teaching resources on the website.

Community Groups

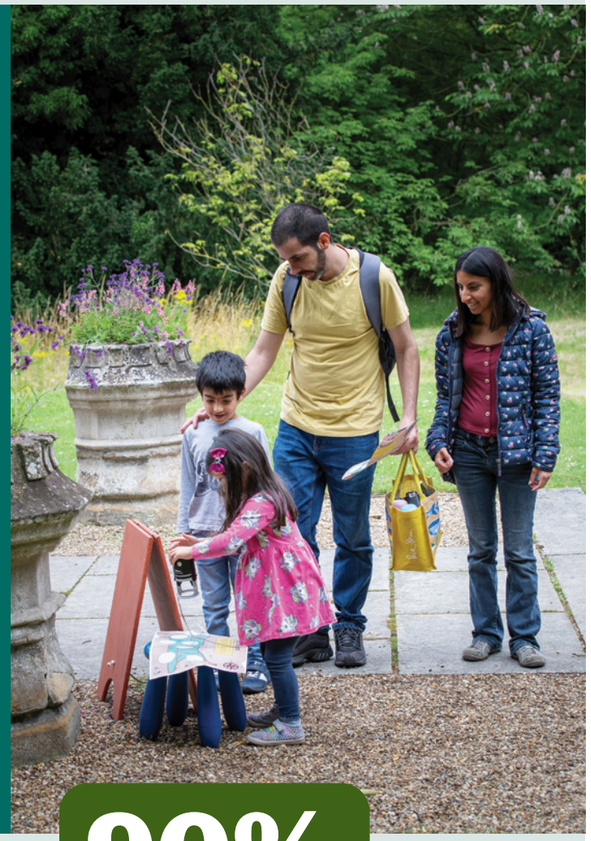
St Paul's Thursday Group
CamSight Group
Walking for Health Group
WinterComfort Group
Arts & Minds Group

It has been great to see so many of regular community groups starting to visit the Garden again. These include St Paul's Thursday group, CamSight, the City Council's Walking for Health Group and WinterComfort. We have also welcomed new groups too, including Arts and Minds who are using the Garden as inspiration for art therapy sessions.

Staff and Conferences

In February 2021 Bronwen Richards, Schools Learning Coordinator, began her maternity leave and we were joined by Catherine Swift to cover that post. The team attended training coordinated by BGEN on the creation of engaging digital content.

Evaluation of Learning Programme



207

Visitors completed the survey

90%

Agree or Strongly Agree the Garden provides a warm welcome to their family.

92%

Agree the Garden is an environment where families can explore, have fun and learn.

This year we have been keen to explore more robust ways of evaluating the Learning Programme and we started with the Families section. This has included new systems to count how many families participate in our self-led trails as well as a survey that we ran in spring. The survey was open from the 25th March until the 6th May and was completed by 207 visitors. We were keen to learn more about the demographic of our family audience, to gauge their opinion of what we currently offer, and to discover what else they might like. The wider Garden, children's trails and family drop-in activities came out as the most popular things from our family offering.

Areas of focus are around communication of the family programme, with a clear need for a family mailing list, which we have now set up, as well as looking at how we can better communicate the purpose and rules of the Garden to children and families.

Curation

This is the second year in which operations have been significantly impacted by the pandemic, but we have continued to make progress on many projects, behind the scenes, which would otherwise have taken far longer to reach fruition. These projects include the continued optimisation of IT and upgrades to online collaboration tools, the mounting of our herbarium specimens, and the development of our collection analytics tools.

Dr Samuel Brockington
Curator

Work connectivity

Pete Atkinson, as well as being our Plant Records Officer, is our primary lead on the CUBG information technology front, and so has been extremely busy during the pandemic, ensuring that we remain functional (and even productive!). Pete has been invaluable to ensuring that different teams can continue to collaborate through the rolling out of software such as Teams and Microsoft Exchange. Pete has also been tireless in purchasing the various bits of new hardware that we now need, including cameras and microphones, to enable us to collaborate online. It seems that these tools and approaches will continue to be a substantial part of our working life going forward. And I suppose it is worth reflecting that it has always been a challenge to communicate across the Garden, when we are so widely distributed physically, and so these sorts of tools have been long overdue. Moving online has also enabled us to connect much better internationally with Curators and curatorial teams in other Botanic Gardens, and I expect we will ultimately see all sorts of positive knock-on effects for international collaboration (with reduced carbon output!).

Analysing our Collections data

Angela Cano, our Assistant Curator, and I have been working hard on a bioinformatic pipeline that streamlines our analysis of our collections data. In essence, as part of the Garden's operation we collect a tremendous amount of data, but often it is cumbersome to then use that data to better inform our collection management processes. We have spent a substantial amount of time during lockdown developing software that will ultimately allow us to do this with ease. We hope that when it is up and running we will be able to use it to quickly share strong graphics and visuals to communicate what we are doing with our own staff and stakeholders, and importantly to track progress on our new Living Collections Strategy, which we launched just before the pandemic.

Updating the Herbarium

Mar Millan, our curation technician, has continued to cater to a relatively low level of research requests, which are finally picking up. But primarily she has taken charge of processing the many herbarium specimens which we have accumulated from multiple expeditions over the past three years (to South Africa, Central Asia, and Vietnam). Each pressed plant is carefully mounted on archival paper, with a label indicating the species, collector, collection date, and location. It is laborious, but creative, work and something Mar is very good at. She has mounted many hundreds of specimens and has cleared an enormous backlog from past expeditions. Subsequently we will place them in the herbarium for long term storage, hopefully in perpetuity, as a permanent record of the plants we have collected and grown in the living collection.

Finally, looking forward, I am delighted to note that Angie is now a new mother of a beautiful little girl Vera, and will be enjoying maternity leave in Northern Spain for much of the coming year. We have just finalised the release of a new position in the team, a Collections Coordinator, which will be a valuable addition to the team. This new position will help us link our different collection (living, herbarium, and seed) and the teams that work on them. We are looking forward to turning our back on the disruption of the past two years, and returning to the implementation of the Living Collections Strategy, and especially our collecting expeditions!

Curation

Stoeberia arborea **specimens from the South Africa expedition.**

Collecting specimens on the South Africa expedition.

Collecting specimens on the South Africa expedition.

Lampranthus godmaniae **specimens from the South Africa expedition.**

Friends

This year we are more grateful than ever for the constant support of the Friends of Cambridge University Botanic Garden.

Anna Patterson Lee
Head of Development & Communications

Yet again we have been overwhelmed by the support for the Garden from our Friends and Corporate Friends. Thank you to everyone for your continued support, it is always appreciated, but especially at the moment.

Despite, or perhaps because of, the various lockdowns and restrictions that continued into this year, the Friends scheme has continued to grow, with 8,528 Friends joining/renewing in this year, which is 1,725 more than the previous year and 923 more than the year before that.

The Friends programme of events was, unsurprisingly, somewhat altered to accommodate the restrictions. We created new online events - the annual lecture was turned into a Zoom event where Sam Brockington and Sally Petitt talked about the Garden in lockdown and answered questions live. The Christmas wreath-making workshops went online, though the materials and mince pies were definitely delivered in real life!

As the year progressed, we were delighted to reinstate some face-to-face events for Friends, starting with the annual trip, this year exploring the gardens of the Lake District and Borderlands. We then enjoyed seeing everyone again at the Friends' Evening Highlights Tour of the Garden - which had a 'bring your own picnic' slant this year. There were also tours of two college gardens - Newnham (pictured) and Murray Edwards.

The Friends programme benefitted from the Garden's Culture Recovery Fund grant, with funding for a marketing campaign. New designs were produced that were used on posters, adverts and on flyers which were delivered to over 1,000 houses in CB1 and CB2. There are now Friends recruitment posters on the back of the toilet doors in the Garden, and flyers on table toppers in the Café. We hope to build on these activities with future social media campaigns and in-Garden recruitment.

8,528
Friends

1,725
up from previous year

923
more than the year before that

Friends' Annual Lecture zoom event

Stills Photography / Newnham College

Flower borders at Newnham College

New Friends marketing posters and leaflets

Visitors & Events

We were unable, again, to run our full programme of events this year, but have been delighted to welcome 288,203 visitors to the Garden during the reporting period.

Anna Patterson Lee
Head of Development & Communications

288,203
Visitors during report period

75
Tours

28,925
Visitors during November/December

Visitor Surveys

We carried out two visitor surveys this year. The Learning team created one that went out with the Spring Bingo trail to find out more about the demographic of our family audience and to see what people thought of the family provision at the Garden. Find out more on the Learning pages 16-22.

We also did a general visitor survey, funded by the Culture Recovery Fund, in June. This asked questions such as why people were coming to the Garden, where from, how they got here and what their thoughts were about the Garden and their visit. We were delighted with the response, with over 1,000 visitors taking part, and plan to use their responses to inform our communications both on and off site. It was also lovely to read so many positive comments about the Garden – it became very clear what a vital role our beautiful green spaces played over the past year, especially to people who live nearby.

