University of BRISTOL

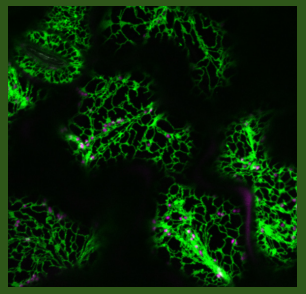
Bristol Centre for Agricultural Innovation

# Bristol Centre for Agricultural Innovation

bristol.ac.uk/biology/bcai

The Bristol Centre for Agricultural Innovation supports world-leading plant and agricultural sciences at the University of Bristol through research, innovation, engagement and translation.

*Wheat field I Photo credit: Helen Harper*



*Florescent microscopy of plant organelles Photo credit: Chiara Perico*

*Life Sciences I Photo credit: Life Sciences stock photos*



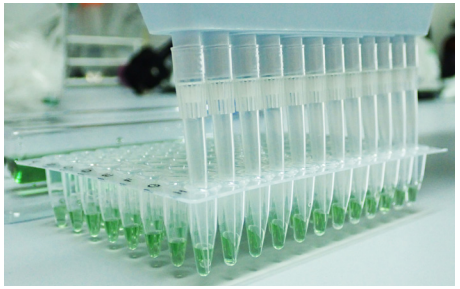
# About BCAI

The Bristol Centre for Agricultural Innovation (BCAI) is supported by funding from the Lady Emily Smyth Trust, established at the University of Bristol in 2003. BCAI provides funding to University of Bristol academic and research staff to promote and support plant and agricultural research, with particular reference to arable, fruit and vegetable systems.

The BCAI fund is managed by a board of academics, from multiple disciplines, who are appointed for three-year terms. The current management team is chaired by Professor Gary Foster.

*Bramley apple blossom I Photo credit: Helen Harper*

# BCAI Funding



*Life Sciences labs I Photo credit: Helen Harper*

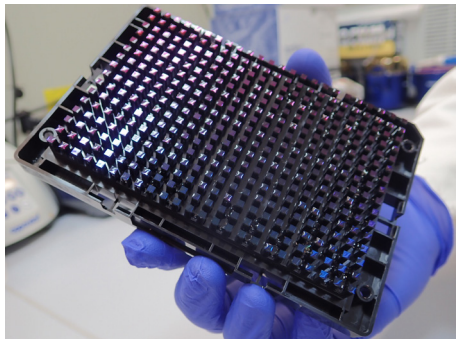
BCAI offers grants with the following remit:

- Novel cutting-edge research projects
- Match funding to underpin research and studentship applications
- Pump priming new research proposals to facilitate the award of further funding
- Development of collaborations between University of Bristol staff with a shared interest in agricultural research
- Research equipment relating to agricultural research
- Meetings that facilitate future research collaborations with external partners or industry
- Promotion of agricultural research in the form of workshops, lectures and educational outreach

Further information on funding can be found on the BCAI website: www.bristol.ac.uk/biology/bcai/

# BCAI Research Community

The main objective of the BCAI research community is to conduct innovative research which advances the societal challenges of sustainable agriculture and food security. Solutions to these challenges are multi-faceted, requiring a broad interdisciplinary approach from a variety of research areas. We have particular strengths in genomics, bioinformatics, plant development, plant pathology, nanophotonics, ecology, cell signalling and systems biology.



*Genotyping Microarray*
*Photo credit: Helen Harper*

BCAI supports research across seven main themes:

- Precision agriculture
- Plant-insect interactions
- Crop protection
- Ecology and sustainable agriculture
- Crop genomics
- Plant-environmental interactions
- Translating fundamental research to crops

*Winter Wheat I Photo credit: Helen Harper*

bristol.ac.uk/biology/bcai

# 1. Precision Agriculture

Precision agriculture aims to increase productivity and reduce the environmental impacts of farming by ensuring that crops are given the optimal amount of water, light and nutrients.

