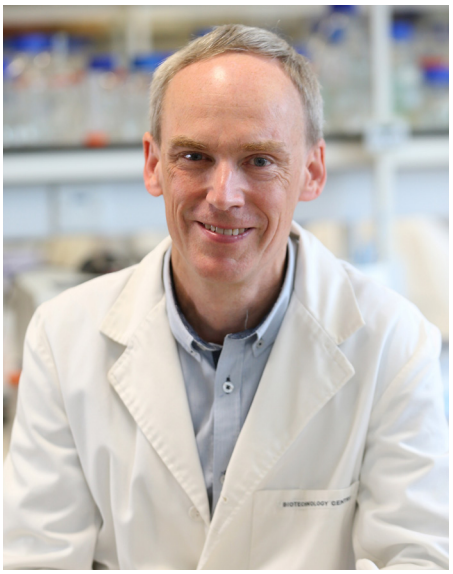
CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

School of Biosciences
Ysgol y Biowyddorau

Research Strategy | BIOSI 2030



Jim Murray: Our research addresses the major global challenges of today, seeking to deliver new solutions with major economic, societal and environmental impact. We provide a dynamic and stimulating environment to nurture cutting-edge research across the areas of Biomedicine, Molecular Biosciences, Neuroscience, and Organisms and Environment, gaining international recognition for our research.

Our 10-year Research Strategy, BIOSI 2030, aims to build on and integrate our current strengths across the biological and biomedical sciences. Its objectives highlight our ambition to promote interdisciplinary research and opportunities for collaboration, as well as strengthening the School's position in research grant income and attracting new talent to add to our pool of world-leading researchers.

BIOSI 2030 is a forward-looking vision of future research, underpinned by innovation, collaboration and sustainability, to provide the platform for our faculty to produce internationally leading research.

Equality, diversity and inclusion

We endeavour to promote equality and diversity in all of our practices and activities.

Our aim is to establish an inclusive culture which welcomes and ensures equal opportunities for applicants of all ages, ethnicities, disabilities, family structures, genders, nationalities, sexual orientations, races, religious or other beliefs, and socio-economic backgrounds.

Athena SWAN

We are proud to hold the Athena SWAN Silver Award and we continually strive to ensure gender equality.

Our research

The world faces unprecedented challenges to sustain the planet's ecosystems and keep its growing population healthy. Bioscience has a crucial role to play in both understanding the underlying mechanisms and in researching solutions.

Our research ranges across the biological and biomedical sciences and is led by internationally renowned researchers running dynamic research programmes with access to a range of state-of-the-art technology facilities.

We seek to support and build on our core strengths, with a focus on investment in key research priorities in:

1. Global change and its impacts
2. Molecular mechanisms of life and disease
3. Modelling and engineering living systems

Objectives

Our future research is supported by five themes:

1. Interdisciplinary Research Networks

We will build and promote opportunities in interdisciplinary research by drawing together networks across the breadth of the School and the University, positioning us to exploit new funding and research opportunities that transcend traditional discipline boundaries.

2. Collaboration

The School of Biosciences hosts three of the University's Research Institutes and provides substantial leadership for six other Institutes across Cardiff University. Within Cardiff, we will continue to enable collaboration of resources and expertise between University Research Institutes and across Schools. We seek to build further our international reputation and reach through the development of new collaborations and networking opportunities with leading global research centres.

3. Recruitment and Career Development

We aim to build on our research strengths and increase our existing team of world-leading researchers, seeking opportunities to bring in talent to develop and evolve these areas of research activity. We will focus on early career researchers bringing innovation and new ways of working, providing effective support for career development.

4. Investment for Research Success

The School established Technology Research Hubs in 2015 to provide access to state-of-the-art expertise and technology to support cutting-edge research and will continue to develop and invest in these Hubs. Research grant success will be built through effective mentoring and peer review of applications to support a growing portfolio of funding from all major funding councils and charities, with a specific aspiration to be in the top 15 universities in the UK for BBSRC funding.

