
John Innes Centre
Unlocking Nature's Diversity
2022 / 2023
ANNUAL REVIEW

Contents

Cover image: *Oilseed Rape (Brassica napus) in the glasshouses at the John Innes Centre. Phil Robinson*

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Message from our Director

Being given the opportunity to write this introduction brings me great joy, as it marks my first as Director. I would like to begin by thanking everyone at the John Innes Centre, across the Norwich Research Park and beyond, for welcoming me so warmly into this new role

Over the past few months, we have experienced an exciting and busy time with some significant milestones that we celebrate here in this report. It is difficult to include everything from such a successful year, and so I have selected a diverse range of significant organisational and scientific achievements to showcase.

Every five years, BBSRC reviews the financial support it provides to its strategically funded institutes. Through Autumn and Winter 2022, we prepared for the Institute Assessment Exercise and renewal of the Institute Strategic Programmes.

I am delighted to say that the John Innes Centre scored very highly across all categories. Our research, including the Germplasm Resource Unit, and our technology platforms were classified as 'exceptional' and 'excellent'. Our culture was rated as 'very good', which was the highest score awarded to any of any of the BBSRC institutes, and this area is a priority for me. I am truly grateful for the support and contributions from across the institute in this process. Without this team effort, the review process would not have been so successful.

The second major organisational milestone we celebrate is that the UKRI Infrastructure Fund investment into our ground-breaking plant and microbial science and innovation hub has been confirmed and announced. This transformational capital investment will fund new cutting-edge, world-class facilities for the John Innes Centre and The Sainsbury Laboratory (TSL) at the heart of the Norwich Research Park. This infrastructure underpins our research capability and aims to revolutionise the translation of scientific knowledge into bio-based solutions in response to some of society's most pressing challenges.

It is a pleasure to step into leadership at such an exciting point in our history, as we progress our collaborative vision – Healthy Plants, Healthy People, Healthy Planet (HP^3) – with TSL.

We have recently renewed our Athena Swan Gold award, which underpins our continuing commitment to gender equality and to an inclusive, fair and diverse research culture.

Our research endeavour continues to be diverse, world-leading and relevant, and our publications reflect that, from tomatoes that produce high levels of provitamin D, the discovery of new molecules and antibiotics, through to a discovery that challenges established thinking on long-distance plant signalling.

This year, we have had plenty of opportunities to celebrate with our colleagues. Many scientists and technicians have been acknowledged by being shortlisted and nominated and by winning awards and receiving fellowships and funding to support their research at the John Innes Centre.

As an institute, we are well known for our unique interdisciplinary approach and I'm looking forward to working closely with colleagues to continue to build on our strength in fundamental science, as well as applying our knowledge to global challenges such as food security, climate change and health and well-being.

Professor Graham Moore,
Director of the John Innes Centre

Message from the Chair of the Governing Council

This review paints an extraordinary picture of an exciting time at the John Innes Centre, as we embark on an ambitious development programme both on the site and in the way we work. The Governing Council and I are delighted to support this bold vision of the future.

It is my pleasure to to welcome Professor Moore into the role of Director. He is an outstanding scientist who will be a world-class Director for the John Innes Centre. He brings decades of leadership experience, a wealth of research expertise in crop improvement, as well as a strong appreciation for fundamental research.

Our Healthy Plants, Healthy People, Healthy Planet vision, launched with The Sainsbury Laboratory, embodies the breadth and depth of the research, and its potential to secure a healthier, more sustainable future for our planet. To meet the challenges that we face as a society, this ambitious programme will create a modern new home for these two world-leading research institutes, and a hub for plant and microbial innovation, together with the Earlham Institute, Quadram Institute, the University of East Anglia, the Anglia Innovation Partnership LLP and the Norfolk and Norwich University Hospital here at the Norwich Research Park.

The John Innes Centre is embarking on a period of even greater collaboration nationally and internationally, as we tackle the biggest challenges facing the planet. This will include extending our work with governments, farmers, industry and charitable foundations.

Sir Thomas Hughes-Hallett,
Chair of the Governing Council

About the John Innes Centre

The John Innes Centre is a world-leading international centre of excellence in plant science and microbiology

The JIC mission is to generate knowledge of plants and microbes through fundamental research and to use this knowledge to benefit agriculture, the environment, human health and well-being. We train excellent scientists for the future and engage with policy makers and the public.

Our joint strategy with The Sainsbury Laboratory – Healthy Plants, Healthy People, Healthy Planet (HP^3) – outlines our vision for delivering a safer, healthier and more sustainable future through the power of plant and microbial science.

We are home to over **40 RESEARCH GROUPS** working on a variety of plant and microbial science research projects.

In collaboration with our **WORLD-LEADING ACADEMIC PARTNERS** we are uniquely positioned to lead the fundamental scientific advances needed to address three intertwined, era-defining challenges:

FEEDING THE WORLD

GLOBAL HEALTH THREATS

CLIMATE CHANGE

We are a diverse organisation with an
INTERNATIONAL WORKFORCE
61% from the UK, 15% from the EU27 and 24% from the rest of the world.

Our staff come from 42 countries around the world.

We provide world-class
POSTGRADUATE EDUCATION
in plant science and microbiology as part of our mission to train the scientific leaders of the future. At any one time, we are training around 100 PhD students.

We were the
FIRST INDEPENDENT INSTITUTION
to be awarded the Athena Swan Gold award in 2017, and we are proud that this award was renewed in 2023.

We were a founding signatory of the
TECHNICIAN COMMITMENT
and are committed to embedding a culture where all staff across the organisation are supported and developed.

Research and Innovation

#1

The John Innes Centre ranked as the top plant science research organisation worldwide, based on citations between 2008 and 2017.

When assessed by a panel of independent experts, our strategic programmes achieved rankings rated from very good to exceptional in BBSRC's Institute Assessment Exercise in 2022.

Since 2014, we've spun out seven companies and attracted four businesses to Norwich.

Impact

In 2022, the John Innes Centre commissioned Brookdale Consulting to produce an updated socio-economic impact assessment.

For every £1 invested in the John Innes Centre,
£15.29 IS GENERATED
for the wider UK economy.

We are ranked among the
TOP 10 institutions in the world for **PATENT INFLUENCE**.

Essential investment secured for HP³

Transforming plant science and microbiology research for a sustainable future

Healthy Plants, Healthy People, Healthy Planet (HP³) is a collaborative call to action to provide the solutions desperately needed in a world with a rapidly changing climate, facing massive losses in biodiversity, a growing global population to feed and the urgent need to decarbonise agricultural practices.