Events

Our usual programme of events (Festival of Plants, Apple Day and Sounds Green) could not take place due to continuing Government Covid-19 restrictions. So we concentrated on self-led events that visitors were able to take part in while comfortably socially distanced and within their household groups. The only exception to this was in the summer, when we celebrated the Garden's 175th anniversary on its current site in July. Though we were still operating under restrictions, it was wonderful to welcome 2,093 visitors on the day to help us celebrate. To read more about this event, please go to pages 30-33.

Mischievous Elves

We were thrilled when the Garden was touched by magic at Christmas! Mischievous elves (masterminded by Wendy Godfrey and helped by Heloise Toope, with support from the Horticulture Team) created surprises around the Garden for visitors to discover and enjoy. From Father Christmas's washing line to a boat loaded up with presents on the lake, a tree filled with lost and found objects and a fountain filled with rubber ducks, there was something around every corner. Children enjoyed looking for particular objects with a 'lost and found' game. As the Garden enjoyed its highest recorded November/December visitor numbers, it looks as though it was a success.

Spring Bingo

The Spring Bingo family trail saw hundreds of children racing around the Garden to find signs of spring.
A completed bingo card won them a reward, and while some of the children chose the lovely packets of seeds, the majority were tempted by the chocolate eggs!

Weekend Tours

Free weekend tours started again and we were delighted to welcome our volunteer guides back into the Garden on a regular basis. Over this year, there have been 51 free tours (which includes weekends and events) and 24 paid, pre-booked tours.

Summer Late Night Openings

As our usual summer late night openings with the Sounds Green concerts were cancelled, we instead kept the Garden open late on Thursdays in June and July. The visitor numbers were not huge, a total of 1,375 visitors enjoyed the summer evenings, but it was great to be able to offer another way for people to enjoy the Garden. Of those visitors, 50% were Friends, and the rest a combination of walk ups and pre-booked visitors.

175th Anniversary Celebration

We do not have a record of the exact date that CUBG opened its doors in 1846, but we do know the year. So it seemed like a good opportunity to spread the celebrations for our 175th anniversary across 2021.

175th Anniversary Celebration

'In our anniversary year, we really wanted to appreciate and reflect on what the Garden means to our local community and everyone who makes this a wonderful place to visit and work in and who gives the Garden its unique and special spirit.'

Professor Beverley Glover, Director CUBG

The main focus of our celebrations was 10 July, when we held a public event in the Garden. Just over 2,000 people joined us (there were still Government restrictions on public gatherings) to enjoy our first public event in over a year. There was a range of activities to entertain all ages and interests. We were delighted to welcome lots of families, who took part in special wand making activities in the Schools' Garden and we also launched a new trail on the day (the Mystery History Family trail, which continued throughout the summer). Live music played on the Main Lawn, along with food trucks and plant and craft stalls, which created a very jolly party atmosphere. Elsewhere in the Garden, Plant Science Explainers talked to the public about the importance of plants and some of their research, and there was a varied programme of tours led by CUBG staff and volunteers for visitors to take part in.

As well as the public event, there was also a private afternoon tea for Garden supporters, including the University of Cambridge's Vice Chancellor, Professor Stephen Toope, who gave a speech about the work, and importance, of the Garden. Professor Toope and Professor Glover then commemorated a newly planted Cambridge Oak tree to mark the occasion. We hope that this iconic tree will mark this anniversary for many years to come.

Other activities during the year included regular snippets about the history of the Garden on social media, the new IGPOTY Spirit of Cambridge University Botanic Garden photography competition and the Mystery History Family trail.

Pictorial Press Ltd / Alamy Stock Photo

1815
The original, small Botanic Garden in Cambridge city centre

Professor John Stevens Henslow and the original map of the new Garden, designed by Andrew Murray

1846

The Garden's entrance gates in their original position in the centre of Cambridge

Henslow's herbarium samples show his interest in variation, which he passed on to his most famous student, Charles Darwin (inset)

Staff photo, 1876
Staff of the Botanic Garden in 1876. The Curator, William Mudd, is wearing the top-hat. He was a well-known authority on lichens, and called the 'father of British Lichenology'

Transferring Plants, 1890
Transfer of plants from the old glasshouses to the new ones

1900

Staff photo, 1900s
Richard Irwin Lynch, Curator 1879-1919, is holding his hat. Richard Lynch built a connection between the Garden and teaching in the Botany department and was responsible for the plantings being both scientific and aesthetic. He began the practice of supplying material for teaching and research, which continues today

Glasshouse Team, 1935

Staff tea party, 1932

Aerial photograph, c. 1940-45
A large part of the Eastern section of the Garden was transformed into allotments during WWII. Cory Lodge can be seen in the middle of the allotments with a semi-circular drive. On the far side of Trumpington road are air-raid shelters

The Garden at 175
Snapshots of our past

The Garden's move to our current site was masterminded by John Stevens Henslow, a biologist and Professor of Botany at the University of Cambridge from 1825, and the landscape was designed by the Garden's first Curator, Andrew Murray. The new site saw the Garden evolve from a small city centre physic garden into a large and accessible garden, showcasing plants from around the world grown for research and teaching purposes in beautiful landscapes.

The transition to the Garden's current location was made possible through Henslow, who successfully persuaded the University of the need for a much bigger site. The purpose of this new botanic garden would be to study plants in their own right, marking a clear shift from the traditional concept of a physic garden. Henslow also wanted more space to grow a collection of large trees, particularly those being discovered in different parts of the world.

175th Anniversary Celebration

Rock Garden construction, c. 1954–58
Building of the Limestone Rock Garden. This took four years to complete with man-power and a pulley. Large blocks of stone up to three tonnes in weight were manually hauled and used to create the rock base

Teaching in the Garden
John Gilmour, Director 1951-1973 teaching in the Garden

Opening the new Tropical Palm House, 1989
HRH Duke of Edinburgh opening the new Tropical Palm House

Sainsbury Laboratory, 2011
This hub for plant science research was officially opened in 2011 by the Queen

2020
Publication of the Garden's first *Living Collections Strategy*

2000

2021

175th Anniversary

Laying out the Eastern Garden, c.1950s
John Gilmour and Bob Younger (Superintendent 1947-1974) transformed the whole Eastern area of the Garden from allotments into a garden with ecological and other themes. Bob Younger created paths driving round in curving sweeps with the tyres marking out the shape of the paths. The Eastern area was officially opened in 1959. This development was made possible by a significant bequest from Reginald Cory after his death in 1934

1969
Prams were allowed into the Garden for the first time

1997
Dry Garden opens

2017
The drained lake

The Rising Path
opens to help visitors explore the evolution of plants

Glasshouse Refurbishment

Carl Tatterton
Head of Estates and Operations Manager
Sally Petitt
Head of Horticulture

'The project started 'open ended' as no date or time to conduct the works could be confidently set, until the condition and repair requirement of the upper reaches was known. Inclusive to this time estimate was the bespoke scaffold design, and inherent uncertainty of the time required to erect the complex scaffold'

The work on the Glasshouse Range was part of the University's Estate Management department planned maintenance schedule. The timing, with the closure of indoor visitor attractions, was fortuitous.

No doubt all Garden stakeholders and visitors observed the monolithic structure that developed around the Glasshouse Range in 2020. This was a bespoke scaffold, erected to permit safe access and a working platform for a decoration team who stripped and replaced all putty work, cleaned, inspected, repaired and treated all of the teak structure, repaired damaged glass and refitted the glass in their frames securely, refurbishing the whole timber range. There was also an internal element of scaffold required to protect the decoration team from falls from height into the glasshouse, this being crash decks and nets installed throughout the timber structure.

Why did we undertake this work in association with University Estate Management? Due to the structure's design and height, high level routine maintenance cannot be easily conducted, so the Range features on the University long term maintenance programme and budget is allocated for detailed attention to the structure at regular intervals. That programmed time appeared in 2020, so despite the pandemic leading to the cancellation of many University funded maintenance tasks, we were fortunate to be able to conduct this work in this, a quieter time for the Garden.

The project started "open ended" as no date or time to conduct the works could be confidently set, until the condition and repair requirement of the upper reaches was known. Inclusive to this time estimate was the bespoke scaffold design, and inherent uncertainty of the time required to erect the complex scaffold. Also, new for 2020 was the impact of the Covid-19 pandemic restricting or indeed pausing works due to new safety measures and sickness levels, along with related isolations, quarantines and furloughs.

The project step-by-step

1 The two elements of the project, decoration and scaffolding, were started running in tandem from 19 August 2020. The scaffold alone took approximately twenty weeks to complete. It was essential that this was in place and inspected before the decoration team could work on the upper timber elements, and this could only happen should the temperature and weather be favorable for the work.

The Alpine House was the first to reach completion, with the decoration team working from the highest point downwards across the whole range where practical. The decoration team required three consecutive dry days to clean and treat the timber - which was a challenge with all the wet weather we experienced in 2020 and the cold weather impacting on the application of wood preserving oils.