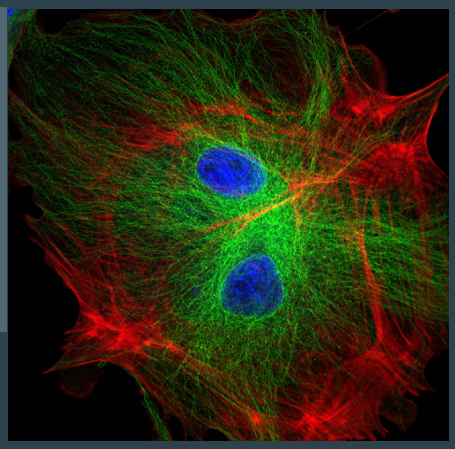
5. Cardiff Innovation System

Cardiff University's reputation for innovation is demonstrated by placing 36th in the European Most Innovative Universities in 2017. We will continue to build on these strengths to support University-level investments in innovation and new research areas.

Research Divisions

Our research is organised in four Divisions led by leading researchers, and spans the scales of biology, from the whole ecosystem to molecular biology and protein structure, including biomedical sciences and neuroscience.

Bovine pulmonary artery endothelial cells grown in monolayer culture conditions. Cell nuclei in blue, microtubules in green and actin stress fibres in red. Sample imaged by Dr Tony Hayes, Bioimaging Research Hub, Cardiff School of Biosciences, using a Zeiss LSM880 Airyscan confocal laser scanning microscope.



Research Institutes

The School of Biosciences hosts several of the University's Research Institutes:

European Cancer Stem Cell Research Institute, Water Research Institute and Medicines Discovery Institute.

We also provide substantial leadership for the Neuroscience and Mental Health Research Institute, Sustainable Places Research Institute, Dementia Research Institute, Arthritis Research UK Biomechanics and Bioengineering Centre and the Danau Girang Field Centre in Malaysia.

Organisms and Environment

Organisms and Environment aims to understand how organisms and their environment interact, including the fundamental biology, ecological health and consequences of environmental change on biological diversity to understand interventions that could support conservation in a period of global change.

This area of research is multidisciplinary in nature and the Division has strong links with research groups across the sciences and social sciences, as well as direct links with University Research Institutes. This includes the Water Research Institute, the Sustainable Places Research Institute and the Data Innovation Institute.

As well as representing a strong research facility in its field in the UK, the Division has an international reach through research at the Danau Girang Field Centre in Sabah, Malaysia. This division also has strong external affiliations with the Environment Agency and British Ecological Society, as well as multiple charities and non-government organisations.

The Organisms and Environment research strategy focuses on three specific areas:

- **Global change and resource resilience –** exploring the effect of climate change and other processes driven by man on organisms and ecosystems.
- **Conservation and evolution –** to elucidate how disease, parasitism and habitat loss affect species survival.
- **Understanding microbiomes and parasites –** addressing the challenges of understanding how microbiomes interact with their hosts to drive both health and disease.

Molecular Biosciences

Molecular Biosciences seeks to understand the molecular and cellular mechanisms of life, with applications in health, food security and technological development.

This research integrates basic biological research and develops cutting-edge techniques in biotechnology and modelling to allow us to predict how biological systems respond to change.

Our researchers explore the fundamental structure and interaction of molecules and cells, understand developmental processes in key model organisms especially plants and insects, develop and exploit novel imaging tools, and engineer biological systems for beneficial functions such as crop production.

The Division also leads five of the seven Technology Research Hubs within the School of Biosciences, reflecting its technological strengths.

Molecular Biosciences research strategy areas are:

- **Understanding molecular and cellular systems –** using biochemical, structural and cellular phenotyping approaches to understand biological function at the molecular level
- **Developmental biology and modelling –** taking multiscale approaches to understand and model developmental and stem cell processes in key model organisms such as insects and plants.
- **Imaging and engineering biological systems –** using interdisciplinary approaches in biology, physics and chemistry to image and engineer biological systems.