Working with The Sainsbury Laboratory and BBSRC, we have secured UKRI Infrastructure Fund capital investment of £317.7m to develop a new world-class research environment at the heart of the Norwich Research Park to realise this ambitious vision.

This transformational investment will fund new cutting-edge, world-class facilities for the John Innes Centre and The Sainsbury Laboratory at the heart of the Norwich Research Park, to deliver a step change in our capability to translate scientific knowledge into bio-based solutions in response to some of society's most pressing challenges.

As well as transforming the existing capabilities of the John Innes Centre and The Sainsbury Laboratory, both internationally recognised centres of excellence in plant and microbial science, the new hub also aims to become a net-zero carbon laboratory.

The Next Generation Infrastructure programme will develop the site over the next seven years, with £54.7 million being invested over the first three years.

HP³ has already garnered generous contributions from the Gatsby Charitable Foundation, the University of East Anglia, the John Innes Foundation, the Wolfson Foundation and the Garfield Weston Foundation.

Construction of the research hub has already begun and is expected to be completed in 2030. It requires an ongoing fundraising campaign to secure a further £30m to support the full cost of the programme.

Securing this funding is a major step forward in realising our vision to improve collaborative working across the UK and overseas, helping us to provide a safer, healthier and more sustainable future through the power of plant and microbial science.

As well as new laboratories, the investment includes a redevelopment of our plant growth facilities, which, in conjunction with our existing field station, will improve our ability to study the effects of climate change

Professor Graham Moore, Director of the John Innes Centre

Science highlights 2022–2023

Discovery of wheat's clustered chemical defence genes

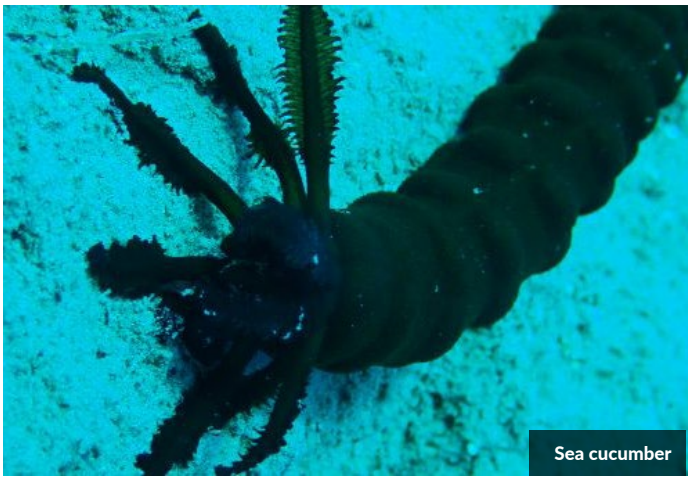
By using recent advances in mapping of bread wheat's complex genome, a collaborative team, led by the John Innes Centre, discovered several sets of genes in wheat that are switched on when the plant is attacked by disease-causing microbes.

These genes are found in six biosynthetic gene clusters in the wheat genome and were found to encode a diverse set of molecules, including triterpenes, diterpenes and flavonoids. One of the previously unknown triterpenes has been named ellarinacin.

This discovery highlights the start of a significant new direction for wheat research, as Dr Guy Polturak explained: "Our genomics-driven approach has allowed us to identify compounds that are produced in wheat only under certain conditions – in this case pathogen attack. Finding these molecules by the 'classical' approach of chemical analysis of wheat extracts would be challenging."

Pathogen-induced Biosynthetic Pathways Encode Defence-Related Molecules in Bread Wheat, PNAS. DOI: 10.1073/pnas.2123299119

Wheat produces defensive compounds when under pathogen attack



Sea cucumber

Sea cucumbers and lessons in self-defence

Genome mining techniques have helped to explain how sea cucumbers produce defensive chemicals that enable them to fend off foes and defend their ecological niche at the bottom of the ocean. These curious marine animals produce a category of molecule known as triterpenoid saponins, which are widespread in plants but rare in animals. Until now, the question of how they evolved their unusual ability to produce these molecules has been unexplained.

Research from the Osbourn group has shown that an enzyme, essential for building membranes and hormones, was missing in sea cucumbers, and instead, they have two alternative genes with new functions. One makes an alternative type of saponin for self-defence, and the other produces molecules that protect the sea cucumber from the toxic effects of its own chemicals. The sea cucumber is highly valued for it's medicinal properties. By understanding how they are made we can work to produced these high-value compounds using plants or yeast more cheaply and help conserve sea-cucumbers in the wild.

Innate immunity in sea cucumbers: repurposing sterol biosynthesis for defense, Nature Chemical Biology. DOI: 10.1038/s41589-022-01054-y

Gene-edited tomatoes could be a new source of vitamin D

Tomatoes gene edited to produce vitamin D, the sunshine vitamin, could be a simple and sustainable innovation to address a global health problem.

Professor Cathie Martin's group used CRISPR-Cas9 gene editing to make revisions to the genetic code of tomato plants so that provitamin D3 accumulates in the tomato fruit. This was then converted to vitamin D3 through exposure to UVB light.

"We've shown that you can biofortify tomatoes with provitamin D3 using gene editing, which means tomatoes could be developed as a plant-based, sustainable source of vitamin D3," said Professor Cathie Martin.

Biofortified tomatoes

Biofortified tomatoes provide a new route to vitamin D sufficiency, Nature Plants. DOI: 10.1038/s41477-022-01154-6

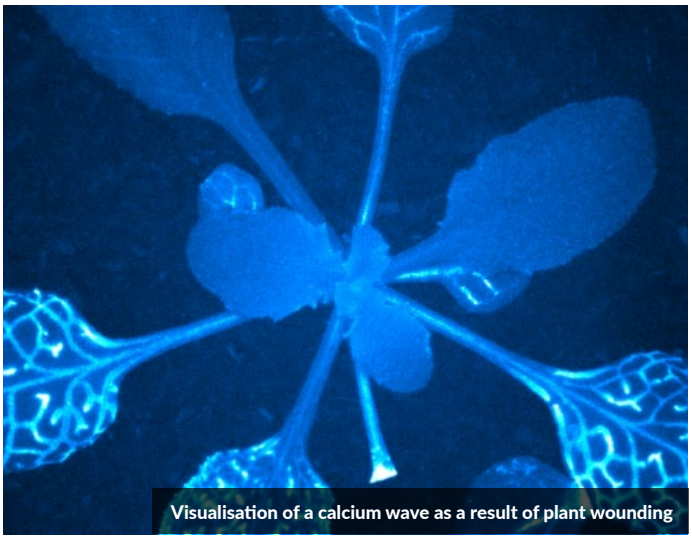
The science of how plants register trauma catches a new wave

Longstanding theories of how plants rely on calcium waves to respond systemically to wounding and other stresses have been given a fresh perspective. Research from Dr Christine Faulkner's group has shown that calcium waves are not a primary response, but rather they are a secondary response to a wave of amino acids released from the wound.

