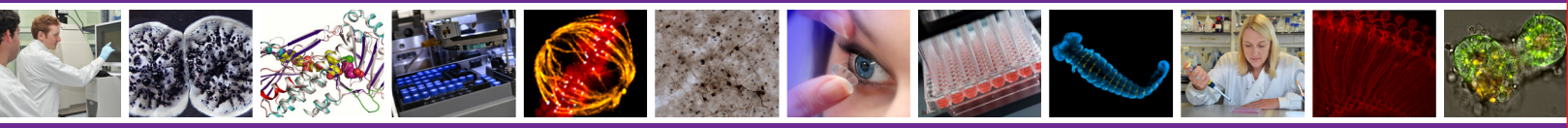
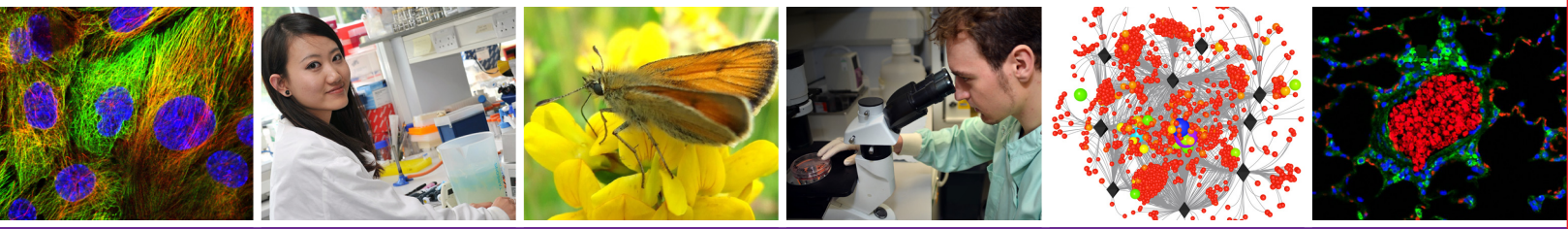
MANCHESTER 1824

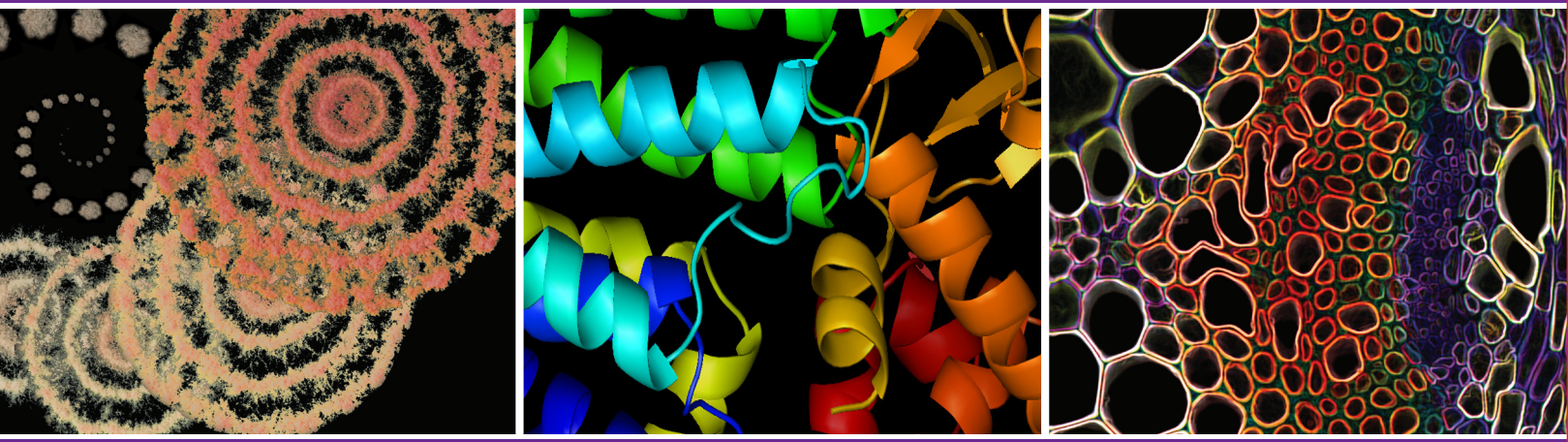
The University of Manchester

Faculty of Life Sciences

Research







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Faculty of Life Sciences

Message from the Associate Dean for Research

Professor Ian Roberts

The Faculty of Life Sciences at The University of Manchester is one of the leading interdisciplinary research-focused life science faculties in Europe. We produce research outcomes of the highest quality that are impacting globally in areas such as human health, the mechanisms of life, and environmental sustainability.

The latest 2014 Research Excellence Framework (REF) results confirm that the Faculty of Life Sciences is a powerhouse for research in biological sciences. REF is a national system implemented by the UK government to assess the quality of research in UK higher education institutions. The Faculty's submission was ranked fourth nationally, in the top 10% of institutions for research power[1] in biological sciences. These results reflect the excellent research performance across the breadth of life sciences taking place within the Faculty and reaffirm that the Faculty is a first class environment in which to conduct world-leading research.

Cutting edge research within the Faculty is ongoing across the entire spectrum of life sciences, from studies of individual molecules at the atomic level, to cells, tissues, organisms, and populations. The Faculty has three Beacon areas of significant critical mass that place it at the forefront of world leading research. These are 'Biological Timing and Quantitative Dynamics', 'Inflammation Biology', and 'Synthetic Biology for Biotechnology' (awarded a BBSRC Synthetic Biology Centre in 2014). While predominantly based in and led by the Faculty, these three research groupings are interdisciplinary and collaborative, bringing together researchers from across the University.

Our research excellence is underpinned by superb infrastructure with a suite of state-of-the-art analytical research facilities supported by dedicated technical support staff. The Faculty is organised as a single departmental structure, unrestricted by discipline boundaries, which enables collaboration. Research is driven through eleven themes and many researchers are members of more than one theme, demonstrating the interdisciplinary nature of our research.

The Faculty also supports a number of internationally renowned research centres, which are in receipt of significant long-term external funding. A reflection of the depth and breadth of expertise within the Faculty is the impressive track record of productive and sustained collaboration with a wide range of industrial partners both in the UK and overseas.

In conclusion, the Faculty of Life Sciences provides a truly exciting and stimulating research environment, confident and capable of answering the globally important questions in life sciences research. I hope that this research brochure will give you a taste of the strengths and opportunities for outstanding research in the Faculty.

[1] Calculated from the grade point average of the research quality profile multiplied by the number of staff submitted

About the Faculty of Life Sciences

- **Research spans the following eleven research themes with extensive cross-theme collaboration:**
  - Biotechnology and Synthetic Biology
  - Cardiovascular and Metabolic Disease
  - Cell and Cancer Biology
  - Cell Matrix Biology
  - Computational and Evolutionary Biology
  - Development
  - Environment and Ecology
  - History of Science, Technology and Medicine
  - Infection, Inflammation and Immunity
  - Neurobiology
  - Sensory and Computational Neuroscience
- **Three world-leading research Beacon areas:**
  - Biological Timing and Quantitative Dynamics
  - Inflammation Biology
  - Synthetic Biology for Biotechnology
- **Annual Faculty turnover of over £80 million**
- **More Biotechnology and Biological Sciences Research Council (BBSRC) funding than any other university**
- **Collaborations with universities/institutes in over 70 countries**
- **Industrial collaborations with over 70 companies**
- **Around 1000 members of staff, including over 200 academics**
- **Over 460 postgraduate students**

"At the University of Manchester, we have created an outstanding environment for life sciences research – like-minded colleagues, brand new buildings, highly sophisticated facilities, and a culture of collegiality and teamwork. I hope you enjoy reading about our achievements and plans."

Professor Martin Humphries
Vice-President and Dean of the Faculty of Life Sciences

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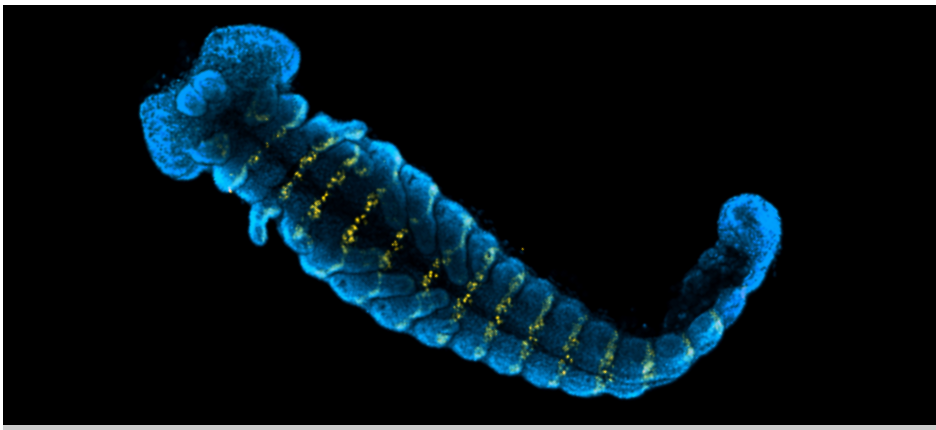
Faculty of Life Sciences

About the Faculty

Facts & Figures 2013/14



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People

226 Academic staff members

75 Professors

25 Independent Research Fellows

31 Experimental Officers

261 Post-doctoral Researchers

127 Technical Support Staff

468 Postgraduate Students

Research Funding

£136.3m Total value of research grants and contracts held by the Faculty in 2013/14

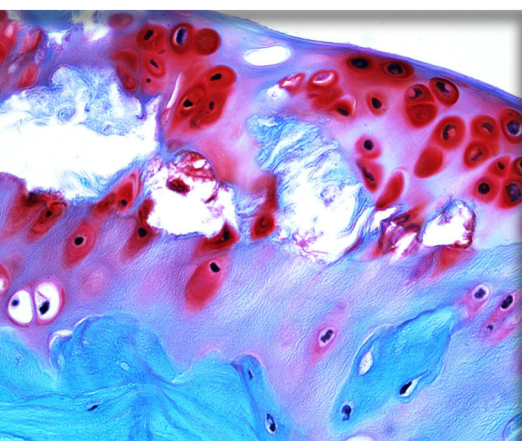
£33.8m Research grants and contracts awarded to the Faculty in 2013/14

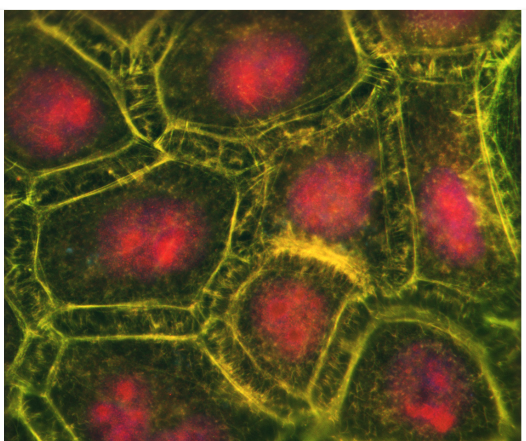
£19.9m Research Council grants awarded to the Faculty in 2013/14

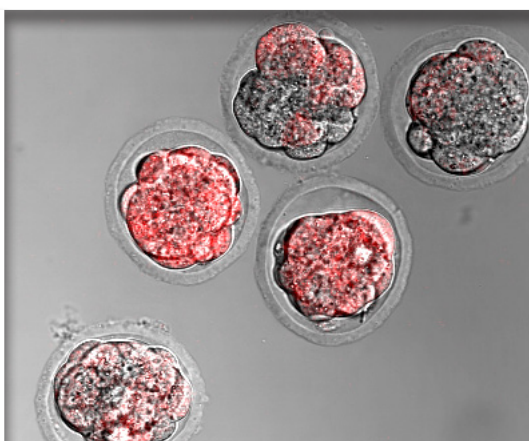
£6.6m Charity grants awarded to the Faculty in 2013/14

Research Publications

501 Research publications in 2013







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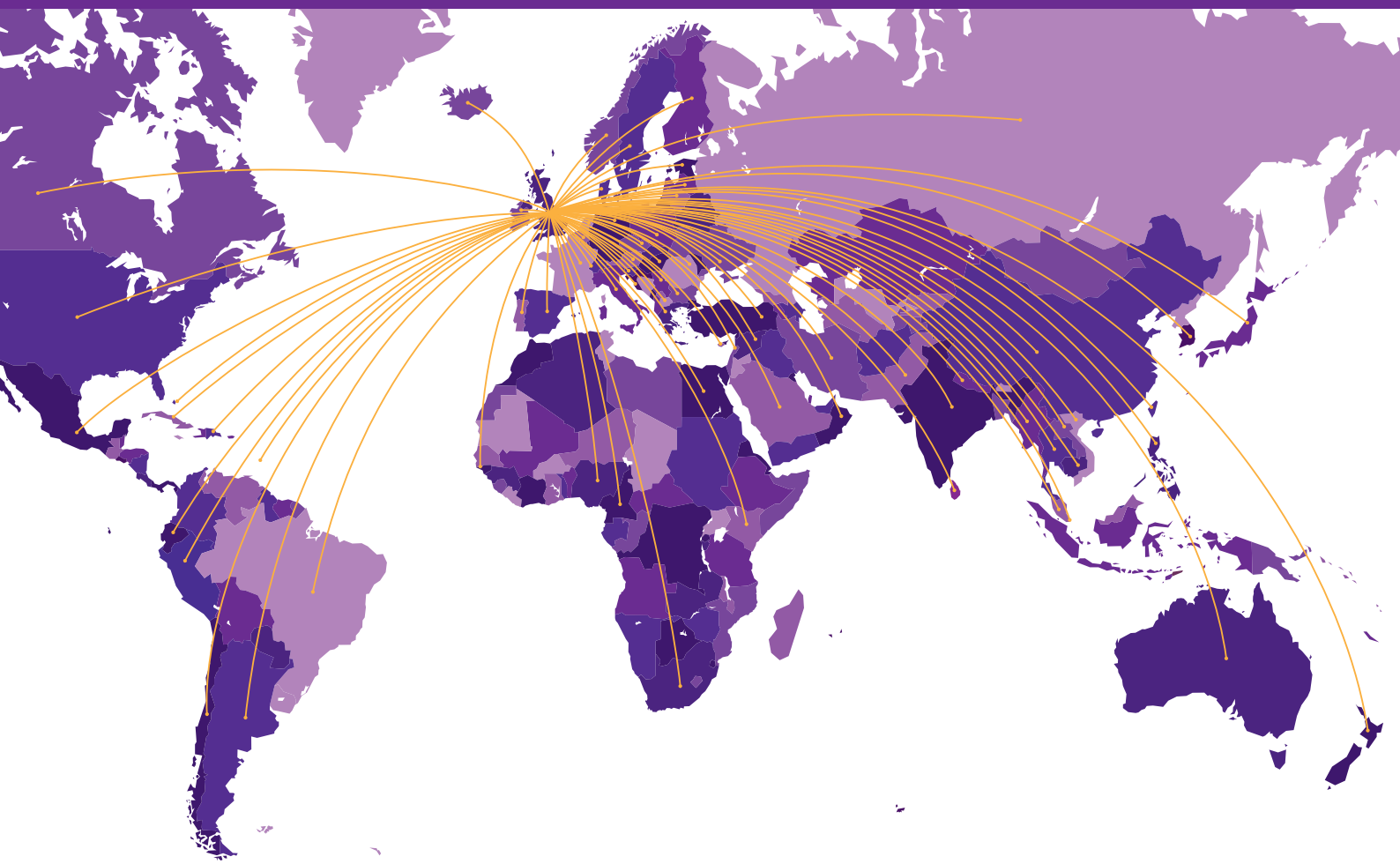
International Collaborations



Research within the Faculty of Life Sciences is truly global. Researchers have collaborated with universities and institutes from 76 countries* in the last four years, as well as hosting PhD students from over 60 countries.

Argentina
Australia
Austria
Bahamas
Belgium
Brazil
Bulgaria
Cambodia
Cameroon
Canada
Chile
China
Croatia
Cuba
Cyprus
Czech Republic
Denmark
Dominica
Dominican Republic
Ecuador
Egypt
Estonia
Finland
France
Gambia
Germany
Greece
Hungary
Iceland
India
Iran
Ireland
Israel
Italy
Japan
Kenya
Laos
Latvia
Lebanon
Lithuania
Luxembourg
Macedonia
Malaysia
Mexico
Myanmar
Nepal
Netherlands
New Zealand
Nigeria
Norway
Oman
Pakistan
Peru
Philippines
Poland
Portugal
Romania
Russia
Saudi Arabia
Serbia
Singapore
Slovakia
Slovenia
South Africa
South Korea
Spain
Sri Lanka
Sweden
Switzerland
Syria
Taiwan
Thailand
Turkey
Ukraine
USA
Vietnam

* based on publications from 2010 to 2013

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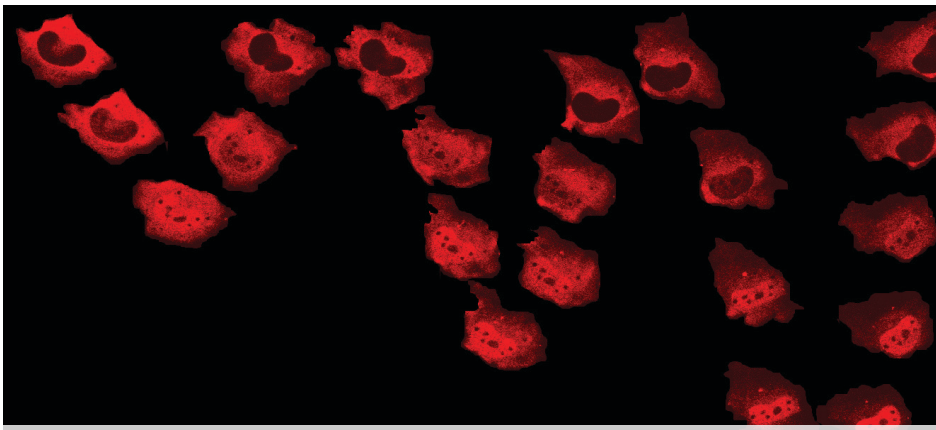
Faculty of Life Sciences

About the Faculty

Research Beacons



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Beacon Leaders

- **Biological Timing and Quantitative Dynamics**
  - Professor Andrew Loudon
  - Professor Nancy Papalopulu
  - Professor Mike White
- **Inflammation Biology**
  - Professor Richard Grencis
  - Professor Dan Davis
  - Professor Ian Kimber
  - Professor Werner Muller
- **Synthetic Biology for Biotechnology**
  - Professor Nigel Scrutton
  - Professor Rainer Breitling
  - Professor Eriko Takano

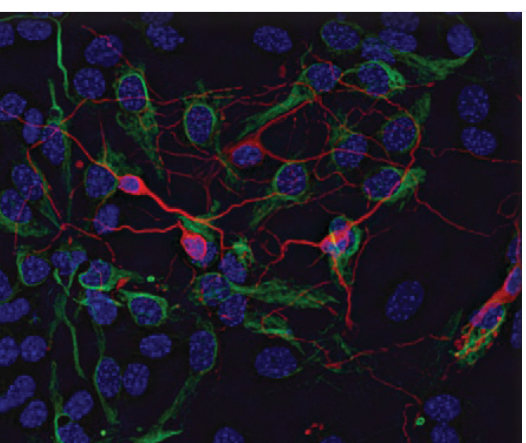
World leading research

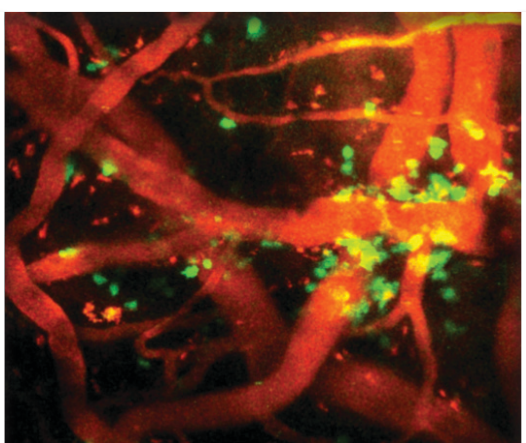
The Faculty has three areas of significant critical mass that place it at the forefront of world leading research. These are 'Biological Timing and Quantitative Dynamics', 'Inflammation Biology', and 'Synthetic Biology for Biotechnology'. While predominantly based in and led by the Faculty of Life Sciences, these three research groupings are interdisciplinary and collaborative, bringing together researchers from across the University.

The **Biological Timing and Quantitative Dynamics Beacon** links world-class expertise in basic mechanisms, quantitative biology and whole organism physiology to understand cellular timing.

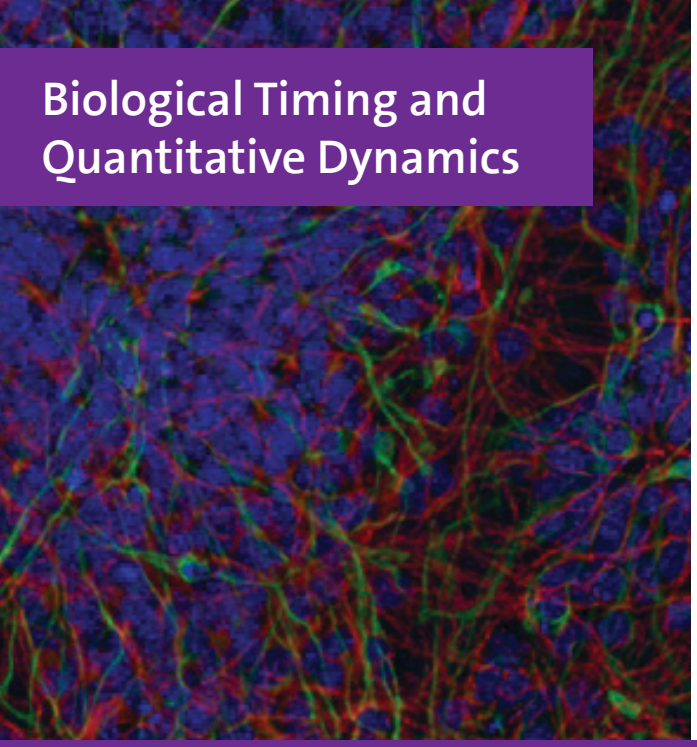
The **Inflammation Biology Beacon** is focussed on defining the underpinning mechanisms of inflammation, an event critical to the outcome of many diseases including cancer, infection, cardiovascular disease, and chronic neurological disorders.

The **Synthetic Biology for Biotechnology Beacon** is at the forefront of the emergence of a new industrial revolution in biotechnology, using the concepts from traditional engineering and computing science to increase the predictability and control of biological production systems.





Biological Timing and Quantitative Dynamics



Biological timing is a central feature of living organisms. Cells and tissues must be able to measure time and respond appropriately to dynamic internal and external cues. These cues occur across temporal and spatial scales, from single cells in early development, to the physiological responses of adult organisms, to daily and seasonal changes in the environment. Therefore, understanding how biological timing is generated and interpreted is key to understanding tissue development, physiology and disease.

Biological timing systems are driven by dynamic cell processes, which are oscillatory or pulsatile in nature. These include gene transcription, post-translational protein modifications, sub-cellular protein dynamics, and epigenetic mechanisms. Biological timing systems are powerful and versatile as they can generate reproducible responses, such as tissue patterning, or non-genetic heterogeneity, such as the cellular responses to genotoxic damage and inflammation. They also drive biological cycles at the whole organism level, such as the circadian clock.

To generate a unified understanding of how biological timing operates, we are developing a quantitative multidisciplinary approach to determine:

- How cellular timers are set-up, controlled and interact across scales.
- How evolutionarily-conserved cellular timers control cell physiology, cell-to-cell communication, development and environmental responses.
- How timing mechanisms are involved in health and disease.

Inflammation Biology

Inflammation underpins disease. Indeed it is now accepted that regulation of inflammation dictates the outcome of cancer, infection, autoimmunity, allergy, acute and chronic neurological disease, cardiovascular disease, injury, repair and ageing. Furthermore, the blurring of the concepts of innate and adaptive immunity has placed inflammation at the centre of disease discovery in its broadest sense.

Our focus is defining the mechanistic basis of inflammation from initiation through to resolution. Mucosal inflammation both in gut and lung is a clear strength. Neuroinflammation has been a continuing theme from fundamental studies right through to the clinic, as has the mechanisms controlling wound healing. Single cell signalling and dynamic regulation of inflammatory cytokines underpins strengths in systems inflammation. The integrated approach to biology that we embrace is a significant advantage in maximising our research efforts in inflammation discovery.

The capacity to move from gene to cell, to *in vivo* systems, and on to embrace cross-University excellence in inflammation epidemiology and the clinic is extremely powerful. Moreover, the Faculty of Life Sciences has a major stake in the Manchester Collaborative Centre for Inflammation Research, internationally recognised as a hub of excellence in inflammatory disease research from fundamental science through to major Pharma.

Synthetic Biology for Biotechnology

Biotechnology is presently undergoing a revolution. In times of increasing scarcity of resources, we are searching for new, environmentally friendly methods of production, harnessing the power of living systems to sustainably drive industrial processes and produce valuable compounds such as drugs, fertilisers, biofuels, flavours, fragrances, and cosmetics.

The aim is to complement, and in the long term to replace, the current (petro-) chemical industry with green biotechnology. One of the main enabling techniques underlying recent advances in biotechnology is synthetic biology, the design and engineering of new and useful biological functions using rapid genetic manipulation.

Synthetic biology uses concepts from traditional engineering and computing science to increase the predictability and control of biological production systems. The Synthetic Biology Beacon develops the biological insights and tools underpinning this development. Manchester's research in this area will contribute to the emergence of a new industrial revolution in biotechnology, with applications in many sectors, including healthcare, sustainable energy, green chemistry, pharmaceuticals, novel materials and bioremediation.

The University of Manchester was awarded a BBSRC Centre for Synthetic Biology of Fine and Speciality Chemicals (SYNBIOCHEM) in 2014.

Version updated - Sept 2016

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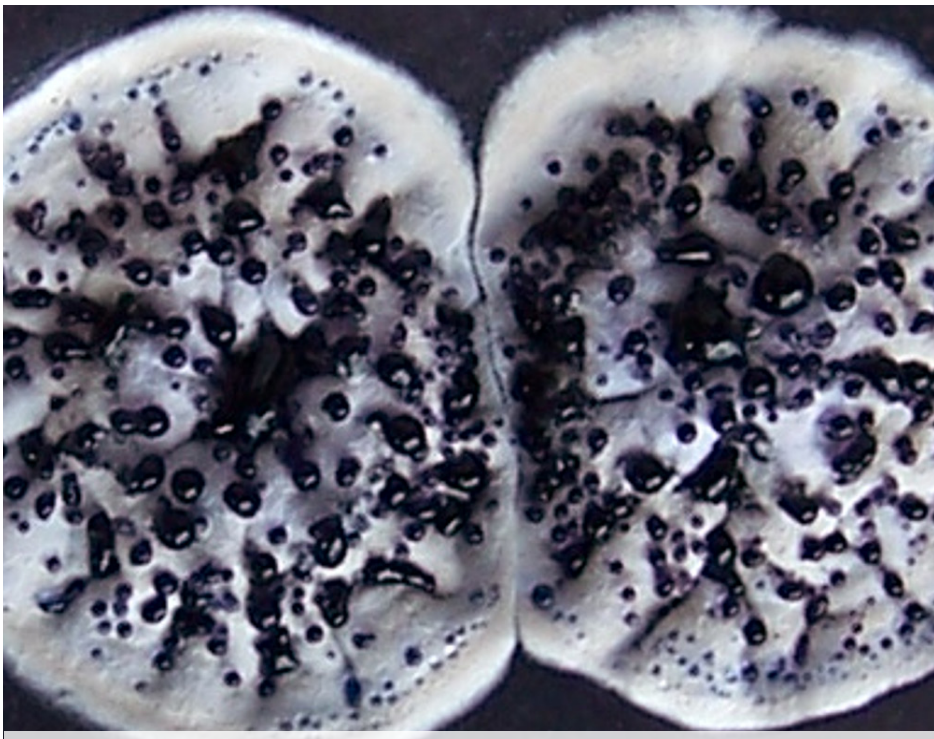
Faculty of Life Sciences

Research Theme

Biotechnology & Synthetic Biology



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Biotechnology is presently undergoing a revolution. In times of increasing scarcity of resources, we are searching for new, environmentally friendly methods of production, harnessing the power of living systems to sustainably drive industrial processes and produce valuable compounds such as drugs, fertilisers, biofuels, flavours, fragrances, and cosmetics.

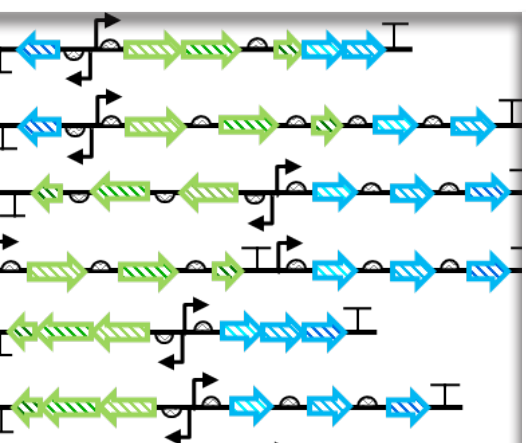
The aim is to complement, and in the long term to replace, the current (petro-) chemical industry with green biotechnology. One of the main enabling techniques underlying recent advances in biotechnology is synthetic biology, the design and engineering of new and useful biological functions using rapid genetic manipulation.

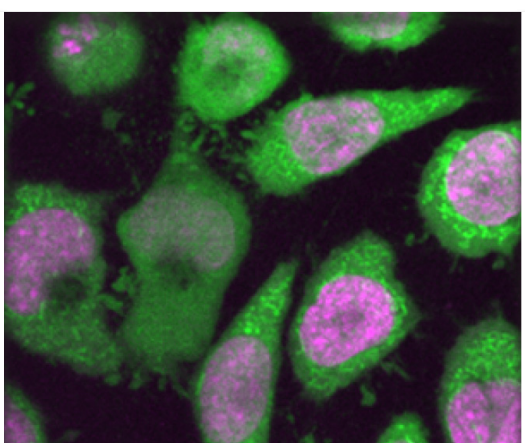
Synthetic biology uses concepts from traditional engineering and computing science to increase the predictability and control of biological production systems. The Biotechnology and Synthetic Biology research theme develops the biological insights and tools underpinning this development.

