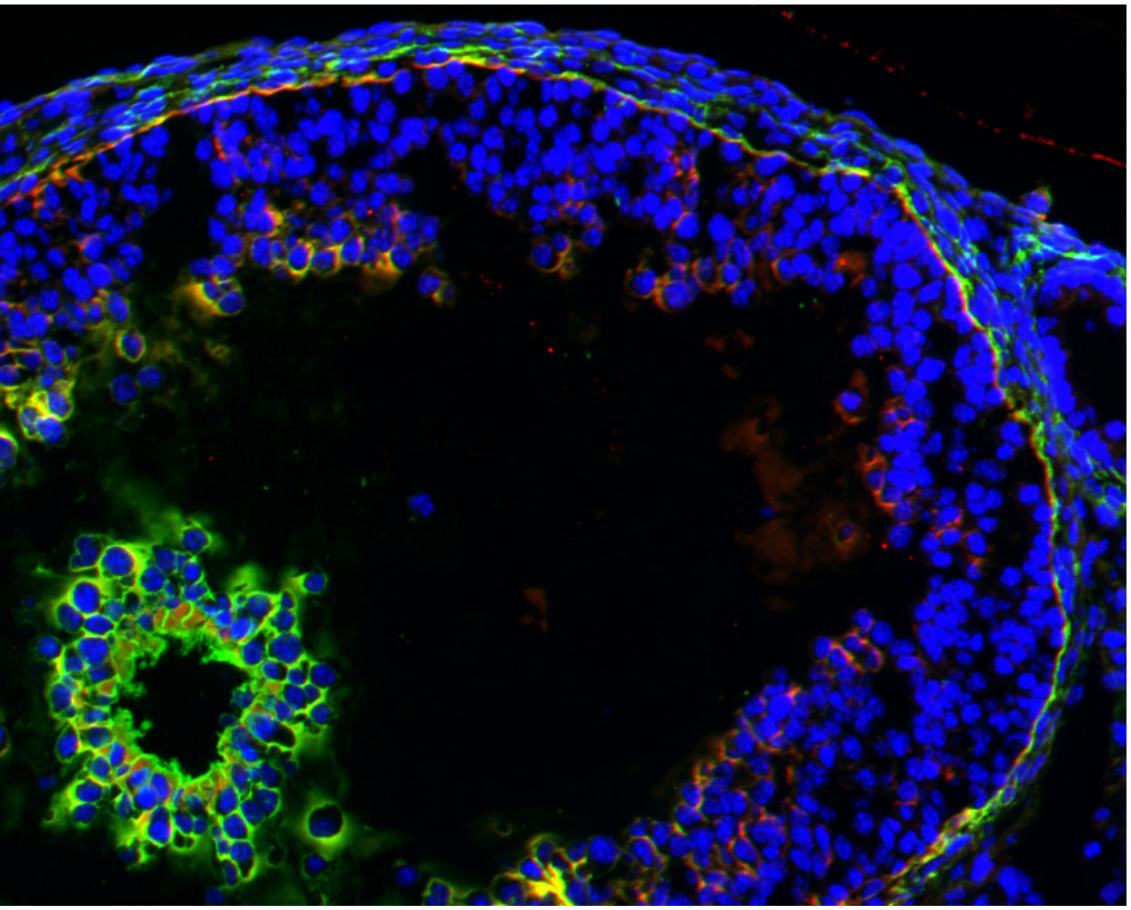
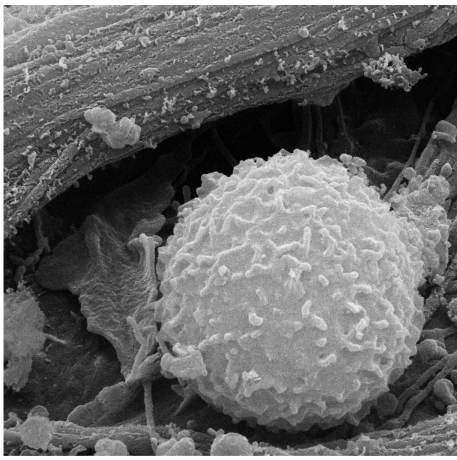
MANCHESTER 1824

The University of Manchester

Faculty of
Life Sciences

Research Brochure





www.manchester.ac.uk/lifesciences

The University of Manchester

The University of Manchester is a world-renowned centre for scholarship and research, matching the leading universities in the world in attracting researchers, innovators and scholars of the highest quality. The University exhibits a higher education brand synonymous with the finest international standards of academic excellence, assembling and maintaining research teams applying pioneering approaches to major global challenges. A distinctive feature of the University is its commitment to a social responsibility agenda, aimed at enhancing the lives of all people, from local communities to international populations, through knowledge transfer and education.

The University of Manchester is currently ranked 38th in the "Academic Ranking of World Universities" carried out annually by the Institute of Higher Education in Shanghai Jiao Tong University. No other institution in the top 100 of this Index has risen as quickly or as far as The University of Manchester in the past seven years, indicative of a steep trajectory of improvement. Consistent with its Jiao Tong ranking, The University of Manchester performed outstandingly in the national 2008 Research Assessment Exercise and this has helped to confirm its position as one of the UK's premier research institutions, alongside Oxford, Cambridge and the two leading London institutions. Knowledge transfer has also seen spectacular successes, with more than £200M having been provided by third-party investments and grants to our spin-out companies and IP projects over the last seven years.

The University is pursuing its ambitious agenda in the context of the city of Manchester's dramatic regeneration over the past 20 years. The aim is to make the world's first industrial city a great post-industrial city. A vibrant culture of creative industries, entrepreneurs, and technology-based start-ups is served by iconic buildings and a re-modelled city centre - and now by a powerful university.