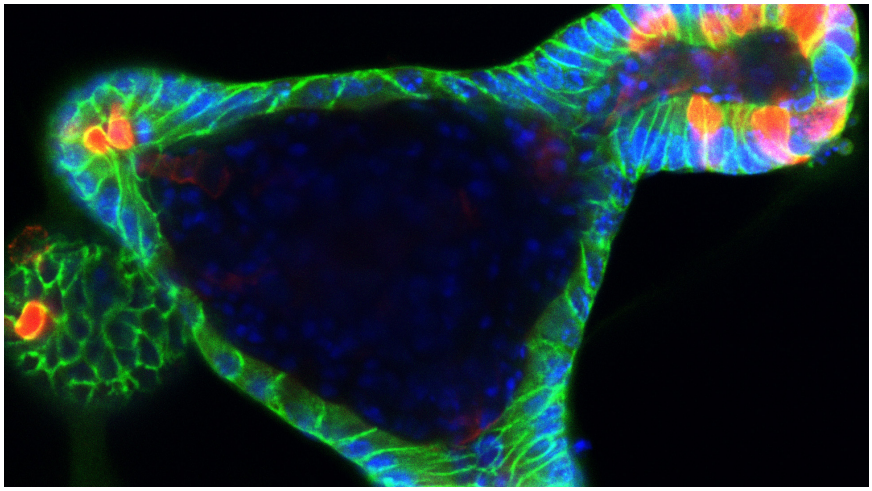
Biomedicine

Biomedicine lies at the interface between basic and preclinical research, and investigates the fundamental mechanisms of the normal and disease processes that influence life-long health; spanning conception to old age, and from single cells to the whole organism in its environment.

This division has direct links with two University Research Institutes - the European Cancer Stem Cell Research Institute and the Neuroscience and Mental Health Research Institute. Our Biomedicine division also plays central roles in the Arthritis Research UK Centre and Wales Gene Park Genome Editing Facility.

The Biomedicine research strategy encompasses:

- **Developmental origins of disease –** elucidating the prenatal and epigenetic influences that impact on later life risk of disease.
- **Mechanisms of health and disease –** understanding the physiological, connective tissue, neurological and cancer-based mechanisms of disease.
- **Disease intervention –** the development of therapeutic strategies to prevent and treat disease.



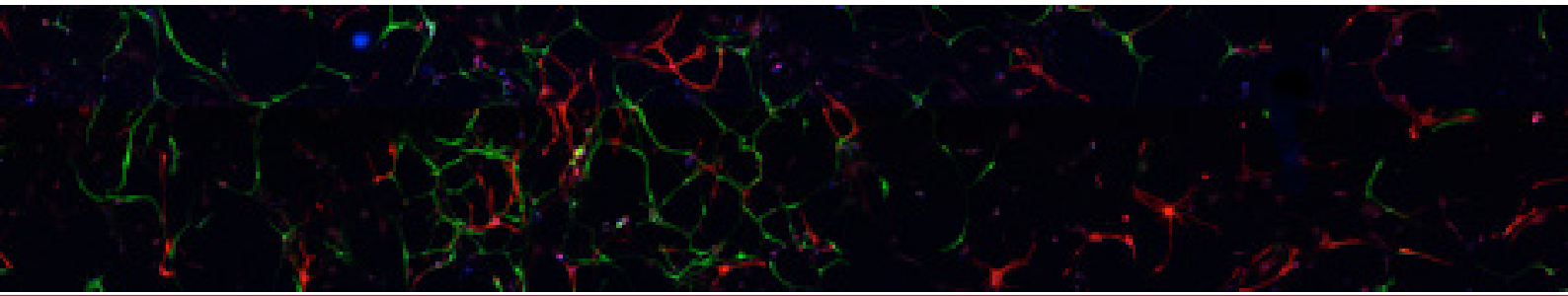
Neuroscience

Neuroscience strives to gain a better understanding of the function of a healthy nervous system and the mechanisms leading to neurological diseases, an area in which Cardiff University's reputation is internationally recognised.