2 Due to the poor weather conditions, the original scaffold design had to be amended to include overhead roofing to enable the continuation of preservation, this added time and cost to the project. The additional roofing enabled the decoration team to increase in number - important for the completion of areas before the diminished light levels impacted upon the health of the living collection below.

During the whole renovation process multiple damaged panes of glass, unobserved from ground level, were replaced, and many water ingress points with moss invasion and rotten timber replaced or repaired as the team progressed across the Range. Supplementary teak pegs were added to the high level roof glass to prevent slippage of the glass panes.

3 As winter 2020 set in, supplementary lighting and ventilation had to be deployed in areas within the Glasshouse Range to maintain plant health. These key areas, under the sheet metal temporary roof, would have suffered without this intervention.

In 2021, as pandemic restrictions eased, the pressure was on to complete the Glasshouse renovation and permit visitors back into the Range. This was a challenge as much of the high level corridor work remained incomplete, so safety requirements limited access for both staff and visitors, but limited reopening did commence from January 2021. As the weather improved through spring 2021, renovation work gained momentum and the strip out of the scaffold commenced. Handover of the project back to the Garden was achieved on 18 June 2021.

Development and Communications

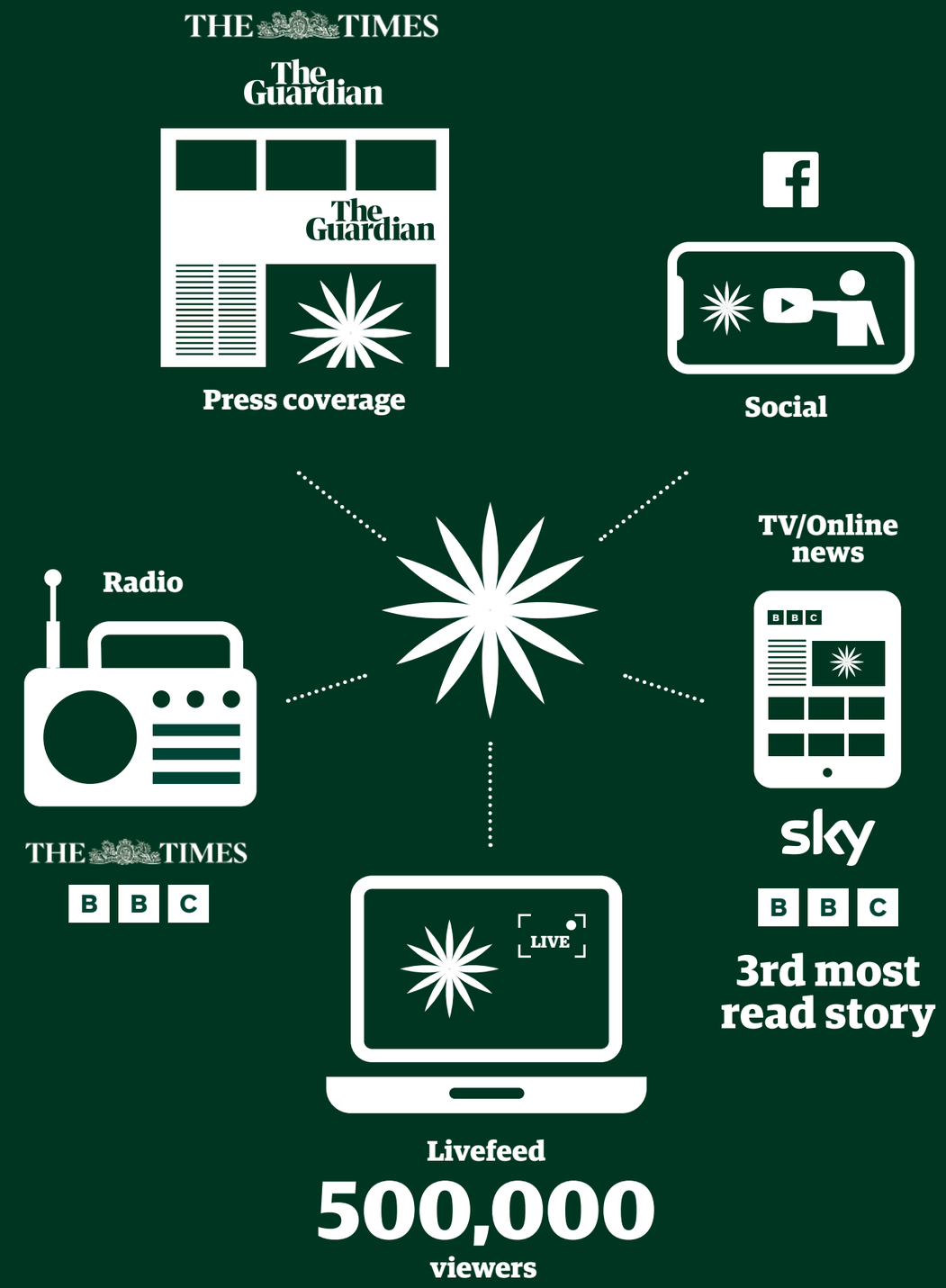
Anna Patterson Lee
Head of Development & Communications

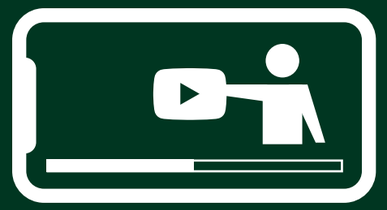
It has been another busy year for the Communications team. The various lockdowns and restrictions on movement meant that we continued to create a lot of digital material to enable people to visit virtually when they couldn't in person.

Moonflower coverage

The biggest event of the year for us was the flowering of *Selenicereus wittii*, the Moonflower. Due to a perfect storm that saw a miserable February lockdown combined with a lack of good news, the flowering of this rare Amazonian cactus for the first time in the UK went viral. Thanks to Glasshouse Supervisor Alex Summers and Plant Records Officer Pete Atkinson, a timelapse camera and live feed camera were installed next to the bud and we started livestreaming on 9 February. We alerted the press and shared on our website and social media, hoping that this UK 'first' would be a welcome distraction from Covid-19 news. Thousands of people became hooked on the stream, watching and waiting for the petals to appear - and it was amazing to see that we had people watching from around the world. In the run up to the flowering there was a lot of press interest, with articles in *The Guardian*, on *The Times, Times* Radio and BBC Online, and Beverley Glover appeared regularly on the local BBC breakfast radio show. Then, after 10 days of watching and waiting, there was a 24 hour press frenzy as the flower opened - not as anticipated in the evening, but the afternoon! It was watched by nearly 500,000 people on the livefeed and the Potting Shed was turned into a temporary press office as we fielded press interest from around the world and constantly updated our social media and website. Alex and Beverley were also very accommodating as we sent them up and down the ladder all evening to be photographed and take part in a Facebook Live that we held for the public to ask their questions direct.

The resulting press coverage was fantastic - articles in all the national papers (including some cover images), the third most read story on the BBC website and features on media around the world. Alex was also interviewed on BBC *Breakfast* News, BBC *World* and Radio 5 *Live*.





Digital activities

Other activities this year have included the continuation of the regular *Wellness Wanders* films, an *Ask the Gardener* Facebook Live series and a day of digital activities for Fascination of Plants Day. A lot of content was created for the website and Friends news for the 175th anniversary, as well as on social media. One of the legacies of the Moonflower was the development of a relationship with Brinno who have donated a timelapse camera - used to share the opening of some of our stunning plants in the Glasshouse Range.

Filming

The Garden has had a good media profile over the year both locally and nationally, and we were delighted to secure the Garden's appearance on two high profile BBC programmes. *Heavenly Gardens* was broadcast on BBC1 on Good Friday; and a highlight during the summer was a 3-day visit from the BBC *Green Planet* crew who were filming the next series, due to go out in 2022. The Garden was on BBC *Gardeners' World*, with a feature on night-scented plants, and we were part of a Channel 4 series about accessible visitor attractions with Rosie Jones. We also welcomed local media into the Garden throughout the year.

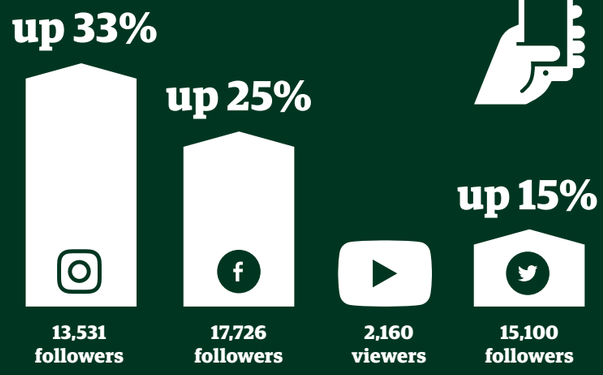
Marketing Campaigns

We also had a busy spring after the Garden received a Culture Recovery Fund grant. We created new marketing campaigns for the Garden as a whole, the Friends scheme and the Corporate Friends scheme. This involved new designs, advertising in places we had never advertised before - such as on the radio and bus sides - leaflet drops to local houses and new promotional materials in the Garden, including poster frames and table top leaflet holders. We were very grateful that the funding also included provision for a temporary member of staff too!