The achievements of the Faculty of Life Sciences, one of four faculties in the University, have contributed enormously to the progress made by The University of Manchester, and the Faculty has extreme ambitions that mirror those of the institution. We hope that you enjoy reading about its research portfolio in the pages that follow.

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

Professor Dame Nancy Rothwell,
President and Vice-Chancellor

Contents

www.manchester.ac.uk

The Faculty of Life Sciences is one of the leading research-led Life Science Faculties in Europe. We produce research outcomes of the highest international quality that are impacting globally in areas such as mechanisms of life, human health and environmental sustainability.

The Faculty has ~200 academic staff members who conduct research across the whole of biology, both as individual researchers and in intra- and inter-Faculty teams. In the 2008 UK Research Assessment Exercise, our biological sciences research was ranked 3rd out of 52, and our preclinical and human biological sciences, 2nd out of 13.

Research within the Faculty spans the entire spread of life sciences from studies of individual molecules at the atomic/quantum level to cells, tissues and organisms, and the environment. Our **Research Challenges** of global significance are: Understanding Life, Disease Biology, Biotechnology for Industry and Sustainable Environments. Research activities are arranged into 13 thematic **Research Groups** (see pages 6-18). Our single school structure promotes international excellence in research and education by removing barriers to collaboration and communication.

The Faculty supports a number of internationally renowned research centres (see page 19), which are in receipt of significant long-term funding. Prominent amongst these are the Wellcome Trust Centre for Cell-Matrix Research, the Centre for the History of Science, Technology and Medicine, the Centre for Integrative Mammalian Biology, the Centre of Excellence in Biopharmaceuticals, and the Healing Foundation Centre for Tissue Regeneration. Recent Faculty investment has led to the establishment of the Manchester Centre for Biophysics and Catalysis, and the Systems Microscopy Centre. The new Manchester Collaborative Centre for Inflammation Research is jointly hosted by our Faculty, with the Faculty of Medical and Human Sciences and industrial partners (AstraZeneca and GlaxoSmithKline).

Our multi-disciplinary focus is supported through involvement in major University research institutes, which bring together staff from all four Faculties (Life Sciences, Engineering and Physical Sciences, Medical and Human Sciences and Humanities). Of particular note are: the Manchester Cancer Research Centre (a hub for basic and translational work in the cancer area); the Manchester Interdisciplinary Biocentre (with a focus on quantitative bioscience research at the physical sciences interface); the Neuroscience Research Institute (encompassing both clinical and preclinical research) and the Institute for Science, Ethics and Innovation (explores the moral imperatives and public interest that underpins the theory and practice of science).

The depth and breadth of expertise within the Faculty has provided the basis for an impressive track record of productive and sustained collaboration with a wide range of industrial partners, both in the UK and overseas (see pages 26-27). The Faculty also encourages the quick and effective commercial and translational exploitation of our research achievements, that has resulted in substantial numbers of disclosures, patents and successful spin-out companies.

Researchers in the Faculty benefit from continued investment in infrastructure and a centralised structure. Our research is conducted in a series of exceptional interlinked buildings, all built in the past decade. Our facilities house advanced equipment and resources, and are fully supported with over 25 dedicated staff (see pages 21-23). The Faculty is committed to attracting and supporting the very best researchers at all levels. We have an enduring record of recruiting outstanding scientists to undertake fellowships in Manchester, with an excellent track record in retaining independent fellows as permanent academic members of staff. We strongly invest in staff development through training courses for new academic and research staff (see pages 24-25). By providing a stimulating and supportive environment, we are advancing our world class status in life sciences at Manchester

A Message from the Associate Dean for Research

The Faculty of Life Sciences at The University of Manchester is a world-class research establishment. In biological, biomedical and pre-clinical research, our Faculty is recognised as an international site of excellence in terms of research power (~200 academic investigators) and importance (RAE 2008). The ambition of our Faculty is captured in our mission statement '...to be one of the leading research-led Life Science faculties in the world, through curiosity-driven and translational research, knowledge transfer and innovation, reflected in the quality, volume, societal and economic impact of our research'. As a dynamic and forward-looking research-led Faculty, we promote discovery at the frontiers of knowledge with substantive impact for basic, translational and cross-disciplinary research, knowledge transfer and innovation. Our research excellence is supported by superb infrastructure and an environment that is unrestricted by discipline boundaries, and by the training and development of our staff in the latest research advances. In these pages, you will find details of our Research Challenges, Research Groups, internationally renowned Centres of Excellence, and superb buildings and infrastructure. With this brochure, we reach out to prospective new staff, postgraduate students, business and other stakeholders. We hope you enjoy browsing its pages.

Professor Cay Kielty
Associate Dean for Research
Faculty of Life Sciences

Research Challenges

In the Faculty of Life Sciences, we are addressing four Research Challenges of global significance through cross-disciplinary working in the life sciences, and strong links with the medical and physical sciences. Our aim is to deliver paradigm-shifting advances in some of the major problems facing the world today. By integrating our molecular, cellular, organismal and population research programmes, we are applying powerful combinatorial approaches to understanding life and disease biology, developing innovative advances in biotechnology for industry, and advancing 21st Century needs for sustainable environments by exploring local and global ecology, biodiversity and conservation biology.

Understanding Life

There are hundreds of different types of cells in the human body, yet they are derived from a single cell, the fertilized egg. How does this single cell give rise to such a dazzling array of cell types? How does a system as complex as a cell function? How do different cell types collaborate and become organized into functional organs? How do these organs and cells cooperate to produce an organism that shows adaptive behaviour? How does our genome code for all of this functional complexity? How do cells communicate with each other and with their local environment?