The research strategy focuses on key areas of strength, aiming to translate knowledge of underpinning mechanisms into pharmacological and cell-based therapies and improved clinical practice.

The Neuroscience division has strong links to the Neuroscience and Mental Health Research Institute, as well as the new Dementia Research Institute and Medicines Discovery Institute.

- **Synaptic biology –** understanding neuronal plasticity, organisation and function.
- **Neurocellular and neurodevelopmental biology –** understanding the cell and developmental processes that underpin healthy brain function and mechanisms of disease.
- **Systems neuroscience –** elucidating the circuits and connectomics that drive brain function.



Interdisciplinary Research Networks

To meet our aim of nurturing collaboration and networking, we will operate Interdisciplinary Research Networks across the School of Bioscience and beyond, bringing together expertise, knowledge and research areas.

Our current Interdisciplinary Networks are:

- CURE-Infection: Cardiff University Antimicrobial Resistance and Infection Biology Network
- Systems and Predictive Biology Network
- Biosensors and Advanced Imaging Network
- Drosophila In Vivo Analysis Research Network

Technology Research Hubs

The Technology Hubs combine research facilities with integrated research expertise and academic leadership. In addition to offering School researchers access to state-of-the-art research technology, expertise and research support, each Technology Hub aims to ensure all research facilities continue to develop.

Bioimaging Research Hub develops and supports research using a range of microscopy techniques and associated sample preparation methods.

Experimental MRI Centre (EMRIC) offers flexible non-human in vivo structural and functional imaging with full technical support for functional magnetic resonance imaging (fMRI), Diffusion Tensor Imaging (DTI) and magnetic resonance spectroscopy (MRS).

Single Cell Analysis Research Hub provides expertise in technologies to support the analysis of cell-by-cell variation. Central to the Hub's mission is the support and development of fluorescence cell analysis technologies (FACS).

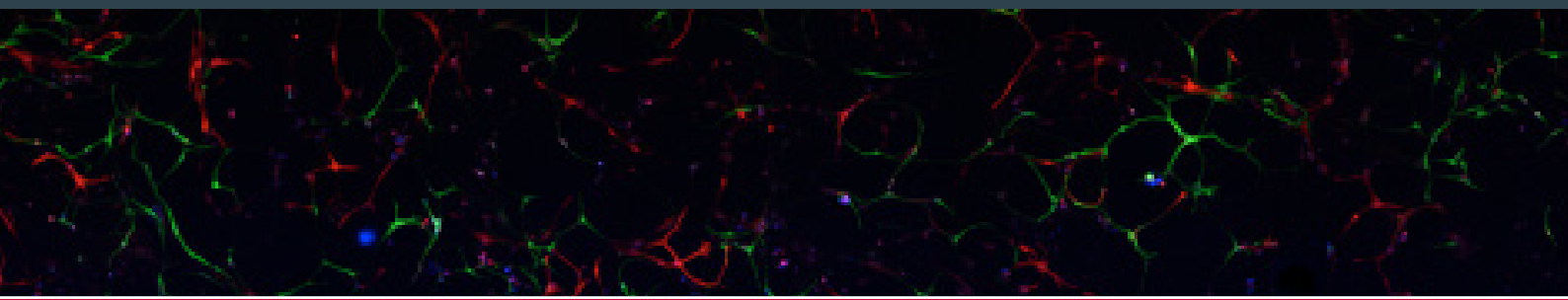
Plant Growth Technology Hub offers a broad range of growth facilities for plant research including the Talybont Glasshouse Facility.