35 Bus adverts
11 Train station posters
2 Radio adverts
9,900 Leaflets distributed to local houses for the Friends advertising.

Social Media

This got a huge boost from the Moonflower, but we have not lost any of these new followers and continue to gain them.



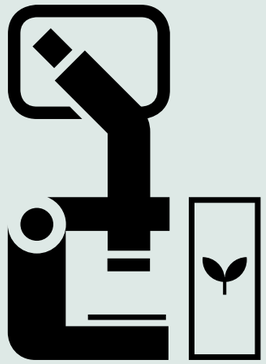
Development

Development activities have, as with the last year, been mainly subsumed by the pandemic, however we were delighted to renew our partnership with Cambridge Water (pictured above) as they partnered with us again to sponsor the Dry Garden.

The Henslow Circle have remained fantastically steadfast supporters and we were delighted to welcome them back to the Garden again when their summer late night openings restarted. We were able to enjoy a zoom talk from Beverley and Alex after the Moonflower opening, and we are looking forward to an increase in activities in the next year.

Research supported and facilitated

In the past year we have supported research by providing researchers with material of 277 accessions.



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, funded by the BBSRC, NERC, HFSP, EU Marie Curie Actions, Leverhulme Trust, Isaac Newton Trust, and the Cambridge University Botanic Garden Research Fund. Material maintained at CUBG, analysed in the experimental plots, or accessed from living collection, for projects including:

The relationship of floral morphology to pollination success in *Vicia faba*, with Dr Jane Thomas (National Institute of Agricultural Botany), Roger Vickers (PGRO) and Jake Moscrop (PhD student).

Molecular evolution of key developmental pathways in plants, with Dr Sam Brockington (Curator, CUBG), Thea Kongsted (PhD student) and Dr Eva Herrero (post-doc).

Development and evolution of insect-mimicking petal spots in *Gorteria diffusa*, with Dr Paula Rudall (RBG Kew), Dr Allan Ellis (Stellenbosch University), Dr Boris Delahaie and Dr Roman Kellenberger (postdocs), Roisin Fattorini and Farahnoz Kohjayori (PhD students).

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), Professor Silvia Vignolini (Department of Chemistry, University of Cambridge), Dr Edwige Moyroud (Sainsbury Laboratory Cambridge University), Dr Chiara Airoldi and Dr Carlos Lugo-Velaz (postdocs) and Jordan Ferria (PhD student).

The effect of plant viral infection on pollinator attraction, with Professor John Carr (Department of Plant Sciences, University of Cambridge), Dr Alex Murphy (post-doc) and Netsai Mhlanga (PhD student).

Evolution and development of nectar spurs in *Linaria*, with Ben Fisk (PhD student).

The relationship of floral morphology to pollination success in strawberry, with Hamish Symington (PhD student).

Development and evolution of prism cells in the epidermis of California poppy petals (with Kristina Buch, PhD student).

Provision of liverworts, mosses, ferns, lycophytes and cycads for undergraduate teaching.

Dr Sam Brockington, *Curator*

Research programme focussed on the evolutionary genomics of the order Caryophyllales, funded by NERC, the NSF and the Isaac Newton Trust, and using material grown in the experimental glasshouses, and across the living collections:

Sequencing transcriptomes in Caryophyllales 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 (PhD student) and Dr Hester Sheehan (post-doc).

Exploring the evolution and regulation of arogenate dehydrogenase (TyrA), the key enzyme for the production of the essential aromatic amino acid tyrosine (Tyr), in *Caryophyllales*, with Dr Samuel Lopez Nieves (postdoc).

Sampling the diversity of liverwort specimens in the Garden to extract high quality DNA for genome sequencing by BGI (Beijing, China), as part of the 10KP genome sequencing project, with Nathaniel Walker-Hale (PhD student).

Studying the phylogeny, evolution and diversity of tulip species with Brett Wilson (PhD student) and Flora and Fauna International (FFI).

Sampling material for genomic sequencing projects in Caryophyllales.

Dr Chantal Helm

Integrative species delimitation and evolution in the American palm genus *Brahea*, with Dr Craig Barrett (West Virginia University) and Dr Larry Noblick (Montgomery Botanical Center).

Bat survey in collaboration with Kevin Hand (National Bat Monitoring Project) Moth survey in collaboration with Dr Helen Leggett (Cambridge University, Dept. of Zoology).

Department of Plant Sciences, University of Cambridge

Professor Sir David Baulcombe, FRS
(RNA Silencing and Disease Resistance Group)
Use of the Experimental Glasshouses to propagate the progeny of *Solanum lycopersicum x S. pennellii* hybrids through to the F4 generation, to investigate 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.

Professor John Carr
(Plant Virology Group)
We have been using a bay of the glasshouse, and part of the outdoor Experimental Plots, to investigate the effects of virus infection of the interactions of tomato and bean (*Phaseolus vulgaris*) with bumblebees (*Bombus terrestris*). The work suggests that virus-infected plants are more attractive to pollinators than healthy or resistant plants and findings may be useful for improving pollinator service in gardens and for understanding how plants, pathogens and pollinators coevolve in the wild. We are expanding the work to include peppers (*Capsicum*). The new project concerns plant 'persistent' viruses (PVs), which are RNA viruses of the family Partitiviridae or genus Endornavirus. Unlike 'acute' viruses, they cause no disease, are inherited via seed or pollen, and cannot be transmitted to other plants by vectors (insects, soil fungi etc.) or wounding. PVs are inherited in certain lines of cultivated crops including beans (*Phaseolus vulgaris*, *Vicia faba*), pepper (*Capsicum spp.*), and rice (*Oryza sativa*). It has been proposed that PVs are mutualists and not pathogens. A student will detect PVs in a range of *Capsicum* and other species and perform phylogenetic analysis of PV sequences, and determine how possession affects plant resilience to stress and disease in *Capsicum*.

Professor David Coomes
(Forest Ecology and Conservation Group)
Analysing weather data collected at CUBG to inform studies of the impact of drought on UK woodland.

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 all are 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.

Professor Jim Haseloff
and **Dr Jennifer Deegan**
(Synthetic Biology for Engineering Plant Growth Group)
Anatomical studies of fern gametophytes and of liverworts, requiring access to the living collection.

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.

Professor 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. Also exploring the presence of mycorrhizal associations in diverse grass species from the Garden's collection. The mycorrhizal status of the sedge *Carex littledalei*, the first member of the *Cyperaceae* family to have its genome sequenced, will be assessed for a comparative study of mycorrhizal signalling between monocots and eudicots.

Professor Alison Smith and Dr Matt Davey
(Plant Metabolism Group)
The Botanic Garden has provided space for the Algal Innovation Centre glasshouse facility, to allow different algal species to be grown to establish what role algae can play in the development of a low carbon economy.

Other Departments, University of Cambridge

Stefanie Neun
Department of Biochemistry
Characterization of Glycoside Hydrolases from Functional Metagenomic Screening. A metagenomic fosmid library from bovine rumen bacteria was functionally screened for activity towards oligosaccharides in microfluidic droplets. This led to the discovery of novel polysaccharide utilization loci. Involved glycoside hydrolases have been characterized individually for their activity towards labelled substrates. Next, we aim to show how these enzymes act together on a natural substrate. For this purpose plant cell wall polysaccharides will be extracted and tested as suitable substrates.

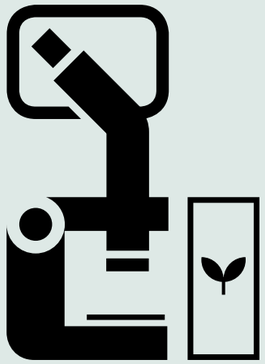
Konan Ishida
Department of Biochemistry
Diversity of galactoglucomannan in the plant kingdom. We have recently found a new structure of mannan, which is found in the plant cell wall. To evaluate when plants acquired this type of mannan, we are investigating the plant cell wall from a variety of species from the living collection.

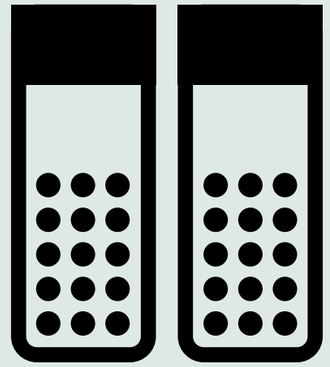
Louis Wilson
Department of Biochemistry
Xyloglucan sidechain diversity. This project seeks to verify the existence of novel polysaccharide structures in plant cell walls from a variety of species.

Hassan Aftab Sheikh
Department of Earth Sciences
Nano-magnetic approach to characterising air pollution. Characterising air pollution using biological proxies.

Amelia Ford
Department of Pathology
Obtaining a polyphenol-rich extract from *Eriobotrya japonica* leaves. The extract will then be assessed for transmission blocking potential against both the rodent malaria *Plasmodium berghei* and potentially against

Research supported and facilitated





the human malaria *Plasmodium falciparum*.