BCAI supports a range of projects within this theme, examples of BCAI funding include:

- Understanding the impact of photoperiod and light intensity on plant growth in vertical farms
- Studying the influence of carbon nanoparticles in enhancing crop yield

*Vertical Farming I Photo credit: Jack Wiseall, LettUs Grow*

# 2. Plant-Insect Interactions

*Honey Bee on Lavender I Photo credit: Helen Harper*

*Small cabbage white butterfly caterpillar I Photo credit: Helen Harper*

Within this fascinating theme, researchers investigate the complex interactions taking place between insects and plants. Interdisciplinary research is key to understand interactions with a wide variety of techniques used by researchers from field experiments to molecular approaches.

Examples of research funded by BCAI include:

- Characterising the role of gloss in plant-pollinator signalling
- Exploring the role of wasps as biological pest controllers in agricultural environments
- Understanding the effect of power lines on pollinators.

# 3. Crop Protection

Crop protection has a vital role in stabilising global food security. Plant diseases, weeds and pests can affect crop productivity by significantly reducing yield, impacting the appearance and nutritional composition of the crop and reducing shelf-life.

BCAI funds projects that investigate a wide range of innovative plant protection technologies, at times working alongside industrial partners and international collaborators to identify key issues.

Examples of BCAI funding:

- Biocontrol of plant pathogen *Armillaria*
- Investigating Cassava brown streak disease
- Discovery of novel crop protection agents
- Gene editing of the plant pathogen *Armillaria mellea*

*Strawberry plant with Armillaria infection I Photo credit: Helen Rees*

*Cassava brown streak disease I Photo credit: Richard Wyatt*

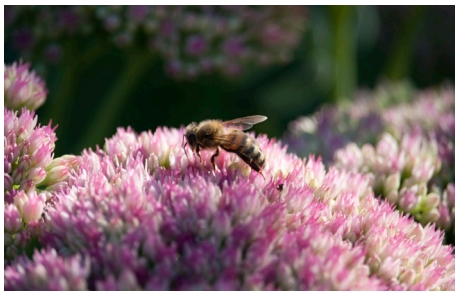
bristol.ac.uk/biology/bcai

# 4. Ecology & Sustainable Agriculture

Approximately one third of the Earth's land is used to produce food. At this vast scale many agricultural practices contribute to greenhouse gas emissions, habitat and biodiversity loss, soil degradation and freshwater consumption. Our changing climate is predicted to affect agriculture with increased likelihood of extreme weather events such as heatwaves, droughts, floods and storms as well as rising temperatures, sea level changes and fluctuations in rainfall. However, efficient sustainable agriculture can be part of the solution to climate change. In this theme researchers explore how knowledge of ecology can guide agricultural sustainability.

Examples of BCAI funding:

- BCAI is co-funding a study of the effect of climate change on pollinators.
- Understanding the effects of restoring native grasslands on pollinators and decomposers.



*Honey Bee on sedum I Photo credit: Helen Harper*

*Beautiful Demoiselle I Photo credit: Helen Helen Harper*

*University of Bristol Wild flower Meadow I Photo credit: Helen Harper*

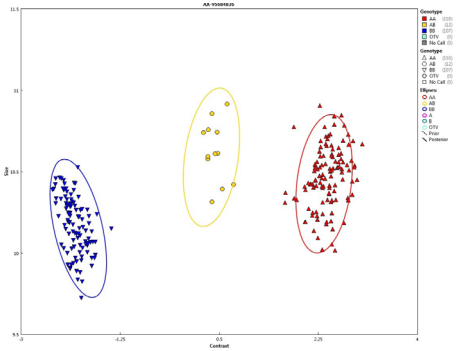
*Restoring degraded land to revive native biodiversity also benefits nearby agricultural land by providing key ecosystems services (maintenance of fresh water and pollinators).*