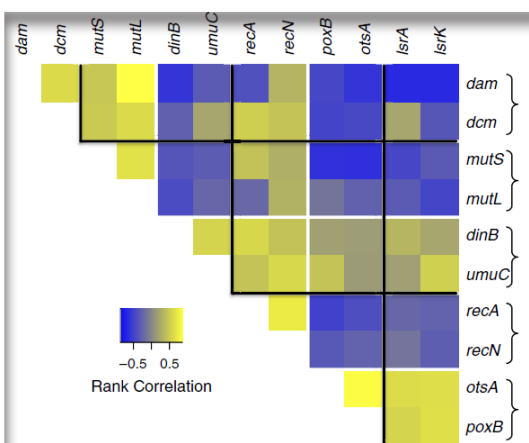
Research Theme Director - Professor Eriko Takano

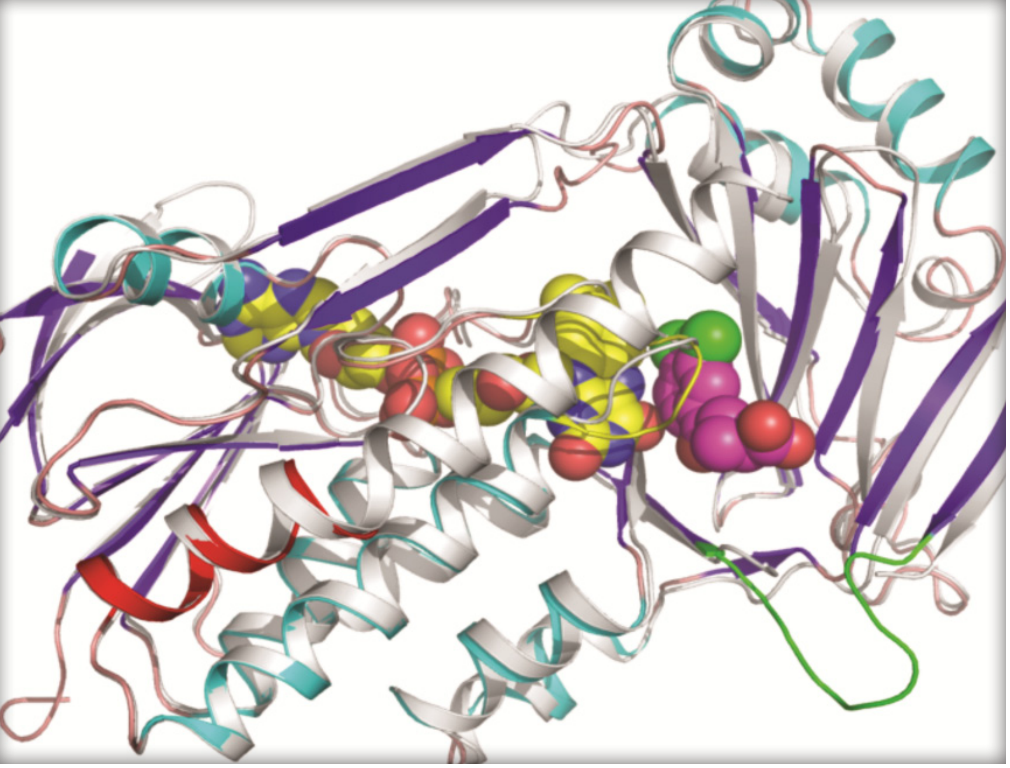
Principal Investigators include:

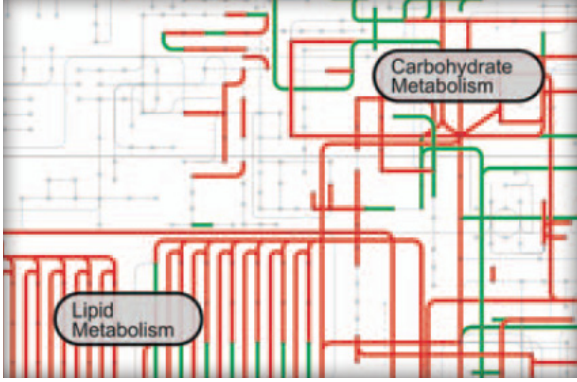
Dr Andrew Almond
Dr Mark Ashe
Prof Clair Baldock
Dr Jordi Bella
Dr Caroline Bowsher
Prof Rainer Breitling
Prof Terry Brown
Dr Susan Crosthwaite
Dr Anil Day
Dr Daniela Delneri
Prof Jeremy Derrick
Prof Alan Dickson
Dr Neil Dixon
Dr Curtis Dobson
Prof Andrew Doig
Prof Bob Ford
Dr Alexander Golovanov
Prof Chris Grant
Dr Sam Hay
Dr Finbarr Hayes
Dr Christian Heintzen
Prof Simon Hubbard
Dr Chris Knight
Prof David Leys
Dr Hui Lu
Prof Andrew Munro
Dr Ray O'Keefe
Prof Graham Pavitt
Dr Jon Pittman
Dr Stephen Prince
Dr Malcolm Rhodes
Dr Steve Rigby
Prof Ian Roberts
Dr Geoff Robson
Dr Alan Roseman
Prof Nigel Scrutton
Dr Lubomira Stateva
Prof Eriko Takano
Prof Simon Turner
Prof Richard Walmsley
Prof Jonathan Waltho
Dr Jim Warwicker

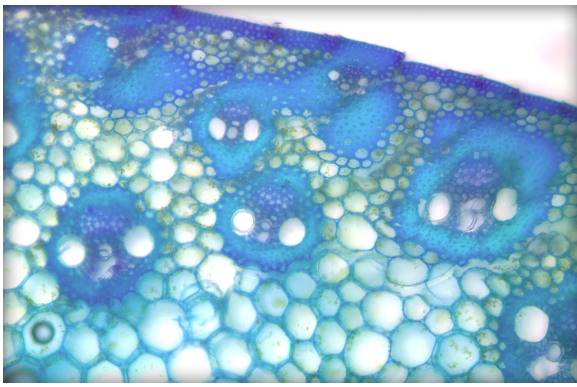












The Biotechnology and Synthetic Biology research theme brings together researchers interested in the application of their diverse biological expertise for industrial processes.

Research in the theme encompasses the full range of enabling technologies underpinning modern biotechnology and synthetic biology, including:

- **Bioparts engineering**: structural biology, advanced enzyme biocatalysis, protein evolution
- **New regulatory systems**: stress response manipulation, transcriptional and translational circuits (riboswitches, ncRNAs, signalling)
- **Cell engineering / metabolic engineering**: manipulation of metabolic pathways and cell wall matrix, artificial organelles, metallometabolism, ABC transporters / ion channels, large-scale DNA synthesis and assembly
- **Biosystems design using computational biology**: genome sequence analysis, postgenomic analytics (transcriptomics, proteomics, and metabolomics), network biology, genome-scale modelling, retro(bio)synthesis
- **Evolutionary biology**: patterns of antibiotic resistance evolution, exploitation of new evolutionary strategies for advanced biotechnological engineering

Model systems range from *E. coli, Streptomyces*, cyanobacteria, algae and yeast, to higher plants, human and other mammalian cells.

Applications of these technologies are naturally very diverse; highlights include:

- Small molecule production, including a wide range of valuable compounds such as antibiotics, biofuels, flavours, and fragrances
- Biotherapeutics, including antibodies and vaccines
- Biosensors, for example for the detection of heavy metal pollutants, microbes, dialysis monitoring
- Anti-infective peptides for medical devices and consumer health applications for the ophthalmic market

Research within the theme relies heavily on multi-disciplinary collaborations, both within the University and with external institutions and industry. Funding for this research comes from many sources including BBSRC, EPSRC, MRC, NERC, EU FP7, ERA-IB, and a wide range of industry partners.

Current collaborations involve large biotech companies such as Activis, AstraZeneca, Bausch and Lomb, Bruker, Croda, Dr. Reddy's, Eli Lilly, Fujifilm Diosynth, GSK, Johnson and Johnson / Vistakon, Lonza, MedImmune, Pall Life Sciences, Sauflon Pharmaceuticals, Shell, Thermo Fisher, and UCB, as well as specialist industries, including Arecor, Aroma Chemicals Services International, Biocomposites, Genzyme, Glenmark, Novimmune, Phosphor Technology, Symphogen, and TgK Scientific.

Highlight Publications

Breitling R, Achcar F, Takano E, (2013). Modeling challenges in the synthetic biology of secondary metabolism. **ACS Synthetic Biology**, 19, 373.

Khara B, Menon N, Levy C, Mansell D, Das D, Marsh ENG, Leys D, Scrutton NS, (2013). Production of propane and other short chain alkanes by structure-based engineering of ligand specificity in aldehyde-deformylating oxygenase. **ChemBioChem**, 14, 1204.

Amaral M, Levy C, Heyes DJ, Lafite P, Outiero TF, Giorgini F, Leys D, Scrutton NS, (2013). Structural basis of kynurenine 3-monooxygenase inhibition. **Nature**, 496, 382.

Karuppiah V, Collins RF, Thistlethwaite A, Gao Y, Derrick JP, (2013). Structure and assembly of an inner membrane platform for initiation of type IV pilus biogenesis. **Proceedings of the National Academy of Sciences of the USA**, 110, E4638.

Moore S, Lawrence A, Biedendieck R, Deery E, Frank S, Howard M, Rigby S, Warren M, (2013). Elucidation of the anaerobic pathway for the corrin component of cobalamin (vitamin B12). **Proceedings of the National Academy of Sciences of the USA**, 110, 14906.

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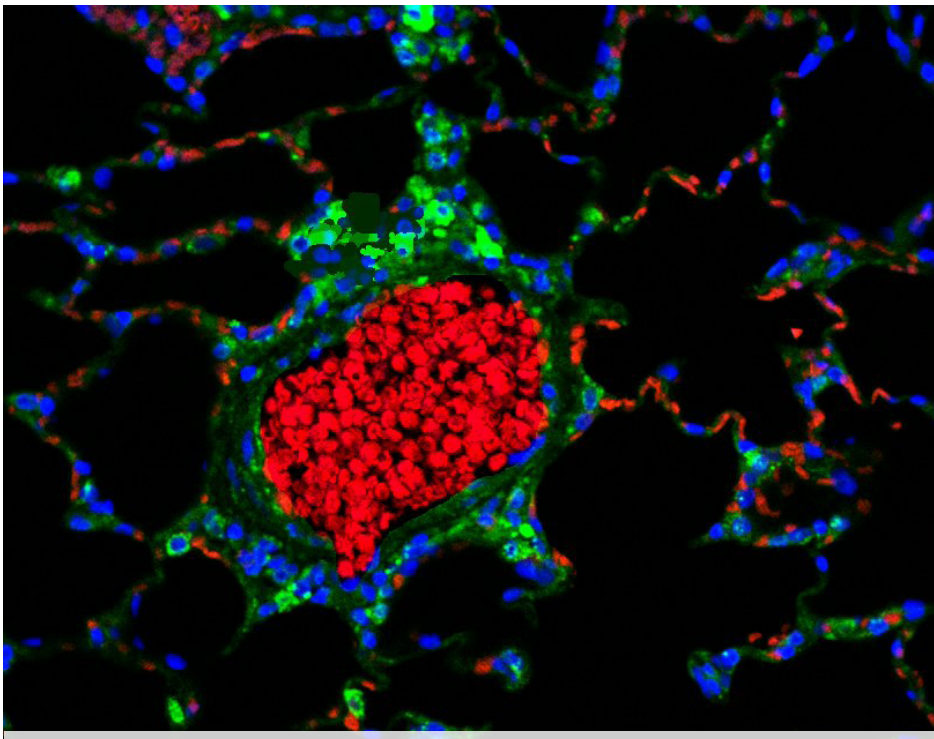
Faculty of Life Sciences

Research Theme

Cardiovascular & Metabolic Disease



www.manchester.ac.uk/ls/cmd

The Cardiovascular and Metabolic Disease research theme uses inter-disciplinary approaches to advance our understanding of the basic mechanisms underlying normal metabolism and metabolic diseases.

This understanding is critical as metabolic dysfunction is responsible for many common and life-threatening disorders such as obesity, diabetes, heart attack, stroke, and cancer.

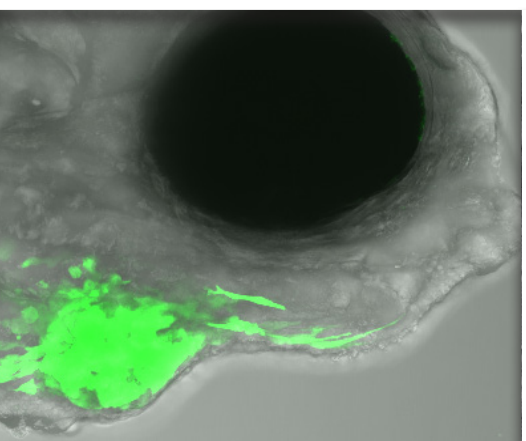
Although diverse, these diseases are commonly associated with energy imbalance, with many overlapping molecular pathways and pathological characteristics. The Cardiovascular and Metabolic Disease theme comprises over 30 Principal Investigators, and spans research topics ranging from appetite and nutrition, hormonal regulation, circadian rhythm, cardiovascular function to cellular bioenergetics, cancer, and inflammation.

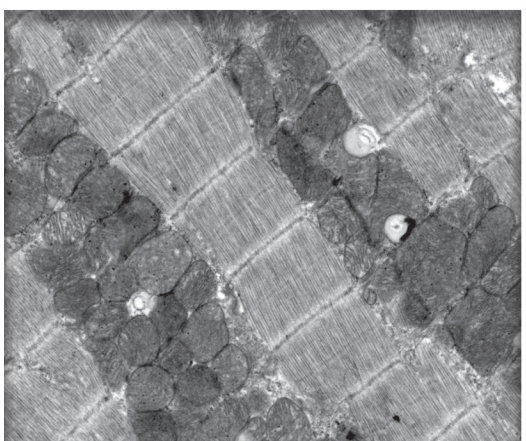
We employ cutting-edge technologies in both fundamental basic science and translational research, with an aim to achieve the ultimate goal of improved health and quality of life by driving forward the development of novel approaches to diagnosis, prevention, and treatment.

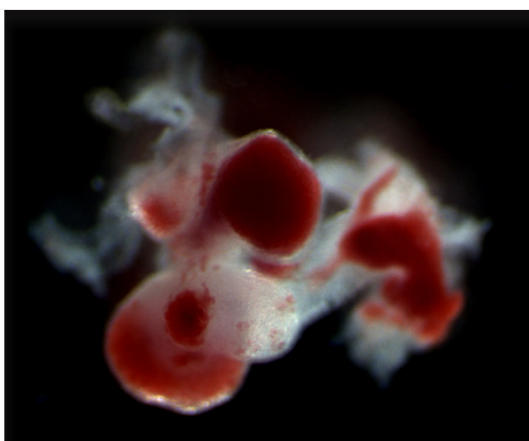
Research Theme Director - Dr Xin Joy Wang

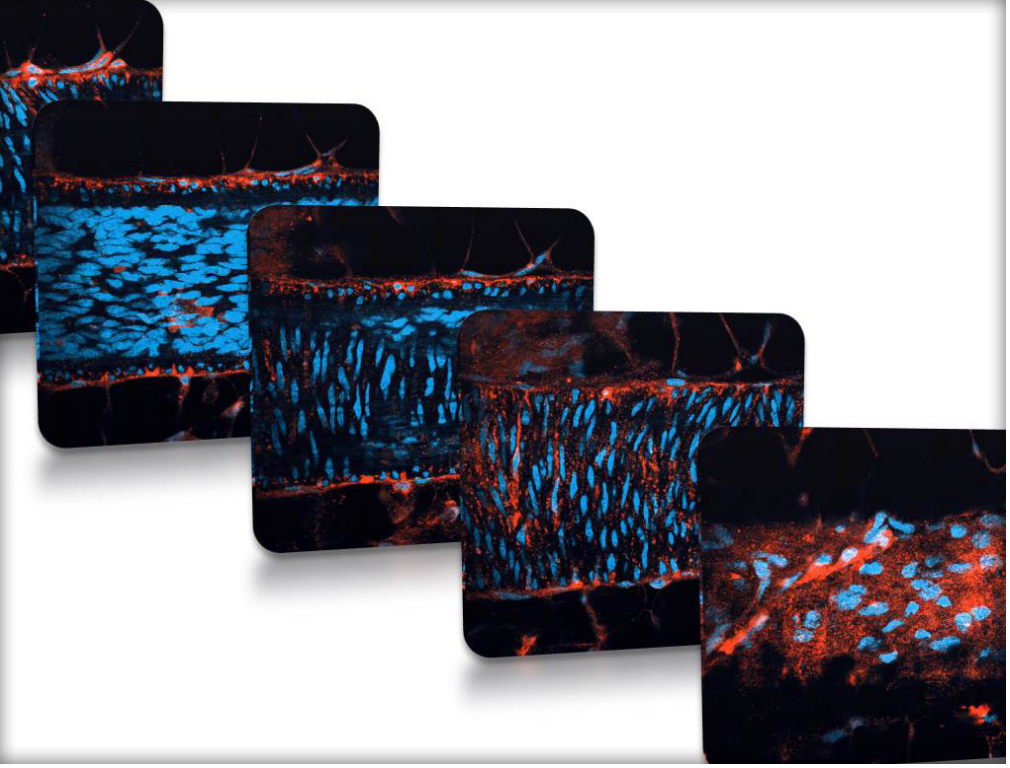
Principal Investigators include:

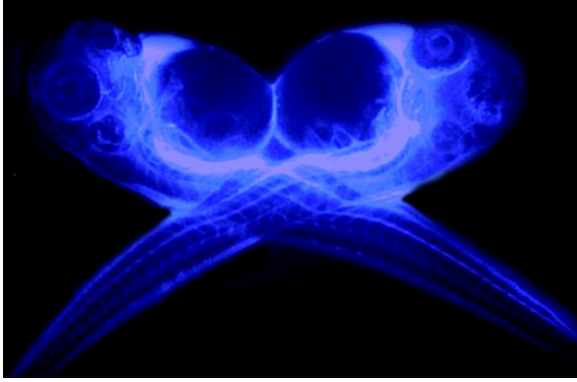
Prof Stuart Allan
Dr Nick Ashton
Dr David Bechtold
Dr Peter Brown
Dr Jason Bruce
Dr Karen Cosgrove
Prof Alan Dickson
Prof Mark Dunne
Dr Gillian Edwards
Dr Liz Fitzgerald
Prof Bob Ford
Dr Natalie Gardiner
Prof Alison Gurney
Dr Kathy Hentges
Dr Adam Hurlstone
Dr Catherine Lawrence
Prof Andrew Loudon
Prof Martin Lowe
Dr Hui Lu
Prof Simon Luckman
Dr Qing-Jun Meng
Dr Catherine Millar
Dr Stephen Prince
Prof Dame Nancy Rothwell
Dr Holly Shiels
Dr Craig Smith
Dr Lisa Swanton
Dr Mark Travis
Dr Xin Joy Wang
Dr Donald Ward
Prof Anne White

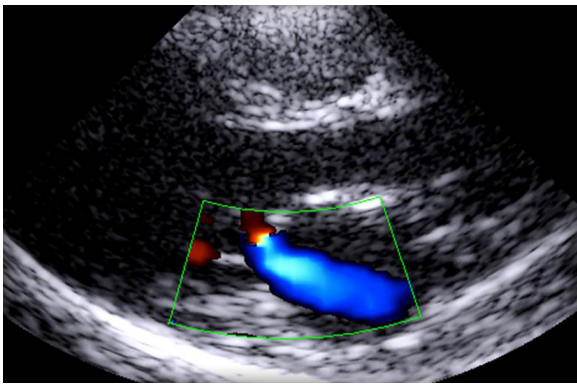












The worldwide prevalence of metabolic disorders, such as obesity, diabetes, and hypertension, has increased steadily over the past two decades, and there is no indication that this will decrease in the near future. Metabolic disturbance is a common feature of ageing, and is associated with numerous disease states including cardiovascular disease, stroke, neurodegeneration, cancer, and chronic inflammation.

The Cardiovascular and Metabolic Disease (CMD) research theme brings together teams from a range of disciplines to drive novel and innovative approaches to understanding metabolism and metabolic diseases at all levels of biological organisation, from isolated mitochondria to patients in the clinic.

Many of the CMD investigators have well established links with clinical colleagues and with industry, ensuring that our research can be rapidly translated to clinical or industrial settings.

Although inter-connected and dynamic, research within CMD centres on five core topics:

- **Cellular bioenergetics**: to study energy production and consumption in the cell
- **Cardiovascular health**: to study energetics and well-being in the heart and blood vessels
- **Endocrinology and energy balance**: to understand endocrine control of energy, glucose and mineral homeostasis in health and metabolic disease
- **Metabolic dysfunction in ageing and disease**: to understand how disordered metabolic processes contribute to physical decline and disease pathology
- **Metabolic syndrome**: to understand underlying drivers of obesity, diabetes, and hyperinsulinaemia

To address these issues, the CMD theme forms a synergised multi-disciplinary platform encompassing gene regulation, biophysics, structural biology, organelle biology, stem cell biology, physiology, neuroscience, pharmacology, live-cell imaging, mathematical modelling, and computer simulation. Researchers have full on-site access to world-class facilities including bioimaging and electron microscopy suites, a range of mass spectrometers, and a dedicated *in vivo* facility. The CMD theme also has access to a sophisticated analyser for monitoring metabolic process in various health and disease conditions.

The CMD theme creates an environment in which undergraduate teaching is informed by the latest research discoveries, benefiting students and nurturing the next generation of researchers.

Highlight Publications

Pekovic-Vaughan V, Gibbs J, Yoshitane H, Yang N, Pathiranage D, Guo B, Sagami A, Taguchi K, Bechtold D, Loudon A, Yamamoto M, Chan J, van der Horst GT, Fukada Y, Meng QJ, (2014). The circadian clock regulates rhythmic activation of the NRF2/glutathione-mediated antioxidant defense pathway to modulate pulmonary fibrosis. **Genes & Development**, 28, 548.

Gibbs J, Ince L, Matthews L, Mei J, Bell T, Yang N, Saer B, Begley N, Poolman T, Pariollaud M, Farrow S, DeMayo F, Hussell T, Worthen GS, Ray D, Loudon A, (2014). An epithelial circadian clock controls pulmonary inflammation and glucocorticoid action. **Nature Medicine**, 20, 919.

Liu W, Zi M, Tsui H, Chowdhury SK, Zeef L, Meng QJ, Travis M, Prehar S, Berry A, Hanley NA, Neyses L, Xiao RP, Oceandy D, Ke Y, Solaro RJ, Cartwright EJ, Lei M, Wang X, (2013). A novel immunomodulator, FTY-720 reverses existing cardiac hypertrophy and fibrosis from pressure overload by targeting NFAT (nuclear factor of activated T-cells) signaling and periostin. **Circulation: Heart Failure**, 6, 833.

James AD, Chan A, Erice O, Siriwardena AK, Bruce JI, (2013). Glycolytic ATP fuels the plasma membrane calcium pump critical for pancreatic cancer cell survival. **Journal of Biological Chemistry**, 288, 36007.

Worthington JJ, Klementowicz JE, Rahman S, Czajkowska BI, Smedley C, Waldmann H, Sparwasser T, Grencis RK, Travis MA, (2013). Loss of the TGFβ-activating integrin αvβ8 on dendritic cells protects mice from chronic intestinal parasitic infection via control of type 2 immunity. **PLOS Pathogens**, 9, e1003675.

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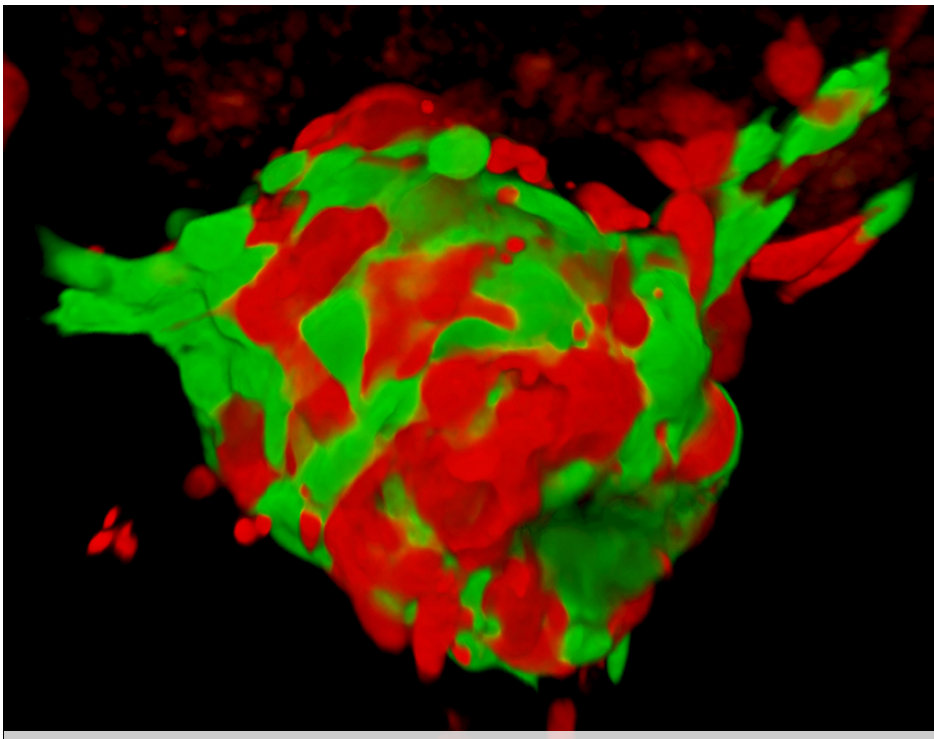
Faculty of Life Sciences

Research Theme

Cell & Cancer Biology



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The Cell and Cancer Biology research theme studies the underlying cell biology that is essential to maintain a healthy organism but which, when deregulated, causes disease. This becomes particularly relevant in cancer where a better understanding of cancer specific cell biology can improve treatments.

A living cell is at the centre of all organisms, be it a single-cell or a multicellular organism with many specialised cells. All cells divide more or less frequently and thereby inherit the genetic information contained in their DNA. However, to perform their individual functions, cells use different ways of regulating their genetic programme and modulate the way that proteins act within the cell.

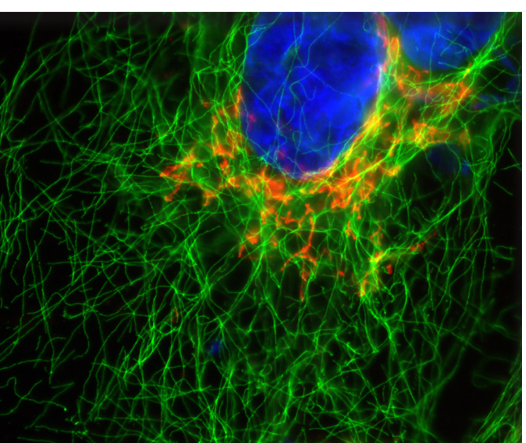
In a healthy organism the cellular processes regulating cell function and division are very well controlled, but in cancer the control is lost, often as a result of mutations or other genetic alterations in the DNA.

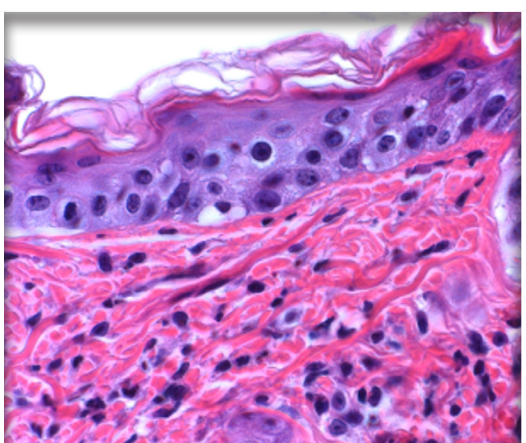
We investigate cell growth, migration, metabolism, stress and death and all the steps involved in making proteins from genes. We study these processes in normal and cancer cells in test tubes and in model organisms such as yeast, worms, flies, fish, frogs and mice.

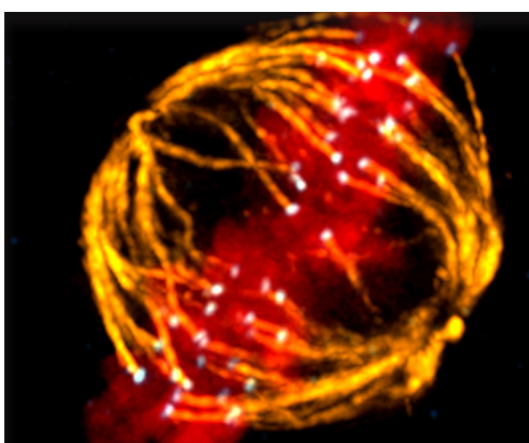
Research Theme Director - Dr Claudia Wellbrock

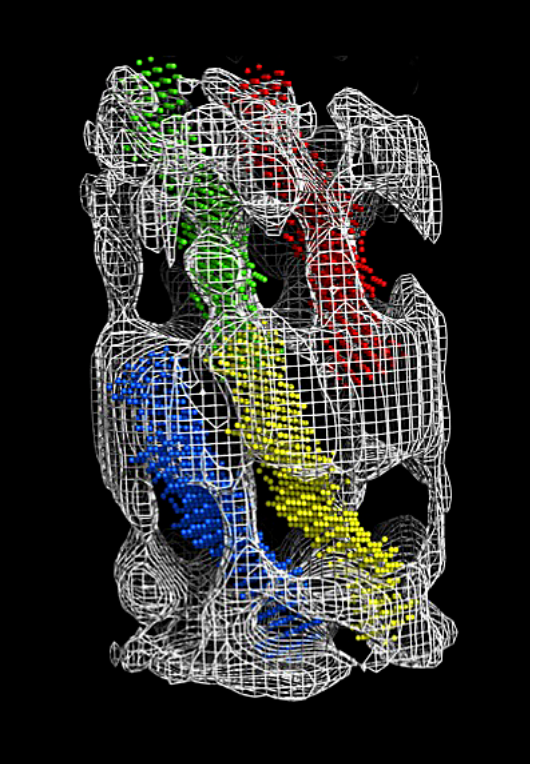
Principal Investigators include:

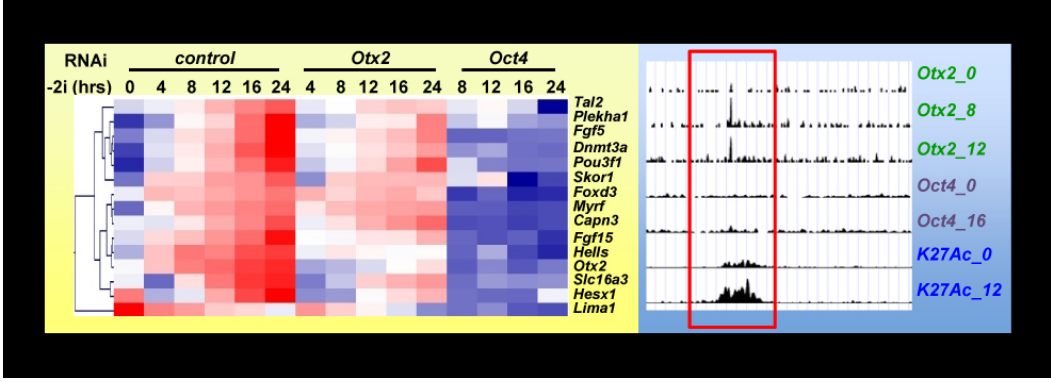
Prof Viki Allan
Dr Mark Ashe
Dr Martin Baron
Dr Casey Bergman
Prof Keith Brennan
Dr Jason Bruce
Dr Patrick Caswell
Prof Daniel Davis
Prof Alan Dickson
Prof Mark Dunne
Prof Bob Ford
Dr Andrew Gilmore
Dr Alexander Golovanov
Prof Chris Grant
Prof Stephen High
Prof Martin Humphries
Dr Adam Hurlstone
Prof Dean Jackson
Prof Cay Kielty
Prof Sue Kimber
Dr Gloria Lopez-Castejon
Prof Andrew Loudon
Dr Josip Lovric
Prof Martin Lowe
Dr Hui Lu
Dr Lindsay MacDougall
Dr Catherine Millar
Dr Ray O'Keefe
Prof Nancy Papalopulu
Prof Graham Pavitt
Dr Janni Petersen
Dr Berenika Plusa
Dr Martin Pool
Dr Gino Poulin
Dr Matthew Ronshaugen
Dr Alan Roseman
Dr Ilaria Russo
Prof Andy Sharrocks
Dr Paul Shore
Prof Charles Streuli
Dr Lisa Swanton
Dr Lydia Tabernero
Prof Stephen Taylor
Prof Chris Thompson
Dr Cathy Tournier
Prof Richard Walmsley
Dr Xin Joy Wang
Dr Jim Warwicker
Dr Claudia Wellbrock
Dr Melissa Westwood
Prof Mike White
Dr Alan Whitmarsh
Prof Philip Woodman
Dr Sarah Woolner

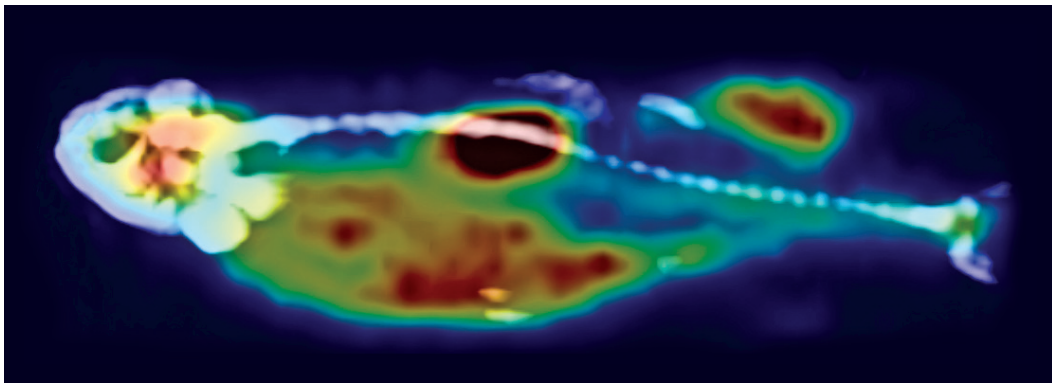












Specialised cells in our body can perform a vast variety of unique functions such as transmitting information in the brain, making the heart beat, or giving the skin a tan. Understanding how individual components of a cell work together in order to perform these individual functions is crucial for learning how our body operates. Moreover, principles learned from studying cell biological processes can often be translated into new technologies used for instance in medical treatment and diagnosis.

Essential Cell Biology

Cell biology research within the Cell and Cancer Biology (CCB) theme studies all aspects involved in making and controlling a protein according to genetic information in the DNA. We investigate the regulation of gene expression (including epigenetics and chromatin biology), RNA transcription and processing, protein translation and biogenesis, and mechanisms of protein sorting and trafficking. These studies are performed at the structural level, in single cells and in multi-cellular organisms, where the complexity of cellular diversity can be considered. As well as enhancing our general knowledge in cell biology, this research is closely linked to processes relevant for ageing and for inherited human disorders such as Lowe syndrome and Vanishing White Matter disease, as well as for Alzheimer's disease, pathogenic infection and cancer.