Dr Edwige Moyroud
Sainsbury Laboratory
The bullseye patterns in the centre of many flowers attract pollinating insects, but we do not know how plants control their formation. We are working with *Hibiscus trionum*, which creates a central bullseye of pigmented tissue in the middle of the flower, to understand the development of these patterns. In the Experimental Glasshouses we are screening a large population of mutagenized *H. trionum* plants to identify mutants with altered floral patterns.

Dr Sebastian Schornak
Sainsbury Laboratory
Plants engage with fungi to improve access to nutrients such as phosphate. We sample liverwort species from the Botanic Garden and stain them to detect 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.

Dr Raymond Wightmann
Sainsbury Laboratory
Working with CUBG Alpine and Woodland Section to study hydathode development in *Saxifraga* using cryoSEM microscopy and to analyse their secretion products with Raman microscopy. Another project focuses on the control of phyllotactic patterning in *Saxifraga* species. I am also exploring surface patterning mechanisms and the development of wood using the living collection.

Professor Paul Dupree
Department of Biochemistry
Use of the greenhouses to grow thermotolerant plants for biochemical analysis. Provision of species with polysaccharide gums. Pilot investigation of the presence of polysacharides of interest. Eventually, the polymers could be used to study enzyme activity from microbes involved in digestion.

Sarah Robinson
Sainsbury Laboratory
The mechanics of plant growth. To compare the mechanical properties of plants with different cellular architecture we are sampling diverse species from the living collection.

Walter Federle
Department of Zoology
Biomechnical measurements of *Nepenthes alata* to explore pitcher plant evolution and function. *Nepenthes* pitchers used for outreach activities.

External collaborations

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, Suffolk 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.
I am also working to develop ex-situ stock of *Artemisia campestris* (Sched 8, Critically Endangered) for study and introduction stock, as part of strategy to rebuild UK distribution of the plant and repopulate former sites, now returned to suitable condition.

Dr Peter Stroh
Botanical Society of the British Isles
I am a Scientific Officer for the BSBI, based at Cory Lodge. In 2017 I co-authored 'Threatened Plants in Britain and Ireland' (Walker et al., 2017), interpreting data collected for the BSBI's Threatened Plants Project. This was the most extensive sample-based survey of threatened plants ever undertaken in the British Isles, and focused on 50 of our least studied threatened plant species. The main aims of the project were to quantify the extent of recent losses, why they had taken place and gather information on their local abundance, habitats and ecological and management requirements.

Jordan Price
National Institute of Agricultural Botany, Cambrdge, UK
The evolution of actinorhizal symbiosis. Investigation of actinorhizal symbiosis through whole genome sequencing and comparative genomics in various species.

Hannah Hall
University of Reading, UK
The Mediterranean Basin is an area known for its high levels of biodiversity, but little is known about the factors contributing to the current distributions and diversification we see amongst Mediterranean flora today. Through the use of genomic data and phyloclimatic modelling, I aim to develop an understanding of the phylogenetic patterns in Mediterranean plants that underlies this unusually high biodiversity, with focus on the horticulturally and economically important subtribe, *Hyacinthinae* (order *Asparagales*, family *Asparagaceae*, subfamily *Scilloideae*). This work will help to solve the generic delimitations associated with the group while utilising their past climate preferences to gain an insight into current Mediterranean biodiversity and its future in the face of climate change.

Zoe Dennehy
University of Reading, UK
The high diversity and endemism of the Mediterranean Basin biodiversity hotspot has primarily attributed to the complex geological and climate histories of the region, however, current distributional patterns are poorly understood across Mediterranean flora. My project uses *Narcissus* as an exemplar genus to determine the effect of past climate change and climatic events on evolution and distributional patterns through the use of next generation sequencing data and phyloclimatic models. This will additionally provide insights into potential species response to anthropogenic climate change.

Anne Osbourn
John Innes Centre, UK
Taccalonolides are a class of highly oxidised steroidal molecules produced by plants in the genus *Tacca*. We intend to investigate taccalonolide biosynthesis in *Tacca* and engineer their production in other hosts. We will generate transcriptomic resources from relevant tissues, allowing us to identify candidate biosynthetic genes. We will use a plant transient expression system which has been optimised for production of sterol precursors as a chassis to screen candidates for desired activity. We anticipate that this will allow us to delineate biosynthesis of the various taccalonolides and to be able to engineer production of specific products of interest via expression of a subset of genes.

Roland Wouters
John Innes Centre, UK
The project aims to determine the genome of size of *Portulacaria afra* "spekboom" as a basis for a larger and longer-term molecular analysis of the basis for phenotypic diversity within the species.

Yiliang Ding
John Innes Centre, UK
We are exploring the evolution of an RNA structure motif in the AP2 floral development genes and the evolution of a second RNA structure motif, the G-quadruplex motif, in diverse plant species using the CUBG living collection.

Nikos Krigas
Institute of Plant Breeding & Genetic Resources, Balkan Botanic Garden of Kroussia Mountains, Thessaloniki, Greece
The MULTI-VAL-END project brings focus on unique, neglected and underutilised plants (399 single-region endemics) of Crete (Greece), northern Morocco and Tunisia, with the aim to: (a) Provide solid and multifaceted documentation for these plants including selective DNA barcoding; (b) Explore and evaluate their existing potential in economic sectors using multiple attributes; (c) Identify basic opportunities, main barriers and steps needed to build and establish new product supply chains in the selected regions; (d) Facilitate the sustainable exploitation of selected endemic plants by bridging gaps with targeted actions.

Dr. Matthias Fladung
Thuenen-Institute of Forest Genetics, Germany
The evolution of dioecy is still under active discussion. A prominent model suggests a transition from hermaphroditism via gynodioecy. Empirical data of some dioecious species seem to be consistent with this model. On the other hand, a pathway from monoecy might be more likely in other taxa such as the genera *Populus* and *Salix*. Since several details on the genetic and molecular mechanisms of dioecy in poplar have recently been revealed, it is now possible to directly test a putative evolutionary path via monoecy by studying the monoecious relative *Poliothyrsis sinensis*. We therefore want to examine gene expression and hormone concentrations in relation to flower development in *P. sinensis* in comparison to *Azara microphylla*.

Andrea Berardi
Harvard University Herbarium, United States of America
Floral colour evolution in North American *Silene*. A subset of *Silene* sect. *Physolychnis* is the only clade in which red floral colour occurs in the genus. The main goal of my project is to determine whether red floral colour in North America only is due to pollinator competition, the advent of polyploidy, or other less obvious factors. *Silene/Lychnis chalcedonica* is an essential outgroup to my project and has been difficult to find, yet it is one of the only diploids that produces red-orange pigments in the genus.

Plant material supplied to other gardens

CUBG directly supplied 226 accessions of plant material in diverse forms to 11 institutions. Of these, 17 accessions were distributed through the Index Seminum Seed Exchange Scheme and 209 to other gardens via direct contact.

Index Seminum Seed Exchange Scheme
Nantes Botanic Garden, Nantes, France (1 accession)
Botanischer Garten Universitat Konstanz, Germany (3 accessions)
Departimento Di Scienze Ambientali Orto Botanico, University of Siena Botanic Garden, Italy (2 accessions)
Giardino Botanico 'Caplez' Nibbiano, Italy (3 accessions)
Botanic Garden of the University of Debrecen, Hungary (1 accession)
Hortus Botanicus Universitatis Jagellonicae, Krakow, Poland (7 accessions)

Material supplied Direct to other Institutions

Horniman Museum and Gardens, Garden Team, London United Kingdom (1 accession)
Jardin Botanique de Lyon, Lyon, France (3 accessions)
Birmingham Botanic Gardens, Birmingham, United Kingdom (27 accessions)
National Botanic Garden of Wales, Llanarthne, United Kingdom (178 accessions).

Plant material accessioned

During the period 1st October 2020 to 30th September 2021 the Garden accessioned 519 plants, of which 337 were of wild origin.
In addition, we accessioned 336 seed lots.

Publications by Staff

B Xu, L Taylor, B Pucker, T Feng, BJ Glover, SF Brockington 2021 The land plant-specific MIXTA-MYB lineage is implicated in the early evolution of the plant cuticle and the colonization of land. *New Phytologist* 229 (4) 2324-2338.

C Chen, C Airoldi, CA Lugo, RK Bay, BJ Glover, AJ Crosby 2021 Flower Inspiration: Broad-Angle Structural Color through Tunable Hierarchical Wrinkles in Thin Film Multilayers. Advanced Functional Materials (italics) 31 (5) 2006256.

CA Airoldi, CA Lugo, R Wightman, BJ Glover, S Robinson 2021 Mechanical buckling can pattern the light-diffracting cuticle of *Hibiscus trionum*. *Cell Reports* 36 (11) 109715.