# 5. Crop Genomics

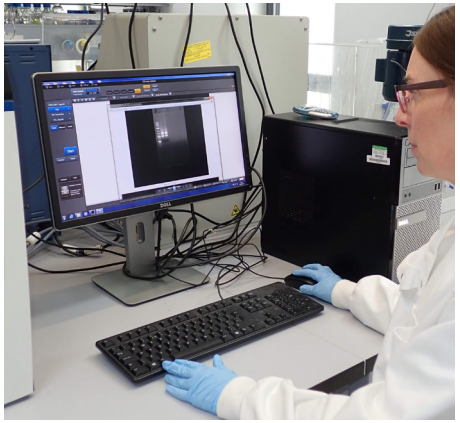
Recent advances in genomic technology have played a key role in increasing crop productivity and efficiency; enabling the development of new crop cultivars with increased yield, greater resistance to pests and capable of growing in a wider range of conditions. Within the Crop Genomics theme BCAI has funded a range of projects, often working with industrial partners.

Examples of BCAI funding include:

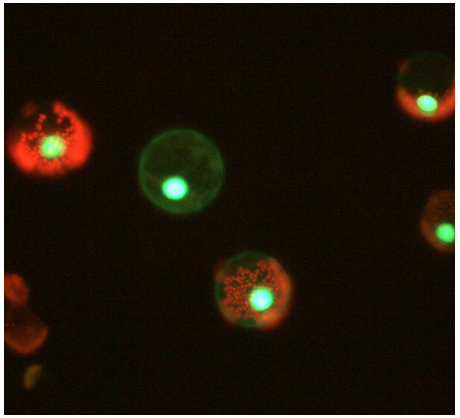
- Identifying the genetic diversity of cider apples.
- Engineering larger wheat ears.
- The creation of the Gene Editing Facility, which provides core expertise in gene editing in a range of plant species.



*Genotyping cluster analysis' I Credit: Amanda Burridge*



*Life Sciences Labs I Photo credit: Lucia Primavesi*



*Fluorescent labeled transformed wheat protoplasts*
*Photo credit: Mark Winfield*

bristol.ac.uk/biology/bcai

# 6. Plant-Environmental Interactions

In this theme researchers explore the effects of environmental stresses on plants, identifying the mechanisms plants have evolved to deal with environmental challenges and in turn, understanding the influence plants can have on the environment.

Examples of BCAI funding in this area:

- Exploring the effects of increased atmospheric $CO^2$ on the composition of wheat grains
- Exploring circadian regulation under natural conditions
- Investigating root and shoot growth at increased elevations and different soil types
- Investigating the effects of shading on plant development

*Wheat I Photo credit: Helen Harper*

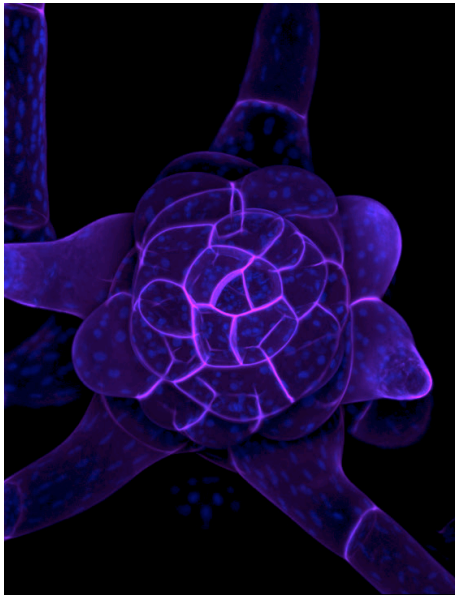
*Coriander I Photo credit: Helen Harper*

# 7. Translating Fundamental Research to Crops

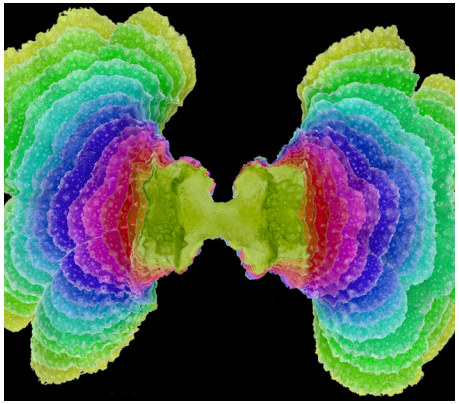
In this theme BCAI funded research focuses on understanding the fundamental mechanisms controlling the development and growth in model plant species and seeks to apply this knowledge to crops.