Cancer Research

In cancer, normal cell biological processes are out of control. This leads to cells dividing when they should not, invading tissues where they should not be, and surviving in situations when controlled cell death should occur.

Cancer research within the CCB theme investigates all the features of cancer development. We study the mechanisms underlying deregulated cell division, and how an altered metabolism allows cancer cells to grow using different 'fuels'. We analyse proteins that help cancer cells to survive even when they are damaged by cancer drugs. We examine how cancer cells invade tissue and spread throughout the body, and how they escape being attacked and removed by the immune system. Our research focuses on pancreatic, breast, ovarian, oesophageal and melanoma skin cancer, and by collaborating with clinicians we can use the knowledge we acquire from our studies to improve the way cancer is treated.

Cancer researchers in the CCB theme are part of the Manchester Cancer Research Centre, which is a partnership between The University of Manchester, the Cancer Research UK Manchester Institute and The Christie NHS Foundation Trust, and which provides outstanding facilities where researchers and clinicians can work closely together.

Highlight Publications

Ali N, Zhang L, Taylor S, Mironov A, Urbé S, Woodman P, (2013). Recruitment of UBPY and ESCRT exchange drive HD-PTP-dependent sorting of EGFR to the MVB. **Current Biology**, 23, 453.

Jennings MD, Zhou Y, Mohammad-Qureshi SS, Bennett D, Pavitt GD, (2013). eIF2B promotes eIF5 dissociation from eIF2*GDP to facilitate guanine nucleotide exchange for translation initiation. **Genes & Development**, 27, 2696.

Hálová L, Du W, Kirkham S, Smith DL, Petersen J, (2013). Phosphorylation of the TOR ATP binding domain by AGC kinase constitutes a novel mode of TOR inhibition. **Journal of Cell Biology**, 203, 595.

Smith MP, Ferguson J, Arozarena I, Hayward R, Marais R, Chapman A, Hurlstone A, Wellbrock C, (2013). Effect of SMURF2 targeting on susceptibility to MEK inhibitors in melanoma. **Journal of the National Cancer Institute**, 105, 33.

Pisco AO, Brock A, Zhou J, Moor A, Mojtahedi M, Jackson D, Huang S, (2013). Non-Darwinian dynamics in therapy-induced cancer drug resistance. **Nature Communications**, 4, 2467.

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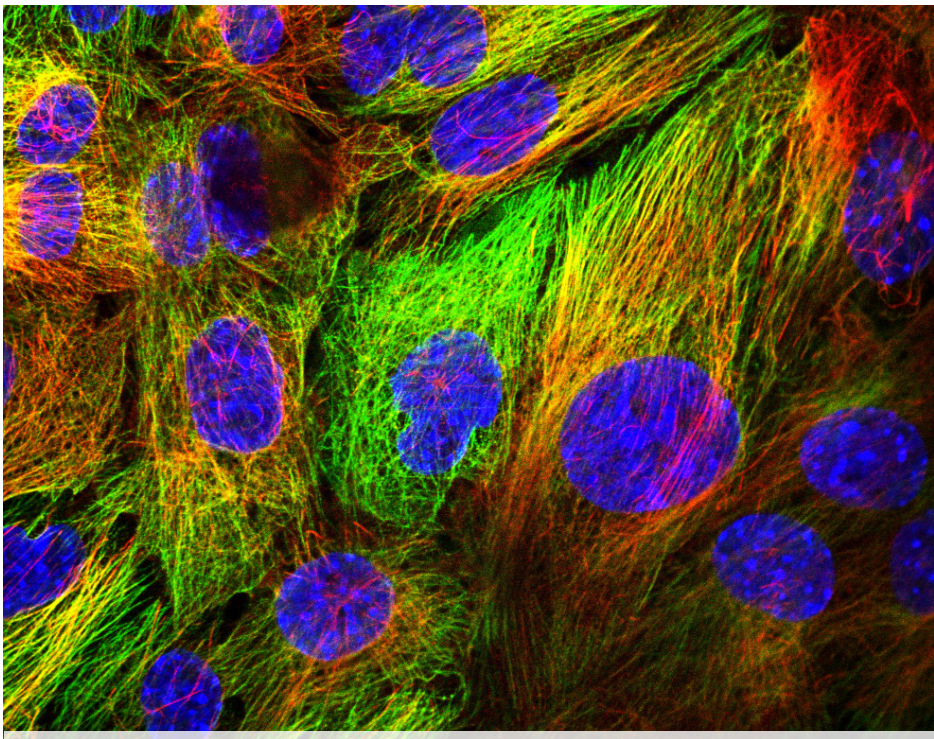
Faculty of Life Sciences

Research Theme

Cell Matrix Biology



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The aim of the Cell Matrix Biology research theme is to understand how cells make their extracellular matrix microenvironment, and how they integrate matrix-derived chemical and physical cues to build and repair tissues.

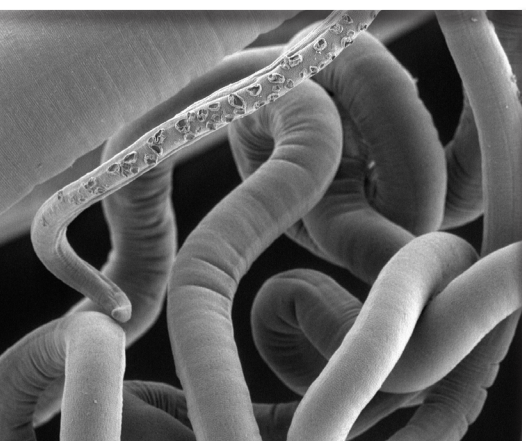
The extracellular matrix is found around and between all cells, providing the microenvironment in which cells live. It creates the three-dimensional framework that braces individual cells, shapes organs, and supports the body as a whole. However, the matrix is not merely a passive scaffold, it also interacts with cells to control the way that they behave. At the same time, cells remodel and maintain the matrix. Cell-matrix interactions are therefore crucial for animal development and nearly every aspect of body function.

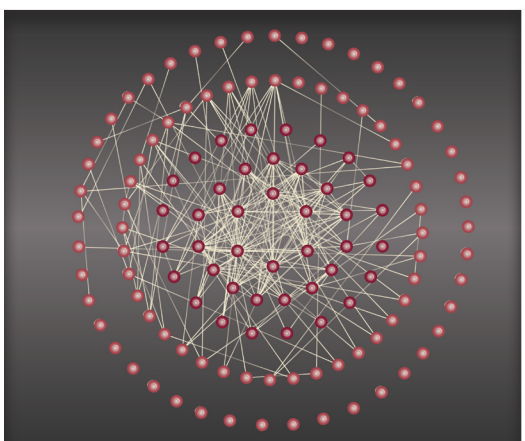
Due to the close connection between cells and the matrix, failures in the matrix are linked to many human ailments, including ageing and chronic diseases such as cancer, osteoarthritis, inflammation, and musculoskeletal abnormalities. Discoveries coming from the various laboratories within the research theme have vastly improved the understanding of these human diseases and are having a global impact.

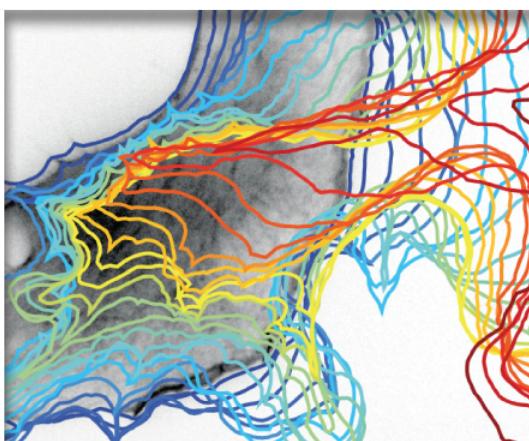
Research Theme Director - Professor Charles Streuli

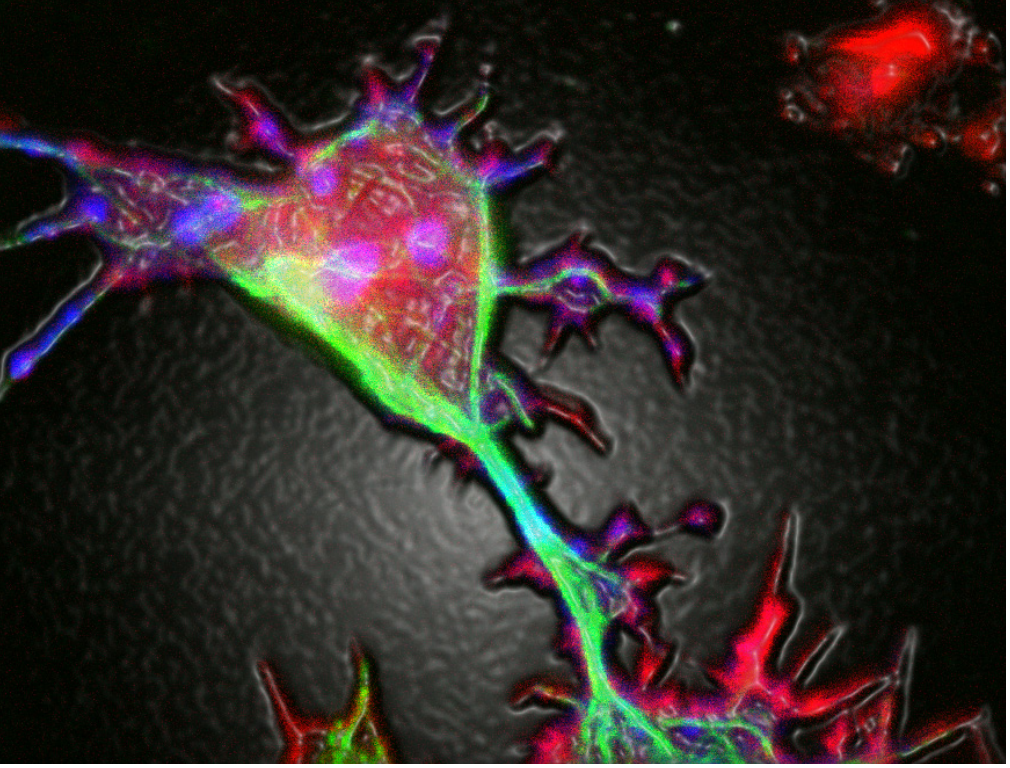
Principal Investigators include:

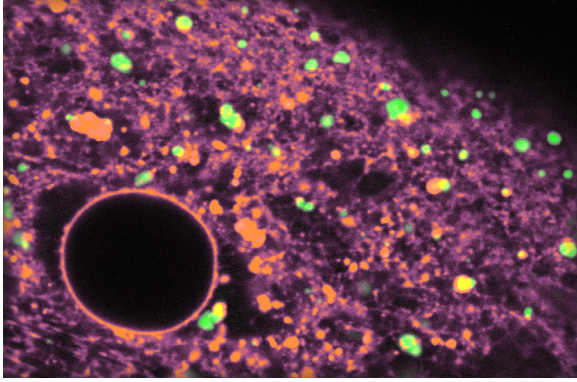
Prof Hilary Ashe
Prof Clair Baldock
Dr Christoph Ballestrem
Prof Ray Boot-Handford
Prof Keith Brennan
Dr Patrick Caswell
Prof Tony Day
Dr Andrew Gilmore
Prof Richard Grencis
Prof Martin Humphries
Prof Karl Kadler
Prof Cay Kielty
Dr Qing-Jun Meng
Dr Jean-Marc Schwartz
Prof Charles Streuli
Prof Dave Thornton
Dr Mark Travis
Dr Claudia Wellbrock
Dr Sarah Woolner

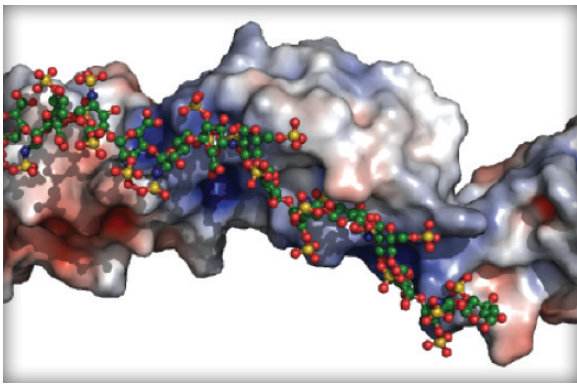












Our work focuses on three specific areas in cell-matrix biology that are changing the understanding of development, ageing, and chronic disease.

Cellular Matrix Microenvironment

Cells in all our tissues assemble and are embedded within an extracellular matrix microenvironment. By remodelling this matrix throughout life, cells fine-tune the extrinsic signals that are essential to maintain healthy cell and tissue function. However, degenerative changes in matrix organisation and cell-matrix interactions cause or exacerbate many major diseases as well as ageing. Our research aims to determine the molecular mechanisms by which cells assemble and remodel their three-dimensional matrix, and how the matrix generates signals to control cellular behaviour. In the longer term, this will lead to the design of new treatments for diseases arising from inherited skeletal disorders, defective wound healing, and malignant cancers.

Matrix Immunobiology

The extracellular matrix has an important role in leukocyte adhesion and migration. However, the matrix is also central in controlling other aspects of immune function that become disrupted with age, infection, and disease. Our research is determining how the matrix controls innate and adaptive immune responses, and how it regulates the immunomodulatory functions of multipotent stromal cells. Ultimately, our research will lead to new ways to exploit stem cells in many applications in regenerative medicine, to devise new treatments for chronic inflammatory diseases such as colitis, for age-related macular degeneration, and for the control of parasitic nematode infections.

Mechanobiology of Matrix

Mechanical forces contribute to all levels of vertebrate development, morphology, and tissue function. Cells exert tension on the surrounding extracellular matrix to guide tissue assembly, and they migrate through mechanically varied and biophysically complex matrices. Moreover, matrix stiffness is now known to govern cell fate and phenotype. Our research aims to determine the mechanisms by which cells make and maintain viscoelastic extracellular matrix, and how the biomechanical and rhythmic properties of tissues can be explained by forces generated by individual cells. In the longer term this will establish principles to understand the basis of diseases that are caused by abnormal matrix biomechanics and altered cellular mechanotransduction including fibrosis, tendonopathies and kidney failure.

Highlight Publications

Gossan N, Zeef L, Hensman J, Hughes A, Bateman JF, Rowley L, Little CB, Piggins HD, Rattray M, Boot-Handford RP, Meng QJ, (2013). The circadian clock in murine chondrocytes regulates genes controlling key aspects of cartilage homeostasis. **Arthritis & Rheumatology**, 65, 2334.

Carisey A, Tsang R, Greiner AM, Nijenhuis N, Heath N, Nazgiewicz A, Kemkemer R, Derby B, Spatz J, Ballestrem C, (2013). Vinculin regulates the recruitment and release of core focal adhesion proteins in a force-dependent manner. **Current Biology**, 23, 271.

Morgan MR, Hamidi H, Bass MD, Warwood S, Ballestrem C, Humphries MJ, (2013). Syndecan-4 phosphorylation is a control point for integrin recycling. **Developmental Cell**, 24, 472.

Jacquemet G, Green DM, Bridgewater RM, von Kriegsheim A, Humphries MJ, Norman JC, Caswell PT, (2013). RCP-driven α5β1 recycling suppresses Rac and promotes RhoA activity via the RacGAP1-IQGAP1 complex. **Journal of Cell Biology**, 202, 917.

Akhtar N, Streuli CH, (2013). An integrin-ILK-microtubule network orients cell polarity and lumen formation in glandular epithelium. **Nature Cell Biology**, 15, 17.

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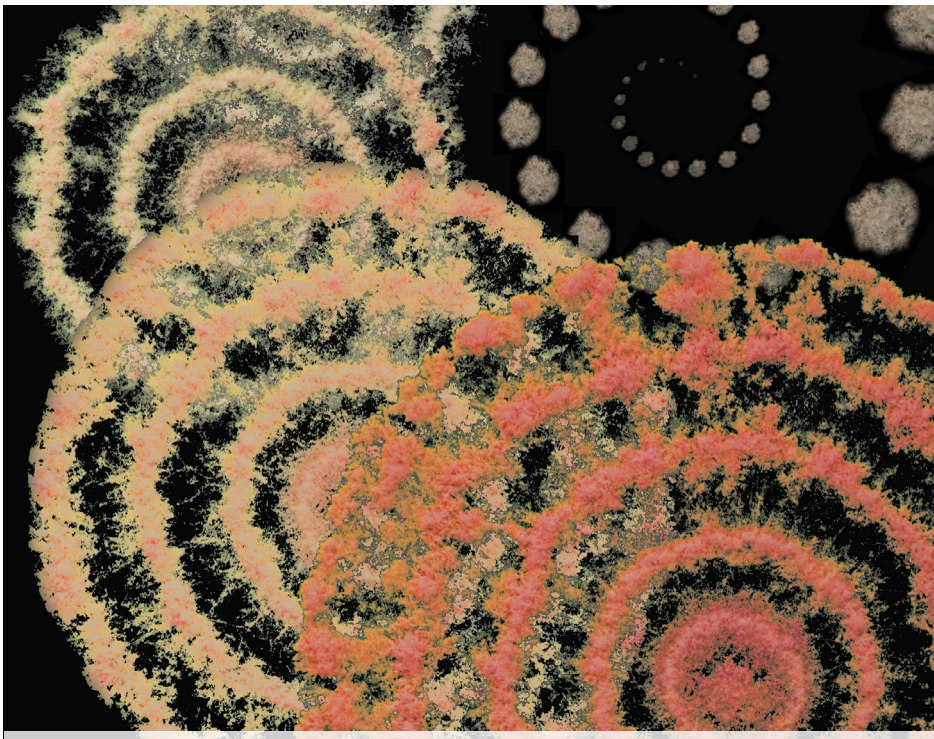
Faculty of Life Sciences

Research Theme

Computational & Evolutionary Biology



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Research in the Computational and Evolutionary Biology theme focuses on understanding biological systems through the study of evolutionary processes and gene function.

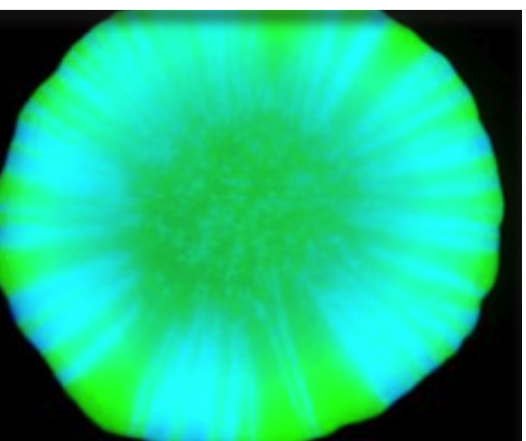
Researchers seek to understand biological function at different levels: molecular and genomic, organismal, population, and ecosystem. Study of living organisms is undertaken computationally, in the laboratory and on whole animals in the field. This includes the diverse relationships among organisms and their environments, including humans and their pathogens. The close linkage between modelling and *in vivo* experiments means that interdisciplinary approaches are key to the theme's research.

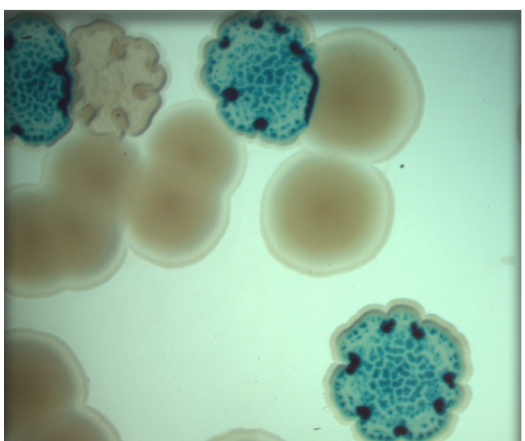
A main subject of our research is the use of an evolutionary perspective to inform and predict the behaviour of biological systems. As such, the study of evolutionary processes is central to much of our work. Comparative analysis, frequently involving model organisms and humans, is enabling new understandings across biology, from molecules via single cells to whole organisms and their social networks.

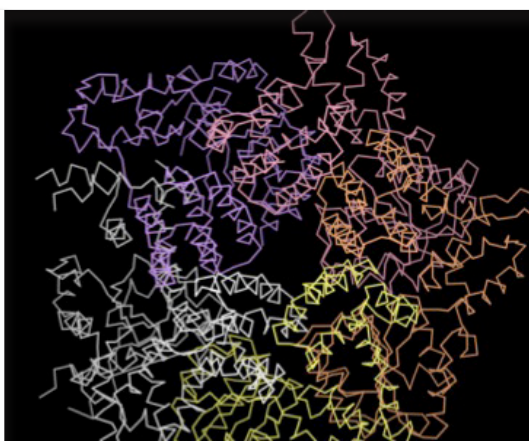
Research Theme Director - Dr Daniela Delneri

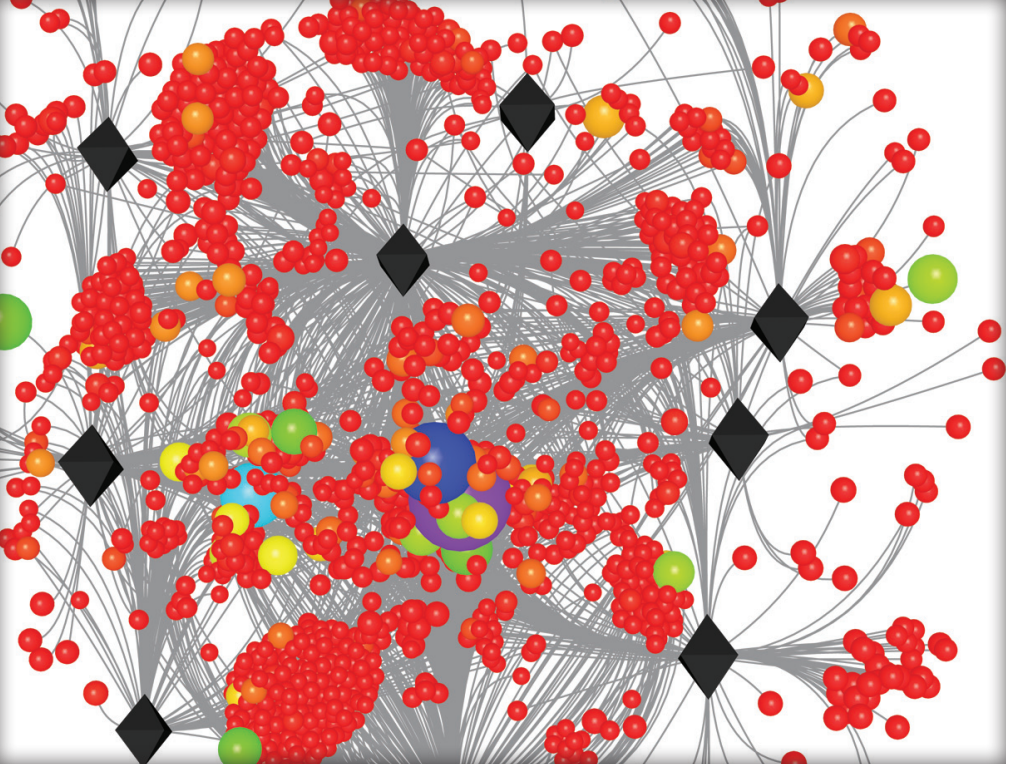
Principal Investigators include:

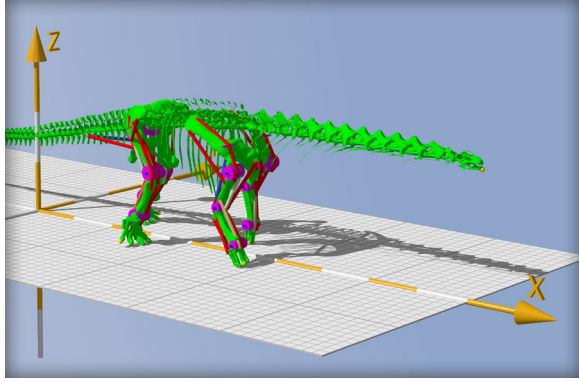
Dr Mark Ashe
Prof Teresa Attwood
Dr Douda Bensasson
Dr Casey Bergman
Prof Andy Brass
Prof Rainer Breitling
Prof Terry Brown
Dr Mike Buckley
Prof Andrew Chamberlain
Prof Matthew Cobb
Dr Jonathan Codd
Dr Susan Crosthwaite
Dr Anil Day
Dr Daniela Delneri
Prof Michael Dixon
Prof Andrew Doig
Dr John Fitzpatrick
Prof Bob Ford
Dr Tucker Gilman
Prof Chris Grant
Dr Sam Griffiths-Jones
Dr Reinmar Hager
Dr Sam Hay
Dr Christian Heintzen
Dr Kathy Hentges
Prof Simon Hubbard
Dr Minsung Kim
Prof Chris Klingenberg
Dr Chris Knight
Prof Simon Lovell
Dr Catherine Millar
Dr Marcelo Montemurro
Dr Robert Nudds
Dr Ray O'Keefe
Dr Pawel Paszek
Prof Graham Pavitt
Dr Gino Poulin
Prof Richard Preziosi
Prof Magnus Rattray
Prof David Robertson
Dr Matthew Ronshaugen
Dr Alan Roseman
Dr Jennifer Rowntree
Dr Robert Sansom
Dr Jean-Marc Schwartz
Dr Bill Sellers
Dr Susanne Shultz
Dr Lubomira Stateva
Dr Tokiharu Takahashi
Prof Eriko Takano
Prof Chris Thompson
Dr Catherine Walton
Dr Jim Warwicker
Dr Keith White











In the Computational and Evolutionary Biology research theme, we use a wide range of techniques from computational to whole organism experimental approaches in our pursuit of understanding biological systems.

The group includes computational and molecular scientists as well as organismal and evolutionary biologists. The former focus on gene function, genome evolution, comparative 'omics, experimental evolution, quantitative biology, and dynamics of biological systems (represented in the sub-themes of **Computational Biology**, **Functional Genomics & System Biology** and **Molecular Evolution**), while the latter focus on evolution of sociality, comparative zoology and physiology, palaeobiology, behavioural genetics, and co-evolution (represented in the sub-themes **Behaviour & Evolution** and **Organismal Biology**).

The use of computational approaches in biology has never been so important and a major goal of computational biology is the in silico representation of dynamic biological systems.

The shift from data representation, visualisation, and analysis to predictive biology has the potential to yield novel insights into the most important biological, biotechnological, and medical problems that we face. This was demonstrated in a recent study where researchers found that the rate of mutation in bacteria varied according to how many cells were present in the population, enabling experimental manipulation of mutation rates via the social environment, which has the potential to be exploited medically to minimise the evolution of antibiotic resistance.

Understanding how organisms work and interact with their environment also forms a key part of research carried out in the theme. Indeed, analysis of biological systems cannot be undertaken entirely with laboratory-based research and, therefore, our research is conducted to ensure it is relevant to the whole animal and the field situation.

We aim to understand evolutionary processes, animals' interactions and adaptations at the structural and functional level. Specific research projects include:

- comparing genomes from divergent species to identify probable non-coding RNAs (i.e. miRBase database, www.mirbase.org)
- development of new bioinformatics software
- use of computer simulations to understand the movements of both living and fossil animals such as dinosaurs
- evolution of hybrid genomes
- evolutionary genetics of social interactions and complex traits

Highlight Publications

Lüpold S, Tomkins JL, Simmons LW, Fitzpatrick JL, (2014). Female monopolization mediates the relationship between pre- and postcopulatory sexual traits. **Nature Communications**, 5, 3184.

Krašovec R, Belavkin RV, Aston JA, Channon A, Aston E, Rash BM, Kadirvel M, Forbes S, Knight CG, (2014). Mutation rate plasticity in rifampicin resistance depends on *Escherichia coli* cell-cell interactions. **Nature Communications**, 5, 3742.

wa Maina C, Honkela A, Matarese F, Grote K, Stunnenberg HG, Reid G, Lawrence ND, Rattray M, (2014). Inference of RNA polymerase II transcription dynamics from chromatin immunoprecipitation time course data. **PLOS Computational Biology**, 10, e1003598.

Piatkowska EM, Naseeb S, Knight D, Delneri D, (2013). Chimeric protein complexes in hybrid species generate novel phenotypes. **PLOS Genetics**, 9, e1003836.

Opie C, Atkinson QD, Dunbar RI, Shultz S, (2013). Male infanticide leads to social monogamy in primates. **Proceedings of the National Academy of Sciences of the USA**, 110, 13328.

MANCHESTER 1824
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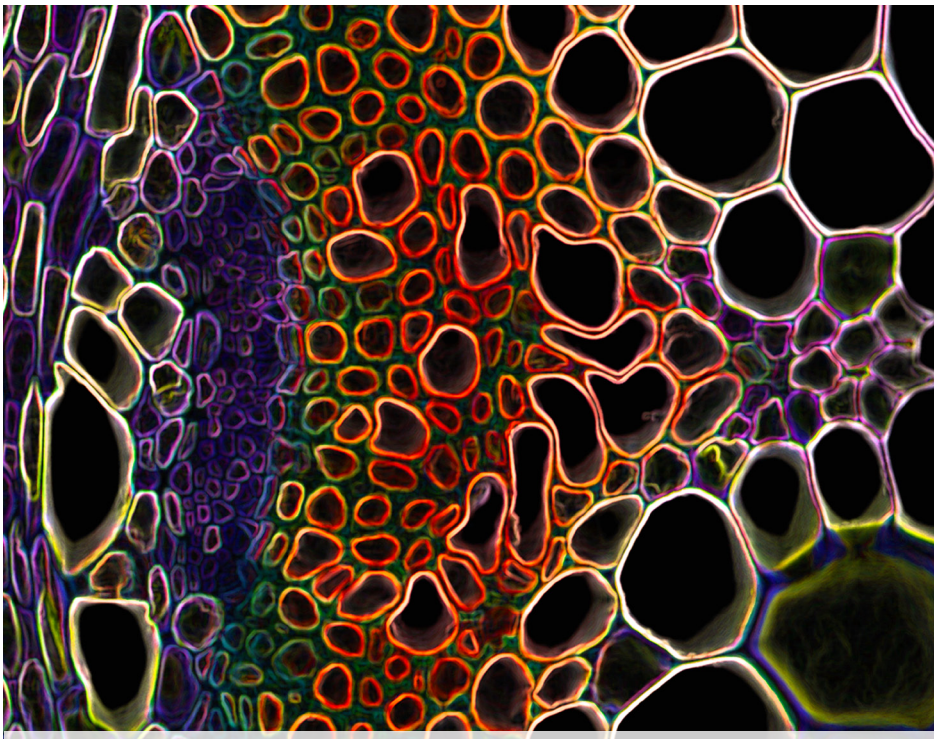
Faculty of Life Sciences

Research Theme

Development



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The Development research theme addresses one of the most fascinating questions in biology: how does a single cell, the fertilised egg, give rise to a complex multicellular organism?

Researchers in the Development theme investigate the fundamental mechanisms underlying normal development, how their failure can lead to disease, and how this knowledge can be used to achieve regeneration.

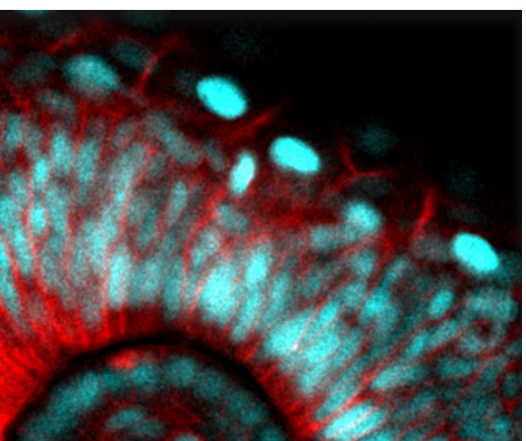
Our specific interests include cell fate specification and differentiation; pluripotency, patterning, and organogenesis; cell signalling; epithelial development and morphogenesis; cell adhesion in development; and the developmental role of genes involved in human diseases including heart and craniofacial defects. Development researchers within the Healing Foundation Centre investigate the cellular and molecular basis of tissue repair and regeneration.

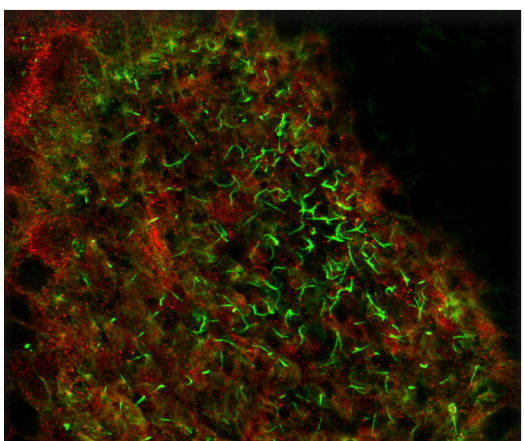
Our research utilises a variety of model organisms including *Dictyostelium*, *Drosophila*, mouse, zebrafish, and *Xenopus*. Development researchers use a diverse array of state-of the-art techniques including genetic analysis, transgenesis, gene targeting, expression profiling, functional genomics, and imaging.