These findings challenge established thinking on long-distance plant-signalling molecules and the mechanisms by which information travels from the point of stress through living and non-living plant tissues.

Dr Christine Faulkner said: "Every time active propagation models were presented, I would question how this wave travelled from cell to cell. It appeared to me that there was a hole in the theory, and this research uncovers a new mechanism that shows that the calcium wave isn't what it seems."

Dr Faulkner's group specialises in the study of plasmodesmata, the channels or bridges that connect cells and the team speculated that a wound signal would travel from cell to cell through plasmodesmata. However, using quantitative imaging techniques, data modelling and genetics they found that the mobile signal is a glutamate wave that travels outside of cells, along the cell walls.



Visualisation of a calcium wave as a result of plant wounding

Diffusion and bulk flow of amino acids mediate calcium waves in plants appears, Science Advances. DOI: 10.1126/sciadv.abo6693

Heated plot experiments reveal link between warmer early winters and lower crop yields

Innovative experiments using temperature-controlled field plots have helped to explain the link between early winter temperatures and yield in some of our most marketable arable crops.

Laboratory and in-field technology enabled the team to simulate full growing seasons and establish that chilling is important in late November/early December because it promotes growth during early floral development of the crop.

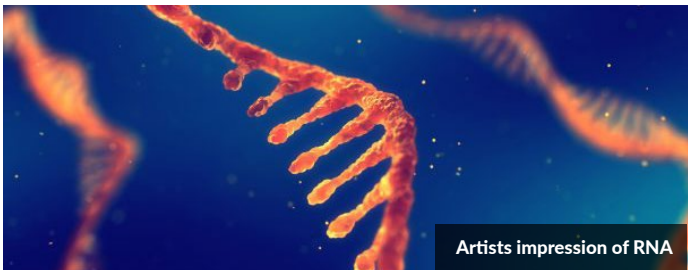
They showed that oilseed rape plants can undergo a developmental phase known as flower bud dormancy if the winter temperature is too warm. This physiological process occurs as the microscopic, newly formed buds lie inactive waiting for low temperatures to signal growth and is well understood in perennial plants, which grow year after year.

This development stage was not known to exist in annual crops.

Professor Steve Penfield said: "It was surprising to find that winter annuals have this flower bud dormancy – no one has ever suggested that this mechanism is important to flowering time control in annual plants."

Heated field trials at Church Farm

Winter warming controls flowering time via bud dormancy activation and affects yield in a winter annual crop, PNAS. DOI: 10.1073/pnas.2204355119.



Artists impression of RNA

How environmental changes affect the shapes of RNA in living cells.

The impact of environmental conditions on the dynamic structures of RNAs in living cells has been revealed by technology developed thorough a collaboration between the groups of Professor Dame Caroline Dean FRS and Dr Yiliang Ding. This research increases our understanding of what happens at single-molecular level in response to environmental signals and raises the possibility that we may use this knowledge to fine-tune crops or develop RNA-based therapies for diseases.

Dr Ding said: "Our work has shown that RNAs can adopt different conformations, or structures. These diverse conformations dynamically change in response to external conditions. In this study, by tuning the RNA structure, we altered the flowering time of the plant."

The understanding of how RNA structure affects RNA function and the ability to engineer plant genomes at the RNA cellular level, increases the possibility of designing crop types with more desirable agronomic and nutritional traits. The group says that the technology can also be applied to human cells where RNA structures could serve as a guide for designing RNA-based therapies.

In vivo single-molecule analysis reveals COOLAIR RNA structural diversity, Nature. DOI: 10.1038/s41586-022-05135-9

New Green Revolution gene discovery sows hope of drought-resilient wheat

Reduced height, or semi-dwarf, wheat varieties with improved drought resilience may soon be grown in fields across the globe following an exciting scientific discovery.

Dr Philippa Borril's team have discovered a new height-reducing gene, Rht13, which means that seeds can be planted deeper in the soil, giving access to moisture, without the adverse effect on seedling emergence seen with existing wheat varieties.

"We have found a new mechanism that can make reduced-height wheat varieties without some of the disadvantages associated with the conventional semi-dwarfing genes. The discovery of the gene, its effects and exact location on the wheat genome, means that we can give breeders a perfect genetic marker to allow them to breed more climate-resilient wheat," said Dr Borrill.

Varieties of wheat with the Rht13 gene could be rapidly bred into wheat varieties to enable farmers to grow reduced-height wheat in drier soil conditions.

An autoactive NB-LRR gene causes Rht13 dwarfism in wheat, PNAS.
DOI: 10.1073/pnas.2209875119

Sweet salvation – how a sugar cane pathogen is gearing up a new era of antibiotic discovery

A potent plant toxin with a unique way of killing harmful bacteria has emerged as one of the strongest new antibiotic candidates in decades. Albicidin is produced by the bacterial plant pathogen *Xanthomonas albilineans*, which causes the devastating leaf scald disease in sugar cane.

It has been known for some time that albicidin is highly effective at killing bacteria, including E. coli and S. aureus. But despite its antibiotic potential and low toxicity in pre-clinical experiments, pharmaceutical development of albicidin has been hampered because scientists did not know precisely how it interacted with its target, the bacterial enzyme DNA gyrase.

Dr Dmitry Ghilarov's research group exploited advances in cryo-electron microscopy to show that albicidin forms an L-shape, enabling it to interact with both the gyrase and the DNA in a unique way. In this state, gyrase can no longer move to bring the DNA ends together, an effect akin to a spanner thrown between two gears.

The way albicidin interacts with gyrase is sufficiently different from existing antibiotics that the molecule and its derivatives are likely to be effective against many of the current antibiotic-resistant bacteria.