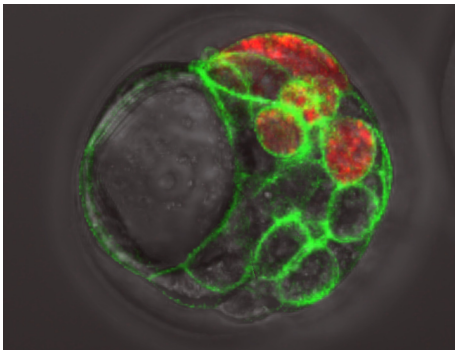
To answer these questions, our researchers use a variety of model organisms and, together, our research covers the whole timeline of life, from fertilization to ageing. Insights from studying evolution, normal development and life processes are used to understand better the causes of disease, develop new therapeutics, and improve the ability of our bodies to repair and regenerate.

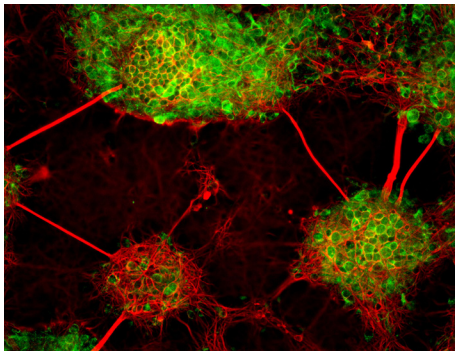
Research Groups

Cell-Matrix Research
Cell Organisation and Dynamics
Computational and Evolutionary Biology
Developmental Biology
Gene Regulation and Cellular Biotechnology
Immunology and Molecular Microbiology
Molecular Cancer Studies
Neurosciences
Physiological Systems and Disease
Structural and Functional Systems

Centres and Institutes

Wellcome Trust Centre for Cell-Matrix Research
Healing Foundation Centre
North West Embryonic Stem Cell Centre

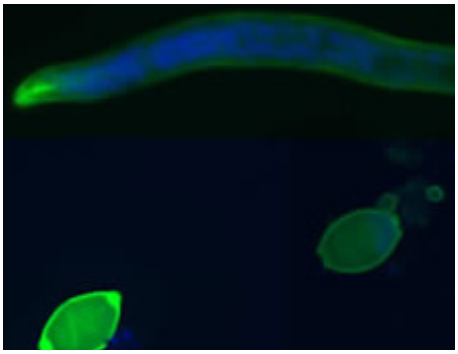


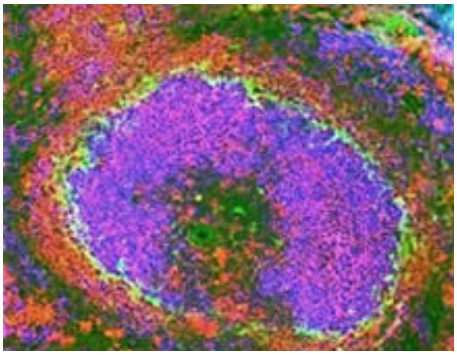


Disease Biology

Disease is defined as the incorrect functioning of a system of the body that results in a disruption of the normal homeostatic balance. It arises from infection, genetic or developmental dysfunction and is often exacerbated by poor nutrition and age. A consequence of disease will be damage to the host resulting in both acute and chronic health problems.

This research challenge encompasses both infectious disease caused by viruses, bacteria and parasites, and non-infectious conditions such as cancer, diabetes, vascular and obesity. The aims are to understand the processes that result in the onset and development of disease (for example, genomic changes), host and immune responses to disease, and to identify new therapeutic opportunities.





Research Groups

Cell-Matrix Research
Cell Organisation and Dynamics
Computational and Evolutionary Biology
Gene Regulation and Cellular Biotechnology
Immunology and Molecular Microbiology
Molecular Cancer Studies
Neurosciences
Physiological Systems and Disease

Centres and Institutes

Wellcome Trust Centre for Cell-Matrix Research
Centre for Integrative Mammalian Biology

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

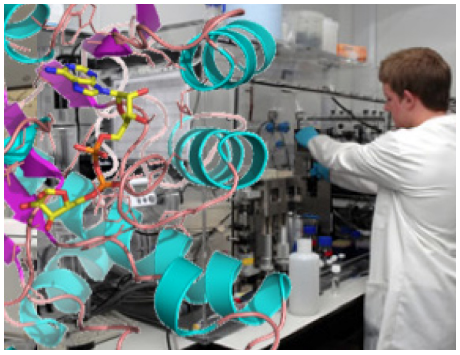
Biotechnology for Industry

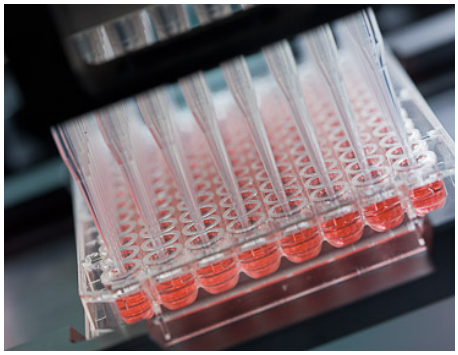
The Biotechnology for Industry challenge involves technology-driven research that addresses UK industry's needs in applied biology. We are addressing agrochemical and biopharmaceutical production, and environmentally sustainable processes for transformation of plant biomass and other waste products into biofuels to replace fossil fuels. This research challenge addresses the Knowledge Based BioEconomy (KBBE) agenda that is central to the UK's economic development.