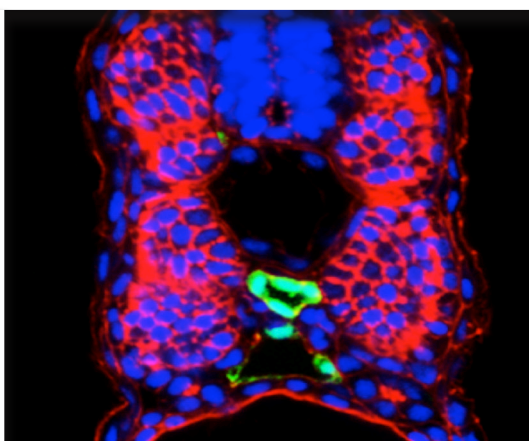
Research Theme Director - Professor Chris Thompson

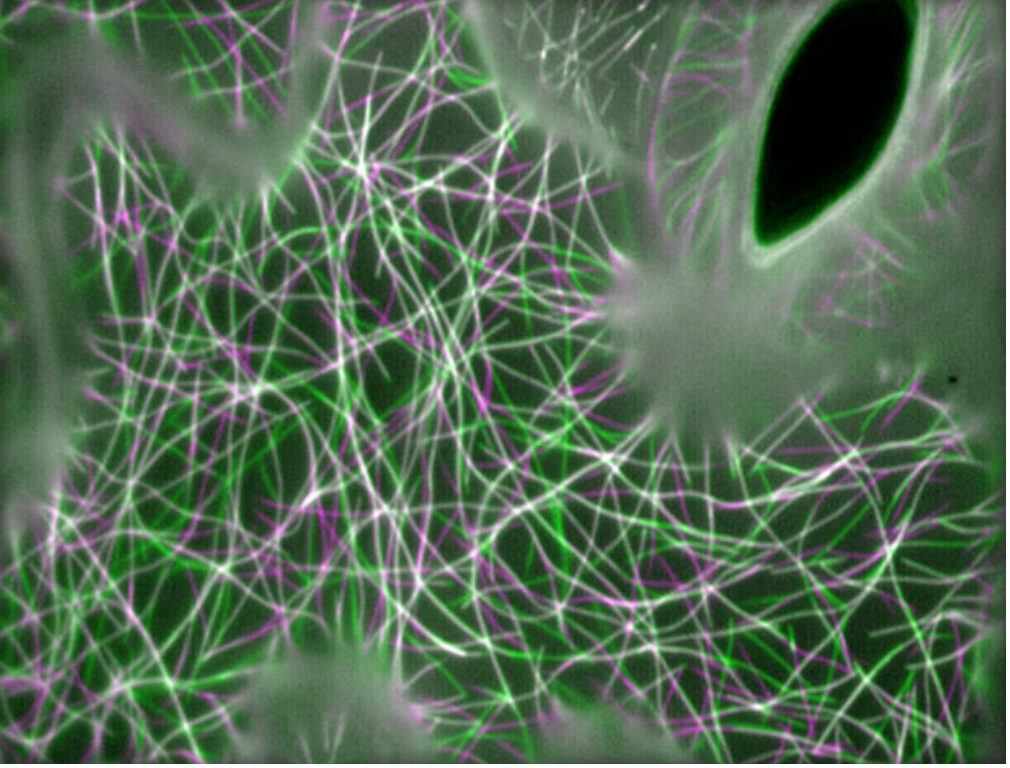
Principal Investigators include:

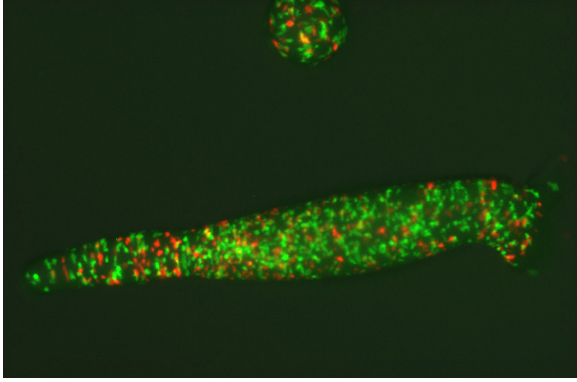
Prof Viki Allan
Prof Enrique Amaya
Prof Hilary Ashe
Dr Martin Baron
Prof Keith Brennan
Dr Maria Canal
Dr Karen Cosgrove
Prof Michael Dixon
Dr Karel Dorey
Dr Nicholas Glossop
Dr Sam Griffiths-Jones
Dr Matthew Hardman
Dr Kathy Hentges
Dr Shane Herbert
Dr Minsung Kim
Prof Sue Kimber
Prof Chris Klingenberg
Dr Lindsay MacDougall
Dr Kimberly Mace
Dr Tom Millard
Prof Nancy Papalopulu
Dr Berenika Plusa
Dr Gino Poulin
Prof Andreas Prokop
Dr Matthew Ronshaugen
Dr Ilaria Russo
Prof Andy Sharrocks
Dr Tokiharu Takahashi
Prof Chris Thompson
Prof Simon Turner
Dr Melissa Westwood
Dr Sarah Woolner

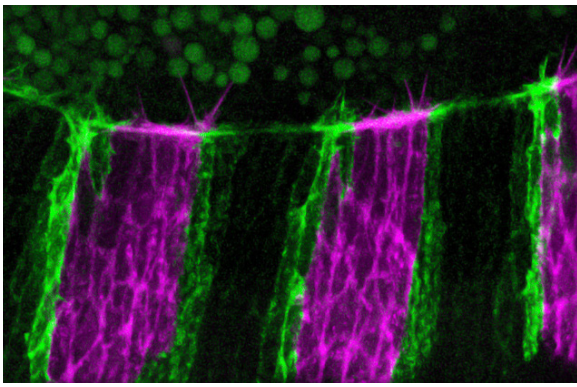












Cell Differentiation and Morphogenesis

A central question in developmental biology is how undifferentiated cells acquire different fates. Crucially, for this to occur, cell division, cell interactions, cell movements, and cell fate determination must all be coordinated in space and time. Our researchers are studying the mechanisms underlying these processes and, specifically, how the control of transcription and protein abundance can lead to the diverse cell fates observed, and how these differences affect the behaviour of cells during development.

Dynamic Transcription and Heterogeneous Cell Fate Choice

Embryonic development is remarkably reproducible. However, developing cells are actually subject to many fluctuating processes ranging from stochastic molecular events such as bursting gene transcription, to more regular periodic phenomena, such as oscillating gene expression and protein localisation. Developmental biology researchers in the Faculty are studying how the outcome of stochastic or periodic molecular fluctuations at the single cell level is integrated to play a key role in the generation of reproducible tissue patterns, with the correct cell types generated at appropriate times.

Development and Disease

Developmental biology researchers in the Faculty combine genetics and developmental biology to identify genes or pathways that are mutated in different developmental disorders. A better understanding of the molecular mechanisms underlying such conditions, not only provides insights into fundamental developmental mechanisms involved in normal and abnormal development, but also provides new avenues for the prevention or treatment of such disorders.

Stem Cells and Tissue Healing and Regeneration

Stem cell biology is concerned with issues of maintaining pluripotency, understanding cell renewal, and directing differentiation, all of which are also fundamental questions in developmental biology. Healing and regeneration of adult tissues utilises the same molecules and cellular mechanisms that operate during the formation of tissue in the embryo. Consequently, developmental biology researchers have strong ties with The Healing Foundation Centre, led by Professor Enrique Amaya, which represents a 25 year, £10M commitment between the Healing Foundation and The University of Manchester to advance the understanding of wound healing and tissue regeneration.

Highlight Publications

Shimizu H, Woodcock SA, Wilkin MB, Trubenová B, Monk NA, Baron M, (2014). Compensatory flux changes within an endocytic trafficking network maintain thermal robustness of notch signaling. **Cell**, 157, 1160.

Goodfellow M, Phillips NE, Manning C, Galla T, Papalopulu N, (2014). microRNA input into a neural ultradian oscillator controls emergence and timing of alternative cell states. **Nature Communications**, 5, 3399.

Chattwood A, Nagayama K, Bolourani P, Harkin L, Kamjoo M, Weeks G, Thompson CR, (2013). Developmental lineage priming in *Dictyostelium* by heterogeneous Ras activation. **eLife,** 2, e01067.

Saunders A, Core LJ, Sutcliffe C, Lis JT, Ashe HL, (2013). Extensive polymerase pausing during *Drosophila* axis patterning enables high-level and pliable transcription. **Genes & Development**, 27, 1146.

Love NR, Chen Y, Ishibashi S, Kritsiligkou P, Lea R, Koh Y, Gallop JL, Dorey K, Amaya E, (2013). Amputation-induced reactive oxygen species are required for successful *Xenopus* tadpole tail regeneration. **Nature Cell Biology**, 15, 222.

MANCHESTER 1824
The University of Manchester

Faculty of Life Sciences

Research Theme

Environment & Ecology

www.manchester.ac.uk/ls/ee

The Environment and Ecology research theme focuses on applied research that addresses 21st century environmental challenges.

The food we eat, the water we drink, and the fuel that powers our industries are all dwindling resources that we harvest from the world around us. As our populations expand and natural areas are converted to farmland and cities, we lose the services that nature provided for free.

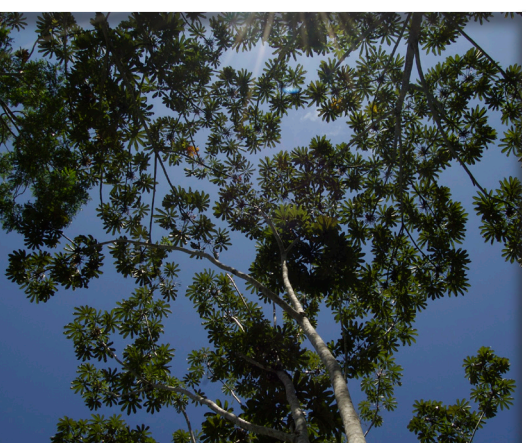
Global changes in climate alter species ranges, causing the loss of some species and allowing pathogens and parasites to colonise new areas and new host populations. From laboratories to rain forests, researchers in the Environment and Ecology research theme are working to meet these challenges and improve our quality of life while sustaining the natural world around us.

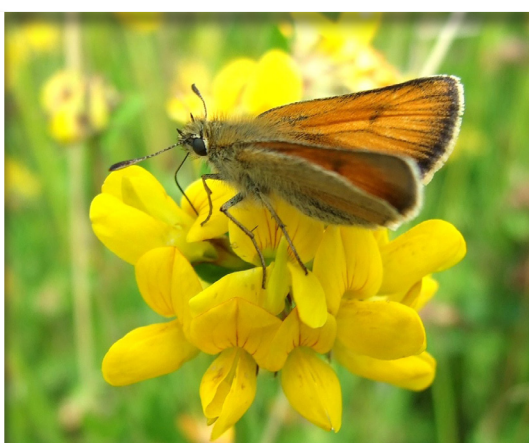
We have active research programmes in ecology, emerging and re-emerging diseases, biodiversity, bioarchaeology and palaeobiology, water security, conservation biology, and food security.

Research Theme Director - Professor Richard Preziosi

Principal Investigators include:

Prof Richard Bardgett
Dr Douda Bensasson
Dr Casey Bergman
Dr Caroline Bowsher
Prof Terry Brown
Dr Mike Buckley
Dr Jen Cavet
Prof Andrew Chamberlain
Dr Sarah Chan
Dr Anil Day
Dr Franciska de Vries
Dr Daniela Delneri
Prof Kathryn Else
Dr John Fitzpatrick
Dr Patrick Gallois
Dr Tucker Gilman
Dr Giles Johnson
Dr Minsung Kim
Prof Chris Klingenberg
Dr Chris Knight
Prof Andrew Loudon
Dr Jon Pittman
Prof Richard Preziosi
Dr Catherine Rhodes
Prof Ian Roberts
Dr Geoff Robson
Dr Jennifer Rowntree
Dr Robert Sansom
Dr Bill Sellers
Dr Holly Shiels
Dr Susanne Shultz
Dr Simone Turchetti
Prof Simon Turner
Dr Catherine Walton
Dr Keith White





Plant and Soil Systems

The greatest challenge facing human society in the 21st century is feeding our still growing population without destroying all our natural ecosystems. We urgently need to reduce nutrient and water inputs into agriculture and minimise the use of fossil fuels. Plant and Soil Systems researchers at Manchester are addressing these challenges across a broad range of scales, from molecules to ecosystems, and by combining biological understanding with knowledge and philosophies from traditionally separate fields such as sociology, maths, chemistry and physics.

Biodiversity and Conservation

Environments are changing on a global and local scale through activities like resource harvesting, land conversion and climate change. This affects the abundance and distribution of species, has consequences for biodiversity and conservation, and reduces the sustainability of natural resources. We work across levels of biological organisation to understand biotic interactions and how they impact water and food systems, land use, aquatic and terrestrial plant and animal populations, and pathogen and parasite interactions.

Bioarchaeology and Palaeobiology

Palaeontological and archaeological remains provide a unique window to the past that is essential for understanding how organisms, including humans, evolve and respond to long term environmental change. We use diverse sources of evidence, from fossils and osteological remains to ancient molecules, to address a broad range of topics such as the early diversification of animals, origins of flight and bipedalism, development of agriculture, and historic population changes.

Environmental 'Omics

Understanding the function and sustainability of current and past ecosystems relies on a detailed knowledge of the constituent communities and populations. This knowledge is not simply the identities of the organisms that are present, but also the biological activities of those organisms. The term "environmental 'omics" describes a broad set of disciplines designed to study the patterns of gene expression in these complex ecosystems.

Highlight Publications

Ward SE, Ostle NJ, Oakley S, Quirk H, Henrys PA, Bardgett RD, (2013). Warming effect on greenhouse gas fluxes in peatlands are modulated by vegetation composition. **Ecology Letters**, 16, 1285.

Dean AP, Lynch S, Rowland P, Toft B, Pittman JK, White KN, (2013). Natural wetlands are efficient at providing long-term metal remediation of freshwater systems polluted by acid mine drainage. **Environmental Science and Technology**, 47, 12029.

Bragazza L, Parisod J, Buttler A, Bardgett RD, (2013). Biogeochemical plant-soil microbe feedback in response to climate warming in peatlands. **Nature Climate Change**, 3, 273.

Rybczynski N, Gosse JC, Harington CR, Wogelius RA, Hidy AJ, Buckley M, (2013). Mid-Pliocene warm-period deposits in the high arctic yield insight into camel evolution. **Nature Communications**, 4, 1550.

De Vries FT, et al., (2013). Soil food web properties explain ecosystem services across European land use systems. **Proceedings of the National Academy of Sciences of the USA**, 110, 14296.

MANCHESTER 1824
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Faculty of Life Sciences

Research Theme

History of Science, Technology & Medicine

www.manchester.ac.uk/ls/hstm

The primary base for the History of Science, Technology and Medicine research theme is the Centre for the History of Science, Technology and Medicine (CHSTM), which was founded in 1986 as a research group focused on the social, political, cultural, economic, and environmental implications of science, technology and medicine since 1800.

The theme also includes the Institute for Science, Ethics and Innovation (iSEI), established in 2008 to observe and analyse the role and responsibilities of science and innovation.

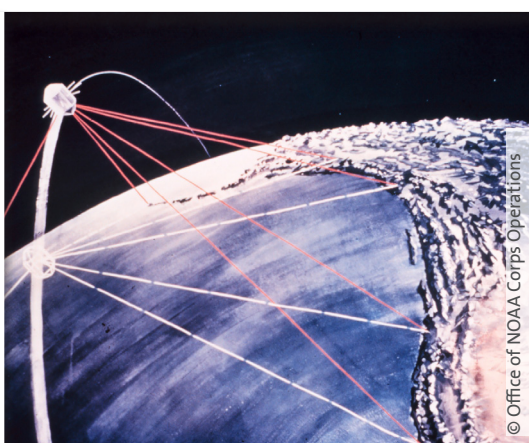
Our work draws on approaches from social and cultural history, science and technology studies, bioethics, and extends to science communication and contemporary history.

While much of our research is on Britain, this work has a significant international comparative context, and we have researchers investigating topics involving Continental Europe, North America, and the developing world.

Research Theme Director - Dr Ian Burney

Principal Investigators include:

Dr Ian Burney
Prof Pratik Chakrabarti
starting July 2015
Dr Sarah Chan
Prof Matthew Cobb
Prof Daniel Davis
Prof John Harris
Dr Jeff Hughes
Dr Vladimir Jankovic
Dr David Kirby
Prof Sir John Sulston
Dr James Sumner
Dr Carsten Timmermann
Dr Simone Turchetti
Prof Michael Worboys



Our research is diverse in subject matter and broad ranging in approach, but is unified by a commitment to the study of the interrelations between science, technology, and medicine (STM) and their social relations. We have an excellent record of attracting research funding and have recently started four major projects:

- The Earth Under Surveillance: Climate Change, Geophysics, and the Cold War Legacy
- Before 'Translational Medicine': Bench-Clinic Relations since 1950
- Playing God: Exploring the Interactions among the Biosciences, Religion, and Entertainment Media
- Pedigree Chums: Science, Medicine, and the Remaking of the Dog in the Twentieth Century

Our programme of research engages the following set of sub-themes:

Connections between the Sciences, Technologies, Medicine, and Society

We adopt an integrative approach to investigate historical interactions across disciplines, periods, sites, and cultures. This work informs our interests in the ethics and politics of STM.

Medical Sciences and Technologies since 1800

We focus on the intellectual, social, cultural, and political history of medicine, from around 1800 to the most recent biomedical sciences and technologies. We have particular strengths in medicine and health care, nonhuman animals in science and medicine, and the production and circulation of expert knowledge.

Physical Sciences and Technology

Our coverage ranges from the switch from craft to scientific methods in the technologies of the industrial revolution and nineteenth century, through to the major big sciences of the twentieth century, including nuclear physics and computing and their cultures.

Environmental Humanities

Our research encompasses work on the understanding of, and responses to, environmental and climatic changes, from the global to the local. We focus on the origins of current research in meteorology, glaciology, and oceanography, and investigate the international developments in the geophysical sciences, urban climatology, and the economics of climate change.

Science, Ethics and Society

Our research is conducted within the context of current and future trends in life sciences, and involves 'bench-scientists' as much as those with backgrounds in ethics, law, philosophy and governance. We cover a broad range of historical and contemporary topics, through which we seek to develop a greater understanding of the social, cultural, and moral impacts of modern science.

Highlight Publications

Duncan Wilson, (2014). **The Making of British Bioethics**. Manchester University Press.

Daniel Davis, (2013). **The Compatibility Gene**. Allen Lane.

Aya Homei and Michael Worboys, (2013). **Fungal Disease in Britain and the United States, 1850-2000**. Palgrave Macmillan.

Catherine Rhodes, (2013). **Governance of Genetic Resources: A Guide to Navigating the Complex Global Landscape**. Elgar.

James Sumner, (2013). **Brewing Science, Technology and Print, 1700-1880**. Pickering & Chatto.

Carsten Timmermann, (2013). **A History of Lung Cancer**. Palgrave Macmillan.

Sarah Chan and Daniela Cutas (eds), (2014). **Families Beyond the Nuclear Ideal**. Bloomsbury.

Ian Burney, David Kirby and Neil Pemberton (eds), (2013). **Forensic Cultures, Studies in History and Philosophy of Biological and Biomedical Sciences**. *Special issue*. Elsevier.

MANCHESTER 1824
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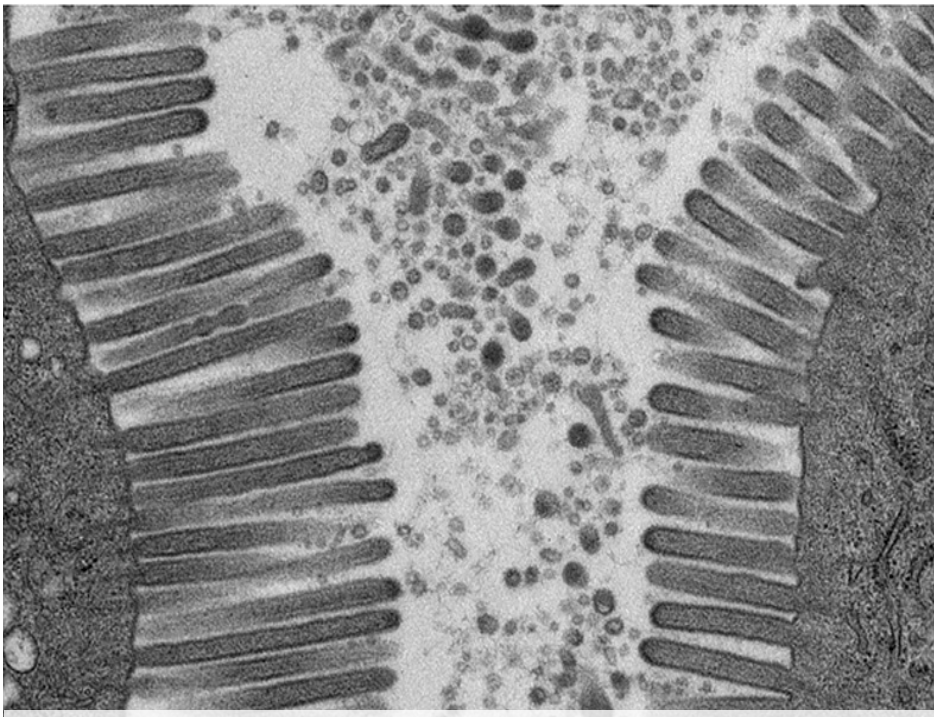
Faculty of Life Sciences

Research Theme

Infection, Inflammation & Immunity



www.manchester.ac.uk/ls/iii

The Infection, Inflammation and Immunity research theme covers all topics related to the role of our immune system in health and disease.

Many symptoms of both infectious and non-infectious diseases are caused by reactions of the host's immune system. In this theme, researchers study the initiation and the resolution of immune responses and associated diseases.

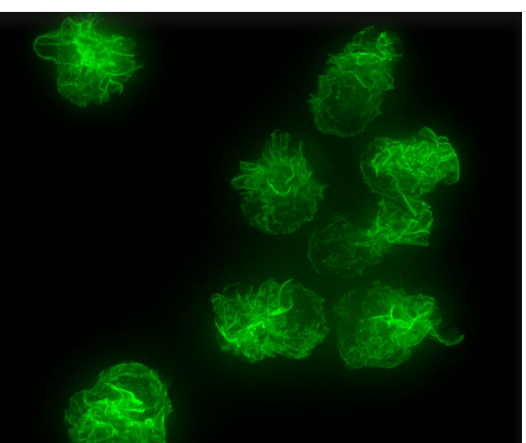
Researchers in the theme use multidisciplinary experimental approaches including advanced imaging, genomic and trans-genomic technologies, mathematical modelling, and fragment based approaches to drug design.

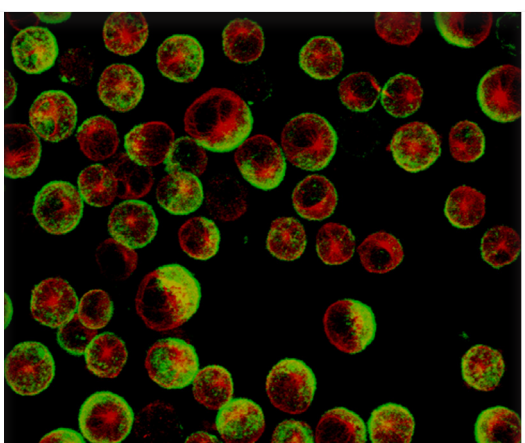
The theme is centrally placed within a range of other Faculty research themes, most notably Neurobiology and Cardiovascular & Metabolic Disease. Some theme members are also part of the Manchester Collaborative Centre for Inflammation Research (MCCIR) and the Wellcome Trust Centre for Cell-Matrix Research. The interaction between the immune system, infection, and extracellular matrix has a prominent role within the theme.

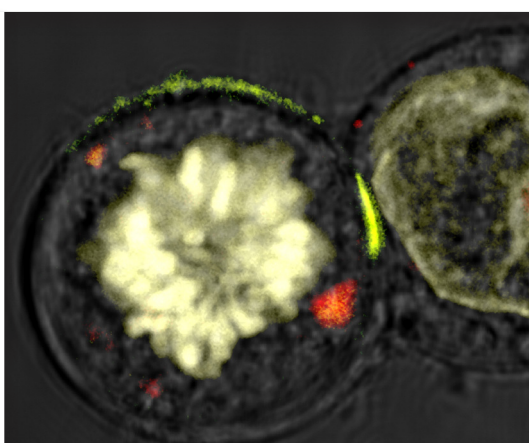
Research Theme Director - Professor Werner Muller

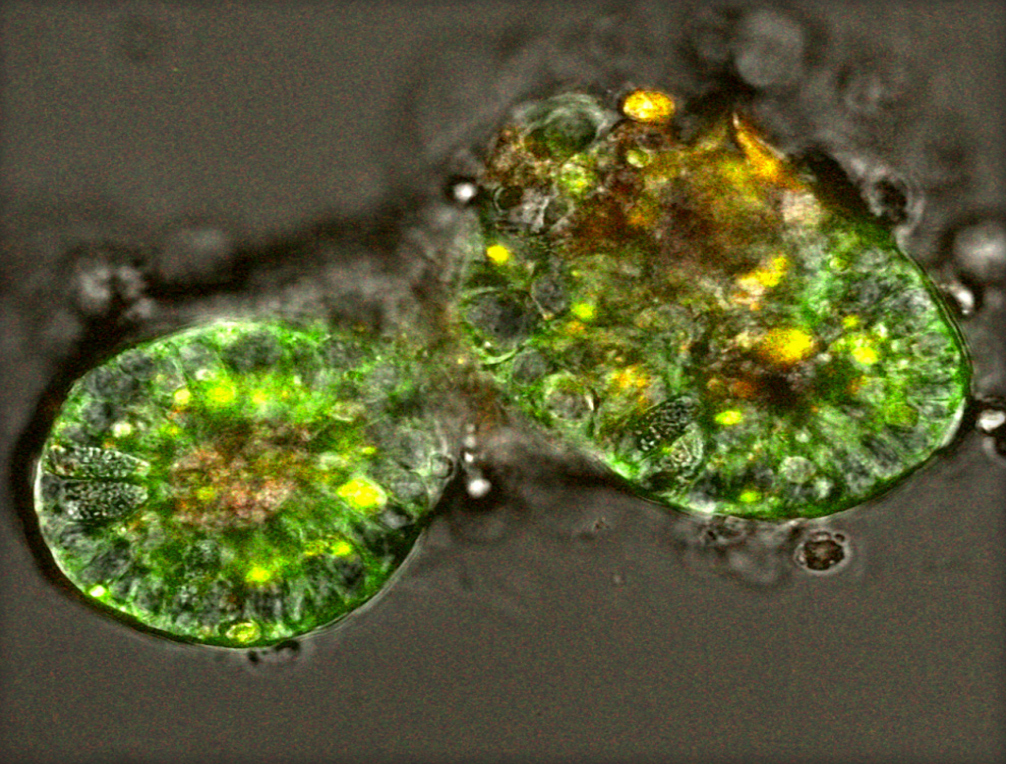
Principal Investigators include:

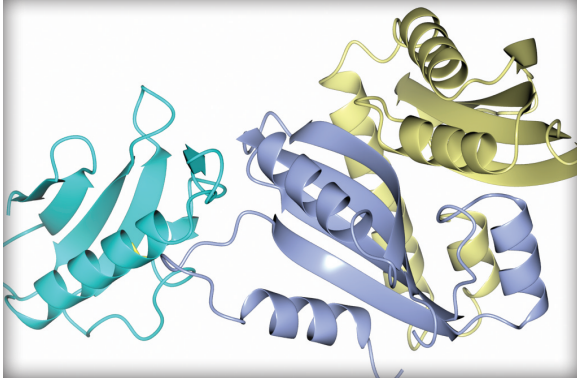
Prof Stuart Allan
Prof Enrique Amaya
Prof Andy Brass
Dr David Brough
Dr Jen Cavet
Dr Kevin Couper
Dr Sheena Cruickshank
Prof Daniel Davis
Prof Tony Day
Dr Rebecca Dearman
Prof Jeremy Derrick
Dr Curtis Dobson
Prof Kathryn Else
Prof Bob Ford
Dr Alexander Golovanov
Dr John Grainger
Prof Richard Grencis
Dr Matthew Hardman
Dr Finbarr Hayes
Dr Adam Hurlstone
Prof Dean Jackson
Prof Ian Kimber
Prof Sue Kimber
Dr Joanne Konkel
Dr Catherine Lawrence
Dr Dennis Linton
Dr Gloria Lopez-Castejon
Prof Andrew Loudon
Prof Andrew MacDonald
Dr Kimberly Mace
Dr Caroline Milner
Dr Jaleel Miyan
Prof Werner Muller
Prof Andrew Munro
Dr Pawel Paszek
Prof Ian Roberts
Dr Geoff Robson
Dr Matthew Ronshaugen
Dr Alan Roseman
Prof Dame Nancy Rothwell
Dr Ilaria Russo
Dr Lydia Tabernero
Prof Dave Thornton
Dr Mark Travis
Dr Xin Joy Wang
Prof Mike White
Dr John Worthington

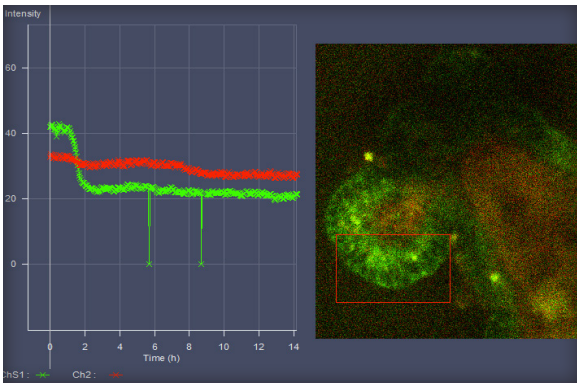












The Infection, Inflammation and Immunity research theme consists of over 45 Principal Investigators and has close links to other research themes and faculties at The University of Manchester.

Infection

Our research in infection focuses on bacteria and parasites. In bacterial infections we are interested in understanding how the bacteria adapt to new environments encountered in the host during the course of an infection. Understanding such processes will facilitate both novel approaches in the design of new anti-microbial drugs to combat antibiotic resistance and the generation of effective vaccines. In addition, we are studying how both infection, and non-infectious diseases affect the host microbiome in the large intestine and the pathological consequences of such changes.

The parasites we study include Malaria, Whipworms, Toxoplasma and Schistosoma, all of which can cause severe health problems in humans. In particular, we want to find out how the interaction of the parasite with the host immune system is regulated.

Inflammation

Inflammation embraces many areas of biology and medicine and can affect almost all tissues and organs, including lung, skin, and gut. We have several groups working on understanding inflammatory bowel disease, and also lead an extensive research consortium funded by the European Commission in this field. Within the research theme we also cover the area of neuroinflammation linked to stroke, dementia, and Alzheimer's. Likewise, we study inflammation during wound healing and cardiovascular diseases. The theme also has research interests in skin and respiratory allergy caused by chemicals and proteins, and the ways in which allergy can be controlled.

Immunity

Our immunological expertise provides the underlying framework for our work on infection and inflammation. In immunology, we study the development and differentiation of immune cells, understand how immune cells interact with each other or with non-immune cells, decipher the network of immune regulatory molecules driving the immune system like cytokines, and look at receptors that the immune system uses to sense the status of our body prior, during, and after immune defence.

Highlight Publications

Zigmond E, Bernshtein B, Friedlander G, Walker CR, Yona S, Kim KW, Brenner O, Krauthgamer R, Varol C, Muller W, Jung S, (2014). Macrophage-restricted interleukin-10 receptor deficiency, but not IL-10 deficiency, causes severe spontaneous colitis. **Immunity**, 40, 720.

England H, Summersgill HR, Edye ME, Rothwell NJ, Brough D, (2014). Release of interleukin-1α or interleukin-1β depends on mechanism of cell death. **Journal of Biological Chemistry**, 289, 15942.

Roy MG, et al., (2014). Muc5b is required for airway defence. **Nature**, 505, 412.