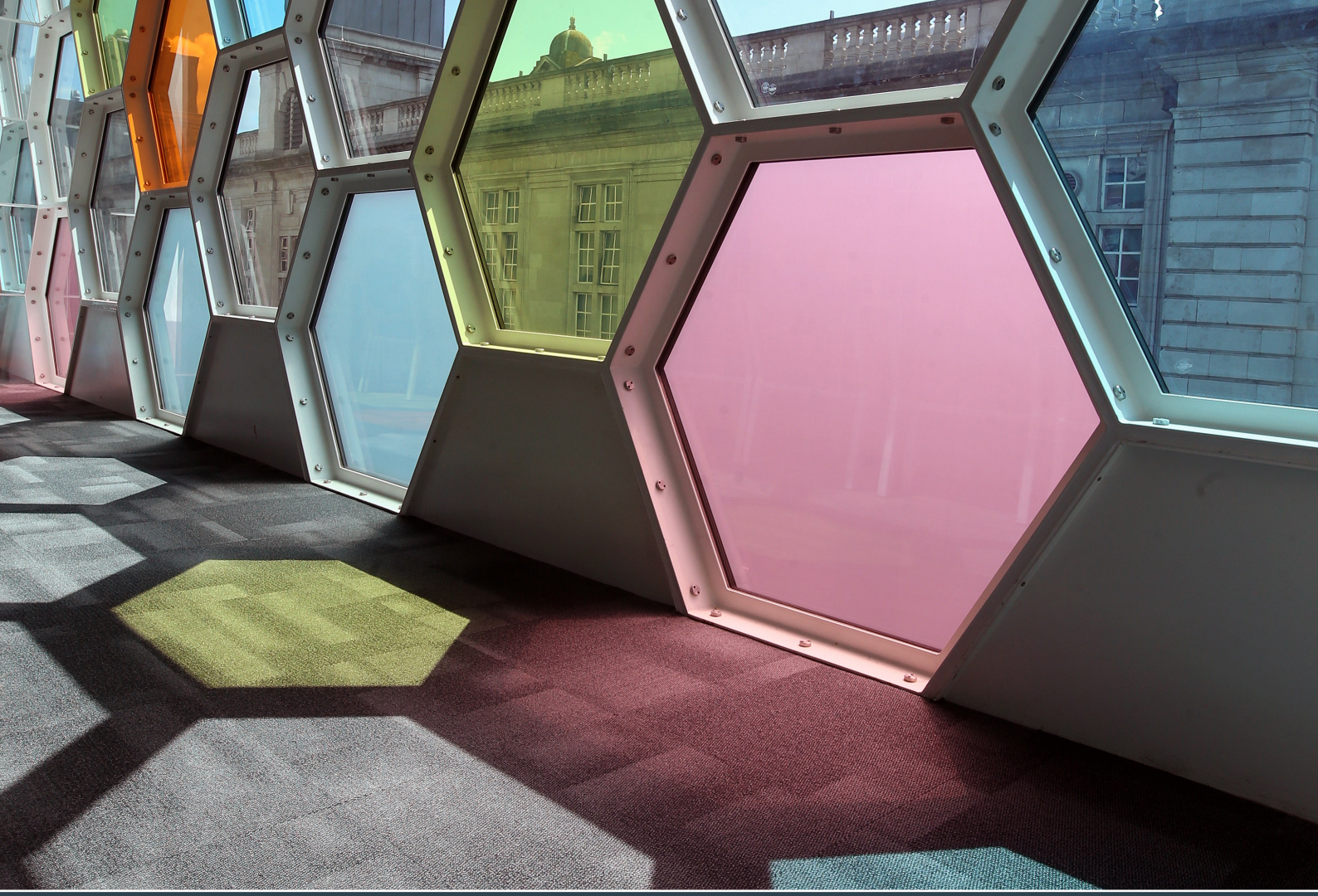
Small Molecule Research Hub provides customised solutions for the analysis of primary and secondary metabolites, and for environmental small biomolecules

Protein Technology Research Hub provides expertise and access to facilities for protein expression, purification, and the analysis of protein structure, function and interactions

Genome Research Hub acts as a focus for a vibrant community of genomics researchers and supports user-driven next-generation sequencing for a wide range of users and applications.

Biocomputing Research Hub brings together hardware infrastructure and informatics for high-end data analysis and modelling, liaising closely with ARCCA.





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