The Faculty research teams collaborate with several pharmaceutical and biotechnology companies for cutting-edge research in areas crucial for development of new medicines and industrially important chemicals and materials, including generation and exploitation of new enzyme activities for making industrially important molecules.

Research Groups
Cell Organisation and Dynamics
Eye and Vision Sciences
Gene Regulation and Cellular Biotechnology
Structural and Functional Systems

Centres and Institutes
Centre of Excellence in Biopharmaceuticals
Manchester Centre for Biophysics and Catalysis
Manchester Interdisciplinary Biocentre





Sustainable Environments

Finding ways to live sustainably and conserve our environment are urgent issues around the world. 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.

From laboratories to rain forests, researchers in the Faculty of Life Sciences are working to find solutions. We have research programmes in biofuels, urban ecology, emerging diseases, biodiversity, water security, conservation biology and food security.

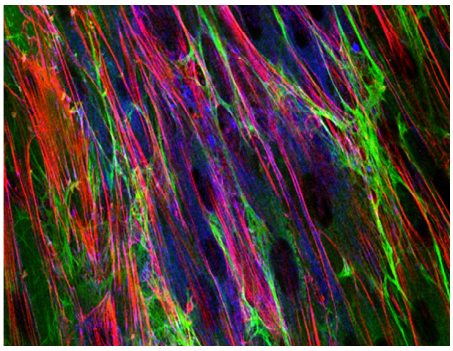
Research Groups
Cell Organisation and Dynamics
Computational and Evolutionary Biology
Environmental Research
Physiological Systems and Disease
Structural and Functional Systems

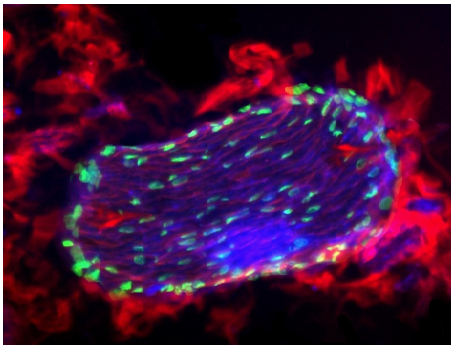
Centres and Institutes
Manchester Interdisciplinary Biocentre

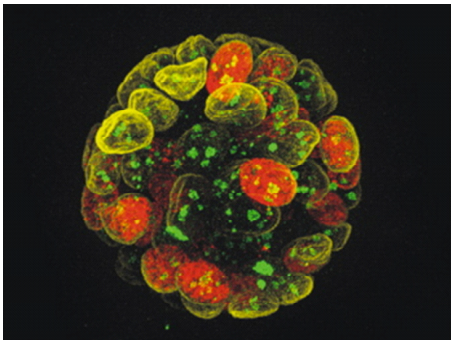
Research overview

Cell-matrix research is all about how cells interact with their local micro-environment to build tissues, and to control how they work. Cells are structurally and functionally integrated with their surrounding extracellular matrix (ECM), otherwise known as connective tissue, via numerous dynamic connections. Inside the cell, adhesion receptors tether the contractile cytoskeleton to the plasma membrane and compartmentalise cytoplasmic signalling, while at the extracellular face, the same receptors direct the deposition of the ECM itself and thereby shape higher order tissue structure. Understanding the molecular events that underpin ECM function will therefore illuminate key organizing principles of multicellular life. Defects in ECM molecules, or in the way that cells interact with it, underpin many of the prevalent diseases of our time, including cancer, diabetes, heart disease, osteoarthritis, inflammatory disorders, some forms of blindness, and many genetically inherited conditions. So understanding the molecular details of cell-matrix interactions will have a huge potential for medical benefit.

Group Leader: Professor Charles Streuli *(pictured)*







Recent highlights from the Wellcome Trust Centre for Cell-Matrix Research

A sticky end for parasitic worms

Parasitic worms are a major cause of mortality, affecting up to a billion people worldwide. These worms live in the gut, which is protected by a thick layer of mucus. The mucus barrier is not just slime, but a complex mixture of salts, water and large 'sugar-coated' proteins called mucins that give mucus its gel–like properties. Prof Thornton has studied one particular mucin that is rarely present in the gut, called Muc5ac, during worm infection and discovered that mice lacking the gene for Muc5ac were unable to expel the worms. Muc5ac turns out to be 'toxic' for the worms, so the mucin protects animals who are able to make it in their guts. This research may help to identify who is and who isn't susceptible to parasitic worms, and it may eventually lead to new treatments for people with chronic worm infections. Hasnain et al J. Exp. Med. (2011) 208: 893–900.

Talin's tail controls cell cycle

Integrins have crucial roles in sensing the extracellular matrix environment of cells and delivering signals to control how they behave. It was known for a long time that integrins are essential for cell cycle, but it was not well understood which integrin-binding proteins are involved. Prof Streuli and Dr Ballestrem have studied how a large protein with a bulbous head and a long tail, called talin, is involved in this process. While talin's head activates integrins helping cells to stick to extracellular matrix proteins, this new study has revealed that its tail recruits and activates proteins required for the proliferation of epithelia cells. Talin also has a role in cell cycle regulation of a metastatic mammary cancer line, lending credence to the idea that targeting proteins downstream of integrins might be valuable in cancer therapy. Wang P et al. J. Cell. Biol. (2011) 195: 499–513.