Foth BJ, Tsai IJ, Reid AJ, Bancroft AJ, Nichol S, Tracey A, Holroyd N, Cotton JA, Stanley EJ, Zarowiecki M, Liu JZ, Huckvale T, Cooper PJ, Grencis RK, Berriman M, (2014). Whipworm genome and dual-species transcriptome analyses provide molecular insights into an intimate host-parasite interaction. **Nature Genetics**, 46, 693.

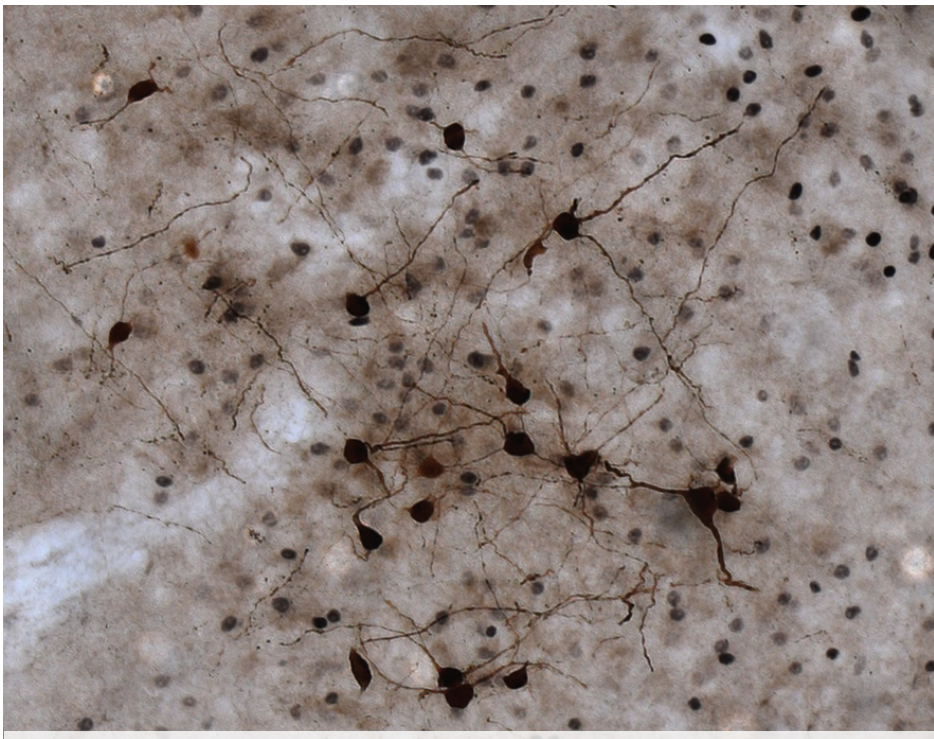
Pageon S, Cordoba SP, Owen DM, Rothery SM, Oszmiana A, Davis DM, (2013). Superresolution microscopy reveals nanometre-scale reorganisation of inhibitory natural killer cell receptors upon activation of NKG2D. **Science Signaling**, 6, ra62.

MANCHESTER 1824
The University of Manchester

Faculty of Life Sciences

Research Theme

Neurobiology



www.manchester.ac.uk/ls/nb

Scientists in the Neurobiology research theme focus on important questions relating to the development, structure and function of the brain and wider nervous system.

Comprising over 100 billion neurones, interconnected by thousands of kilometres of axons, the brain controls, co-ordinates and processes everything we do. Therefore understanding how the brain works and how it is affected by disease remains one of the greatest scientific challenges.

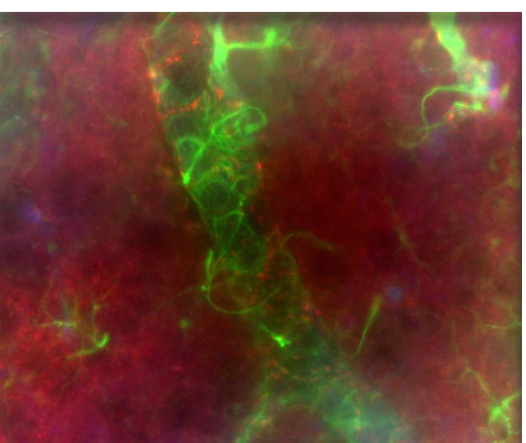
How does the brain detect and respond to changes in day length? How do neurones signal to glial cells and vice versa? How do diseases such as Alzheimer's, epilepsy and stroke affect the brain? To address these and other key questions a number of different experimental approaches are used by researchers in the Neurobiology theme, allowing the study of processes in individual brain cells right through to the whole organism.

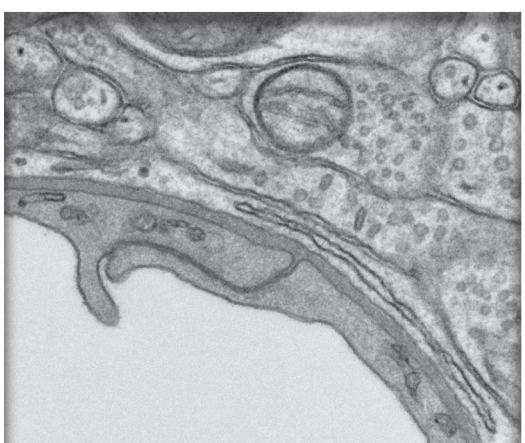
Information obtained is used to explain normal behaviours, to determine the origins and mechanisms of brain dysfunction and degeneration, and to devise new treatments.

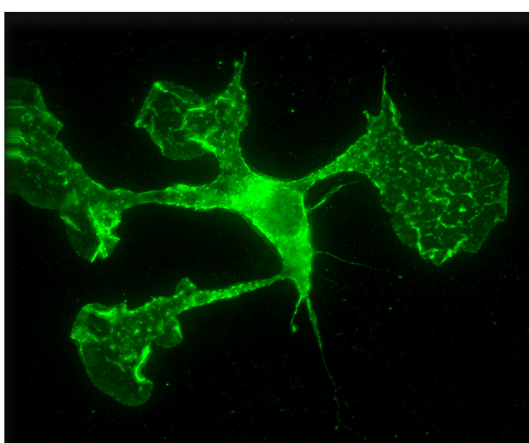
Research Theme Director - Professor Stuart Allan

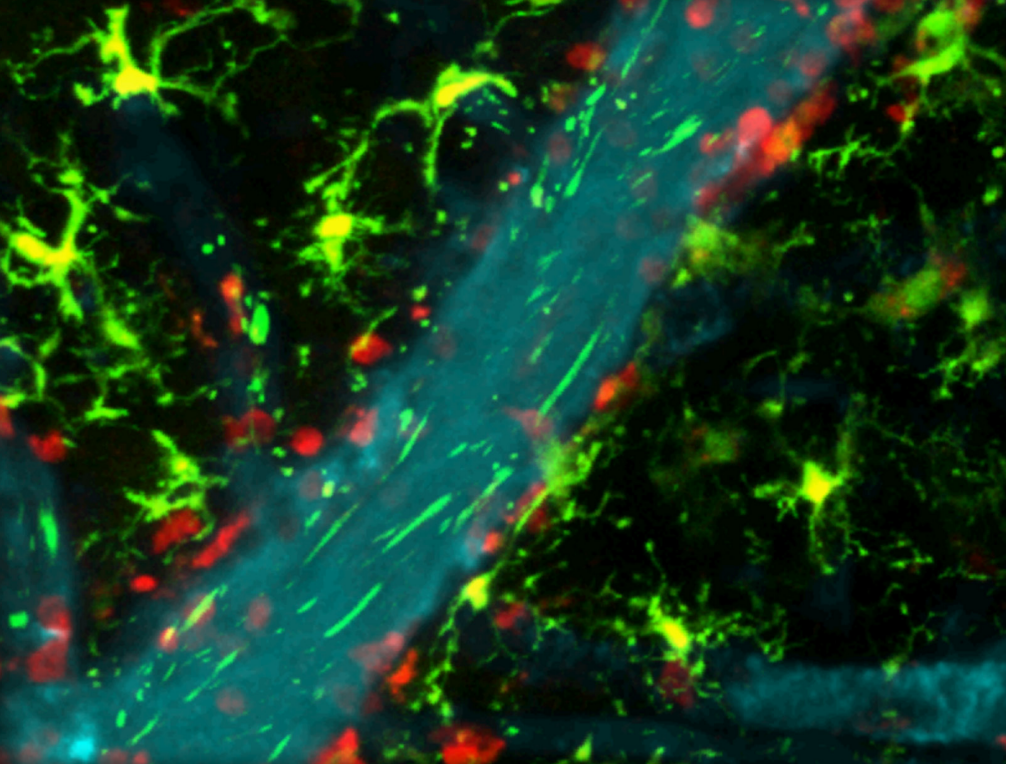
Principal Investigators include:

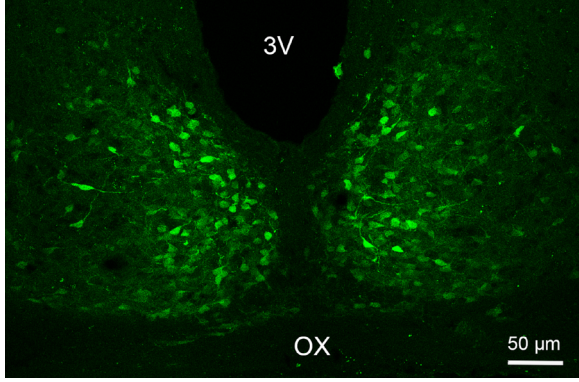
Prof Stuart Allan
Prof Richard Baines
Dr David Bechtold
Dr David Brough
Dr Timothy Brown
Dr Maria Canal
Dr Kevin Couper
Prof Andrew Doig
Dr Natalie Gardiner
Dr John Gigg
Dr Nicholas Glossop
Dr Ken Grieve
Dr Mark Humphries
Dr Catherine Lawrence
Prof Andrew Loudon
Prof Robert Lucas
Prof Simon Luckman
Prof Catherine McCrohan
Dr Qing-Jun Meng
Dr Jaleel Miyan
Prof Nancy Papalopulu
Dr Rasmus Petersen
Prof Hugh Piggins
Dr Emmanuel Pinteaux
Prof Andreas Prokop
Prof Dame Nancy Rothwell
Dr Ingo Schiessl
Prof Alexei Verkhratsky
Prof Anne White

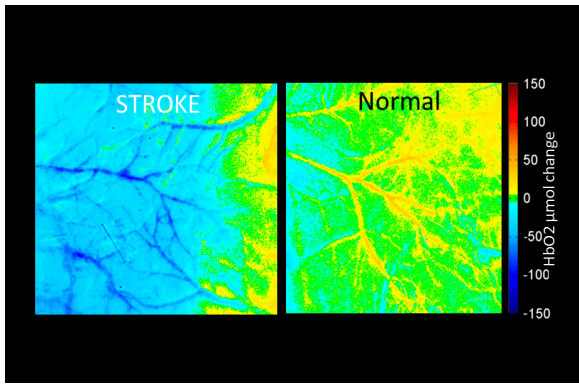












The Neurobiology research theme comprises researchers focused on understanding more about the functions of the brain and nervous system. While individual theme members each have their own independent research interests, broadly speaking the research within the Neurobiology theme is covered by three main topics:

- **Biological timing:** the circadian clock in the hypothalamus of the brain controls daily rhythms in all sorts of behaviours, including sleeping, eating and cognition. How this synchronises to light and other stimuli and impacts on health and disease, is an area of much interest.
- **Metabolism:** food intake, body weight and energy expenditure is controlled by the brain through complex interactions with the rest of the body, involving various hormones and other signalling molecules. A greater understanding of these processes is important in finding treatments for diseases of metabolism, such as obesity and diabetes.
- **Neurodegeneration:** the death of neurones in the brain is a key feature of many brain diseases, with dramatic consequences on patients, including memory loss, paralysis, speech disturbance, and movement problems. How brain cells die, and in particular the role of inflammation, is an important area of current research.

From studying simple organisms such as the fly, through to mice and rats, the Neurobiology researchers are unravelling important details about how brain cells communicate with each other, how brain circuits are established in the first place, how the brain regulates food intake, how the brain reacts to day length and controls everyday functions like eating and sleeping, how the brain and immune system interact, and how the brain is affected by devastating diseases like stroke and Alzheimer's.

Using state-of-the-art research facilities and modern techniques, theme members can record the activity of individual brain cells, analyse complex behaviours in animals, study dynamic processes in cells using advanced microscopy, modify gene expression to understand the key chemicals and pathways involved in different brain functions, and mimic human diseases in animals in order to find new treatments.

Researchers within the Neurobiology theme have links with all of the other research themes within the Faculty of Life Sciences, most notably the Development and Sensory & Computational Neuroscience themes. Interactions between the brain and other body systems are critical to everyday health, so there are also close collaborations between Neurobiology theme members and researchers in the Infection, Inflammation & Immunity and Cardiovascular & Metabolic Disease themes. Translating findings from the laboratory through to new or improved treatments for disease in man, is an important aspect of much of the work in the Neurobiology theme, so strong clinical collaborations are also in place.

Highlight Publications

Dénes A, Pradillo JM, Drake C, Sharp A, Warn P, Murray KN, Rohit B, Dockrell DH, Chamberlain J, Casbolt H, Francis S, Martinecz B, Nieswandt B, Rothwell NJ, Allan SM, (2014). Streptococcus pneumoniae worsens cerebral ischemia via interleukin 1 and platelet glycoprotein Ibα. **Annals of Neurology**, 75, 670.

Pilorz V, Cunningham PS, Jackson A, West AC, Wager TT, Loudon AS, Bechtold DA, (2014). A novel mechanism controlling resetting speed of the circadian clock to environmental stimuli. **Current Biology**, 24, 766.

Wolfram V, Southall TD, Günay C, Prinz AA, Brand AH, Baines RA, (2014). The transcription factors islet and Lim3 combinatorially regulate ion channel gene expression. **Journal of Neuroscience**, 34, 2538.

Knight EM, Martins IV, Gümüsgöz S, Allan SM, Lawrence CB, (2014). High-fat diet-induced memory impairment in triple-transgenic Alzheimer's disease (3xTgAD) mice is independent of changes in amyloid and tau pathology. **Neurobiology of Aging**, 35, 1821.

Prokop A, Beaven R, Qu Y, Sánchez-Soriano N, (2013). Using fly genetics to dissect the cytoskeletal machinery of neurons during axonal growth and maintenance. **Journal of Cell Science**, 126, 2331.

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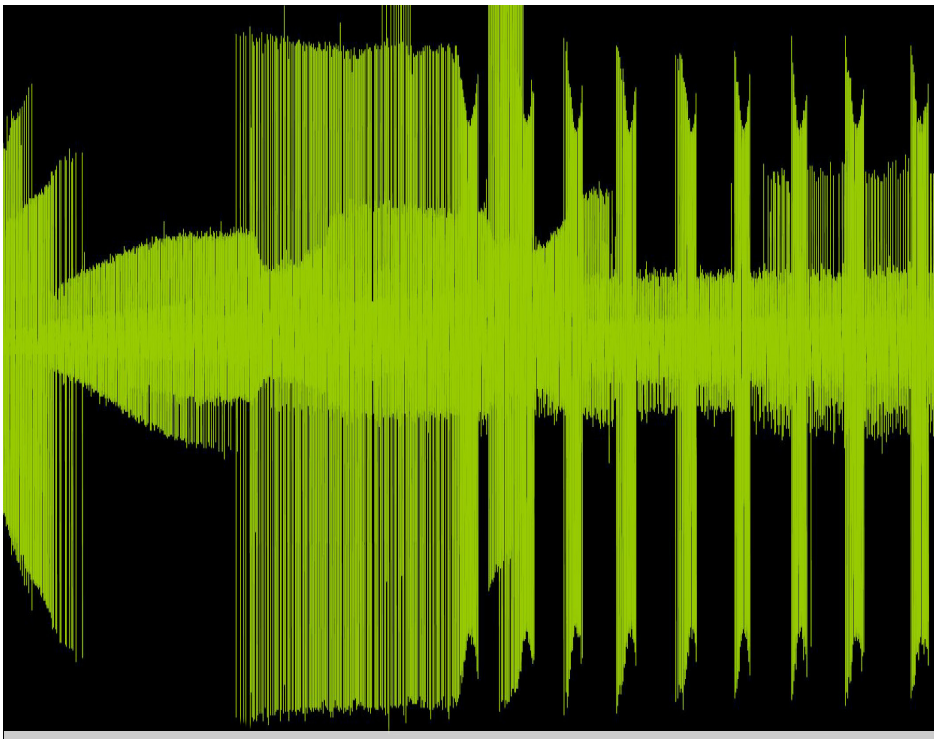
Faculty of Life Sciences

Research Theme

Sensory & Computational Neuroscience



www.manchester.ac.uk/ls/scn

Each of our brains contains more brain cells than there are people alive on the planet. This endows us with extraordinary computational abilities, both sensory and motor, beyond those of the most powerful man-made computers.

To understand the neural basis of mental function is one of the most fascinating challenges of 21st century science. It is also an essential foundation for the development of rational treatments for brain disorders.

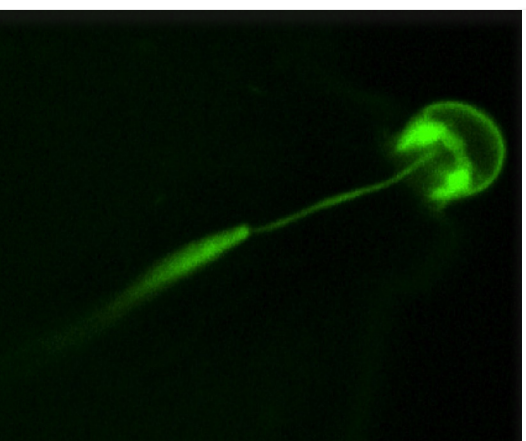
The Sensory and Computational Neuroscience research theme seeks to understand how our senses inform our brains about the world around us and to understand the computational principles by which neural circuits operate. Obtaining accurate information about the environment is a key function of the brain. About half of the brain is devoted to transduction, encoding and analysing information arising from the senses.

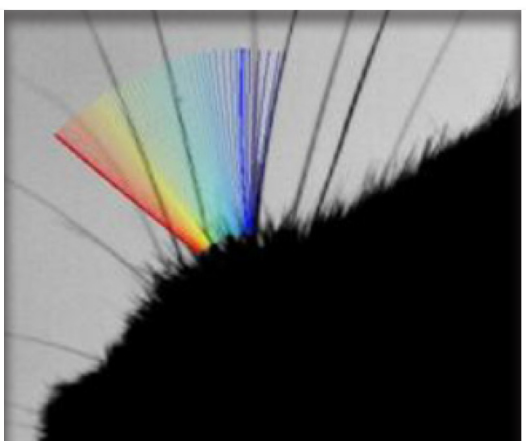
Computational neuroscience investigates brain function both by mathematical modelling of neural circuits, and by application of sophisticated computer algorithms to analyse the ever larger and more complex data sets produced by new experimental neuroscience equipment. Our research is focused on neural coding, neural computation, and eye science.

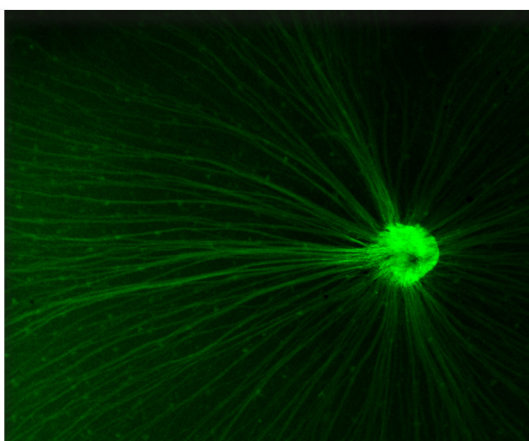
Research Theme Director - Dr Rasmus Petersen

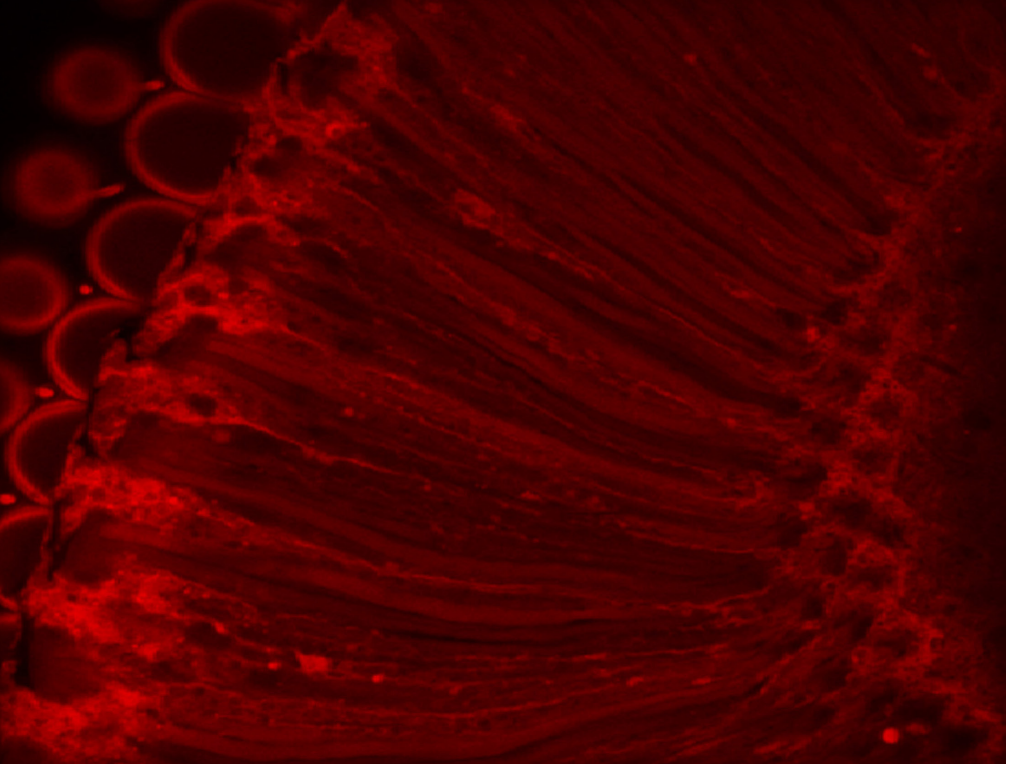
Principal Investigators include:

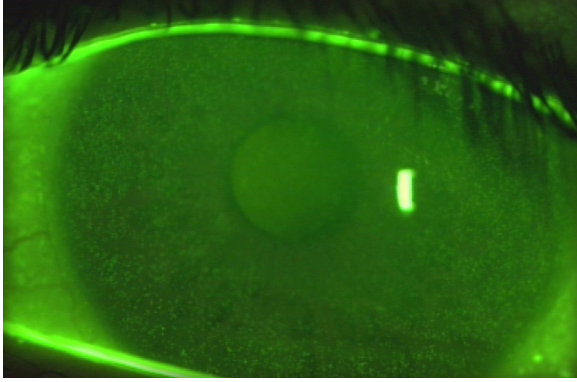
Prof Stuart Allan
Dr Timothy Brown
Prof Matthew Cobb
Prof Chris Dickinson
Dr John Gigg
Dr Emma Gowen
Dr Ken Grieve
Dr Mark Humphries
Prof Robert Lucas
Dr Carole Maldonado-Codina
Prof Catherine McCrohan
Dr Niall McLoughlin
Dr Marcelo Montemurro
Prof Philip Morgan
Dr Ian Murray
Dr Rasmus Petersen
Prof Hugh Piggins
Dr Stephen Prince
Dr Hema Radhakrishnan
Dr Ingo Schiessl

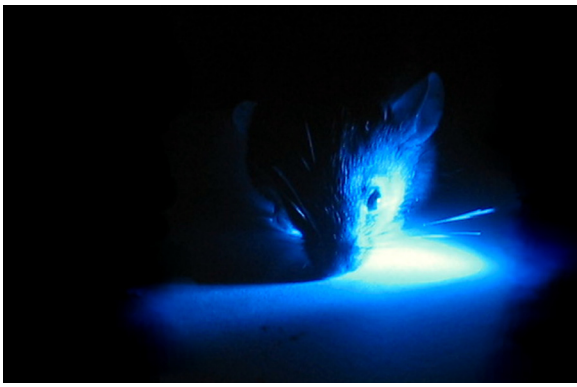












Neural Coding

Neural coding concerns how our brain reconstructs the world around us. Everything that we see, smell, hear, taste, and feel reflects the electrical activity ('spikes') of specialised brain cells called neurons. It is a fundamental challenge of neuroscience to understand how spike patterns represent the physical state of the world. Faculty researchers study many facets of the neural coding problem, using cross-disciplinary approaches that include electrophysiology, optogenetics, and computational modelling. Current research programmes include:

- olfactory code in the fruitfly larva
- active sensing in the somatosensory (whisker) system
- how the eye transposes optical to neural images
- non-rod non-cone photoreception
- electrophysiological investigation of human photoreceptor activity
- brain networks responsible for unconventional aspects of vision, including regulation of 'body clocks' and behavioural state

Neural Computation

Circuits of neurons perform every computation that our minds are capable of - the best way to get from our house to the shop; deciding which laptop to buy; and when to go to sleep. How such computations are executed by neurons passing spikes between them, and how they are disrupted in neurological disorders, is one of science's grand challenges. Combining large-scale recordings from an entire circuit with computational models allows us to turn data on neuronal activity into an understanding of neural computation. Current research programmes include:

- coding of algorithms in groups of neurons
- information flow within the hippocampus
- neural circuit production of circadian rhythms
- optimal selection of actions by the basal ganglia
- dynamics and information processing in neural systems
- computational analysis of functional brain imaging data

Eye Science

A grand challenge of eye science is to investigate the effects of ageing. A major problem is to develop techniques for identifying the borderline between normal ageing processes and degenerative diseases. The ocular optics, the retina-brain pathways, and the mechanisms for integrating visual and motor information deteriorate to varying degrees as we age. Understanding why some older people compensate for these deficits and others do not, will be extremely important in the next decades as the demographics of populations change in developed countries. Current research programmes include:

- sensory coding of spatial/chromatic information between eye and brain
- optical and multispectral imaging of retina and brain
- theoretical modelling of optics of the eye to understand myopia
- evaluating rehabilitation programmes for the visually impaired
- improving contact lenses and understanding their physiological impact
- optimising ocular health and understanding the integration of visual and motor systems, in both typical individuals and those with autism

Highlight Publications

Howarth M, Walmsley L, Brown TM, (2014). Binocular integration in the mouse lateral geniculate nuclei. **Current Biology**, 11, 1241.

Belle MDC, Hughes ATL, Bechtold DA, Cunningham P, Pierucci M, Burdakov D, Piggins HD, (2014). Acute suppressive and long-term phase modulation actions of orexin on the mammalian circadian clock. **Journal of Neuroscience**, 34, 3607.

Murray IJ, Makridaki M, van der Veen RLP, Carden D, Parry NRA, Berendschot TTJM, (2013). Lutein supplementation over a one-year period in early AMD might have a mild beneficial effect on visual acuity: the CLEAR study. **Investigative Ophthalmology and Visual Science,** 54, 1781.

Bale MR, Davies K, Freeman OJ, Ince RA, Petersen RS, (2013). Low-dimensional sensory feature representation by trigeminal primary afferents. **Journal of Neuroscience,** 33, 12003.

Bailes HJ and Lucas RJ, (2013). Human melanopsin forms a pigment maximally sensitive to blue light (λmax ≈ 479 nm) supporting activation of Gq/11 and Gi/o signalling cascades. **Proceedings of the Royal Society B**, 280, 20122987.

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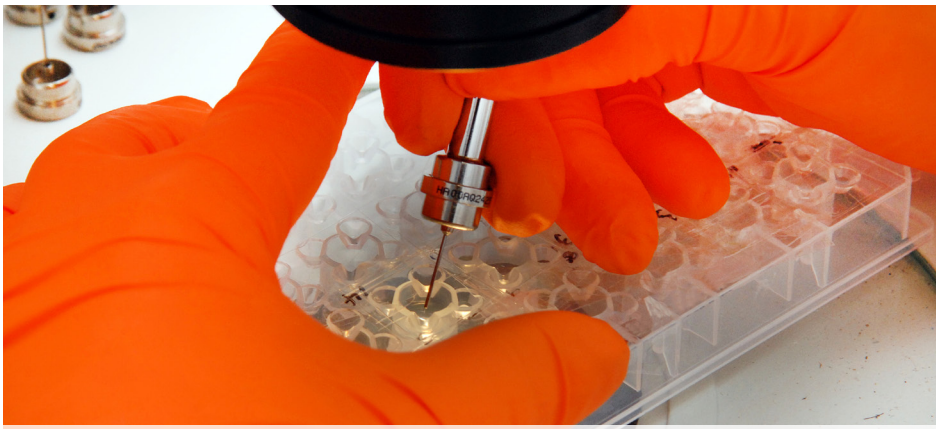
Faculty of Life Sciences

Research Facilities

Research Centres & Institutes



www.manchester.ac.uk/ls/research/centresandinstitutes

Centres and institutes within the Faculty of Life Sciences

- Centre for Biological Timing
- Centre of Excellence in Biopharmaceuticals
- Centre for the Genetics of Ecosystem Services
- Centre for the History of Science, Technology and Medicine
- Centre for Synthetic Biology of Fine and Speciality Chemicals
- The Healing Foundation Centre
- Institute for Science, Ethics and Innovation
- KNH Centre for Biomedical Egyptology
- Manchester Centre for Biophysics and Catalysis
- Manchester Centre for Regenerative Medicine
- Manchester Collaborative Centre for Inflammation Research
- Manchester Institute of Biotechnology
- Northwest Embryonic Stem Cell Centre
- Systems Microscopy Centre
- Wellcome Trust Centre for Cell-Matrix Research

Enabling research to address global issues

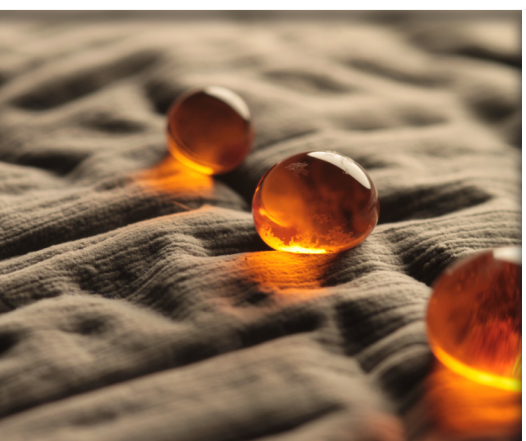
Embedded within the Faculty of Life Sciences are a number of internationally renowned research centres and institutes. Receiving extensive external long-term funding, including significant industrial support, centres and institutes form a focus of excellence helping to drive intra- and inter-university collaborative research.

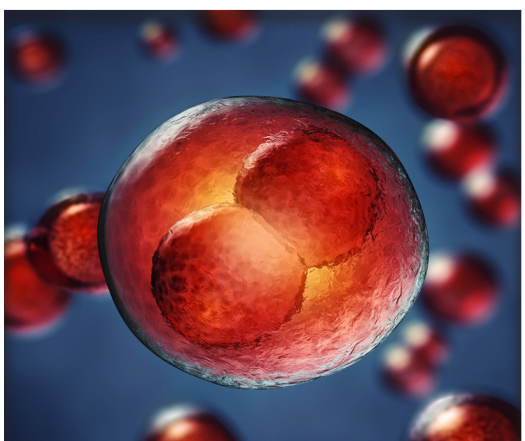
The Faculty of Life Sciences is currently host to 15 centres or institutes which span the breadth of life sciences from inflammation and repair, through biological timing, to industrial biotechnology.

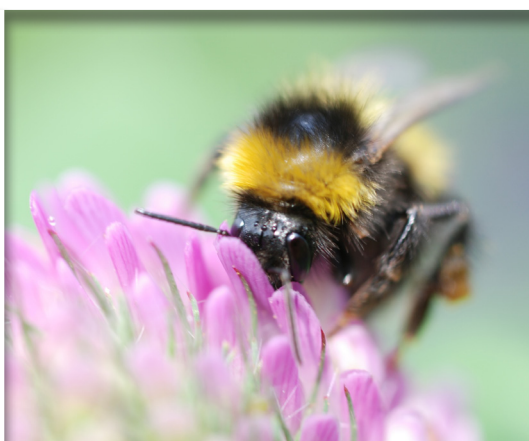
Some centres, such as the Systems Microscopy Centre, are involved in the development of new methodologies to exploit the latest advancements in technology. Other centres, such as the Manchester Collaborative Centre for Inflammation Research, bring together basic scientists, clinicians, and researchers from industry to promote interdisciplinarity and allow challenging scientific questions to be addressed.

"The range of centres and institutes is testimony to both the quality and breadth of interdisciplinary research ongoing in the Faculty."