R Middleton, E Moyroud, PJ Rudall, CJ Prychid, M Conejero, BJ Glover, S Vignolini 2021 Using structural colour to track length scale of cell-wall layers in developing *Pollia japonica* fruits. *New Phytologist* PMID: 33720398 DOI: 10.1111/nph.17346

GV Davis, BJ Glover 2021 Characterisation of the R2R3 Myb subgroup 9 family of transcription factors in tomato. *bioRxiv* doi: https://doi.org/10.1101/2021.01.13.426590

J Moscrop, BJ Glover 2021 Coevolution: plant-insect. *Encyclopedia of Life Sciences* https://doi.org/10.1002/9780470015902.a0029380

V Ruiz-Hernández, L Joubert, A Rodríguez-Gómez, S Artuso, JG Pattrick, PA Gómez, S Eckerstorfer, SS Brandauer, CGI Trcka-Rojas, LMartínez-Reina, J Booth, A Lau-Zhu, J Weiss, P Bielza, BJ Glover, RR Junker, M Egea-Cortines 2021 Humans share more preferences for floral phenotypes with pollinators than with pests. *Frontiers in plant science* https://doi.org/10.3389/fpls.2021.647347

NM Mhlanga, AM Murphy, FO Wamonje, NJ Cunniffe, JC Caulfield, BJ Glover, JP Carr 2021 An innate preference of bumblebees for volatile organic compounds emitted by *Phaseolus vulgaris* plants infected with three different viruses. *Frontiers in Ecology and Evolution* https://doi.org/10.3389/fevo.2021.626851

M Bourdon, J Gaynord, KH Müller, G Evans, S Wallis, P Aston, DR Spring, R Wightman 2021 Microscopy and chemical analyses reveal flavone-based woolly fibres extrude from micron-sized holes in glandular trichomes of Dionysia tapetodes. *BMC Plant Biology* 21, 258

HMontero, TLee, BPucker, G Ferreras-Garrucho, G Oldroyd, SF Brockington, A Miyao, U Paszkowski 2021 A mycorrhiza-associated receptor-like kinase with an ancient origin in the green lineage. *PNAS* 118 (25) e2105281118; https://doi.org/10.1073/pnas.2105281118

A Timoneda, T Yunusov, C Quan, A Gavrin, SF Brockington, S Schornack 2021 MycoRed: Betalain pigments enable in vivo real-time visualisation of arbuscular mycorrhizal colonisation. *PLOS Biology* https://doi.org/10.1371/journal.pbio.3001326

B Pucker, HB Singh, M Kumari, MI Khan, SF Brockington 2021 The report of anthocyanins in the betalain-pigmented genus *Hylocereus* is not well evidenced and is not a strong basis to refute the mutual exclusion paradigm. *BMC Plant Biology* 21, 297

B Wilson, A Dolotbakov, BJ Burgess, C Clubbe, G Lazkov, K Shalpykov, M Ganybaeva, O Sultangaziev, SF Brockington 2021 Central Asian wild tulip conservation requires a regional approach, especially in the face of climate change. *Biodiversity and Conservation* 30, 1705–1730

DF Morales-Briones, G Kadereit, DT Tefarikis, MJ Moore, SA Smith, SF Brockington, A Timoneda, WC Yim, JC Cushman, Y Yang 2021 Disentangling Sources of Gene Tree Discordance in Phylogenomic Data Sets: Testing Ancient Hybridizations in *Amaranthaceae* s.l . *Systematic Biology* 70, 2, (219–235) https://doi.org/10.1093/sysbio/syaa066

Weather

Katie Martyr
Nursery & Experimental
Horticultural Assistant

The winter was quite mild and wet, the spring was warm and dry while the summer had some very high temperatures and long wet spells. The total rainfall for the year was above average, with two months over 100mm, resulting in muddy Cambridge Covid-19 walks.

October was mild and showery throughout, with one notable shower of 16.2mm on the 24th. The total rainfall was double our average of 106.6mm for the month.

November and December continued to be mild and showery with a few night-time air frosts; the coldest night of the month was on the 28th, at -1.5°C. December had a total rainfall of 102.8mm with large amounts of rain on the 3rd and 23rd.

In January the cold weather continued, with -3.1°C on the 23rd. Rainfall was above average with 22.1mm on the 13th. A few snow days occurred towards the end of the month. February continued to be cold with -4.5°C, the lowest temperature for the winter, on the 11th. Low amounts of rain fell throughout, with the highest daily amount on the 4th at 11.3mm. Again a few snow days occurred early in the month, on the 6th and 7th.

March was a cold month with -2.4°C being the lowest temperature recorded, on the 6th. There were strong winds on the 11th in the morning (40 knots plus) causing the Garden to close for half the day. Overall it was a fairly dry month, with 12.0mm of rainfall on the 3rd.

April was a very cold month with 13 nights below freezing, the coldest at -3.0°C on the 17th. It was very dry, especially for the time of year, with the total rainfall a mere 3.1mm.

In May the weather started to become warmer, with the coldest being -1.8°C on the 9th. The rainfall picked up at 82.9mm for the month, with many thundery and showery days, notably on the 11th, 17th and 24th.

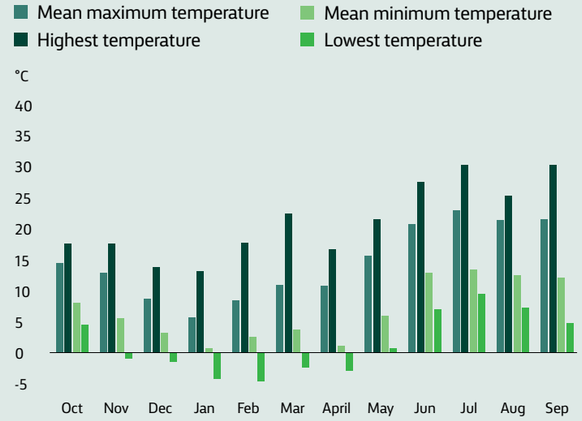
June was about average, with the maximum temperature being 26.2°C on the 3rd. The rainfall was low, with 35.3mm total.

July was slightly hotter than the previous year, with a maximum of 30.2°C on the 19th. The rainfall was about average, 53.4mm total. There was hail and thunder on the 21st, giving 18.7mm of rain in the afternoon followed by two more days of thunder.

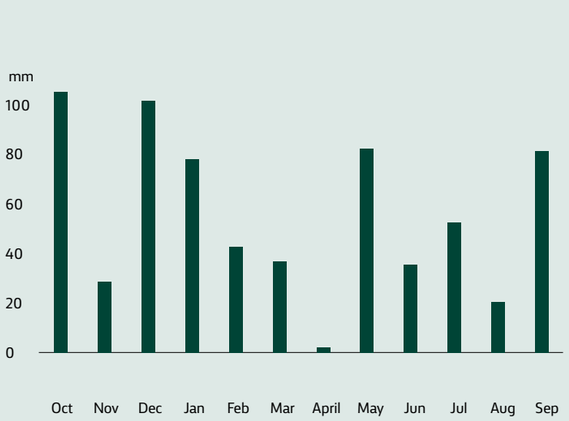
August was a drier and cloudy month with a total of 20.6mm of rain and a maximum temperature of 24.7°C on the 15th.

In September the first half of the month was warm, again reaching a maximum of 30.2°C on the 8th. From the early morning of the 14th, the garden received continuous heavy rain, this totaled 54.3mm, our monthly average, in only 7 hours.

Monthly temperature (°C)



Monthly rainfall (mm)



Funding

Income

Funding Source	*Details*	2020–21 £ k	2019–20 £ k
University Support	Pay and Non Pay	1010.8	992.8
Trust Funds	The Cory Fund	682.4	663.2
	Other Trust Funds	20.7	20.3
Admissions Income	Gate takings (including tours, guidebooks etc)	747.2	406.0
Earmarked Funds	Friends (including income for events and activities)	277.3	259.3
	Other Specific Donations and Trade	418.1	355.0
Project Grants/ Funding			
– See breakdown below		102.2	64.1
Education Courses, Donations & Events		50.2	39.2
Donations – General		8.1	4.9
Other		15.7	30.0
Total Income		**3,332.7**	**2,834.8**

Breakdown of Income (Project Grants/Funding)

	£ k	£ k
Heritage Lottery Fund –Culture Recovery Grant	76.6	0.0
Funding towards Trainee Programme (Perennial)	0.0	22.7
Audience and Learning / Strategic Audience Engagement Grant (UCM)	4.8	14.0
PlaMatSu Exhibition and Workshops (Marie Curie Innovative Training Network)	18.9	27.4
Impact (BBSRC/NERC)	1.9	0.0
Total	**102.2**	**64.1**

Expenditure

Funding Source	2020–21 £ k	2019–20 £ k
University Support	1,014.3	996.7
Trust Funds	614.6	533.7
Admission and Tours	321.1	499.7
Earmarked Funds: Friends	167.7	250.1
Earmarked Funds: Other	341.7	194.2
Specific Project Grants/ Funding – see breakdown below	104.7	68.3
Education Courses, Donations and Events	31.0	44.5
Donations – General	2.8	1.2
Other	4.6	29.1
Total Expenditure	**2,602.4***	**2,617.4***
Total Income less Total Expenditure	**217.4**	**730.3**
Less: Earmarked funds held for future planned expenditure	-714.0**	-213.6**
Funds reinvested by Cory and Trust Fund Managers	0.0	0.7
Funds reinvested in the Research Fund	0.0	-61.9
Funds remaining for discretionary use	**16.3**	**-58.8**

Breakdown of Expenditure (Specific Project Grants/Funding)

	£ k	£ k
Heritage Lottery Fund – Culture Recovery Grant	71.5	0.0
Funding towards Trainee Programme (Perennial)	0.0	29.1
Audience and Learning / Strategic Audience Engagement Grant (UCM)	14.9	11.2
PlaMatSu Exhibition and Workshops (Marie Curie Innovative Training Network)	15.0	27.7
Interpretation (HEIF5/Donation)	2.6	0.0
Impact (BBSRC)	0.7	0.2
Total	**104.7**	**68.3***

Notes:
* Calculations include minor rounding differences.
** Includes specifically funded activity and commitment of funds towards the Garden's Capital Campaign (https://www.botanic.cam.ac.uk/the-garden/development-of-the-garden/current-projects/).
Income figures include interest where funding has been held on deposit.