Molecular mechanism of topoisomerase poisoning by a potent peptide antibiotic, Nature Catalysis.
DOI: 10.1038/s41929-022-00904-1

Can gene discovery methods halt the global march of wheat blast?

An international research collaboration has used innovative genomic discovery methods to show how we might halt the emerging and highly destructive disease, wheat blast. In experiments, researchers identified two genes that protected experimental wheat plants against exposure to the fungal pathogen *Magnaporthe oryzae*, which causes blast.

To make the discovery, the team used a technique called AgRenSeq, which allowed them to search for useful genes among a panel of heritage wheat varieties called the Watkins Collection. They also searched among wild grass relatives of wheat.

Professor Paul Nicholson said: "We have made an important discovery on an emerging disease that threatens global food security and, in the process, highlighted the power of the Watkins Collection and the AgRenSeq genomic toolkit. Now our role is to interact with organisations such as (global research non-profit) CIMMYT to provide information on additional resistance genes and enable them to ensure that their breeding materials contain these genes so that they are protected against blast."

A wheat kinase and immune receptor form host-specificity barriers against the blast fungus, Nature Plants.
DOI: 10.1038/s41477-023-01357-5

Impact Report Summary

In 2022, the John Innes Centre commissioned Brookdale Consulting to produce an updated socio-economic impact assessment

The emerging socio-economic impacts from our research have been quantified using case studies from across our patent portfolio and include impactful research in agri-tech for food security, health and innovation in natural and new-to-nature chemicals. The report highlights JIC's significant contributions to the UK economy and its position as a global leader in science, knowledge and innovation.

WE SUPPORT 881 JOBS

Our extensive training activities are estimated to contribute £89m to the UK economy over the next decade and £49m internationally.

RETURN ON INVESTMENT

for every £1 invested in the John Innes Centre,

£15.29 is generated

for the wider UK economy

Return on Investment is based on a sample of commercialisation projects and research costs.

FOOD SECURITY

With the global population expected to reach nine billion by 2050, our research on improving wheat and oilseed rape yields and mitigating the impact of vernalisation in brassicas is crucial for ensuring food security.

HEALTHIER FOR LONGER

As the proportion of UK citizens living beyond 65 increases dramatically, our fundamental bioscience research on resistant starch, antibiotics and other high-value compounds is critical to enabling people to stay healthy and active for longer.

HIGH-VALUE PRODUCTS FROM PLANTS

JIC's research in developing high-value products from plants, such as adjuvants and drugs, improving extraction sustainability, and increasing oil content in oilseed rape, has the potential to revolutionise the renewable energy and chemical industries.

JIC IS RANKED AMONG THE TOP TEN INSTITUTIONS IN THE WORLD FOR PATENT INFLUENCE

Organisational achievements

"Very good to exceptional" scores for John Innes Centre in assessment exercise

Every five years, BBSRC conducts a review of its strategically funded institutes, known as the Institute Assessment Exercise, or IAE.. The process is designed to ensure that the institutes deliver excellent, strategically relevant research and that BBSRC's investments provide value for money.

This review informs future funding decisions, enabling BBSRC to comply with government policy and providing accountability to wider stakeholders. The IAE submission was scored on a scale of 1 to 6, and the JIC scores for each component of the assessment ranged from 4 to 6, which classified the institute as very good to exceptional.

The 2022 Institute Assessment Exercise was designed to support the implementation of the BBSRC Institute Strategy. The ten overarching principles that frame this strategy address the institutes' unique national capability and strategic purpose; excellence in leadership and management; their role in training and developing a positive, inclusive and diverse research culture; and convening and catalysing, both nationally and internationally.

Three themes of Capability, Connectivity and Culture underpin the ten principles for strategic investment. A key part of the IAE submission was how JIC would address these principles and themes.

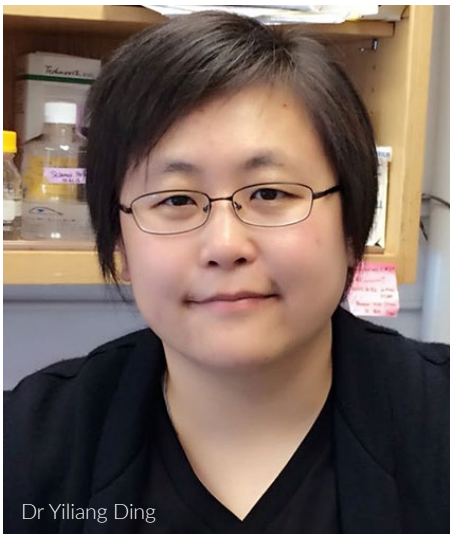
UKRI Biotechnology and Biological Sciences Research Council

Two prestigious European Research Council (ERC) grants

Dr Yiliang Ding received an ERC consolidator grant, which allows her research group to take forward their field-leading research into the structure of RNA.

"This is a genuinely blue-sky, high-risk, high-gain interdisciplinary programme with the potential to provide a breakthrough in understanding at the leading edge of the international RNA biology field," said Dr Ding.

The grant will fund a project named Venture, which will investigate the role that RNA structure plays in messenger RNA (mRNA) export – that is, the movement of information-carrying molecules from the cell nucleus to the cytoplasm where proteins are made.



Dr Yiliang Ding

Professor Saskia Hogenhout

Professor Saskia Hogenhout received an ERC Advanced Grant to further long-term investigations by the team into how virulence proteins, named SAPs, modulate plant processes to promote colonisation by the bacteria and their insect vectors.

Advanced Grants support excellent, established research scientists and scholars in any field.

The five-year project called SAP-ERASER is an ambitious high-risk/high-gain programme to deliver a radically novel Targeted Protein Degradation (TPD) technology. "The project enables us to investigate the mode of action of SAP virulence factors and opens up unprecedented opportunities for a new TPD technology," said Professor Hogenhout.

> The project enables us to investigate the mode of action of SAP virulence factors and opens up unprecedented opportunities

Healthy people at the John Innes Centre

Embedding a positive culture

To support our work embedding a positive research culture at the John Innes Centre, this year we launched the Culture Champions. This small group of staff support positive behaviours at work, provide an independent point of contact when any concerns arise, can signpost to other initiatives and help, and will offer support to help colleagues find a positive way forward.

How we interact with others plays a major role in creating a supportive and inspiring working environment. Sometimes we don't get it right and some well-timed feedback, seeing someone do it differently, or having a sounding board and help to raise concerns can make all the difference.