New insights into tendon injury

As a result of surgery or injury, our internal organs may become damaged, causing internal bleeding. As the organ heals, cells move into the blood clot which over time is replaced by unwanted and painful fibrous tissue known as an 'adhesion'. Prof Kadler has studied the surface of tendons and discovered that it is covered by a thin layer of epithelial cells. These cells are usually found in skin, so the tendon is covered by a thin 'skin' that protects it from damage. Undamaged tendons do not form adhesions, however, when the tendon is damaged, the cells inside the tendon make the unwanted adhesions. This discovery changes thinking about how tendons are made during embryonic development and maintained in adulthood, and will eventually lead to new ways of protecting the tendon epithelium in older people and in athletes. Taylor et al. PLoS One. (2011) 6: e16337.

Principal Investigators

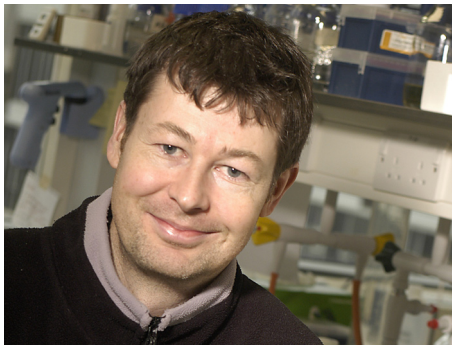
Dr Clair Baldock
Dr Christoph Ballestrem
Prof Ray Boot-Handford
Dr Keith Brennan
Dr Mike Briggs
Prof Ann Canfield
Dr Patrick Caswell
Prof Tony Day
Dr Andrew Gilmore
Prof Tim Hardingham
Prof Martin Humphries
Prof Karl Kadler
Prof Cay Kielty
Dr Rachel Lennon
Dr Paul Lu
Dr Andreas Prokop
Prof Charles Streuli
Prof Dave Thornton
Prof Gillian Wallis

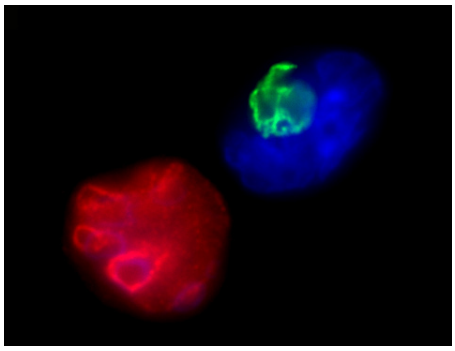
Cell Organisation and Dynamics

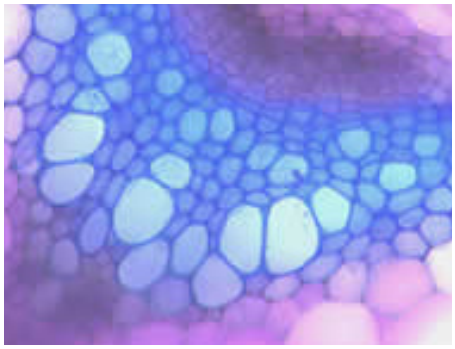
Research overview

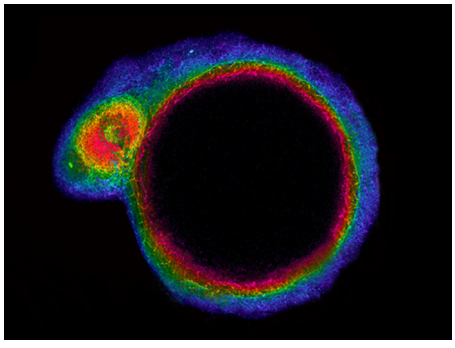
A major goal of the Cell Organisation and Dynamics research group is to understand how eukaryotic cells are organised into subcellular compartments and how these compartments perform their essential functions within the cell. We are studying how newly synthesised proteins are targeted to the endoplasmic reticulum and mitochondria, and how proteins undergo folding, modification and assembly in these compartments. Allied to this we are interested in the machinery and mechanisms that are responsible for the sorting and transport of proteins between the organelles of the endomembrane system. The knowledge gained from these studies will inform us not only of how cells function in the healthy individual but also how defects in these processes lead to human disease. Another major interest of the group is the cell biology of plant growth and development. This includes the mechanisms of cell wall biosynthesis and regulation, metal ion homeostasis, and how plant cells undergo apoptosis. An improved understanding of these processes is relevant to the development of improved crops and biofuels.

Group Leader: Dr Martin Lowe *(pictured)*









An integrated approach to understand cell organisation and dynamics

Our group has a strong collaborative ethos, with numerous joint projects both within the group itself but also with external partners, several of whom are international. A particular strength is the combination of different systems (yeast, plants, zebrafish, and mammalian) and technologies (biophysics, molecular cell biology, biochemistry, bioimaging, and genetics) that we exploit. This balance reflects our philosophy that a detailed knowledge of normal cell function is critical for understanding the molecular basis of health and disease, and for improved crop and biofuel production.

Chemical modulators of protein biosynthesis

The High, Swanton and Pool labs have collaborated with the School of Chemistry to synthesise small molecule chemical modulators of protein targeting and folding at the endoplasmic reticulum. This approach has revealed much about the molecular mechanisms involved in these processes, and offers the potential for development of chemical chaperones that correct the aberrant folding of mutant proteins that cause human disease.

Dynamics of membrane trafficking

Membrane trafficking is a highly dynamic process that requires the coordination of protein machineries to sort proteins, manipulate membrane shape and move membranes. The Woodman and Allan labs have combined with the Physics department to develop sophisticated analysis methods to reveal the highly complex nature of trafficking within the endosomal system. Current studies, in collaboration with the Lowe lab, are aimed at addressing how the dynamics of endosomes relate to their functions in protein sorting and intracellular signaling.