Funding

2020-21 has been a year full of surprises! Following a year of great uncertainty with many twists and turns, through your support and with a great deal of hard work, we ended the financial year positively.

Rachel Agnew
Finance Manager

Operational expenditure budgets at the start of the year were significantly cut in an attempt to better meet forecast revenue. Once again, the message was 'essential activity only'. Anticipated income at that time was appreciably less than in a 'normal' year, when further lockdowns, closures and other restrictions could not be ruled out.

Focus throughout the year remained on income generation and, importantly, our ability to remain open and provide a warm welcome to visitors and Friends.

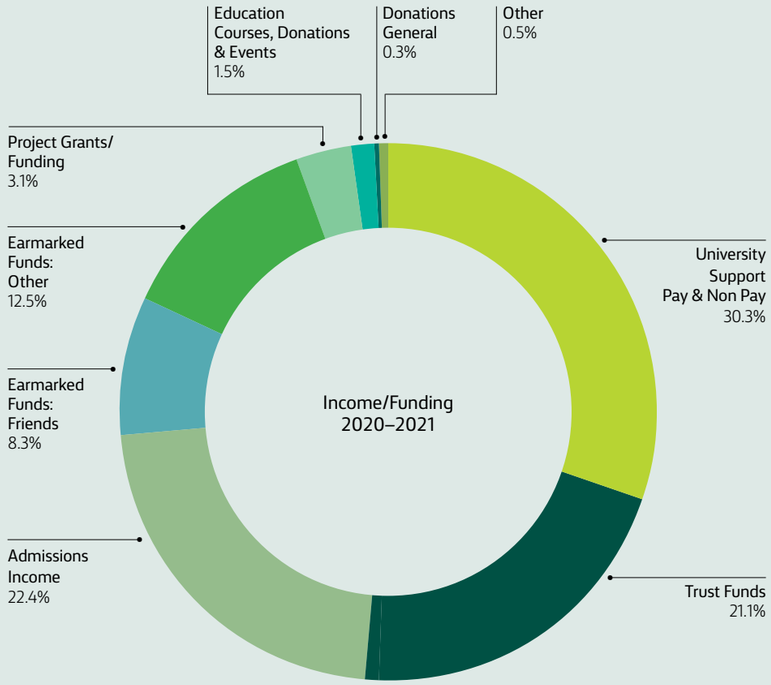
Friends membership was encouraged by offering two months free when signing up to pay by Direct Debit and collaborative, supportive relationships were formed with the Wildlife Trust and Cambridge Past, Present and Future (20% discount offered on membership to the Friends in the first year[1]).

Other initiatives included the relaunch of the popular Celebration and Commemorative Bench scheme[2] and a new Tree Sponsorship scheme[3] .

Both Admission and Friends revenues outperformed expectation, where we safely welcomed visitors and increasing numbers of new and renewing Friends, and, in addition, benefited from the Government initiative to support attractions by introducing a temporarily reduced rate of VAT.

In addition, mid-way through the financial year, we were incredibly fortunate to receive Culture Recovery funding via the Heritage Lottery Fund, which enabled significant reparations and growth. We were able to concentrate our efforts on collections and landscape recovery, encouraging visitation through various marketing programmes, boosting visitor confidence with the provision of additional visitor service staff, and improvements to our digital outreach to engage and connect with new and existing supporters.

Gift aid and a marked increase in general donations were most gratefully received, along with specific support that enabled re-development of the Rock Garden.



[1] See more here https://www.botanic.cam.ac.uk/join-support/friends/).
[2] https://www.botanic.cam.ac.uk/join-support/celebration-and-commemorative-benches/
[3] https://www.botanic.cam.ac.uk/join-support/sponsor-a-tree/)

Gifts, donations and support

Received in Annual Report period August 2020 - July 2021

In Memory Gifts

Donation from Cambridge Conservation Initiative in memory of Professor Chris Abell, dedication of a tree – £500.

Donations received in memory of the late Mrs M.A.W Whyman £365.53 (plus Gift Aid).

Donation received in memory of Christopher Clinch £1000 (plus Gift Aid).

Donations received in memory of Jane Shears £75 (plus Gift Aid).

Donation received in memory of Dr CH Kuan £100 (plus Gift Aid).

Celebration and Commemorative Bench Scheme

In memory of Ben Walter
In memory of Peter Dawes
In memory of Puri Frostick
In memory of Norman Beckitt
In memory of Frederick and Thelma Gilbert
In memory of Ian Charles Braid
In memory of Frederick Nathan Milburn and Alfreda Grace Milburn

Sponsor a Tree Scheme

Wedding gift for Claire and Keith McGregor
In memory of Sarah Wayman.

Individual Gifts and Donations

Anonymous, a donation towards the Rock Garden Project £20,000.

Jonathan Drori, donation in support of Marketing and Communications £1,200.

We are hugely grateful for the numerous donations received online or in our donation boxes, thank you, as always, for your generous support.

Grants, Trust and Societies

BBSRC to support Trails in the Garden £902.46.

NERC to support Trails in the Garden £950 Marie Skłodowska-Curie Innovative Training Network (via the University of Strathclyde) towards the PlaMatsu Exhibition and Workshop £18,917.81.

Corporate and other support

University of Cambridge Museums, Strategic Audience Engagement Grant – £3,000

University of Cambridge Museums, Digital Equipment Grant – £500.

University of Cambridge Museums – The Botanic Garden Audience & Learning Strategic Partnership Grant (1 April 2021 – 31 March 2022) – £10,000.

Gatsby Plant Science Education Programme grant awarded for the support of Plant Science virtual Masterclass 2021, £150.

Friends of CUBG

Thanks also goes to the Henslow Circle, Friends and Corporate Friends for their generous and unwavering support, and to those who continue to make significant gifts over and above the annual renewal subscription.

...and lastly special thanks to those who have chosen to Gift Aid admissions, subscriptions, and donations, helping to support the continuing work of the Garden.

£116,200
Donations & Gifts

£102,200
Grants

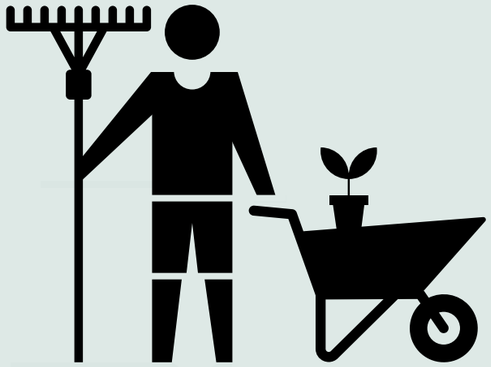
Syndicate & Cory Managers

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 (until end 2020),
Professor David Coomes,
Professor Jon Drori (external),
Dr Laurie Friday,
Dr Ian Furner,
Mr Donald Hearn,
Professor Henrik Jönsson,
Professor Rebecca Kilner,
Ms Raffaella Hull
(student member for one year),
Professor Alison Smith,
Dr Rosy Thornton and Professor Bhaskar Vira.
The Secretary was the Garden's Director, Professor Beverley Glover.

The Cory Managers met four times during the year under the Chairmanship of Professor Alison Smith (Head of the Department of Plant Sciences).
Managers for the year were:
Mr Michael Allen,
Professor David Cebon,
Professor Howard Griffiths,
Dr Kate Maxwell,
with Mr Jonathan Appleton as the representative of the Director of Finance (until end 2020).

Botanic Garden staff

(Oct 2020–Sept 2021)



Director
Professor Beverley Glover
PA to Director: Jane Adams

Assistant Director (Audiences & Enterprise)
Paul Pomfret (from August 2021)

Administration
Administrator: Wendy Godfrey
Assistant Administrators: Richenda Whitehead and Caty Cooke
Learning Administrator: Lucy Watts
Friends Administrator: Sacha Watson

Curation
Curator: Sam Brockington
Assistant Curator: Ángela Cano
Plant Records Officer: Pete Atkinson
Curation Assistant: Mar Millan

Development
Head of Development and Publicity: Anna Patterson Lee
Marketing and Communications Co-ordinator: Helen Needham

Estates
Head of Estates and Operations Manager: Carl Tatterton
Estates Manager: Phil Starling.