Examples of BCAI funding:

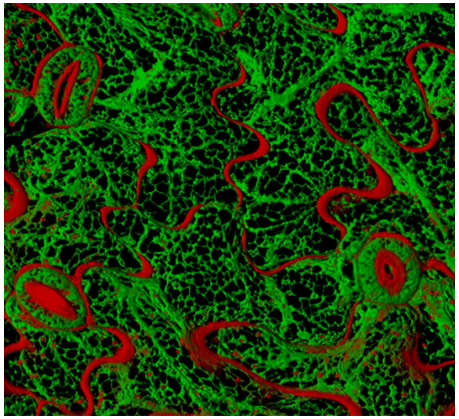
- Studying organelle movement in plants
- Translating knowledge of branching in lower plants to crops



*Microscopic view of a moss shoot tip I Photo credit: Jill Harrison*



*Overlaid time-lapse images of a liverwort, Marchantia polymorpha Photo credit: Jeremy Solly*



*Florescent labelled organelles in Arabidopsis Photo credit: Imogen Sparkes*

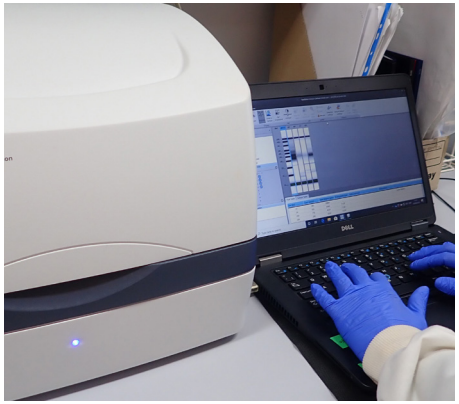
bristol.ac.uk/biology/bcai

# Facilities for BCAI research

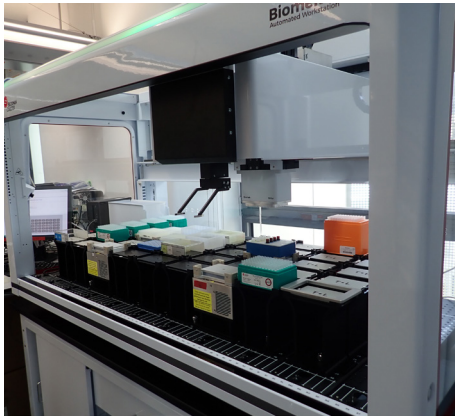
BCAI funded researchers, working at the University of Bristol, have access to excellent facilities in state-of-the-art research laboratories as well as experimental glasshouses, controlled environmental units and sixty-two acres of experimental agricultural land.

Research staff are supported by laboratory managers, horticultural staff. Research staff and students are able to access a wide range of excellent in-house facilities including: the Bristol Genomics Facility, Wolfson Bioimaging Facility and the Proteomics Facility.

*Experimental system for stomatal bioassays Photo credit: Helen Harper*



*Agilent TapeStation 2200 Nucleic acid system, Genomics Facility Photo credit: Helen Harper*



*Beckman Coulter Biomek i7 Liquid Handler, Genomics Facility Photo credit: Helen Harper*

bristol.ac.uk/biology/bcai/

# BCAI Events and Training

BCAI holds workshops and laboratory training sessions throughout the year.

Annually BCAI supports the Lady Emily Smyth Studentships; two fully funded MRes Studentships at the University of Bristol.

To join the BCAI mailing list please email:
uob-bcai@bristol.ac.uk

*Photo credit: Helen Harper*