Exploring the potential of biofuels

Both plant cell wall material (biomass) and algae are potential sources of biofuels with low net CO_2 emissions. As part of a large European Union Framework Programme 7 award the Turner lab is exploiting their knowledge of cell wall biosynthesis to improve the quality and processing of plant biomass. Similarly, in work funded by the Carbon Trust, the Pittman lab is exploiting their interests in plant cell mineral stress to improve algal growth and biofuel yields.

Principal Investigators

Prof Viki Allan
Dr Caroline Bowsher
Dr Patrick Gallois
Prof Stephen High
Dr Martin Lowe
Dr Hui Lu
Dr Thomas Nuhse
Dr Jon Pittman
Dr Martin Pool
Dr Lisa Swanton
Prof Simon Turner
Prof Philip Woodman

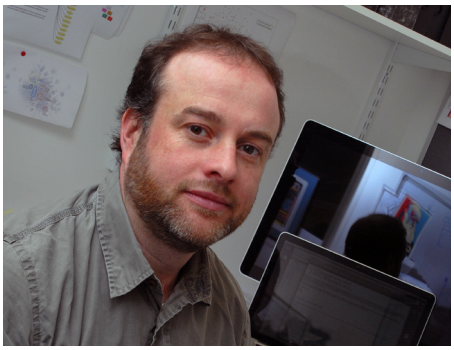
www.manchester.ac.uk/cellorganisationanddynamics

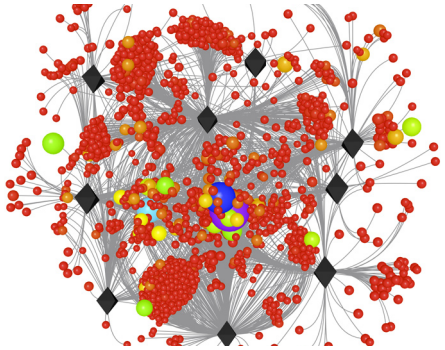
Computational and Evolutionary Biology

Research overview

Computational and Evolutionary Biology (CEB) is a group of researchers in Life Sciences who use a wide range of techniques from computational to whole organism experimental approaches in our pursuit of understanding biological systems. In particular, the CEB grouping seeks to understand biological function at different levels: molecular and genomic, organismal, population, ecosystem and environmental. A main theme 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 signals and processes is central to much of our work. For example, in the biomedical sciences comparisons of model organisms to humans can permit new understanding of human disease, and the characterisation of pathogen diversity, e.g. HIV can yield insights into virulence and the emergence of drug resistance. Such a comparative approach is used throughout our research.

Group Leader: Professor David Robertson *(pictured)*





Research highlights

Using computers successfully in biological research

The use of computers in biology has never been so important and (alongside continuing data acquisition and analysis) a major goal of computational biology is the *in silico* representation of dynamic biological systems. This shift from data representation, visualisation and analysis to predictive biology (e.g. the ability to mimic the complex perturbation of the human system by a mutation) has the potential to yield novel insights into the most important biotechnology and medical problems that we face. For example, in an inter-disciplinary project involving both CEB experimental and computational scientists, hybrid strains of yeast can be used to study specificity of protein-protein interactions. When two yeast species are crossed, the resulting hybrid will harbour two homologous, but divergent, proteomes. The aim is to identify the point at which members of proteomes from different yeast species cannot interact sufficiently to form viable protein complexes. This knowledge will permit the characterisation of both the type and structural context of the evolutionary divergence that leads to changes in binding specificity of proteins. Such understanding will ultimately permit the manipulation of genomes and protein complexes, and could lead to novel biotechnology or therapeutic strategies.

The importance of an evolutionary and environmental perspective

Understanding how organisms work and interact with their environment forms a key part of research carried out in CEB. 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 underway in CEB include: comparing genomes from divergent species to identify probable non-coding RNAs (see the miRBase database, www.mirbase.org), development of new bioinformatics software (e.g. phylogenetic methods), use of computer simulations to understand the movements of both living and fossil animals such as dinosaurs, and the evolutionary genetics of social interactions and complex traits. We are also keenly interested in conservation and sustainability research. For example, amphibian survival is threatened on a global scale and evolutionary genetics has an important role to play in amphibian conservation. Researchers in CEB are gathering information on the genetic diversity of frogs to identify areas with the richest and/or most unique biodiversity as conservation priorities and to identify species most at risk due to their low genetic diversity.

Principal Investigators

Prof Terri Attwood
Dr Douda Bensasson
Dr Casey Bergman
Prof Andy Brass
Prof Terry Brown
Dr Michael Buckley
Prof Matthew Cobb
Dr Jonathan Codd
Dr Daniela Delneri
Dr Sam Griffiths-Jones
Dr Reinmar Hager
Prof Simon Hubbard
Dr Minsung Kim
Dr Chris Klingenberg
Dr Chris Knight
Dr Simon Lovell
Dr Robert Nudds
Dr Richard Preziosi
Prof David Robertson
Dr Daniel Rozen
Dr Jean-Marc Schwartz
Dr Bill Sellers
Prof John Sulston
Dr Cathy Walton
Dr Simon Whelan