Professor Ian Roberts,
Associate Dean for Research, Faculty of Life Sciences







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Research Centres & Institutes

Centre for Biological Timing
Biological clocks drive daily circadian rhythms in all organisms, and in humans most of our physiology is clock-regulated. Modern lifestyles that disrupt our normal circadian rhythms are thought to contribute to various diseases. This Centre brings together a large and diverse community of clock-researchers, and spans interests from basic genetics and cell biology through to studies of human behaviour and the role of clocks in human disease.

Centre of Excellence in Biopharmaceuticals (COEBP)
With initial support from the European Regional Development Fund and the Northwest Regional Development Agency, a cooperative of academic groups have formed a Centre (COEBP) drawn from many disciplines across The University of Manchester. The Centre focuses on working with the industrial and academic sectors to accelerate biopharmaceutical development of emerging medicine formats.

Centre for the Genetics of Ecosystem Services (CenGESS)
CenGESS brings together researchers from within the Faculty of Life Sciences with expertise in ecosystem service measurement and ecological community genetics. This fusion of expertise allows us to answer fundamental questions linking genetic variation and evolutionary processes to the functioning of biotic communities and the delivery of fundamental ecosystem services.

Centre for the History of Science, Technology and Medicine (CHSTM)
CHSTM is the largest research group of its kind in the UK. It incorporates the Wellcome Unit for the History of Medicine and created the National Archive for the History of Computing. Research addresses mainly the 19th and 20th centuries, but ranges widely across scientific, technical, and medical fields.

Centre for Synthetic Biology of Fine and Speciality Chemicals (SynBioChem)
The SynBioChem Centre is advancing synthetic biotechnology through active collaborations with a large variety of industry partners, to propel chemicals/natural products production towards 'green' and more sustainable manufacturing processes.

The Healing Foundation Centre
The Healing Foundation Centre at The University of Manchester represents a 25 year, £10 million commitment between The Healing Foundation and The University of Manchester to advance the understanding of wound healing and tissue regeneration. The ultimate goal of the Centre is to identify treatments that will improve the lives of patients with disfigurements, either congenital, or following accident or disease.

Institute for Science Ethics and Innovation (iSEI)
iSEI was established to observe and analyse the role and responsibilities of science and innovation in the 21st century, to evaluate possible or desirable changes, and to consider the forms of regulation and control that are appropriate or required. Our investigations focus on contemporary cases, and our goal is to present and apply our findings to maximum effect in order to make a difference in the real world.

KNH Centre for Biomedical Egyptology
Research conducted in this Centre focuses on the application of biological, anthropological, and biomedical research techniques to enhance our understanding of the peoples and societies of ancient Egypt and Nubia. The Centre hosts a multidisciplinary team working in the fields of bioarchaeology and Egyptology.

Manchester Centre for Biophysics and Catalysis (MCBC)
MCBC, based at the Manchester Institute of Biotechnology, is a state-of-the-art cross disciplinary platform technology centre integrating biophysical, structural, and computational methods to address contemporary problems in catalysis and the dynamical properties of biological macromolecules.

Manchester Centre for Regenerative Medicine (MCRM)
MCRM develops cell/gene therapies to regenerate damaged or diseased musculoskeletal and cardiovascular tissues. Approaches include stem cell therapy, gene replacement, anti-inflammatory strategies, and bioengineering. MCRM also offers research training through our new EPSRC & MRC Centre for Doctoral Training in Regenerative Medicine.

Manchester Collaborative Centre for Inflammation Research (MCCIR)
MCCIR was established to address current priorities in inflammatory disease in an open innovation, pre-competitive collaboration between academia and the pharmaceutical industry. GlaxoSmithKline, AstraZeneca and The University of Manchester have each invested £5M to promote 'blue sky' research over the next five years.

Manchester Institute of Biotechnology (MIB)
The MIB houses a multi- and inter-disciplinary community of scientists from the faculties of Life Sciences, Engineering and Physical Sciences, and Medical and Human Sciences. Research at MIB focuses on advanced quantitative approaches to specific biotechnology challenges at the interface between medicine and biology and the physical sciences, engineering, and computation. The MIB enjoys a unique pluralistic and open research culture that is supported by world-class infrastructure.

Northwest Embryonic Stem Cell Centre (NWESCC)
The remit of the NWESCC is to derive human Embryonic Stem Cell lines at a standard suitable for their use in clinical therapies after appropriate differentiation. NWESCC is licensed by the Human Fertilisation and Embryology Authority for research and human embryonic stem cell derivation, and by the Human Tissue Authority clinical license for storage and distribution of cells for clinical use. NWESCC forms one of only two centres in the UK to have derived GMP grade human ES cells for banking in the public domain.

Systems Microscopy Centre (SMC)
The SMC develops and applies quantitative timelapse imaging of living single cells and tissues to measure dynamic cellular processes. The major focus of the Centre is on the dynamic integration of signalling systems to control transcription and cell fate. SMC researchers propose that biological timing, and specifically oscillatory dynamics, are critically important in cellular decision making at all levels. Our aim is to make absolute and relative quantitative measurements of biological processes.

Wellcome Trust Centre for Cell-Matrix Research (WTCCMR)
The scientific mission of the WTCCMR is to understand how cells make their extra-cellular matrix (ECM) microenvironment, and how they integrate ECM-derived chemical and physical cues to build and repair tissues. By doing so researchers discover how changes in cell-matrix interactions cause and exacerbate major human pathologies, and exploit these findings for disease prevention, diagnosis, and therapy.

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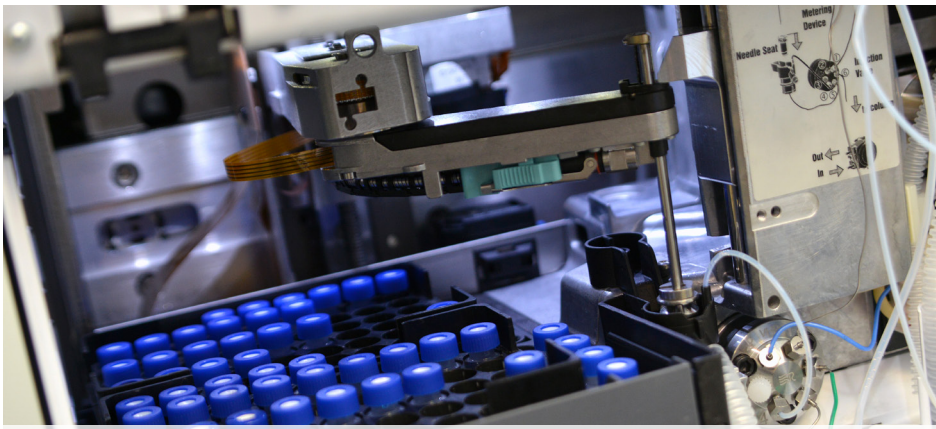
Faculty of Life Sciences

Research Facilities

Analytical Research Facilities



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Analytical research facilities within the Faculty of Life Sciences

- Bioimaging
- Bioinformatics
- Biomolecular Analysis
- Electron Microscopy
- Flow Cytometry
- Fly Facility
- Genomic Technologies
- Histology
- Macromolecular Crystallography
- Mass Spectrometry
- Protein Expression
- Transgenic Technologies

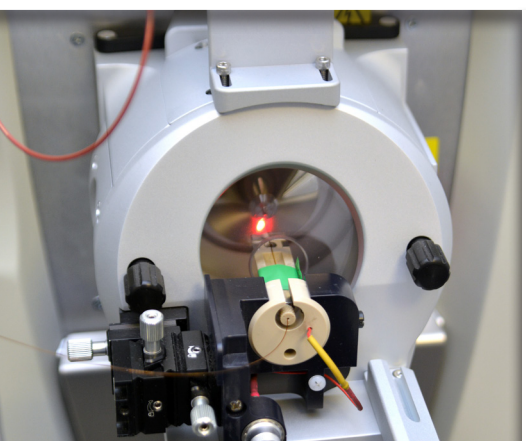
Supporting research within life sciences

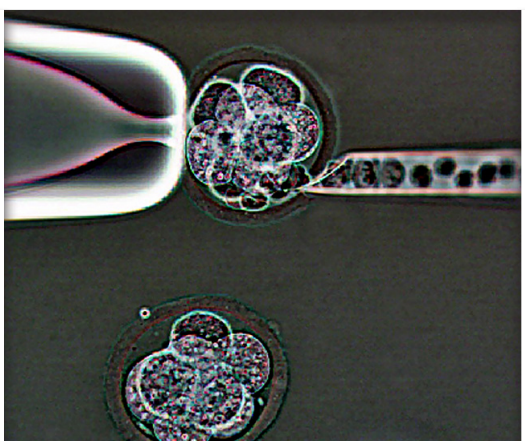
The Faculty of Life Sciences maintains a broad range of state-of-the-art analytical research facilities. These facilities, available to all staff and students, are maintained by dedicated personnel who can provide expertise in planning and running experiments, interpreting data, and technical support and training for routine and specialist techniques.

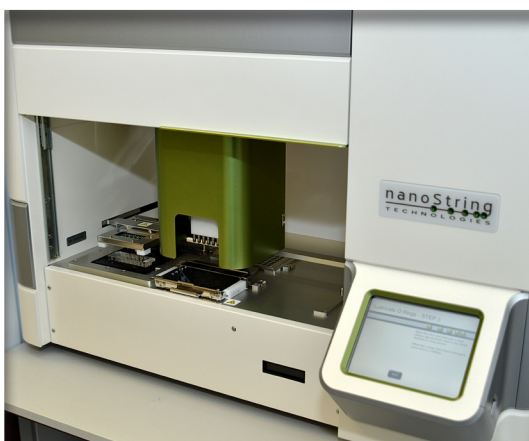
Through the provision of centralised facilities, housed in custom-built laboratories, all researchers in the Faculty have access to the best available equipment that would be beyond the budgets of most individual research groups. There is over £20M of equipment in these facilities, which are maintained and continually updated through a mixed portfolio of external research grants and Faculty/University contributions.

Our facilities allow investigation of biological phenomena at the molecular and cellular levels through to organismal studies. Scales of investigation range from single molecules, through to genome and proteome-wide studies.

Through combining the use of different facilities it is possible to apply an integrated cross-interdisciplinary approach to any given research problem.







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Analytical Research Facilities

Bioimaging

The Bioimaging Facility offers state of the art microscopy to users from across the Faculty of Life Sciences and the University. Life science research is often focused on live cell imaging and the facility addresses this in the equipment provided, with most of the systems allowing multipoint visiting over prolonged periods of time using motorised XYZ, autofocus, temperature, and CO_2 control. The facility provides a range of systems from digital whole slide scanners, manual fluorescent microscopes, timelapse confocals through to *in vivo* multiphoton confocal systems.

Bioinformatics

The Bioinformatics Facility works closely with the Genomic Technologies Facility and provides support for analysing genomic, epigenomic, and transcriptomic data. Levels of support range from routine data analysis including presentation of results for publication, through to project-specific integration of genome-wide datasets. The Bioinformatics Facility also assists with automation of data pipelines and genomics software support. Training of staff in analysis procedures is routinely given.

Biomolecular Analysis

The Biomolecular Analysis Facility aids in sample analysis, grant applications, consultation, training, method development and publications in the field of molecular biophysics. The highly technical instrumentation available within the facility includes methodologies such as surface plasmon resonance with the newest Biacore T200 and the innovative Bio-Rad XPR-36, as well as surface analysis instruments such as dual polarisation interferometry which is able to analyse minute changes within the evanescent field above customisable surfaces. The facility also houses several instruments for the analysis of macromolecular hydrodynamics and light scattering techniques.

Electron Microscopy

The Electron Microscopy Facility houses four electron microscopy systems: an FEI Tecnai 12 Twin, an FEI Tecnai 12 Biotwin, a new FEI Tecnai G2 Polara 300kV FEGTEM, and FEI Quanta 250 with Gatan 3View system. The facility also provides a full range of sample preparation equipment including ultramicrotomes, cryo-ultramicrotomes, knife makers, coating units, high pressure freezing equipment, an FEI Vitrobot plunge freezing unit, and the Leica freeze substitution systems.

Flow Cytometry

The Flow Cytometry Facilities contains cutting edge cell analysis technology. With six analysers and two high speed cell sorters, up to 18 separately labelled markers can be measured on, typically, 10-50,000 individual cells to provide high-throughput analysis of cell characteristics. In addition, cells can be isolated aseptically to high purity from mixed samples in order to perform downstream biochemical or genetic characterisation, or for further culturing.

Fly Facility

The Manchester Fly Facility is one of the largest fly facilities in the UK, comprising 13 groups using *Drosophila* in a broad range of scientific research areas. This dedicated state-of-the-art facility, and the unique expertise therein, is open to all scientists who already use fruit flies or intend to expand their research to *Drosophila*. Resources include constant temperature rooms and incubators for fly storage, dedicated work stations for classical genetic work, fluorescent microscopes, and a supply of consumables for fly work. The facility offers comprehensive training and advice on all *Drosophila* related experiments.

Genomic Technologies

The Genomic Technologies Facility was established to provide access to cutting-edge, post-genomic technologies. The facility supports five main technology categories: Next-generation sequencing, Affymetrix GeneChip Microarrays, real-time PCR instruments (including Fluidigm BioMark HD), RNAi library screening, and digital nucleic acid analyses (NanoString Technologies). Also, the facility has extensive liquid handling and automation capacity, together with instrumentation for quantification and sample QC. The facility operates in close association with the Bioinformatics Facility to facilitate a complete service from experimental design through to bioinformatic analyses.

Histology

The Histology Facility provides the knowledge, expertise, and equipment to take tissue from animals, or cells in culture, to stained, mounted, ready to analyse tissue sections, using light and fluorescent techniques, histochemistry, immunohistochemistry, and cytochemistry. Full on-site training in techniques, use of equipment, and service work is provided by staff with decades of knowledge in both clinical and non-clinical research, and commercial sectors.

Macromolecular Crystallography

The Macromolecular Crystallography Facility provides a complete service pipeline, from purified protein to X-Ray crystal structure. Meeting the often rate-limiting challenge of crystallogenesis are two complementary high throughput nanolitre dispensing platforms (Mosquito & Phoenix), allowing rapid screening and optimisation. The facility houses two rotating anode X-ray generators and associated data collection equipment. These in-house facilities are further supplemented with regular synchrotron access.

Mass Spectrometry

The Mass Spectrometry Facility has six complementary mass spectrometry systems and a staff of six highly experienced analytical biochemists and informaticians. The major approaches within the facility are global proteomics (Thermo Orbitrap Elite), high sensitivity/selectivity targeting (ABSciex 6500 Q-Trap with Selexion), and methodologies for protein identification/characterisation and metabolite profiling. The facility provides high performance and easily accessible and affordable support to biological researchers, whether new to mass spectrometry or highly experienced.

Protein Expression

The Protein Expression Facility provides a comprehensive resource for the cloning and high-level production of recombinant proteins from microgram to gram quantities. Four expression systems are available: bacteria, yeast, insect, and mammalian cells, to help cater for the varying complexities of protein folding and modifications. By using extensive solubility screens the facility staff can quickly identify optimal construct designs and protein expression conditions. In-house training courses are run on a regular basis.

Transgenic Technologies

The Transgenic Unit provides advanced transgenic technologies together with core animal husbandry services. Core services include cryopreservation, embryo implantation, IVF based retrieval, expansion, and quality control. To generate *de novo* transgenic lines we utilise laser assisted embryonic stem (ES) cell (morula microinjection and DNA pronuclear injection). To support this, the unit has a dedicated ES cell culture suite. The unit offers project consultations and guidance regarding new and emerging transgenic methodologies, with particular emphasis on the genomic editing potential of CRISPR/Cas or TALENs sequence specific nucleases.

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Faculty of Life Sciences

Working with Industry

Business Development

www.manchester.ac.uk/ls/business

Academic partner of choice for industrial collaboration

Our Aims

- To be the partner of choice for companies seeking academic collaborations in the life sciences
- To be recognised widely for supporting and driving successful exploitation and commercialisation of research
- To provide our industrial partners with unrivalled access to cutting edge expertise in the biological and biomedical sciences

We Offer

- World class expertise in the life sciences
- State-of-the-art technology and facilities
- An enthusiasm for working in partnership with industry
- An easy to use business model for research collaborations, contract research, and consultancy

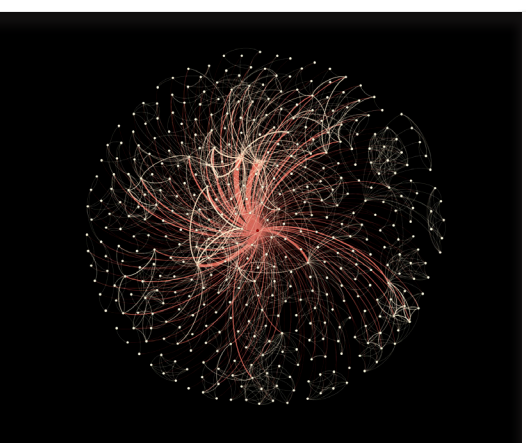
Partnering with industry

The Faculty of Life Sciences has an impressive history of productive partnerships with industry. In 2014 the Faculty had contracts in place with over 70 companies ranging from very large pharmaceutical, agrochemical and petrochemical multinationals, to SMEs and small biotechnology and biopharmaceutical firms.

The nature of these collaborations varies from discrete pieces of work employing skills and technology available within the Faculty, to large scale, strategic research partnerships focused on addressing jointly important challenges in the biomedical sciences. Whatever the scope and scale of the collaboration, the Faculty seeks to deliver important benefits to our partners. This gives us the opportunity to make sure that our research outputs and our know-how can be exploited effectively for wealth creation and improved healthcare.

The Faculty's aim is to be the partner of choice for companies seeking collaborations in the life sciences, and in realising that ambition, the business development function ensures that the Faculty and the University are easy to do business with.

The Faculty Business Development team is led by Professor Ian Kimber (Associate Dean for Business Development) and includes three dedicated business development managers, Dr Victoria Hand, Dr Joanne Flannelly, and Dr Zoher Kapacee. The team aims to ensure that it is easy for industrial partners to work with the Faculty and the University, and to provide full support for all aspects of collaboration.



Industrial partnerships

Partnerships with industry may be based on collaborative research programmes, scoping exercises, technology transfer, joint studentships, service work, and/or consultancy.

One example of a major research collaboration is the Manchester Collaborative Centre for Inflammation Research (MCCIR) - a unique initiative that brings together industrial partners GlaxoSmithKline and AstraZeneca with the Faculties of Life Sciences and Medical and Human Sciences. The aim is to provide an increased understanding of the cell and molecular biology of inflammation that can be translated quickly and effectively into the development of new medicines for the treatment of inflammatory disease.

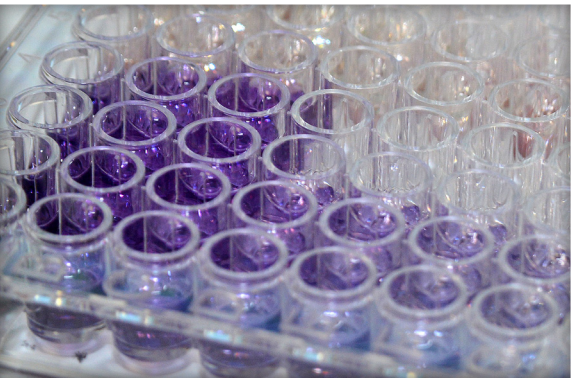
Benefits of collaborative research with the Faculty of Life Sciences include cost effective trialling and testing of products and compounds using University facilities and expertise, the development of close long-term relationships with academic staff, the transfer of innovative techniques and practices, licensing of exciting technologies and processes, and access to Government and European Union funds for research that would be out of reach for purely commercial projects.

Commercial exploitation

The Faculty encourages swift exploitation of our research. The Business Development Team works closely with UMIP, the University's managing agent for intellectual property development and commercialisation, to maximise the benefits derived from each individual opportunity.

Some of our partners

AstraZeneca
Bayer Crop Science
Blueberry Therapeutics
Boehringer-Ingelheim
Cobra Biologics
Coopervision
Covance
Dupont
Edimer
Eli Lilly
GlaxoSmithKline
Johnson & Johnson
Johnson Matthey
Medimmune
Neurophage Pharmaceuticals
Pfizer
Procter & Gamble
Sauflon
Shire
Synapse
Syngenta
Unilever



Contacts

Professor Ian Kimber
Associate Dean for Business Development
ian.kimber@manchester.ac.uk
0161 275 1587

Dr Joanne Flannelly
Business Development Manager
joanne.flannelly@manchester.ac.uk
0161 276 0503

Dr Victoria Hand
Research Business Manager
for Business Development
victoria.hand@manchester.ac.uk
0161 275 5249

Dr Zoher Kapacee
Research Business Manager
for Business Development
zoher.kapacee@manchester.ac.uk
0161 275 1686

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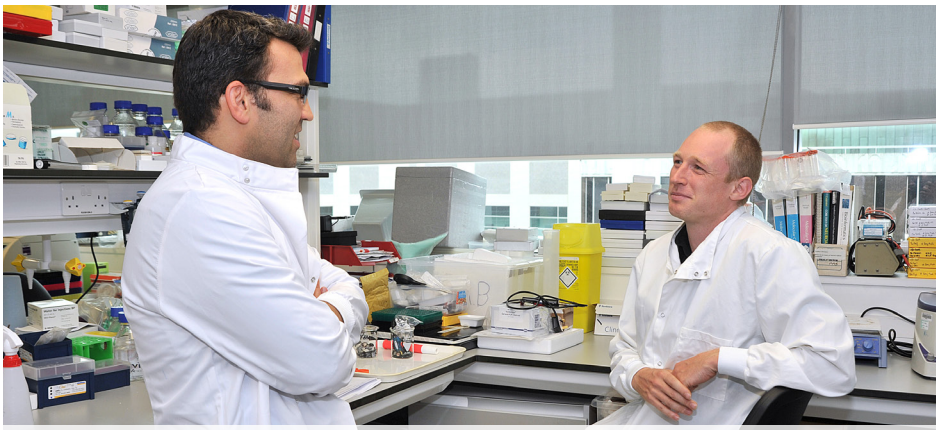
Faculty of Life Sciences

Nurturing Talent

Independent Research Fellows



www.manchester.ac.uk/ls/research/fellowscall

Top reasons to be a fellow in the Faculty of Life Sciences

- Additional financial support to provide a total of six years of fellowship funding when combined with your external fellowship
- One of the largest, and most successful, unified research organisations
- State-of-the-art laboratory and office facilities
- Superb analytical research facilities and services supported by dedicated Experimental Officers/Technicians
- Mentoring from experienced academic colleagues
- Training and development programme through the New Academics Programme
- Dedicated Fellowship Recruitment Coordinator

Nurturing the development of early career independent research fellows

The Faculty of Life Sciences offers an attractive and flexible fellowship scheme for potential fellows who are competitive to apply for external fellowships. The Faculty also welcomes current independent research fellows who have substantive external funding.

For fellows who can attract four to five years of external funding (on qualifying schemes), the Faculty will fund one to two years additional support at the end of their fellowship. For outstanding candidates the Faculty will provide one to two years funding prior to fellowship submission.

This scheme reflects our desire to ensure that fellows can perform to their full potential and develop highly competitive biology research programmes. Throughout the six year period, fellows benefit from close mentor support with formal reviews at three and five years.

In recent years the Faculty of Life Sciences has been host to independent researchers supported by a wide range of fellowships including those from the Biotechnology and Biological Sciences Research Council (BBSRC), Medical Research Council (MRC), Natural Environment Research Council (NERC), Engineering & Physical Sciences Research Council (EPSRC), European Union, Wellcome Trust, Royal Society, Breakthrough Breast Cancer, Cancer Research UK, Healing Foundation, and Research into Ageing.

Why choose the Faculty of Life Sciences?

The Faculty of Life Sciences is the largest, and one of the most successful, unified research organisations of its kind in Europe with research spanning the entire spread of life sciences from studies on individual molecules at the atomic level, to cells, tissues, organisms and populations. Research within the Faculty is organised into eleven interconnecting themes (listed in the table below alongside the relevant Research Theme Directors). With an enduring record of recruiting outstanding scientists to undertake fellowships in Manchester, the Faculty has an excellent track record in developing independent fellows into permanent academic members of staff.

The Faculty offers an excellent research environment comprising over 200 Principal Investigators housed in purpose-built laboratory and office space, fostering interdisciplinary collaborations. Research is facilitated by superb analytical research facilities and services supported by dedicated Experimental Officers/Technicians. Successful candidates will be sponsored to apply for independent, externally-funded research fellowships, most of which are open to international applicants.

Mentoring for new fellows

All research fellows are offered the opportunity to have a dedicated mentor, who will be a more experienced member of Faculty academic staff. The mentoring programme matches new fellows with a mentor who will provide one-to-one advice and guidance on all aspects of academic life (for example grant writing, recruitment, and supervision), act as an independent advisor on career progression, help with integration into the Faculty, and promote collaboration.

The New Academics Programme

The New Academics Programme (NAP) is a Higher Education Academy accredited suite of training and development provided to all new fellows and academic staff. The aim of the programme is to provide key information to allow new academic staff to integrate and progress within the Faculty. The NAP sessions provide the opportunity to meet and talk with senior academic and administrative staff within the Faculty.

Faculty Research Themes	Research Theme Directors
Biotechnology and Synthetic Biology	Prof Eriko Takano
Cardiovascular and Metabolic Disease	Dr Xin Joy Wang
Cell and Cancer Biology	Dr Claudia Wellbrock
Cell Matrix Biology	Prof Charles Streuli
Computational and Evolutionary Biology	Dr Daniela Delneri
Development	Prof Chris Thompson
Environment and Ecology	Prof Richard Preziosi
History of Science, Technology and Medicine	Dr Ian Burney
Infection, Inflammation and Immunity	Prof Werner Muller
Neurobiology	Prof Stuart Allan
Sensory and Computational Neuroscience	Dr Rasmus Petersen

Application Process

To be considered for this scheme, prospective fellows should send a brief curriculum vitae (indicating any previous fellowship applications) and a one page summary of their research interests to fellowships.lifesciences@manchester.ac.uk.

Potential candidates may be asked to submit letters of reference and may be invited to visit the Faculty to talk about their research and career plans with an academic sponsor from the Faculty.

Once sponsorship has been agreed by the Faculty Research Leadership Team, potential fellowship candidates will receive advice for their external funding application on suitable funding sources, scientific proposal preparation, effective CV content, the application process, costing the proposal, and analytical research facilities.

There are two application deadlines each year: 30 April and 31 October.

For further information, or informal discussions at any time, potential candidates should contact the Fellowship Recruitment Coordinator Professor Chris Grant (chris.grant@manchester.ac.uk), or the relevant Research Theme Director as listed above.

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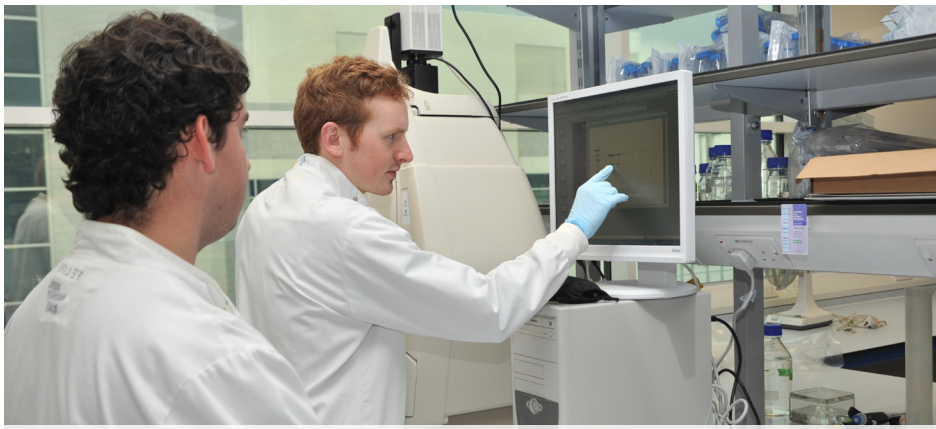
Faculty of Life Sciences

Nurturing Talent

Post-doctoral Researchers



www.manchester.ac.uk/ls/research/beingapostdoc

Supporting professional development

- World-class research facilities
- Annual faculty research symposium
- External seminar programme
- Research skills workshop programme
- Mentored teaching training programme
- Extensive career development services
- Personalised training and career planning
- Career progression fellowships

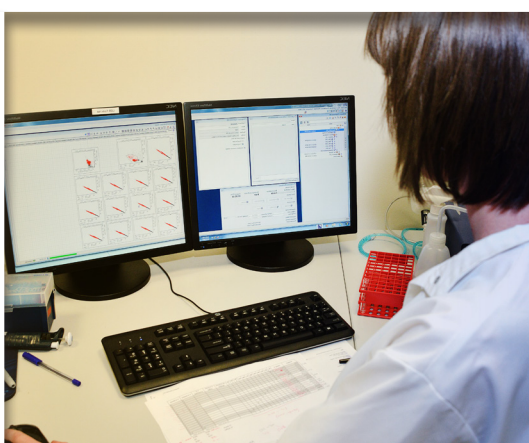
An excellent research environment

The Faculty of Life Sciences has a global reputation in research that spans from molecular, cells, and whole organisms to populations and the environment. This ensures that Faculty researchers have a wealth of scientific and technical expertise.

Research in the Faculty is carried out in a world-class environment, in new buildings housing state-of-the-art equipment. Within the Faculty there is open access to multiple 'analytical research facilities', each run by an experienced Experimental Officer who can assist with planning experiments to expedite research progress. Researchers from across the Faculty are encouraged to take an active part in weekly seminars, Faculty meetings, and the annual Faculty Research Symposium. The symposium is a showcase of research excellence and involves presentations from researchers at all stages of career progression.

The quality of the Faculty research environment is recognised through the European Commission HR Excellence Award for supporting the development of research staff. This award is given to institutions across Europe who actively implement the principles of the European Charter and Code and the UK Concordat to support the career development of researchers.

The University of Manchester has won the Times Higher Education Award for Outstanding Support for early career researchers (awarded 2011). With over 1800 research staff, The University of Manchester is able to offer bespoke support to researchers, which is unparalleled in other institutions.



Supporting personal and professional development

The Faculty development programme provides support across three areas: career development, teaching, and research.

Career development

All staff within the Faculty are actively encouraged to consider their personal career plans. Support for career planning is provided during the annual cycle of performance and development reviews, through career planning workshops designed to meet the needs of research staff, and one-to-one confidential appointments with the Faculty Development Manager.

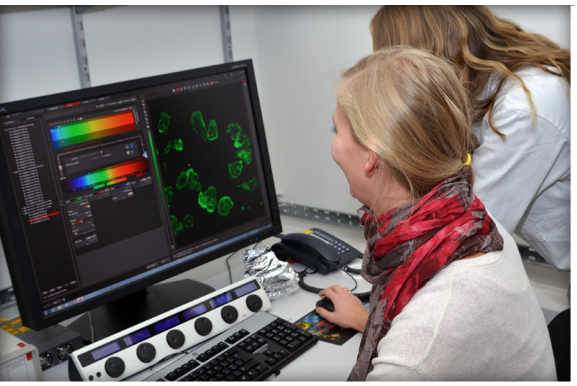
The Faculty provides a dedicated career and professional development programme that is developed in consultation with research staff representatives and academic staff. The Faculty career and professional development programme maps onto the UK Researcher Development Framework. Flagship Faculty workshops presented through this programme include: Fellowship Applications, Career Planning, and Becoming a Biotech Entrepreneur. This Faculty level programme is augmented by University-wide support. Three examples of this University-wide support include: the Institute of Leadership and Management-accredited 'Researchers into Management' programme, the Annual Research Staff Conference, and Pathways (an annual researcher-focused careers event).