The Culture Champions help by supporting others, by being active bystanders and role models and by signposting others to find the support and guidance that they need. They are informal, confidential and independent points of contact for staff.

Our first Culture Champions are, from left: Richard Morris, Clare Stevenson, Gary Creissen, Teresa Penfield, Matt Bush

Women in Wheat

Women in Wheat is a targeted career development programme established in 2019 to address the lack of female representation in wheat research at the independent career stage. It aims to support early-career female researchers to continue working in wheat research and attain senior research positions.

In August 2022, a career development training and networking event was held for 14 early-career researchers from the John Innes Centre, The Sainsbury Laboratory, Rothamsted Research and the University of Nottingham.

This training and networking event included one-to-one mentoring, inspirational career talks from external speakers working in wheat research, and targeted career development training. Over two days, attendees covered topics such as leadership skills, time management and work-life balance, influencing change and being an active bystander.

Since the Women in Wheat mentoring programme was established, 28 participants from across the John Innes Centre and The Sainsbury Laboratory have benefited. Four participants have secured independent research positions in academia, two have secured positions in industry, and others have secured fantastic postdoc opportunities.

Celebrating Athena Swan Gold Renewal

In 2023, we successfully renewed our Athena Swan Gold Award, recognising our continuing commitment to gender equality. The Athena Swan Charter, run by Advance HE, is a framework used across the globe to support and transform gender equality within higher education and research. Director of the John Innes Centre, Professor Graham Moore, welcomed the renewal: "I am delighted that we have successfully renewed our Athena Swan Gold Award. I have seen significant progress towards gender equality since we started working towards our first award in 2013. To achieve a Gold award and to maintain and improve on these high standards is excellent news and I want to thank everyone involved in supporting this activity. Our new action plan is challenging and we hope it will address the areas where more progress is needed. I believe our positive research culture helps us to deliver as a global leader in plant and microbial research and reinforces the notion that excellence in research is intimately linked with equal opportunities."

Awards and honours

Three honours for Professor Anne Osbourn OBE, FRS

Over the past 12 months, Professor Osbourn has been recognised with three honours that show the scientific excellence and societal relevance of her pioneering work. Anne was elected as a member of the prestigious European Molecular Biology Organisation (EMBO), and as an international member of the National Academy of Sciences (NAS), one of the United States' highest honours for scientists, engineers and health professionals. The third accolade was the prestigious 2023 Novozymes Prize for her work in helping to produce important drugs in greater volumes and improving the natural defence systems of plants. The Prize, awarded by the Novo Nordisk Foundation, recognises outstanding research or technology contributions that benefit biotechnological science.

Rank Prize for Nutrition 2022

Professor Cathie Martin was awarded the prestigious Rank Prize for Nutrition 2022 for her globally significant research in making fruit and vegetables more nutritious. The award recognises those who have made a significant contribution to human and animal nutrition, where their ideas have been carried through to practical benefits to humankind.

Professor Dale Sanders said: "The awarding of this prestigious prize is wonderful recognition for the enormous impact her work has had in the field of metabolic engineering. From fundamental discovery to innovative ways of improving human diet, Cathie's research contributions have been inspirational."

Cathie's research into plant genetics and metabolism uses plant science tools to improve human diet and health with emphasis on biofortification and using plant metabolic engineering to enhance foods nutritionally.

Royal Society Rosalind Franklin Award

Professor Diane Saunders was the recipient of the 2022 Rosalind Franklin Award. This recognises her long-term achievements in the field of plant pathology and will support activities to improve representation of women in STEM roles. This award will fund the development of the Rosalind Franklin Women in Wheat Champions programme that will promote the career development of women particularly in wheat research.

Dr Philippa Borrill

Received the President's Medal from The Society of Experimental Biology (SEB). The award honours outstanding early-career scientists and is presented at the SEB annual conference each year.

Professor Martin Howard

Awarded the 2022 Institute of Physics Rosalind Franklin Medal. The prestigious award recognises Professor Howard's pioneering work in applying concepts from statistical physics to molecular biology.

Dr Susan Schlimpert

Named as a new member of the EMBO (European Molecular Biology Organisation) Young Investigator Programme. The prestigious programme supports outstanding early career group leaders who have an excellent track record of scientific achievement. Dr Schlimpert's group investigates molecular mechanisms that underpin the lifecycle of *Streptomyces* bacteria, producers of more than 50 per cent of all clinically used antibiotics.

Professor Paul Nicholson

Received the British Society for Plant Pathology's RKS Wood Prize in recognition of his contribution as a researcher and mentor.

Building entrepreneurial skills

Flexible Talent Mobility Accounts (FTMAs)

FTMAs are competitively awarded grants that enable us to support the mobility and training of researchers interested in pursuing careers in, and making links with, industry.

In the six years leading up to March 2023, we supported 89 individuals through the programme to learn about a different role, gain new skills and access career development support and training without having to step out of their permanent roles. The FTMA grant also enabled scientists and industry collaborators to spend time on secondment placements inside the John Innes Centre.

Activities included supporting 39 researchers and two students into UK or international work placements in industry, three tenure-track fellows to strengthen links with industrial partners, 43 technicians and three students with personal development training and career networking opportunities, two external industry partners on placements within JIC.

So far, 29 per cent of participants in the programme secured a permanent role in industry or academia as a direct result of the upskilling and experience gained during their placement or training.

David Laurie, a farmer, was supported by the FTMA programme to undertake a three-month project with Dr Maria Hernandez-Soriano.

We asked him how the programme has helped to develop his ideas, "Without the FTMA I would still be trying to convince people that our product works, but only with the benefit of anecdotal research. The benefit of a collaboration with the John Innes Centre and its scientists is immeasurable to a company with innovative and unusual solutions."

As this project ended, David sourced additional funding to continue his research with Maria, and commented, "This project is the culmination of many years' research, so to finally meet people who understood what I was trying to achieve and to understand how our product worked was refreshing."

ICURe

The BBSRC ICURe and ICURe Lean Launch programmes provide training, funding and support for research teams to 'get out of the lab' and validate commercially promising ideas, products or services based on their life science ideas, research, science and technologies. Last year, three John Innes Centre scientists were awarded places on these programmes: Dr Rosaria Campilongo, Dr Diego Durantini and Dr Yueying Zhang.

Rosaria identified market opportunities for PfBIO, a JIC spin-out that uses beneficial environmental bacteria to suppress plant diseases. She found the programme to be a very useful experience. Rosaria particularly enjoyed learning how to take a commercially relevant scientific idea from the bench to the real world by focusing on market research and idea validation activities.