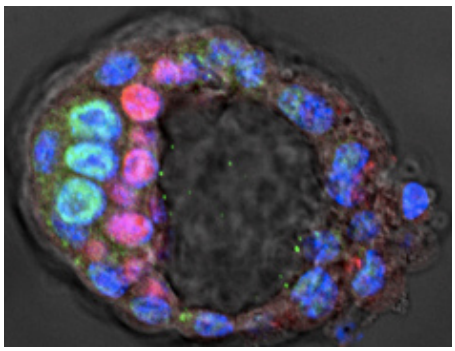
www.manchester.ac.uk/ceb

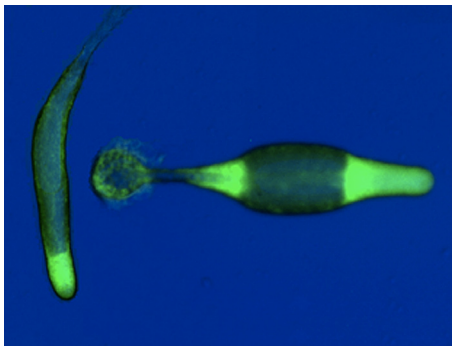
Developmental Biology

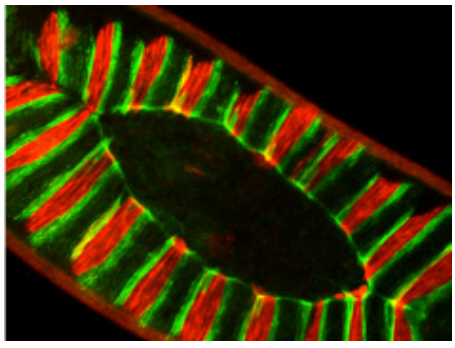
Research overview

Developmental biology is the study of the processes by which complex organisms develop from fertilized eggs. Research in Manchester investigates the fundamental events underlying normal development, how these are subverted in disease and how they can be utilised to achieve regeneration. Specific interests include: pluripotency, cell fate specification and differentiation; patterning and organogenesis; cell signalling; epithelial development and morphogenesis; cell adhesion in development; and the developmental role of genes involved in human diseases including epidermal, heart and craniofacial defects. The newly established Healing Foundation Centre investigates 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, and a diversity of state-of the-art techniques including various types of genetic analysis, transgenesis, gene targeting, expression profiling, functional genomics and imaging.

Group Leader: Professor Chris Thompson *(pictured)*







Development branches out to stem cells, healing and regeneration

Developmental biology addresses one of the most fascinating questions in biology: how does a single cell, the fertilised egg, give rise to a complex multicellular organism. Developmental diology integrates genetics, molecular biology, biochemistry, cell biology, physiology and imaging. Developmental biology research is thus highly interdisciplinary and our researchers enjoy many fruitful interactions with other research groups in the Faculty.

Developmental biology has a particularly strong affinity to two other fundamental areas of research: 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.

Below is a small sample of the group's publications in 2011:

Bonev B, Pisco A. & Papalopulu, N. Micro RNA-9 reveals regional diversity of neural progenitors along the anterior-posterior avis. Dev Cell (2011) 20:19–32.

Harris RE, Pargett M, Sutcliffe C, Umulis D. & Ashe HL. Brat promotes stem cell differentiation via control of a bistable switch that restricts BMP signaling. Dev Cell (2011) 20:72–83.

Griffiths-Jones S, Hui JH, Marco A. & Ronshaugen M. MicroRNA evolution by arm switching. EMBO Reports (2011) 12:172–177.

Parkinson K, Buttery NJ, Wolf JB. & Thompson CR. A simple mechanism for complex social behaviour. PLoS Biology (2011) 9: e1001039.

Principal Investigators

Prof Enrique Amaya
Dr Hilary Ashe
Dr Martin Baron
Prof Mike Dixon
Dr Karel Dorey
Prof David Garrod
Dr Matthew Hardman
Dr Kathy Hentges
Dr Shane Herbert
Dr David Hughes
Prof Sue Kimber
Dr Lindsay MacDougall
Dr Kimberly Mace
Dr Tom Millard
Dr Caroline Milner
Prof Nancy Papalopulu
Dr Berenika Plusa
Dr Matthew Ronshaugen
Dr Toki Takahashi
Prof Chris Thompson

www.manchester.ac.uk/developmentalbiology

Research overview

The Environmental Research (ER) Group 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. Our expanding cities have become ecosystems in their own right with their own unique urban ecology. Global changes in climate alter species ranges causing the loss of some species and allowing pathogens and parasites to colonize new areas and new host populations. From laboratories to rain forests, researchers in the Environmental Research group 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 biofuels, urban ecology, emerging and re-emerging diseases, biodiversity, water security, conservation biology and food security.

Group Leader: Dr Richard Preziosi *(pictured)*

Research highlights

Food and water security

Over-use of natural resources is likely to cause reductions in the availability of clean water and wild food sources such as fish stocks. Climate change will also affect livestock and crop production both directly and indirectly through changes in surrounding environment and natural communities. Current research includes microbial communities important in crop production and disease resistance, selection for stress tolerance in crop plants, evolutionary response of crops to environmental change, effects of soil improvement on microbial communities, effects of climate change on fish stock production and population structure, water pollution, and the impact of emerging and neglected diseases.

Urban ecology

Cities are constantly growing and more of us now live in cities than in rural areas. This expansion presents new environmental challenges and opportunities, and cities are now ecosystems with their own unique ecology. Current research includes environmental benefits of urban vegetation, biodiversity and ecosystem services associated with urban aquatic habitats and the quantification and enhancement of urban biodiversity.

Environmental biotechnology

Many of the environmental and sustainability challenges we currently face may be most efficiently solved using biotechnology. Mitigation of waste and toxin accumulation, improvement of ecosystem services, and fuel production can all be improved by harnessing and enhancing natural biological processes. We are currently developing technologies for bioremediation and biodegradation, improved soil communities for crop production and the production of biofuels from yeast and algae.

Biodiversity, conservation and disease in changing environments

Environmental changes are occurring globally and locally and these changes have consequences for biodiversity and conservation. Interactions between humans and the natural world are important in this context both as our effects on the environment and the environments effects on us (e.g. changing ranges of pathogens). We currently have research programmes in emerging and neglected diseases, biodiversity (including genetic diversity), the consequences of genetic diversity, and the interactions between humans and conservation areas.