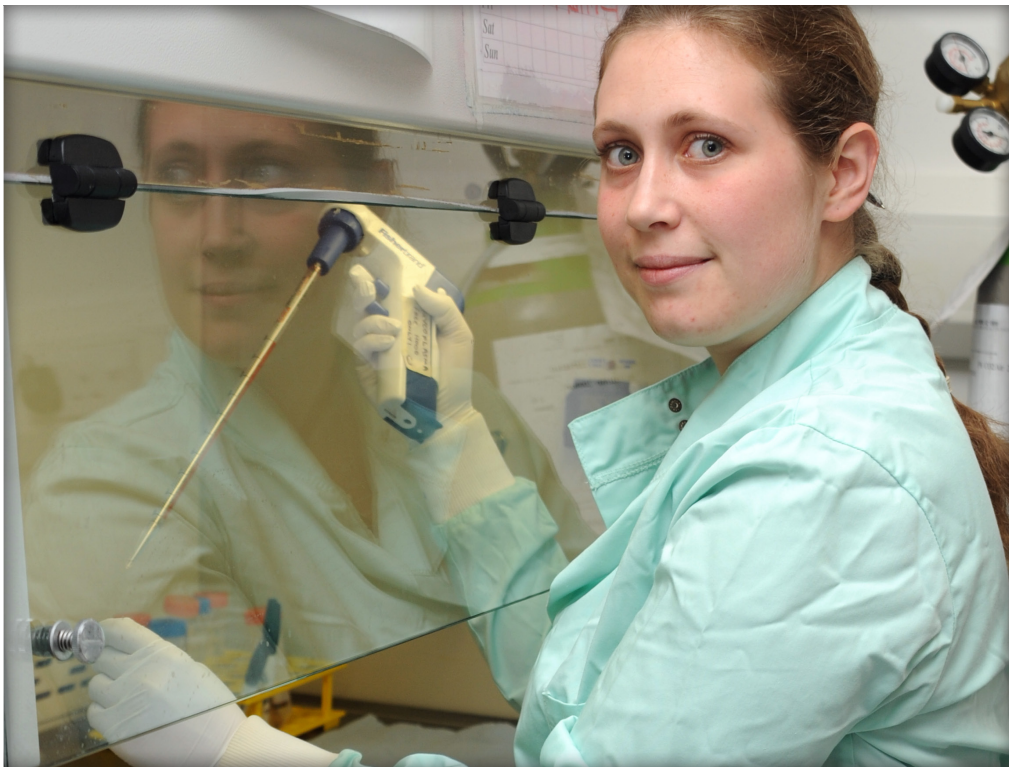
Teaching

There is a well-established work-shadowing scheme providing researchers with the opportunity to further develop their teaching skills and apply to the Higher Education Academy for Associate Fellowship recognition. Researchers undertaking work shadowing are supported through mentoring, face-to-face workshops, and information sessions. Researchers holding Higher Education Academy Associate Fellowship status have further opportunities to undertake independent teaching.

Research

Monthly workshops focus on a research challenge or technique. These workshops are led by Faculty experts or external invited speakers. The goal of these workshops is to bring Faculty researchers together to explore new techniques, consider interdisciplinary research opportunities, and share experiences.





Case Studies

Dr Helena Bailes
Teaching Focused Lecturer of Neuroscience
I was a post-doctoral researcher in the Faculty of Life Sciences from 2006 and recently became a teaching-focused Lecturer. I was unsure where to go with my career and I went to several workshops provided by the Faculty, which really helped me explore alternatives. I also gained more experience in teaching; there are multiple mentored teaching options offered for research staff. These opportunities helped me feel more confident about moving into my new role.

Dr Sarah Woolner
Sir Henry Dale Research Fellow
I started in the Faculty of Life Sciences in 2008 as a post-doctoral researcher. Faculty-wide I received a lot of support, from early advice on my CV, through to help in writing research proposals. A Faculty 'Stepping Stones' fellowship, funded by the Wellcome Trust ISSF, allowed me to continue my research whilst applying for external fellowships. I now have my own lab in the Cell-Matrix Centre, supported by a Wellcome Trust Sir Henry Dale fellowship. I'm thoroughly enjoying running my own group – it's exciting to see your own ideas being developed by others.

MANCHESTER 1824
The University of Manchester

Faculty of Life Sciences

Nurturing Talent

Postgraduate Study

www.manchester.ac.uk/ls/study

Top reasons to study within the Faculty of Life Sciences

- World class research and teaching environment
- Purpose built research complexes housing cutting-edge facilities
- Over 200 active research laboratories
- Structured training programme to enhance academic and personal development
- Peer support through Ambassador and Mentoring schemes
- Thriving international student community
- More than 30 research programmes and a wide range of taught courses
- One of the largest centres for BBSRC-funded PhD student training in the UK
- Seminars by leading scientists

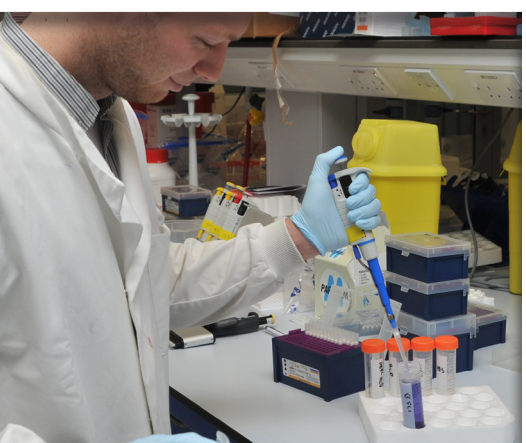
Diverse research programmes and taught courses

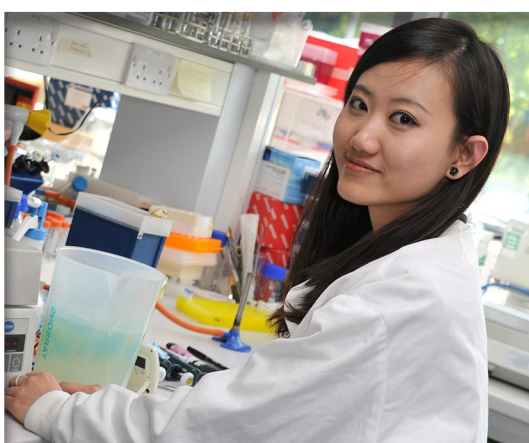
The Faculty is ranked within the top three Biological Sciences departments in the UK. There are over 200 research groups with interests spanning the whole of the biosciences.

A broad range of exciting projects are offered from our research programmes (PhD, MPhil and MRes) and these map onto our research themes, which address areas of significant global importance. In addition, specialist MSc courses are taught in these key areas, preparing students for further postgraduate study or for careers in industry.

In terms of career progression, the majority of our postgraduate students remain in research. Others move into related areas such as education, information technology, consultancy, and science/media communication. Our successful Graduate Training Programme helps students build a set of comprehensive skills during their programme of study.

The Faculty of Life Sciences has a strong ethos of interdisciplinary research. All students have more than one supervisor, with many having supervisors working in different areas/faculties. This cross-disciplinary cooperation allows PhD students to tackle a research question from different angles. The Manchester Doctoral College provides an overarching structure across the University to support and enable cross-faculty Doctoral Training Programmes, including a range of Doctoral Training Centres.





International student environment

The Faculty currently hosts around 400 PhD students from over 60 countries who make a major contribution to our global reputation for outstanding research. Our current international students play a key role in the Postgraduate Society and we ensure that all postgraduate students have the opportunity to get involved in organising events, both social and scientific. The University has an extensive support network, an International Society, and an orientation programme for new international PhD and Masters students.

Postgraduate Society

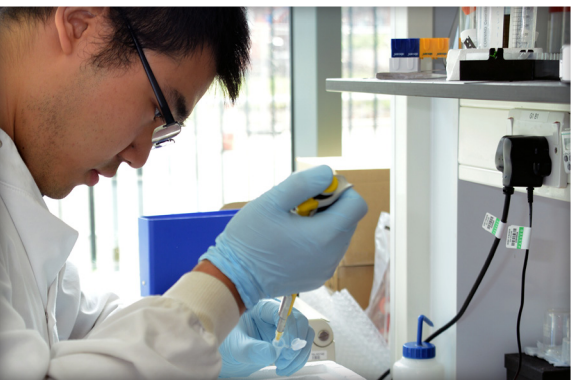
There is a very successful and active Postgraduate Society consisting of student representatives from the across the Faculty. The Society organises annual events and aims to support new students in the Faculty. The Society have organised annual lectures, inviting eminent speakers of academic excellence. They now have an international branch which focuses specifically on the needs of international postgraduate students.

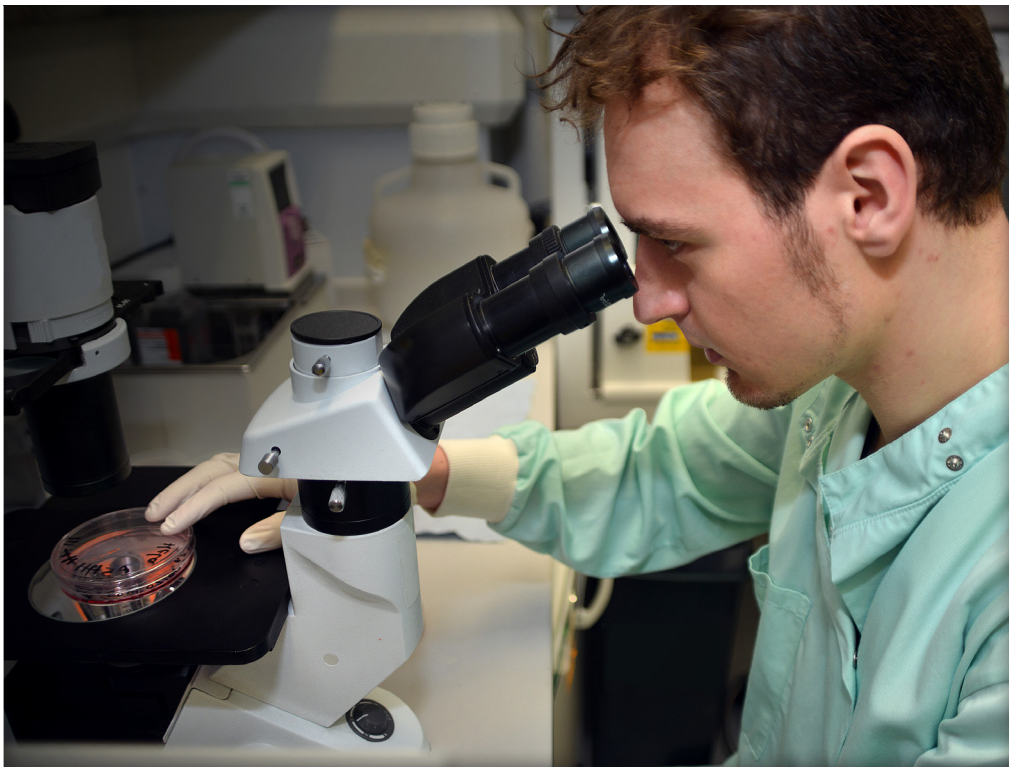
Research with industrial collaboration

The Faculty has strong links with industry and many postgraduate students work on projects that involve collaboration with industrial sponsors. The Faculty is consistently successful in obtaining Research Council support for CASE studentships (Co-operative Awards in Science and Engineering). These PhD projects have a direct industrial relevance and input, and students spend time working at both institutions.

Graduate Training Programme

Our Graduate Training Programme offers bespoke skills training and progression monitoring for every postgraduate student. Each training element facilitates and complements the more specific research training that students receive from their supervisors. We provide training on how to communicate effectively, be a successful researcher, manage projects, and become a leader in the field. Each student has the opportunity to design a training programme that meets their individual needs. This can include specialist training on managing large datasets, one-to-one coaching to improve academic writing, and advice on how to get funding for research.





PhD programmes

We offer a range of PhD projects for self-funded students with some financial support available via our Research Scholarships Scheme and the President's Doctoral Scholarships. We offer a number of funded studentships each year, some of which are cross-disciplinary, including:

- BBSRC, MRC and NERC Doctoral Training Partnerships
- Wellcome Trust 4 Year PhD in Molecular and Cellular Biology
- Graduate Training Programme with A*STAR Institutes, Singapore
- EPSRC-MRC Centre for Doctoral Training in Regenerative Medicine

For full information on our PhD programmes see:
www.manchester.ac.uk/ls/phdprogrammes

Masters courses

- Biochemistry MSc
- Bioinformatics and Systems Biology MSc
- Biological Sciences MRes
- Biotechnology and Enterprise MSc
- Cancer Research and Molecular Biomedicine MSc
- Cell Biology MSc
- Developmental Biology MSc
- History of Science, Technology and Medicine MSc (includes the Science Communication and Medical Humanities award routes)
- Integrative Biology MRes
- Neuroscience MSc
- Plant Sciences MSc

For full information on our Masters courses see:
www.manchester.ac.uk/ls/masterscourses

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The University of Manchester

Faculty of Life Sciences

Nurturing Talent

Women in Science

www.manchester.ac.uk/ls/wils

Promoting equality across the Faculty of Life Sciences

- The Faculty of Life Sciences is home to:
  45 female Professors / Senior Lecturers
  42 female Lecturers / Research Fellows
  153 female Post-doctoral Researchers
- The Faculty holds a Silver Athena SWAN Award, which recognises and celebrates good working practice for women in STEMM subjects (science, technology, engineering, maths, and medicine).
- The Women in Life Sciences Group (WiLS) provides a forum for interaction and discussion, as well as formal support, training, and mentoring schemes for staff at all career stages.
- Faculty initiatives promote an inclusive culture, including part-time and flexible working arrangements and transparent workload models.

Advancing women's careers in life sciences

The University of Manchester Strategic Plan, 'Manchester 2020', commits the University to being a people-centred institution that values its staff as its most precious resource, supports and encourages them in their career development, and seeks to provide a dynamic, exciting environment in which their successes are recognised and rewarded.

Over 40 percent of research and teaching staff in the Faculty of Life Sciences, from Research Associates to Professors, are women, showing the significant and important contribution female scientists are making to the Faculty. From research, to teaching, to public engagement, our scientists are recognised at both national and international level.

The Women in Life Sciences group (WiLS) provides a supportive forum for staff and students. WiLS meetings provide personal and professional development delivered through themed workshops, including a Coaching and Leadership Programme, Neurolinguistic Programming, probation and promotion workshops, and career reflection facilitated by female professors.

"One of the most pleasing developments while I have been Dean is the dramatic increase in the proportion of female members of staff in senior positions."

Professor Martin Humphries,
Vice-President and Dean of the Faculty of Life Sciences

Celebrating our success

Both the supportive environment of the Faculty and the outstanding achievements of its female scientists are recognised at local, national, and international levels. For example, The University of Manchester has been an Athena SWAN Bronze award holder since 2008, with the Faculty of Life Sciences gaining recognition with a Silver award in 2009. The Athena SWAN charter recognises good practice in recruitment, retention, and promotion of women in science, technology, engineering, maths, and medicine subjects. Athena SWAN has been instrumental in highlighting gender issues and stimulating changes to support women in Higher Education.

As evidence of our strength, women throughout the Faculty continue to receive prestigious awards for their outstanding achievements in research, teaching, and communication of science. The following three cases highlight just a few examples:

Nancy Papalopulu, Professor of Developmental Neuroscience
Nancy works to understand how cells decide to divide or differentiate at the molecular level, a decision which is crucial for the correct development of the nervous system. Most recently, she discovered how cyclical fluctuations in levels of protein and small RNAs regulate the fate that cells adopt. Her groundbreaking research over the years has earned her multiple awards including The University of Manchester Distinguished Achievement Award for Research, membership to European Molecular Biology Organisation (EMBO), and her recent election to the prestigious Fellowship of the Academy of Medical Sciences.

Tracey Speake, Senior Lecturer
Tracey is Programme Co-director for the undergraduate biomedical sciences programme at The University of Manchester, and is involved in the development of new educational activities to engage and develop knowledge and understanding of our students. Her significant contribution to the design, delivery, and assessment of our undergraduate programmes was recognised with a University of Manchester Distinguished Achievement Award for Teaching.

Annette Allen, Post-doctoral Researcher
Annette was recently awarded a University of Manchester Postgraduate Distinguished Achievement award for her research in how the retina interprets visual signals and what information it ultimately sends to the brain. In 2013, she was awarded a post-doctoral Career Development Award from the Faculty of Life Sciences, to visit a lab in Madrid and learn new techniques.

Communicating our science

University President and Vice Chancellor, and Faculty of Life Sciences member, Professor Dame Nancy Rothwell champions public communication of science and scientific outreach activities. An important aspect of our work is to engage with the public, not only to educate but also to build excitement and interest in our science. We actively work with the media, local schools, museums, and at Faculty open days, festivals, and community centres. In four of the last five years, female researchers from the Faculty have won a Society of Biology Science Communication Award which recognises outstanding outreach work. In 2013, we took both award categories with Dr Sheena Cruickshank and Rebecca Williams winning the Established Researcher and New Researcher prizes respectively.

Dr Sheena Cruickshank (Faculty of Life Sciences), Dr Jo Pennock (Faculty of Medical and Human Sciences), and Professor Kathryn Else (Faculty of Life Sciences) received the Manchester International Women's Day Award for 'Women & Science, Technology, Engineering and Mathematics' for creation of The Worm Wagon, an educational public activity based on their research. The Worm Wagon raises awareness of the global, economic, and health burden imposed by parasitic worm infections, and the work of scientists studying immune responses to infection. The award recognises women excelling in science, technology, engineering, maths, and medicine, who have a positive impact on women and the wider community.

MANCHESTER 1824
The University of Manchester

Faculty of Life Sciences

Promoting Research

Public Engagement

www.manchester.ac.uk/ls/schoolsandcommunity

An overview of some of the public engagement events the Faculty offers

- **Discover Days:** laboratory and lecture events aimed at Year 13 pupils
- **Science Stars Days:** fast paced workshops attended by Year 8 pupils
- **Teachers' Summer School:** engaging teachers with the research undertaken in the Faculty
- **Pre-16 Work Experience:** a week long programme for pupils including careers workshops, lab shadowing, and a group project
- **Community Open Day:** a public event where the Faculty showcases its pioneering research to the local community
- **Life Sciences Podcast:** a fortnightly podcast, aimed at the interested lay-person, covering all areas of the life sciences (available from the Faculty website)
- **Animal Research Day:** workshops to help Year 13 students understand why animals are used in biomedical research

Bringing science to life

The Faculty of Life Sciences has a long history of engagement with our local schools and community, with an annual programme of exciting activities.

Our established scientists communicate their work in order to excite and inspire the young people who will be the scientists of the future and to explain to the public how their money is being spent. All our postgraduate students are encouraged to be involved in public engagement, from creating their own activity to take into schools, to setting up a blog or showing their research at the Manchester Museum or the Museum of Science and Industry.

For those researchers in biomedical areas, engagement can also have an important public health aspect, for example, communicating basic information about parasites, stroke or cancer.

Our researchers are also involved in bridging the gap between the sciences and the arts, collaborating with local and national artists, or working with patient groups that use art as a way of coping with and overcoming disease.

Members of the Faculty also have a media presence, writing for newspapers, blogging, writing popular science books, appearing on radio or TV programmes, or acting as consultants to ensure that our science is accurately represented in the public eye.

Our researchers and students have won a series of national awards for their innovative approaches to public engagement. As a Faculty we value, encourage, and support these activities as an essential part of our scientific and educational missions.

This huge range of activities underlines the importance we attach to public engagement. We consider it important that we communicate the success and potential of our work in an accessible way to ensure that it is truly understood by the wider community.

Community Open Day

Each year the Faculty throws open its doors to the local community, inviting the public to see the work that goes on inside our buildings, from cancer research to brain imaging.

Visitors can look around our laboratories and use our million pound microscopes, get hands-on with giant insects, find out how the heart works, make edible cells out of cookies, or learn how leeches were used in medicine. Jennifer, aged eight, said: "I had a fabulous day and learned loads!" While eleven-year-old Ben added: "It was fantastic, educational, and fun for all my family".

Each year, hundreds of children and adults come along – for many families this is their first contact with the University. MPs and local councillors are also invited along, with their families, to discuss the research that we carry out.

Body Experience

'The Body Experience' is a suite of activities for families that covers the organs of the body. Children can perform spine surgery, learn about mucus, see how the heart beats, and discover the new advances in tissue engineering that can help alleviate back pain.

We have a 3D ceramic printed model of the glomerulus of the kidney which explains the inner workings of the organ. There is a popular activity involving creating and playing with mucus, while the 'Mammary Glands' stand illustrates how the ductal system in glands work through the milking of a life-size model cow.

This set of activities, which is matched with a 'passport' the children get stamped at each stand, is showcased at the Manchester Museum and the Manchester Science Festival. It provides the public with a basic understanding of how their body works, and provides a glimpse into the research we are carrying out.

Science Stars Days

Each July, 200 Greater Manchester pupils aged 12-14 visit the Faculty, experiencing a taste of university life and finding out more about what it means to be a scientist. Pupils are immersed in a full day of workshops run by Faculty staff and students. There are lectures, films, and lab-based workshops. These include Aquascience, an indoor pond-dipping activity that teaches people about the insect life in rivers, learning about the heart and lungs in a t-shirt drawing activity, making functional models of the heart, building a DNA double helix and, finally, 'diagnosing' some patients with diabetes.

Worm Wagon

This award-winning engagement activity, led by Dr Sheena Cruickshank, Professor Kathryn Else, and Dr Jo Pennock, has gained national renown and been showcased around the country, including in some of our poorest communities and at the annual Jodrell Bank Live concerts in the summer. Using a mixture of traditional Indian art (rangoli), videos and games, the Worm Wagon explains basic concepts relating to worm infestations and how they can be treated. Through this activity, the researchers have made vital contacts with immigrants from the Indian sub-continent, whose experience and insight have altered the way the research is carried out. This is the gold standard of public engagement – where the public can contribute to the development of the research.

Research Impact

Improving Our Waterways

Dr Keith White

Dr Keith White is a Senior Lecturer working in the area of ecology and environment.

Keith is interested in understanding and managing the water quality and ecology of urban watercourses. He also investigates the toxicity of metal pollutants to aquatic animals and plants, and how such toxins are accumulated and transferred through the food chain.

www.manchester.ac.uk/ls/research/impact

Improving our waterways

The Manchester Ship Canal (MSC), opened in 1894, was one of the busiest waterways in Europe. It was polluted by industrial discharges, sewage overflows, and surface water runoff, including from the River Irwell which forms the headwaters of the MSC.

Salmon disappeared from the River Irwell in the 1850s and rowing races were abandoned in the 1970s. Despite the real estate value of the docks being estimated at £550m, development was prevented by unpleasant odours, bubbling gas, and sediment rafts.

Research led by Dr Keith White established the cause and extent of water pollution in the upper MSC and Salford Quays. This led to evidence based restoration programmes that have rejuvenated the waterway and surrounding areas. The improvement in water quality was the essential first step in the development of Salford Quays, an expansion which has seen approximately 2000 homes being built and the arrival of 900 businesses employing over 35,000 people.

Dr White's research has been translated into practical solutions for the clean-up of contaminated waterways. This quick and effective change has been achieved alongside the spin-out company APEM Ltd (Aquatic Pollution and Environmental Monitoring). APEM, founded at The University of Manchester in the 1980s, is now one of the largest independent aquatic science consultancies in Europe. APEM's continuing commercial activities relating to water quality management are underpinned by Dr White's research.

"Maintaining our links with The University of Manchester has been critical to the success of APEM."

Dr Keith Hendry
Managing Director, APEM Ltd.

NERC SCIENCE OF THE ENVIRONMENT

APEM AQUATIC SCIENTISTS

MANCHESTER 1824
The University of Manchester

Faculty of Life Sciences

Research Impact

Preserving Wildlife

Professor Richard Preziosi

Professor Richard Preziosi works in the area of evolutionary, ecological and community genetics.

Richard has a strong interest in conservation biology and has taught on field courses for over ten years. Much of his field work is done in South and Central America as part of conservation and development projects.

www.manchester.ac.uk/ls/research/impact

Preserving wildlife, protecting cultures

Researchers from The University of Manchester have funded and assisted the reconstruction and expansion of the Timburi-Cocha Research Station in Payamino, Ecuador. They have provided employment for the local community and facilitated biodiversity research in an area of high endemism.

Our staff and students have played a vital role in preserving wildlife and indigenous culture in the area, and their fieldwork has discovered new insect species, recorded native birds and mammals, and proven that the community's agricultural practices are safe for wildlife.

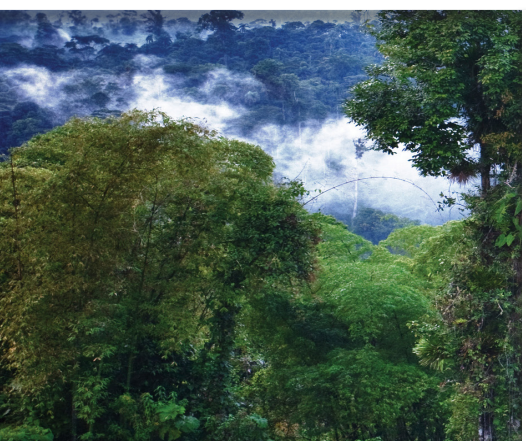
These vital discoveries have armed the local government with the evidence needed to discourage oil and gold companies from investigating the region. Faculty researcher Professor Richard Preziosi, chair of the research station, says that exploration could devastate the region's wildlife, culture, and community.

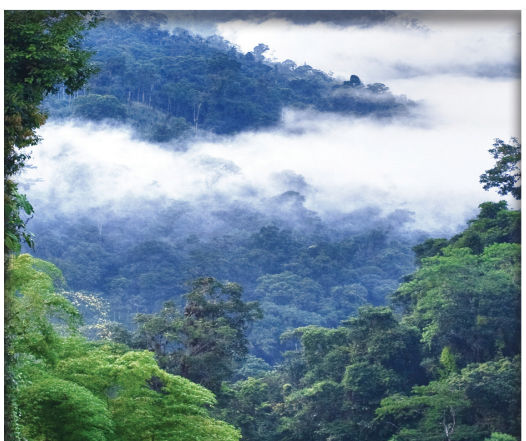
Since 2005, around 80 life sciences students have travelled to the remote research station. Their work is essential to wildlife conservation. According to the community's president, the station is 'a thriving community project that has helped to keep oil companies and illegal meat hunting at bay, while enabling the community to preserve their way of life.

"Our studies prove there is an urgent need for conservation research that enables local people to make a stand against rich industries and illegal hunting, something this community did successfully with an oil company a few years ago."

Professor Richard Preziosi
Professor of Ecological Genetics, Faculty of Life Sciences.

NERC SCIENCE OF THE ENVIRONMENT





Research Impacts

Bringing Scientific Articles to Life

Professor Teresa Attwood

Professor Teresa Attwood studies bioinformatics and is jointly appointed in the Faculty of Life Sciences and the Faculty of Engineering and Physical Sciences.

Terri's research involves using computers to analyse and understand biological information. She has strong interests in protein sequence analysis and the development of software tools to link scientific articles with their underlying research data.

www.manchester.ac.uk/ls/research/impact

Bringing scientific articles to life

The need to manage, analyse, and interpret the volumes of data and literature generated by modern high-throughput biology can be a major barrier to progress. Professor Teresa Attwood and her group are using computers to help readers make better use of scientific articles.

Professor Attwood's research has resulted in the development of Utopia Documents, an innovative software system that links biomedical data to scientific literature. This software 'brings articles to life' by linking what is written with information in online databases and interactive software tools. This gives readers the best of both worlds: access to the original research and to the analysis tools needed to explore findings in real time.

The software has been adopted by international publishing houses like Portland Press, powering the development of the so-called 'Semantic Biochemical Journal'. By allowing publishers to enrich their articles, past and present, and drive more traffic to their online content, it is opening up new business models. It is also used by pharmaceutical companies such as AstraZeneca and Roche, enabling them to recover and exploit in-house knowledge that is otherwise lost during drug-discovery processes. The research also led to the development of a spin-out company, Lost Island Labs, in 2012.

"Utopia Documents provides a key missing link between the content of published papers and many distinct scientific databases, a first for scholarly publishing."

Audrey McCulloch
Chief Executive of the Association of Learned and Professional Society Publishers.

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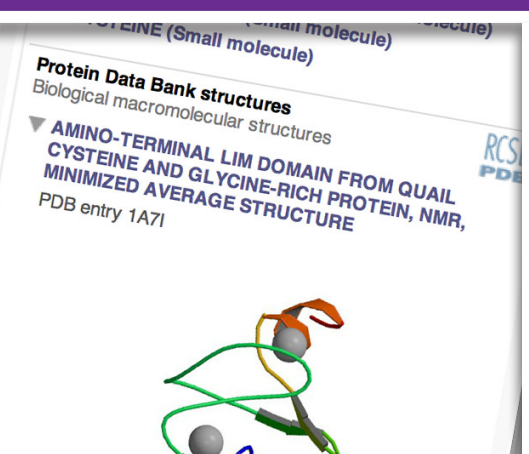
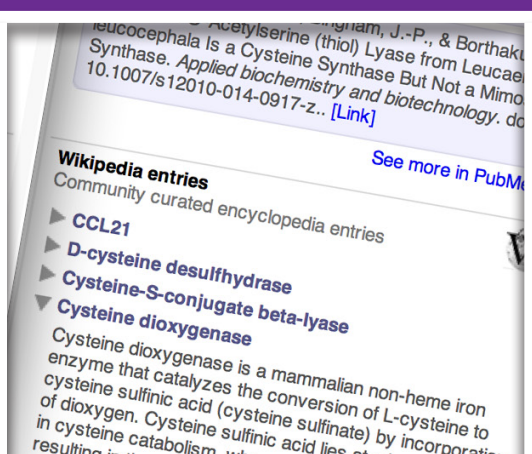
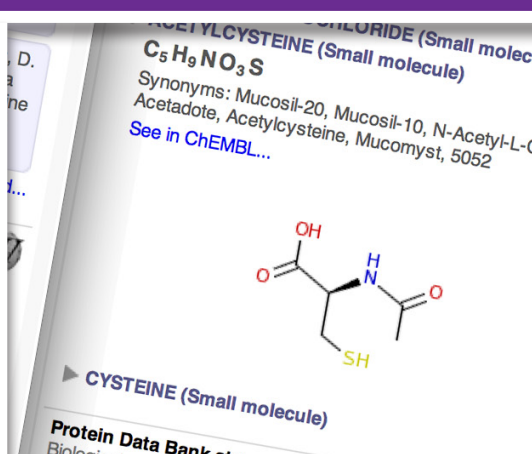
EUROPEAN UNION

PORTLAND PRESS

EMBnet The Global Bioinformatics Network







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Faculty of Life Sciences

Research Impact

MicroRNA Database

Dr Sam Griffiths-Jones

Dr Sam Griffiths-Jones is a Senior Lecturer in the area of computational biology.

The aim of Sam's research is to understand the complement of genomes that codes for functional (non-coding) RNA molecules. In particular, he is interested in the evolution and function of microRNA genes. Much of his work revolves around RNA database resources.

www.manchester.ac.uk/ls/research/impact

Developing a microRNA database

University researchers have developed a database of a class of genes called microRNAs (miRBase - www.mirbase.org) which has become an essential resource in academia and the pharmaceutical industry.

MicroRNAs (miRNA) are non-protein-coding genes that regulate the expression of protein-coding mRNAs in animals and plants. It is predicted that over half of all human genes are regulated by microRNAs, yet they were essentially undiscovered until 2001. Commercial organisations have been quick to adopt microRNA research programmes to exploit their potential as regulators and biomarkers of disease. miRBase is now the central global repository for all published microRNA sequences and annotation. Its production, development, and availability impacts research on a global scale.

The database was created by Dr Sam Griffiths-Jones. The primary use of data comes via the website, which consistently receives 40-50,000 visits per month. The data enables production of experimental kits and resources which underpin experimental microRNA research across academic and industrial settings, benefiting product development, drug discovery, and clinical research.

miRBase's impact on the pharmaceutical industry has been considerable. It has led to new products and significant research gains. MicroRNAs have been implicated in a wide range of disease processes and shown to act as biomarkers for cancer types and stages, disease prognosis, and drug performance. Pharmaceutical companies have active research streams investigating the use of microRNAs as biomarkers. Drugs that target microRNAs are also showing clinical promise for conditions such as chronic heart failure and cardiometabolic disease.

"... everyone in the miRNA research community considers the miRNA content of miRBase to represent the golden standard miRNA repository."

Dr Peter Mouritzen,
Vice President for Research and Development, Exiqon.

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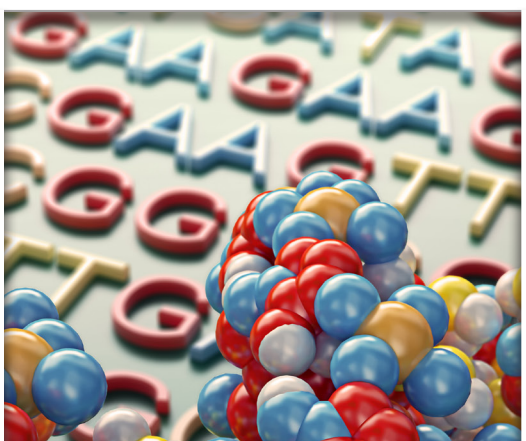

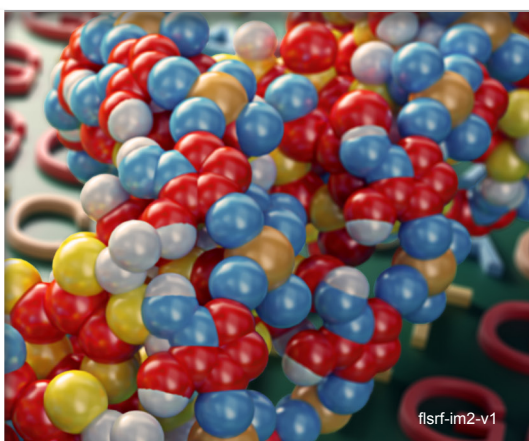

Research Impact

Redesigning Artificial Lights

Professor Rob Lucas

Professor Rob Lucas is a neuroscientist working on neurobiology of the visual system.