Diego explored the potential opportunities for MVPea and learnt how to commercialise research in pea genetics and human health into a nutritious and delicious pea-based food product.

Yueying learnt how to commercialise the DaVinci RNA idea, a technology platform that uses in-vivo RNA structure information to design improved inhibitory RNAs that can be used to target viruses.

> "I found the ICURe boot camp and pitch training very valuable, as well as the digital support to conduct digital experiments based on marker research" Dr Diego Durantini, now at Agritech-E

Stakeholder Engagement: Precision Breeding (Gene Editing)

Our scientists provided evidence to government on the benefits of gene editing to help tackle the complex challenges of climate change, food security and disease

One area of policy where we have made clear and evidenced impact is in supporting development of a new regulatory system for gene edited crops.

The Genetic Technology Act, which passed into law in March 2023, will allow us to work more closely with farmers, crop breeders and food producers to deliver innovative improvements to crops to benefit our health and the environment.

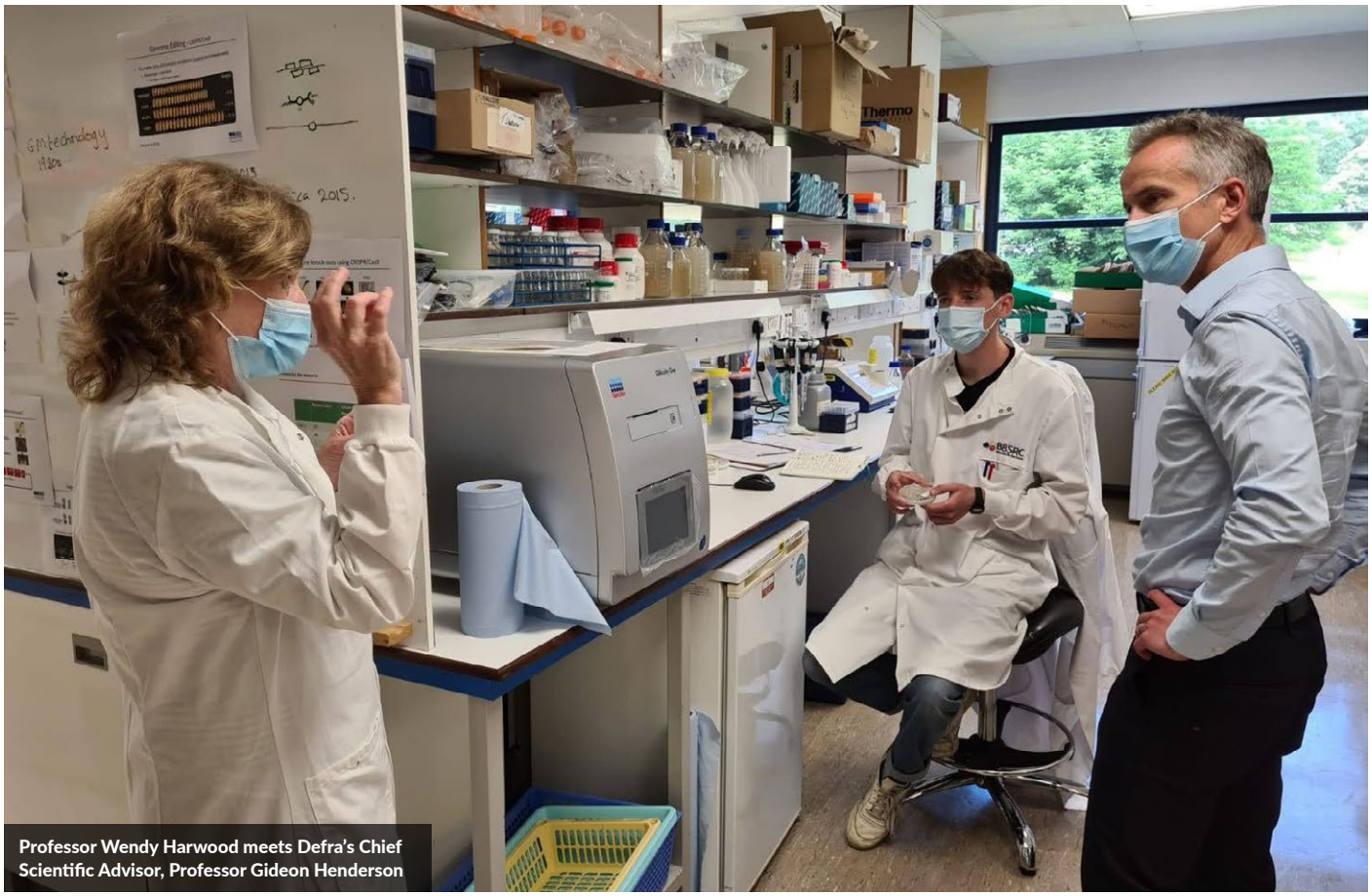
Over the past two years, the John Innes Centre has worked closely with partners across the Norwich Research Park to engage and inform Defra, the Food Standards Agency and parliamentarians about genetic technologies, the impact previous legislation has had on our research, and advise on future policy direction..

This collaborative approach enabled us to provide evidence and advice and ensure that scientists were involved at key points in the development of the legislation. JIC research was used as case studies throughout the process and our researchers gave evidence in parliament to inform and advise decision makers.

Director of the John Innes Centre, Professor Graham Moore, said: "Our scientists use gene editing to improve the crops we eat every day, including wheat, cabbage, tomatoes and peas. The new legislation will allow us to help UK farmers grow higher yielding, more resilient crops, and provide consumers with food that is healthier for them and the environment."

Professor Moore continues: "We must use technologies such as gene editing if we are to meaningfully tackle the complex challenges of climate change, food security and disease. The Precision Breeding Act allows our scientists to work more closely with food producers to address these complex issues and at the same time capitalise on the UK's world-leading research expertise in these areas.

We continue to work with Defra and the Food Standards Agency to develop the secondary legislation to allow farmers, food producers and consumers in England to make the most of this opportunity to deliver real impact from our research into plant and microbial sciences.