Finance
Finance Manager: Rachel Agnew
Finance Coordinator: Tracey Brock
Finance Administrators: Elaine Dalton and Anouska Arthur (to September 2021).

Horticulture to 30 August 2021
Head of Horticulture: Sally Petitt
Horticultural Learning Co-ordinator: Sandie Cain
Alpine & Woodland Section: Supervisor - Paul Aston; Assistant – Simon Wallis
Demonstration & Display: Supervisor - Pete Kerley (to September 2021); Assistant - David Austrin (to January 2021)
Experimental Area: Supervisor - Pete Michna (to April 2021); Assistant – Katie Martyr
Glasshouse Section: Supervisor - Alex Summers (to June 2021); Assistant - Barbara Griffith
Landscape & Machinery: Supervisor - Adrian Holmes; Assistant - Matthew Murawski
Systematics Section: Supervisor - John Kapor; Assistants - Julie Clos, Pete Wrapson
Trees & Shrubs Section: Supervisor - Mark Crouch; Assistant – Alistair Godfrey
Weekend Horticultural Assistant: Alice Riches
Trainee Horticultural Technicians: From September 2020 to September 2021: None appointed due to Covid-19.

Horticulture from 31 August 2021
Head of Horticulture: Sally Petitt
Horticultural Learning Co-ordinator: Sandie Cain
Horticultural Displays: Team Leader - Paul Aston; Assistant Eastern Displays – John Kapor; Assistants Western Displays - Julie Clos, Pete Wrapson
Garden Landscapes: Team Leader – Mark Crouch; Senior Horticulturist Landscape and Machinery – Adrian Holmes, Assistant – Matthew Murawski: Assistant Trees and Shrubs – Alistair Godfrey
Glasshouses: Senior Horticulturist Nursery & Experimental – Simon Wallis, Assistant – Katie Martyr;
Glasshouses Assistant – Barbara Griffith
Weekend Horticultural Assistant: Alice Riches
Trainee Horticultural Technicians: From September 2021: Ros Crowhurst, Luke Ford, John Houston, James Moon & Matt Weston.

Learning
Head of Learning: Hayley McCulloch
Learning Officer: Sally Lee
Schools Learning Officer: Bronwen Richards, Catherine Swift (maternity cover from March 2021)
HE and Research Impact Co-ordinator: Chantal Helm.

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: Amanda Wilkins, Lucinda Fudge, Sue Baker, James Oliver (to September 2021), Vikas Shinde, Laura Middleton (to December 2020), Alicia Lloyd, Kristine Cimals, Alexandra Pond, Betsy Brown, Lorna Ashcroft-Nowicki (from March 2021), Mary Trend (March to April 2021).
Visitor Services Receptionist: Heloise Toop.

Botanic Garden staff activites

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 Gardens Edinburgh; member of the Science Advisory Committee of the Royal Botanic Gardens Edinburgh; member of the Council of the European Society for Evolutionary Developmental Biology; Chair of the Council of Scientists of the Human Frontier Science Programme; member of the Botanical Society of America; member of the British Society for Developmental Biology; Fellow of the Linnean Society; patron of the Cambridgeshire Gardens Trust; vice president of the Cambridgeshire Beekeepers' Association; member of the Advisory Board of New Phytologist; Strategic Advisor to 'Plants, People, Planet'; member of the Editorial Board of Current Opinion in Plant Biology; member of the Natural Environment Research Committee's Peer Review College; gave an invited lecture at the British Society for Developmental Biology annual meeting and to the Cambridgeshire Gardens Trust.

Associate Professor Sam Brockington: is an active member of the High Value Biorenewables Network; Fellow of the Linnean Society; trustee of the Bedfordshire, Cambridgeshire, and Northamptonshire Wildlife Trust; trustee for Thrive (Social and Therapeutic Horticulture) and gave an invited lecture at the Oxford Botanic Garden and Harcourt Arboretum (annual lecture series).

Paul Pomfret served as a trustee for Middleton Hall Trust.

Carl Tatterton continued as a trustee of the Hobson's Conduit Trust.

Helen Needham continued as a member of the Great Days Out In & Around Cambridge committee.

Sally Petitt continued as chair of the Merlin Trust (Grants to Young Horticulturists); as a member of the Borde Hill Garden Management Council; and as a member of the Royal Horticultural Society Education Committee.

Alex Summers continued as Vice Chair of the Royal Horticultural Society Tender Ornamental Plant Committee.

Simon Wallis served as the Chair of the Saxifrage Society.

Chantal Helm: member of Cambridge University's Ecological Advisory Panel; member of Nature in Cambridgeshire Editorial Board; Chair of the Herts and Middlesex Bat Group; trustee of the Hertfordshire Natural History Society; external examiner in Environmental Science at Northampton University; member of the Chartered Institute of Ecology and Environmental Management; member of the Botanical Society of Britain and Ireland; member of the Mammal Society.

Dan Jenkins: member of the Royal Society of Biology Plant Science Group committee; continued as a member of the Biology Education Research Group and the Education Policy Advisory Group of the Royal Society of Biology.

Charlotte Carroll: member of the Careers Committee of the Royal Society of Biology.

Alex Jenkin: member of the Outreach and Engagement Working Group of the Royal Society of Biology.

Corporate Friends

There were 83 Oak and 14 Redwood Corporate Friends during this year. This is up from 57 Oak and 10 Redwood the previous year, and is similar to the year before that in which had 86 Oak and 12 Redwood members - so we are close to pre-pandemic numbers. It has been lovely to welcome back many Corporate Friends this year after lockdowns and working from home meant that the number of visits dropped off dramatically. The Corporate Friends had a marketing campaign for the first time, thanks also to the CRF grant. Flyers were designed, printed and sent out to business parks around Cambridge and as inserts with the Cambridge Chamber of Commerce magazine in June.

Redwood Friends Apple AstraZeneca Cantab Asset Management Costello Medical Consulting Domino UK Limited Gam Systematic LLP GMSL Invenia Labs Limited Microsoft Research Ltd Mills & Reeve LLP MRC Toxicology Unit RealVNC Limited Secondmind Ltd South Staffs Water/Cambridge Water Spotify Ltd.

Oak Friends AKT II Ltd Arcus Foundation Arcus Global Ltd ARM Ltd AstraZeneca Investor Relations Audience Engagement UK Ltd BIOS Health Ltd Birketts LLP Bloomhall Ltd Brookgate Development Management Ltd Cambridge Assessment Cambridge Commonwealth, European & International Trust Cambridge Econometrics Cambridge Education Group Cambridge Flow Solutions Cambridge Institute for Sustainability Leadership Cambridge Intelligence Cambridge Investment Management Ltd Cambridge Judge Business School Cambridge Mechatronics Ltd Cambridge Research Office Cambridge University Information Services Cambridge University Press Cambridgeshire Police Federation Cambustion Limited Carter Jonas Centrica Hive Limited Churchill College Clare Hall Department of Biochemistry Department of Chemistry Department of Geography Department of Pathology Department of Pharmacology Department of Physics Department of Psychology Department of Zoology Dept of Physiology, Development & Neuroscience Docker UK Ltd EMBL-EBI Staff Association Engineering Department Eversheds-Sutherland LLP Faculty of Education Faculty of Mathematics Federation of European Biochemical Societies Functional Gut Clinic Geant Gilead Sciences International Ltd Graphcore Limited Gurdon Institute Hills Road Sixth Form College Historic England Hoare Lea HP UK Development Ltd Institute of Astronomy University of Cambridge Institute of Criminology Intrasonics Ltd Isaac Newton Institute for Mathematical Sciences John Lewis and Partners Lynfield Management Ltd Mander Portman Woodward (MPW) Cambridge Marks & Clerk LLP Marshall Sports and Social Club Mott MacDonald Ltd MRC-CBU Nash Matthews LLP Natural England NIAB Nu Quantum Ltd Pembroke College Penningtons Manches LLP Peters Ellworthy & Moore (PEM) Qualcomm Technologies International Ltd Ramboll Raspberry Pi Foundation Sagentia Innovation Samsung R&D Institute UK Saunders Boston Limited Savills (UK) Ltd School of Clinical Medicine Scott Polar Research Institute Siemens Industry Software Ltd Simmons Wavelength Limited St Andrews Tutorial Services Ltd St Mary's School St. Faith's School Stephen Perse Foundation Stephen Perse Sixth Form College Stone King LLP Taylor Wessing The Biodiversity Consultancy Ltd The Cambridge Crystallographic Data Centre The Leys SchoolThe Positive Internet Company Ltd THIS Institute (The Health improvement Studies Institute) Thomson Webb & Corfield Undo Vine FX VNC Automotive Limited WSP Wyton on the Hill Parish Council.





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