Rob's laboratory conducts basic research aimed at understanding how we measure and respond to the daily change in light intensity. He has developed strong links with industry, clinicians, and non-governmental organisations to realise practical applications of his discoveries.

www.manchester.ac.uk/ls/research/impact

Redesigning artificial lights to suit our biological needs

Disruption of the body clock and sleep-wake cycle, caused by exposure to unnatural light, can have a profound influence on health, productivity, and wellbeing. These effects are common in shift-workers, amongst others.

It has long been known that light activates specific receptors in the eye called rods and cones. However, a third type of light receptor has now been discovered. Neuroscientists at The University of Manchester have shown this receptor to be responsible for a range of important subconscious responses to light, including synchronising the body's natural rhythms to the light-dark cycle.

Lighting design has hardly started to catch up with these new discoveries, with artificial lights engineered only to take account of the requirements of rods and cones. Professor Rob Lucas's research has established ways of measuring light that predict its effect on these newly discovered receptors. He is now working with lighting manufacturers to produce improved artificial lights which will activate these receptors, making them more suitable to our biological needs. Professor Lucas is also working with public policy organisations to produce updated international standards for architectural lighting. These will be applied to a wide range of domestic, public, and industrial settings, reducing the harmful effects of artificial light and disrupted lighting schedules.

"Artificial light has been developed to help us see. It's high time we considered the other impacts it is having on our biology."

Professor Rob Lucas
Professor of Neuroscience, Faculty of Life Sciences.

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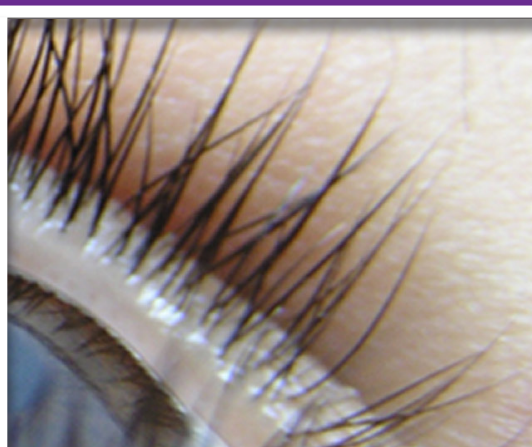

Research Impact

Detect and Protect

Dr Ian Murray

Dr Ian Murray is a Senior Lecturer working in the area of eye and vision sciences.

Ian's laboratory is engaged in basic research on human photoreceptors, night vision and colour vision. He conducts clinical studies aimed at understanding how macular disease develops, and how it might be prevented and managed by enhancing macular pigments and improving diet and life style.

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Detect and protect: screening against Age Related Macular Degeneration

Age Related Macular Degeneration (AMD) is the leading cause of blindness in older people in the developed world.

It affects 30% of those aged over 65, and is set to increase. AMD is associated with a low level of retinal carotenoids, which are collectively known as the macular pigment (MP). MP is a blue light filter and has antioxidant and anti-inflammatory properties.

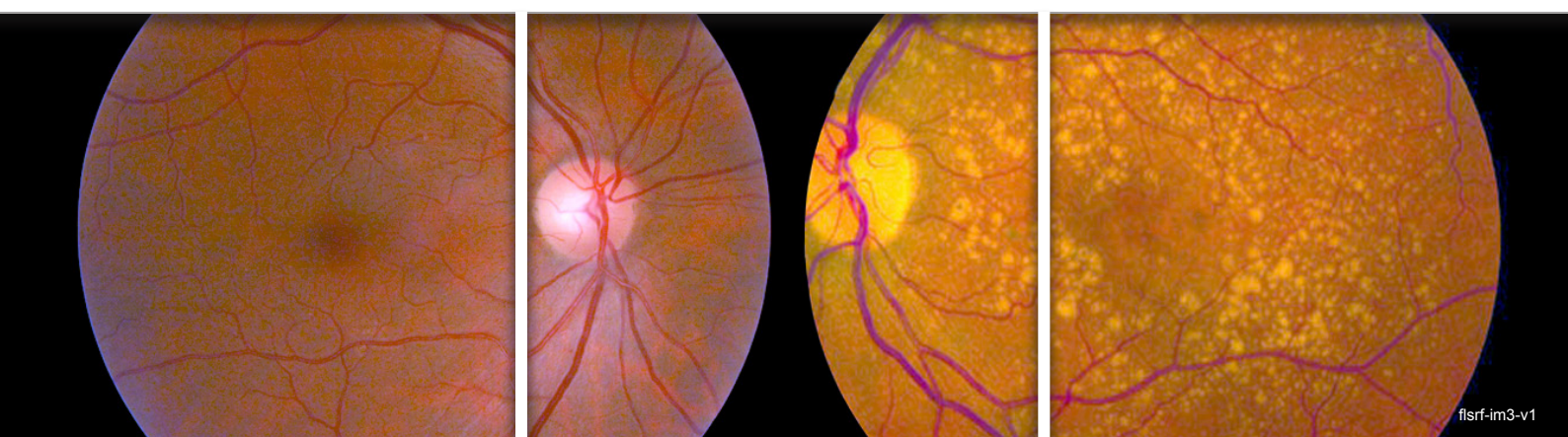
Dr Ian Murray and colleagues at The University of Manchester have developed a new instrument, the Macular Pigment Screener (MPS), which allows patients to have their MP levels routinely tested in ophthalmic clinics. This means that, for the first time, patients can be advised if their MP is low and, if so, how to increase it. This will help to avoid the development or progression of AMD. Over 750 instruments have been sold worldwide, with more than one million patients in the United States alone estimated to be benefiting from MP monitoring.

"... currently the quickest, most affordable, and most clinically relevant device in the world. The technology will revolutionize the practice of eye care."

Dr Stuart Richer
Chief of Optometry, Captain James A Lovell Federal Health Facility, North Chicago, USA.

elektron technology

DH Department of Health



Research Impact

Endocrine Diseases

Professor Anne White

Professor Anne White is an endocrinologist whose research investigates stress hormones in disease.

Anne is internationally recognised as an expert in prohormone processing, the assessment of the stress axis, and the role of a variety of stress hormones in obesity and diabetes.

www.manchester.ac.uk/ls/research/impact

Improving the diagnosis of endocrine diseases

Thousands of people around the world suffer from endocrine diseases. Often life-threatening, these diseases affect the body's hormone producing systems. Their effects can be devastating. Understanding and diagnosing these diseases depends on the ability to accurately measure the hormone levels of patients.

University of Manchester researchers have developed unique antibodies to two important hormones, adrenocorticotrophic hormone (ACTH) and pro-opiomelanocortin (POMC). These antibodies have now been developed into testing kits which are used worldwide to diagnose, monitor, and inform treatment decisions for patients. Since 2008, more than 6 million ACTH tests incorporating our antibodies have been sold by Roche Diagnostics International Ltd.

In collaboration with Professor Anne White, doctors across the globe are now using these tests to diagnose hormone secreting tumours in their patients and to monitor treatment. In another area, this has led to the identification of two previously unknown human syndromes which has aided patient counselling and monitoring.

"The work from Dr White's laboratory has revolutionized how these patients are evaluated."

Professor Hershel Raff
Professor of Medicine, Surgery and Physiology,
Medical College of Wisconsin.

CANCER RESEARCH UK
AstraZeneca
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Faculty of Life Sciences

Research Impact

Accurate Medical Tests

Professor Richard Walmsley

Professor Richard Walmsley works in the area of genetic toxicology and is currently seconded to Gentronix as their Scientific Director and Chief Scientific Officer.

Richard is particularly interested in genome damage in human cells. He entered the field of genetic toxicology almost by chance, when developing tools to understand possible functions for new genes identified by yeast genome sequencing.

www.manchester.ac.uk/ls/research/impact

Developing more accurate medical tests

Genotoxicity describes the property of chemical agents that damage the genetic information within a cell, causing mutations, chromosome re-arrangements/mis-segregation which could lead to cancer.

Internationally required genotoxicity tests are effective in providing positive results for carcinogens, but they can also provide positive results for most non-carcinogens. These results are known as misleading positives. University of Manchester researchers realised that developing a more accurate assay would reduce the number of misleading positives and allow resources to be focused on compounds likely to succeed in the clinic.

In the late 1990s, Professor Richard Walmsley founded a spin-out company call Gentronix. Gentronix provides services which help organisations to optimise the development of drugs and other chemicals by reducing attrition due to genotoxicity. This ensures safer products across a wide range of industries. The direct beneficiaries of the company's technology come from diverse sectors. More than 100 companies worldwide are using Gentronix kits including pharmaceutical, agricultural, health and beauty companies, and manufacturers of food flavourings and household goods.

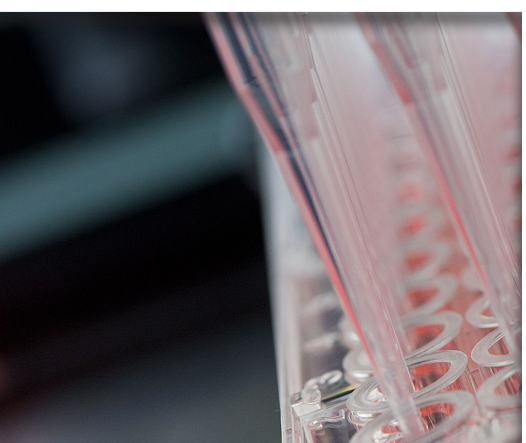
"Gentronix can produce reliable genotoxicity data within 48 hours, and over 70 companies from around the globe have now sent compounds for testing in our laboratories."

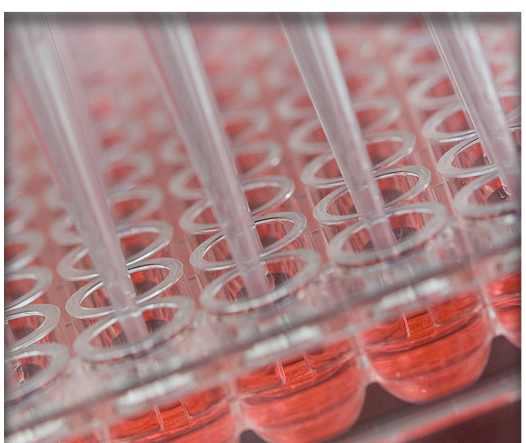
Professor Richard Walmsley,
Professor of Genetics, Faculty of Life Sciences.

BBSRC bioscience for the future

NC3Rs National Centre for the Replacement Refinement & Reduction of Animals in Research

gentronix innovation and service





Research Impact

Reducing the Risk of Infection

Dr Curtis Dobson

Dr Curtis Dobson is a Reader whose research focuses on the interactions between host proteins, microorganisms, and medical device surfaces.

Curtis founded his first company, Ai2, in 2005 and recently founded a second company, Microsensor Ltd, to commercialise novel microbial sensors. He won the BBSRC Commercial Innovator of the Year Award in 2014.

www.manchester.ac.uk/ls/research/impact

Reducing the risk of infection

Almost all medical devices which come into direct contact with the patient share a common drawback; although initially sterile, they can harbour microbes. This can lead to serious infection of the people the devices intended to help.

Dr Curtis Dobson has invented a technology based on a novel anti-infective protein he discovered. This has provided a potential solution to this highly significant problem. In 2005, Dr Dobson founded the company Ai2 Ltd to commercialise this invention.

Ai2's first commercial target was the contact lens sector. Every year, around 6000 of the world's 100 million contact lens wearers suffer a permanent decrease in their vision quality following eye infections from their lenses. The Ai2 anti-infective technology can be used directly on the lenses and as a disinfectant within the solution used to clean them. Ai2 have signed a major commercial deal for their technology with Sauflon Pharmaceuticals, a market-leading UK-based contact lens company.

Ai2 is also pursuing other development projects, demonstrating the applicability of their technology in a range of fields. These include coatings for wound dressings, catheters, orthopaedic devices, and as agents for use in oral care products, highlighting the technology's potential to prevent infections in a wide range of common medical devices.

"Ai2's peptide technology is based on discoveries developed by Dr Dobson at The University of Manchester. Our focus is to exploit these highly potent, biocompatible, anti-microbials in partnership with a number of global companies. The advanced technical support accessible to us in the University is invaluable in helping us toward this aim."

Dr Duncan Henderson
Research & Development Manager, Ai2.

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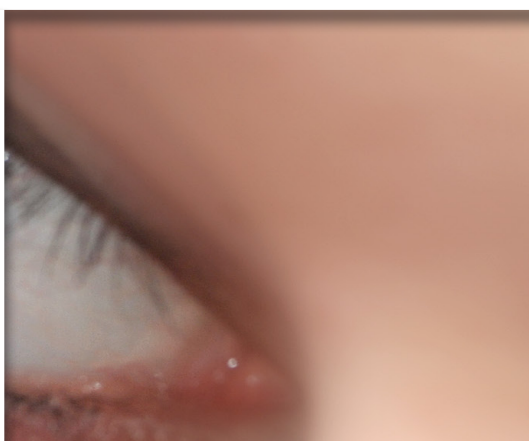

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The University of Manchester

Faculty of Life Sciences

Research Impact

Aiding Drug Discovery

Dr Andrew Almond

Dr Andrew Almond is a Lecturer working in the area of structural biology and is currently seconded to C4X Discovery as their Chief Technology Officer.

Andrew's laboratory is pioneering new technologies to understand complex carbohydrate shapes using techniques such as hardware accelerated computation and ultra-high field nuclear magnetic resonance.

www.manchester.ac.uk/ls/research/impact

Aiding drug discovery: improved technology for determining 3D molecular shapes

Determining the three-dimensional structures of molecules is a critical part of new drug discovery. Traditional methods have often taken months or years to achieve results. University of Manchester researchers have now developed an improved method, using Nuclear Magnetic Resonance (NMR) data, which determines the 3D conformation of drugs within weeks.

Following this success, Dr Andrew Almond and Dr Charles Blundell set up the spin-out company C4X Discovery (formerly Conformetrix.) The company has raised several million pounds in private investment. In 2012, AstraZeneca began to apply this new technology, known as MolGyrate, across their entire pre-therapeutic pipeline, enhancing its drug discovery process. C4X Discovery has also provided paid services to several of the world's other largest pharmaceutical and biotechnology companies.

The VP and Head of Discovery Sciences at AstraZeneca said: "We've been looking to see if there is anything else out there that competes with Conformetrix's technology. We feel it is truly unique."

"... their technology will provide a powerful addition to our hit identification and lead optimisation approaches."

Mike Snowden
Vice President and Head of Discovery Sciences, AstraZeneca.

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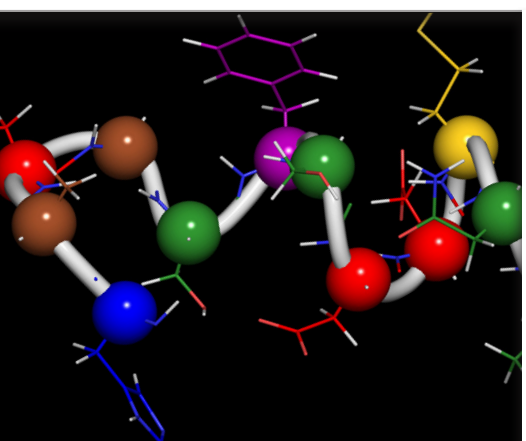

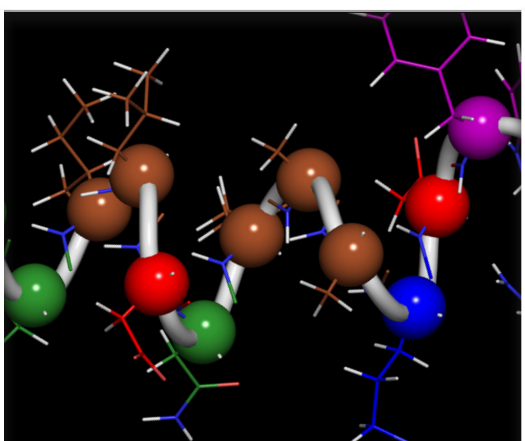

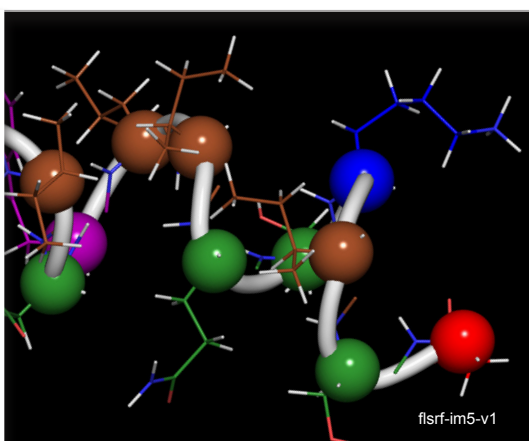

Research Impact

Worm Infections

Dr Sheena Cruickshank

Dr Sheena Cruickshank is a Lecturer in immunology who studies the factors underlying resistance or susceptibility to infection and long-term inflammation.

Sheena is a BBSRC Regional School Champion and co-developed "The Worm Wagon" with Professor Kathyrn Else and Dr Joanne Pennock. In 2013, Sheena was awarded a Society of Biology Communicator of the Year Award.

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Worm infections: education and understanding

Researchers in the Faculty of Life Sciences have developed an educational programme which focuses on the immune response and biology of parasitic worm infections.

About 2 billion people around the world have intestinal worm infections. The World Health Organisation estimates that 600 million school-age children need deworming treatment and preventive intervention. As parasitic worms can infect livestock, this issue also damages the global economy. Although cheap and effective medicines are available, their use encourages drug resistance and does not prevent reinfection, so these medicines are not a sustainable solution. Education about transmission and appropriate treatment is crucial to the reduction of the impact of worm infections across the globe.

Manchester's education programme, known as The Worm Wagon, has already benefited a wide audience. The team have been involved in over 40 events with more than 68,000 participants. Their audiences have been varied, representing the large scope of people that worm infections affect. As well as students and health workers, the team make sure to target areas where worm infections are most prevalent, such as Uganda, Pakistan, and the UK's immigrant communities.

"It is startling to discover how little is understood about how infections are transmitted and their significance to health and the global economy. Education about infection is critical in reducing infection risk and thus improving health."

Dr Sheena Cruickshank
Lecturer, Faculty of Life Sciences.

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MRC Medical Research Council
wellcome trust

Research Impact

Protein Fingerprinting

Professor Teresa Attwood

Professor Teresa Attwood studies bioinformatics, specifically in the area of protein sequence analysis. She is jointly appointed in the Faculty of Life Sciences and the Faculty of Engineering and Physical Sciences.

Terri has taught bioinformatics for over twenty years, and leads a global initiative to enhance and disseminate good practice in bioinformatics learning, education and training worldwide.

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Protein fingerprinting and global databases for the drug development industry

Research by Professor Teresa Attwood and her group involves using computers to analyse and understand biological information. Modern technologies produce data more rapidly than they can be managed and interpreted, meaning that much biomedical information remains unused. Automation has become essential.

The team's focus is on amino acid sequences of proteins, how they can be grouped into families, and what these relationships can tell us about protein function, structure, and evolution. Prof Attwood and colleagues developed a unique method of sequence analysis known as protein fingerprinting and created a fingerprint database, known as PRINTS, which allows them to diagnose protein family members. This led to the development of InterPro, the world's first integrated protein family repository.

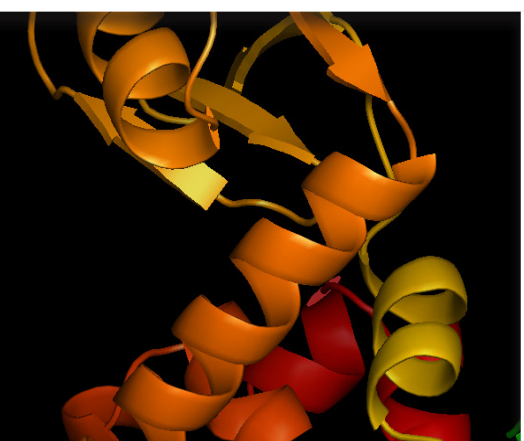
Professor Attwood has a keen interest in G protein-coupled receptors, proteins that are acted upon by more than half of all prescription drugs. This makes them especially interesting to pharmaceutical companies. Consequently, the databases and their search tools are used by international pharmaceutical and agrichemical companies, where they have provided insights into disease mechanisms and revealed potential targets for new drug treatments.

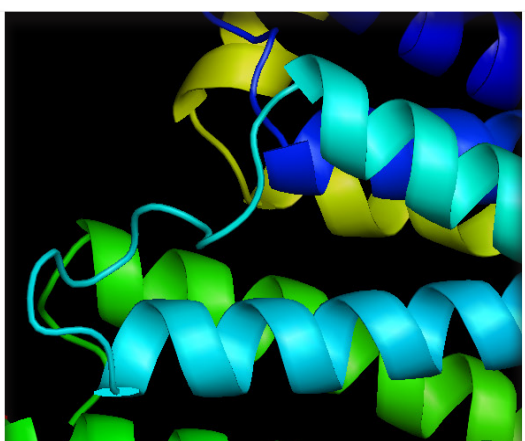
"InterPro now plays a key role in genome and proteome annotation projects around the globe."

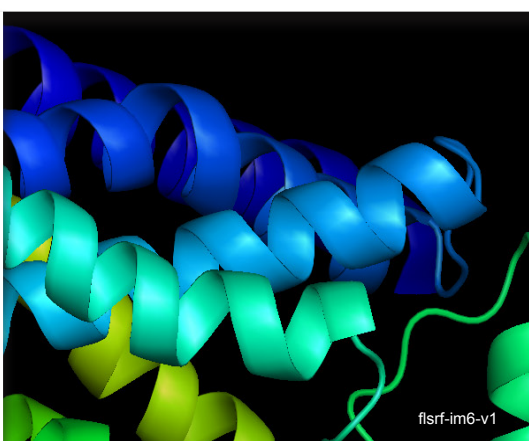
Dr Alex Mitchell
InterPro Content Co-ordinator, European Molecular Biology Laboratory.

AstraZeneca Pfizer Roche gsk do more feel better live longer

MRC Medical Research Council BBSRC bioscience for the future EUROPEAN UNION EPSRC Pioneering research and skills







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The University of Manchester

Faculty of Life Sciences

Research Impact

Climate Proofing Cities

Professor Roland Ennos

Professor Roland Ennos is an Honorary Reader whose research in the area of biomechanics investigates the influence of physics on biology.

Roland's urban greenspace research aims to understand how and why trees can improve the urban environment. He has collaborated with the Red Rose Forest, Manchester City Council, and Barcham Trees to carry out complementary experimental studies.

www.manchester.ac.uk/ls/research/impact

Climate-proofing cities

Lack of urban greenspace can lead to problems such as urban hotspots and flooding. Faculty scientists, led by Professor Roland Ennos, undertook a research project which has led to the development of accessible and easy-to-use tools which assist planners to intelligently design urban greenspace. This has informed policies on a local, national, and international scale.

Professor Ennos and his colleagues have demonstrated just how important trees can be for improving the quality of city living. Their research shows that trees reduce surface runoff by 60% in rain storms. In hot weather, they have shown that trees can cool surfaces by up to 20°C. Furthermore, the team have proved that, to maximise growth rate and cooling properties, trees should be planted in special structural soils.

Community forests across the globe have altered their planting practices. An online tool for assessing the effects of trees on adapting towns and cities to climate change has been developed, and is accessed by more than 350 organisations a year, often as far away as Japan and Brazil. Novel mapping tools created by the Manchester group have also had an international impact, including a role in the city master plan for Addis Ababa, Ethiopia.

"The ongoing research of The University of Manchester into green infrastructure and the associated social benefits is invaluable to Red Rose Forest and its partners in helping us to deliver environments that are sustainable, healthy and resilient to our changing climate."

Tony Hothersall
Forest Director, Red Rose Forest.

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nwe
redroseforest



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Faculty of Life Sciences

Research Impact

Genetic Skeletal Diseases

Professor Mike Briggs

Professor Mike Briggs studies the mechanisms of the genetic skeletal diseases pseudoachondroplasia and multiple epiphyseal dysplasia, which affect the development of the skeleton.

Mike's work has led to the development of accurate and reliable DNA testing protocols which have significantly improved both accuracy of, and access to, genetic testing in the UK, Europe and worldwide.

www.manchester.ac.uk/ls/research/impact

Improved diagnosis of genetic skeletal diseases

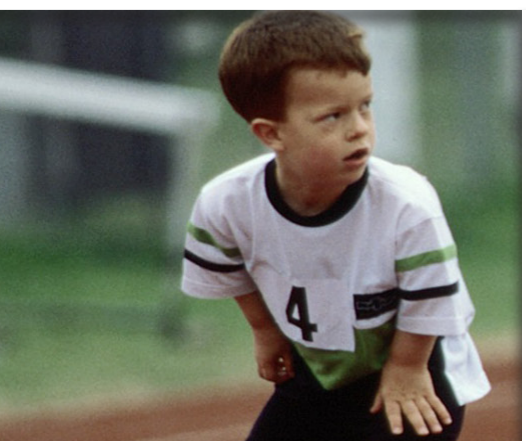
Genetic skeletal diseases are difficult to diagnose and there are currently no treatments. Although these diseases are individually rare, they do affect roughly 225,000 people in the European Union. Those affected suffer from poor quality of life and high healthcare costs. Early diagnosis is crucial so that patients can receive vital support and counselling.

University of Manchester research has had a major influence on establishing the correct diagnosis of these diseases. Researchers have discovered causative genes and mutations which have led to the subsequent development of accurate and reliable DNA testing protocols. This has significantly improved the accuracy of, and the access to, genetic testing across the globe.

Diagnosis of many genetic skeletal diseases has traditionally relied upon clinical and radiological methods. Following research by the Manchester team, led by Professor Mike Briggs, a completely new concept in rare disease diagnosis has been introduced. They have demonstrated that a clinical and molecular diagnosis network could dramatically improve patient access to expert diagnosis for these diseases, as well as increasing mutation detection rates. Since 2003, the network's electronic system has received over 1600 referrals from clinicians.

"This electronic system allows clinicians to submit cases from anywhere in the world, giving quick and easy access to expert advice. The system has over 400 active users from 45 countries, improving diagnosis and detection on a global scale."

wellcome trust
European Commission
The Health Foundation Inspiring Improvement
Arthritis Research UK



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MANCHESTER 1824
The University of Manchester

Faculty of Life Sciences

Research Facilities

Faculty Campus

www.manchester.ac.uk/discover/maps

The Faculty is housed on a purpose built, state-of-the-art campus

- Over £140m investment in Faculty buildings in the last decade
- Space occupied in eleven different buildings totalling 37,000 square metres
- Key research space focused in the following buildings:
  - AV Hill Building
  - Carys Bannister Building
  - Core Technology Facility
  - John Garside Building
  - Michael Smith Building
  - Stopford Building
- Buildings house almost 1000 members of staff
- Purpose built facilities to house state-of-the-art research equipment
- Aerial walkways connecting many of the main research buildings

Providing infrastructure for the 21st century

The majority of the Faculty is housed in purpose built, state-of-the-art research accommodation, designed to remove physical barriers to collaboration and provide an environment conducive to undertaking groundbreaking research.

At the heart of the Faculty, aerial walkways connect the Michael Smith, AV Hill, Stopford, and Core Technology Facility buildings, creating a biomedical complex housing more than 300 research groups. The following is just a highlight of some of the Faculty buildings:

Michael Smith Building

The £39m Michael Smith building houses approximately one third of the Faculty's academic staff. The building is named after Michael Smith, winner of the 1993 'Nobel Prize for Chemistry' for his work in developing site-directed mutagenesis.

AV Hill Building

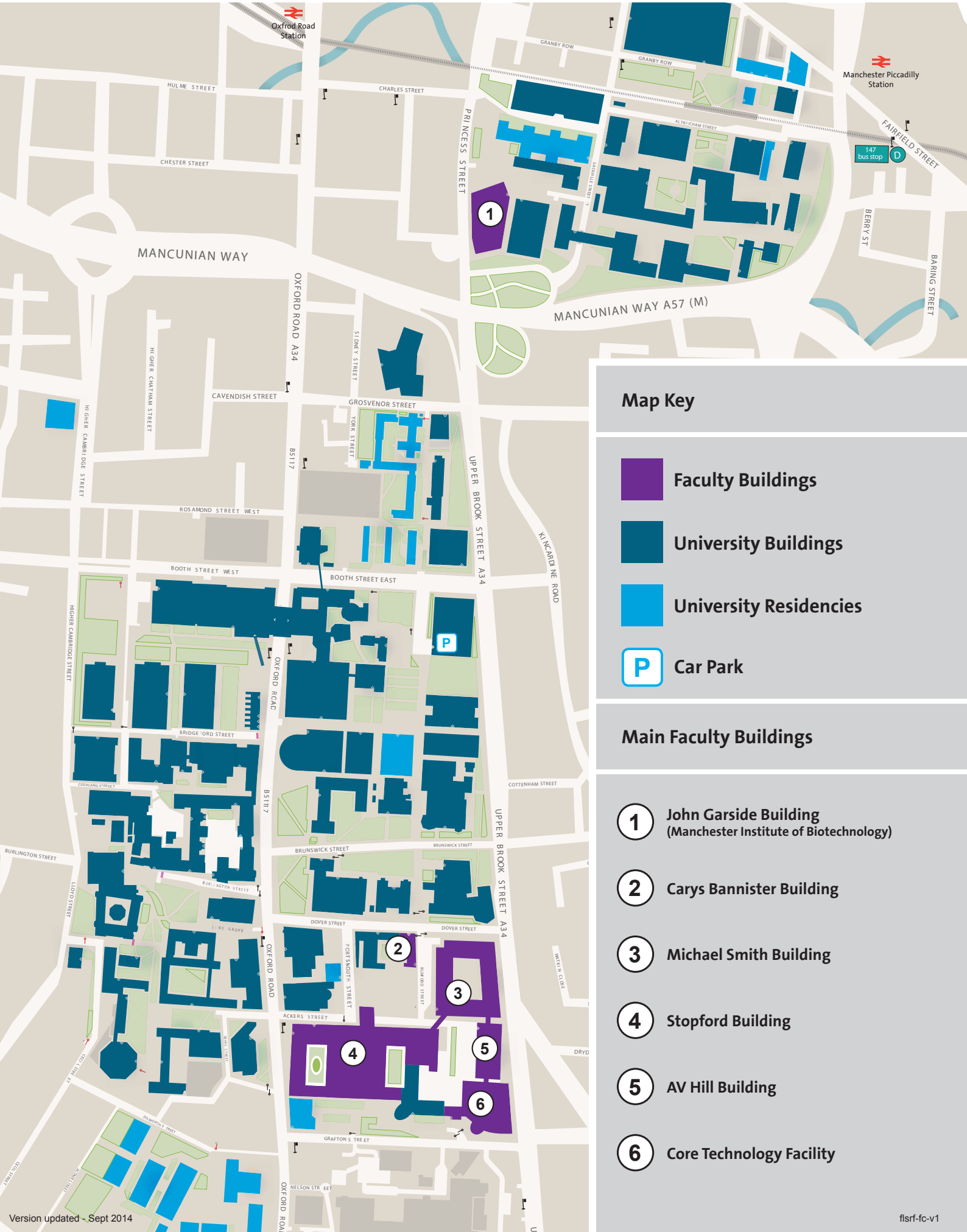
This impressive building, representing a £40m investment, houses over 50 research groups, mainly focusing on neuroscience and immunology. The building is named after Archibald Vivian Hill who won the 'Nobel Prize in Physiology or Medicine' for his work on the generation of heat by muscles.

John Garside Building (Manchester Institute of Biotechnology)

The £38m Manchester Institute of Biotechnology brings together bioscientists, engineers, and mathematicians to undertake research and to develop technologies to meet current challenges in biology and medicine. The building houses 75 research groups from the faculties of Life Sciences and Engineering and Physical Sciences alongside extensive research facilities.

MANCHESTER 1824
The University of Manchester

Campus Map



Map Key

- Faculty Buildings
- University Buildings
- University Residencies
- P Car Park

Main Faculty Buildings

1. John Garside Building (Manchester Institute of Biotechnology)
2. Carys Bannister Building
3. Michael Smith Building
4. Stopford Building
5. AV Hill Building
6. Core Technology Facility

Faculty of Life Sciences
The University of Manchester
1.21 Simon Building
Brunswick Street
Manchester
M13 9PL

Tel +44 (0)161 275 1407
www.manchester.ac.uk/lifesciences

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