Professor Wendy Harwood meets Defra's Chief Scientific Advisor, Professor Gideon Henderson

Institute Strategic Programmes 2023–2028

The John Innes Centre will steer the world towards net-zero agriculture and a more sustainable future with new five-year strategic research programmes

The John Innes Centre was awarded £76.6m in funding from the Biotechnology and Biological Sciences Research Council (BBSRC), part of UKRI. This supports four strategic research programmes, our technology platforms, scientific support services and Germplasm Resources Unit. The research programmes enable research across plant and microbial science, from the unlocking of the remarkable and under-exploited biosynthetic capabilities of plants and microbes, to the understanding and delivery of sustainable, resilient and robust high-yielding crops.

This strategic investment will enable us to continue our research and to invest in delivering solutions that contribute to the national priority of a more secure and sustainable future.

Professor Graham Moore said, "These five-year strategic research programmes allow us to continue our work to understand how we can support the transition to net-zero agriculture, improve public health and mitigate the effects of climate change on food security with our research into plants and microbes."

Germplasm Resource Unit

The Germplasm Resource Unit (GRU) houses one of the world's most important collection of seeds and aims to capture the broadest possible gene-pool diversity of the UK's major strategic crops and crop wild relatives.

The GRU supports plant science and crop improvement through the preservation and development of wheat, pea, barley and oat germplasm and is designed to support UK cereal breeding requirements. The collections include crop wild relatives, traditional landrace, adapted and elite cultivars, as well as derived lines, mapping populations and induced (mutagenised) diversity panels. Seeds are kept in a specialised cool-dry chamber to prolong their life and are regenerated on a 20–30-year cycle.

Delivering Sustainable Wheat (DSW)

Addressing critical challenges in wheat health, yield and production to safeguard the future of this global crop, DSW brings together four institutes – the John Innes Centre, Rothamsted Research, Quadram Institute and Earlham Institute, plus the National Institute of Agricultural Botany, the universities of Leeds, Nottingham, Lancaster and Bristol, and Imperial College London. This coordinated and collaborative initiative aims to safeguard the future of wheat.

Advancing Plant Health (APH)

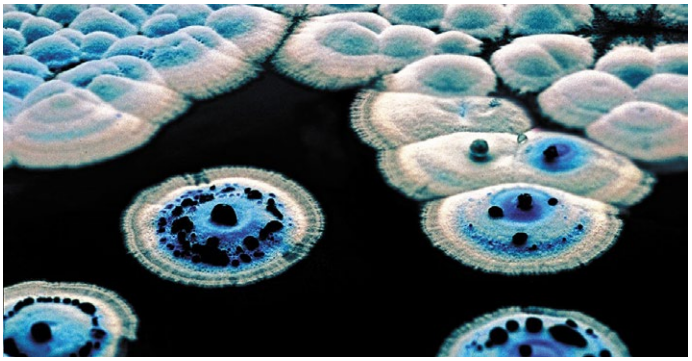
New solutions to promote beneficial interactions and disease/pest resistance in crops of both national and global significance, integrating expertise from the John Innes Centre and The Sainsbury Laboratory.

Building Robustness in Crops (BRiC)

Delivering genetic diversity and knowledge, innovative technologies and training to allow sustainable production of robust, high-yielding crops, including oilseed rape, pea, cereals and brassica vegetables to identify and overcome key challenges caused by our changing climate.

Harnessing Biosynthesis for Sustainable Food and Health (HBio)

Unlocking the remarkable and under-exploited biosynthetic capabilities of plants and microbes to make valuable new molecules to address global challenges of food security and human health.



New appointments and fellowships

Professor Graham Moore – Director

Following an international search, Professor Moore, a world-leading wheat researcher was appointed Director of the John Innes Centre in September 2022.

Professor Moore is internationally known for his work on wheat, one of the most important global crops, and his research has provided a huge impact on cereal research. He has worked at the John Innes Centre for over 30 years, previously holding posts including Deputy Director, Head of Department, and over the past 12 years, he has coordinated the cross-institutional wheat programme, involving eight UK institutions. He developed the concept of cereal synteny, for which he was awarded the Royal Society Darwin Medal. In 2018, he was awarded the Rank Prize for Nutrition for his contribution to research.

Sir Thomas Hughes-Hallett, Chair of Governing Council for JIC, said: "Graham is an outstanding scientist who will be a world-class Director for the John Innes Centre. He has decades of experience in crop improvement as well as a strong appreciation for the fundamental discovery research that makes the JIC so respected. We are delighted that he has accepted the position and know he will provide exceptional leadership in his new role."

Graham Moore

Clare Stevenson

Dr Clare Stevenson – Head of Directorate

Dr Stevenson joined the leadership team in April 2022, working closely with the Director to ensure that the John Innes Centre continues its world-class programme of research and delivers its ambitious plans for the future.

The Head of Directorate acts as an interface between the Director and many aspects of day-to-day functioning of the institute by providing support, advice and the strategic context required for leadership.

Clare, a structural biologist, managed a technology platform at the John Innes Centre for many years and is proud to have had a technical career path that has led to senior management. She believes that the people at the John Innes Centre are our strength and is committed to developing and contributing to our diverse, inclusive and positive research culture where all contributions are recognised.


Dave Foreman

Dave Foreman – Chief Operating Officer

Dave Foreman joined John Innes Centre as Chief Operating Officer in April 2023. He works closely with the John Innes Centre's Director to ensure delivery of our scientific vision.

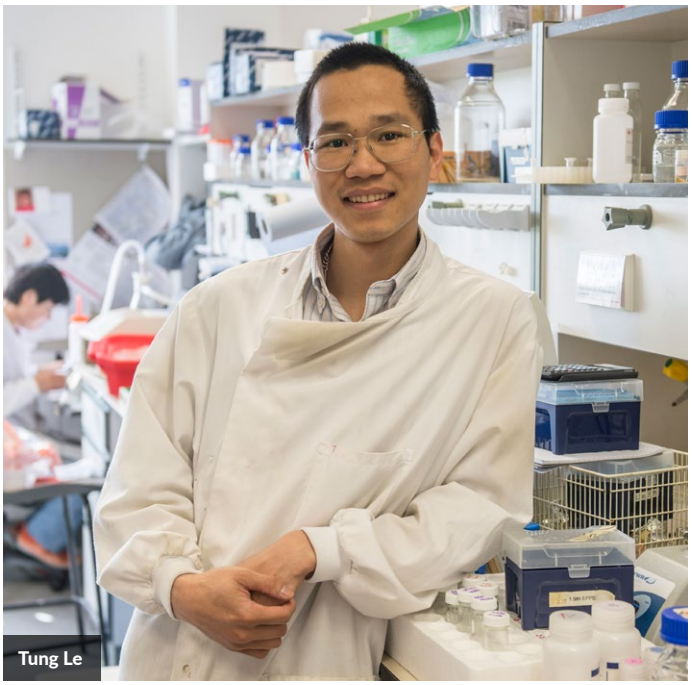
Before joining the John Innes Centre, Dave was the Finance Director for the Norwich Bioscience Institutes Partnership for 11 years.

As Chief Operating Officer, Dave is responsible for leading, developing and coordinating JIC's operational strategy and providing advice and guidance to ensure the development and smooth running of the institute. He is also the Senior Responsible Owner for the Next Generation Infrastructure Programme to deliver new cutting-edge, world-class facilities for the JIC and The Sainsbury Laboratory.


Rebecca Devine

BBSRC Discovery Fellowship

Dr Rebecca Devine has been awarded a BBSRC Discovery Fellowship to take forward her innovative research into finding the antibiotics of the future.


Tung Le

Lister Fellowship

Dr Tung Le, Group Leader, has been awarded a prestigious Lister Fellowship in recognition of his group's innovative research and its potential for antibiotic discovery.

Future Plans

The next 12 months will be an exciting time as we ramp up activity to deliver the Next Generation Infrastructure programme, embed our new Institute Strategic Programmes and embark on a major fundraising campaign to secure the future of the John Innes Centre

NEXT GENERATION INFRASTRUCTURE

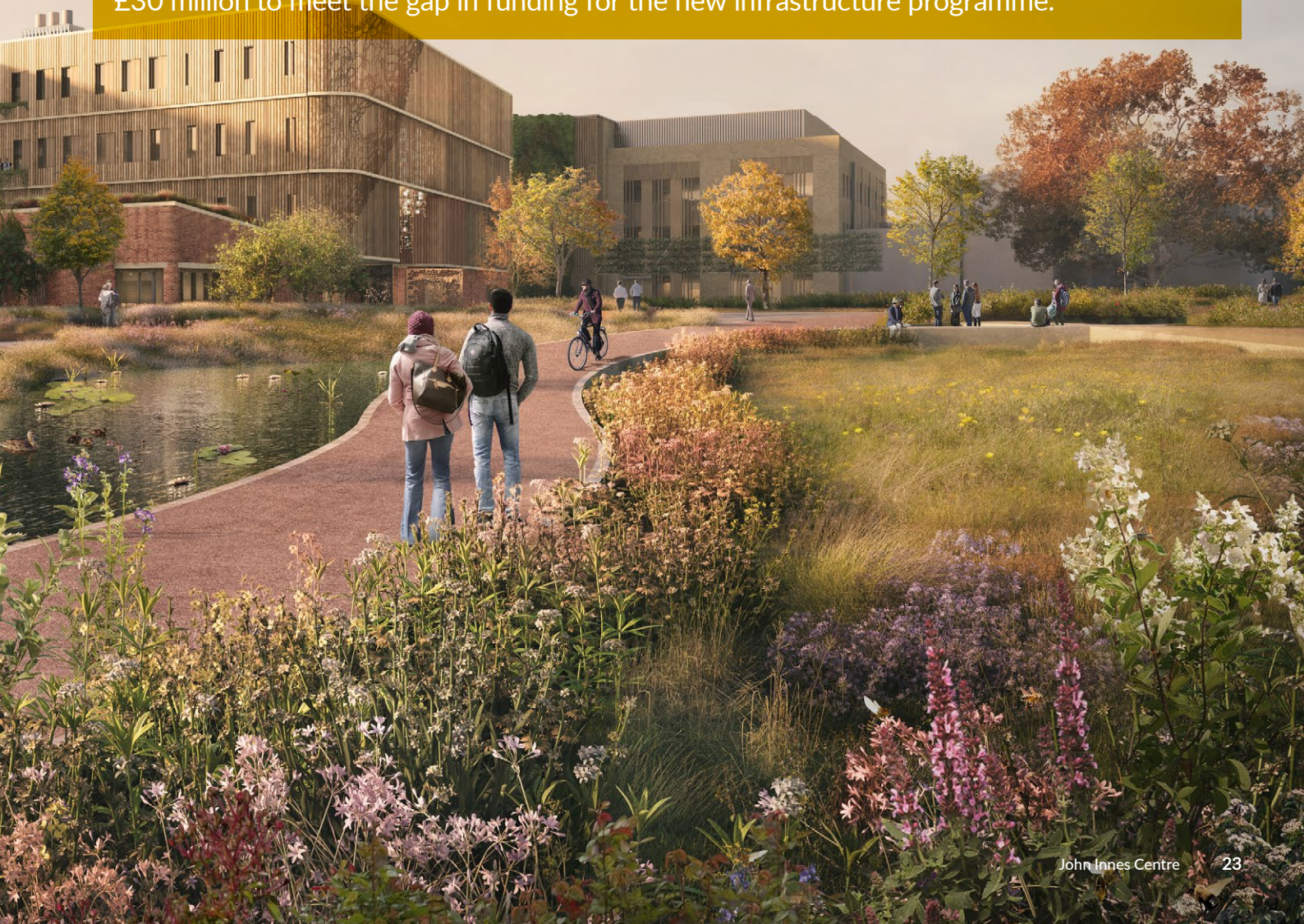
We have secured UKRI capital funding to support the creation of world-leading research infrastructure for the John Innes Centre and The Sainsbury Laboratory here on the Norwich Research Park. The next 12 months will see the start of the redevelopment of our horticulture facilities, Germplasm Resource Unit and Insectary, and we will complete the next phase of design work for the new laboratory building.

INSTITUTE STRATEGIC PROGRAMMES

Following the award of our five-year strategic funding in 2023, we will work to embed the four research programmes into the institute and will work closely with our existing and new partners to ensure that Advancing Plant Health (APH), Building Robustness in Crops (BRiC), Delivering Sustainable Wheat (DSW) and Harnessing Biosynthesis for Sustainable Food and Health (HBio) can deliver their objectives. Turn to page 18 to read more about these programmes.

MAJOR FUNDRAISING CAMPAIGN

We will launch a new fundraising campaign to raise capital to support the delivery of our vision, Healthy Plants, Healthy People, Healthy Planet. This campaign will raise the final £30 million to meet the gap in funding for the new infrastructure programme.



John Innes Centre

Unlocking Nature's Diversity

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