Principal Investigators

Dr Douda Bensasson
Prof Terry Brown
Dr Roland Ennos
Dr Giles Johnson
Dr Jon Pittman
Dr Richard Preziosi
Dr Geoff Robson
Dr Daniel Rozen
Dr Bill Sellers
Dr Holly Shiels
Dr Cathy Walton
Dr Keith White

www.manchester.ac.uk/environmentalresearch

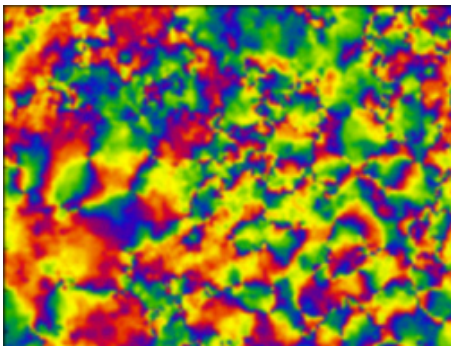
Eye and Vision Sciences

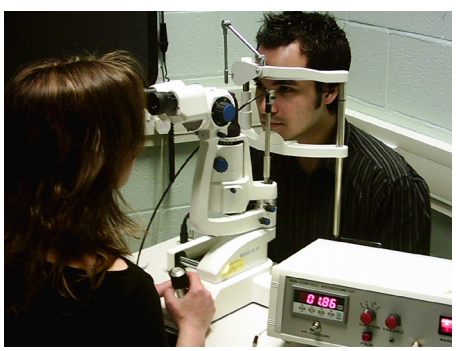
Research overview

Researchers in the Eye and Vision Sciences group work on basic science and clinical projects to improve our understanding of the structure and function of the human visual system, and to translate new knowledge into useful clinical tests. Research programmes encompass: monitoring function and dysfunction in various ophthalmic conditions; visual optics and determinants of optimal performance; ocular and optical imaging; psychophysics and electrophysiology; and the challenges relating to measurement and management of low vision.

Our applied research with patients takes place within specialist clinics (e.g. Low Vision, Learning Difficulties, Paediatrics) of The University of Manchester Vision Centre, the Manchester Royal Eye Hospital and Eurolens Research. The Eye and Vision Sciences research group has strong links elsewhere in the University with the School of Medicine optometric teaching programme and the Investigative Ophthalmology and Vision Sciences MSc course.

Group Leader: Dr Niall McLoughlin *(pictured)*





Leaders in multidisciplinary teaching and research

Cross-campus multidisciplinary research and teaching links

Researchers in the Eye and Vision Sciences group work with academics and clinicians across the University in a collection of multidisciplinary research programmes. There are significant research collaborations with staff from Psychology, Material Sciences, and Neuroscience as well as primary clinical collaborations with the Manchester Eye Hospital.

In addition, researchers in collaboration with staff in the Manchester Eye Hospital, have developed the only multidisciplinary course in Investigative Ophthalmology and Vision Sciences in the world. This course brings together the research expertise of two disciplines – ophthalmology and optometry – in both academic and clinical settings to provide an essential grounding for those wanting to pursue a higher degree and conduct high quality research in these fields. Modular in design, the course comprises seven taught units followed by a four month research project and dissertation. Many dissertation projects have led to peer-reviewed publications in ophthalmic journals.

Contact lens research consultancy

Eurolens Research is a contact lens research and consultancy unit which undertakes basic and applied research of the cornea, ocular surface and contact lens products for the global contact lens industry. Established in 1990, the unit undertakes clinical investigations for worldwide contact lens manufacturers. The unit offers a complete clinical studies service for new contact lenses and contact lens-related products, including protocol development, ethical review, full clinical evaluation, data analysis, report writing, and has significant experience of coordinating multicentre work.

In addition to contractual research for industry, Eurolens Research has a number of postgraduate students (MSc and PhD). Current areas of interest include *in vivo* confocal microscopy of the ocular surface, surface and mechanical characterisation of hydrogels and the ocular response to contact lens wear.

Principal Investigators

Prof Richard Abadi
Prof Neil Charman
Prof Chris Dickinson
Dr Emma Gowen
Prof Janus Kulikowski
Dr Carole Maldonado-Codina
Dr Niall McLoughlin
Dr Philip Morgan
Dr Ian Murray
Dr Vincent Nourrit
Dr Hema Radhakrishnan

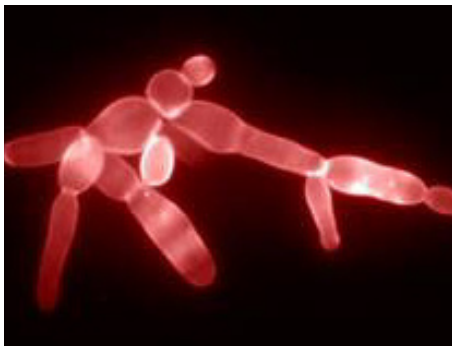
www.manchester.ac.uk/eyeandvision

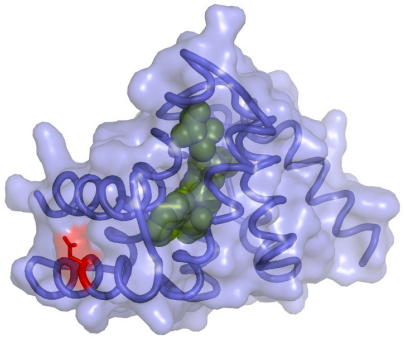
Gene Regulation and Cellular Biotechnology

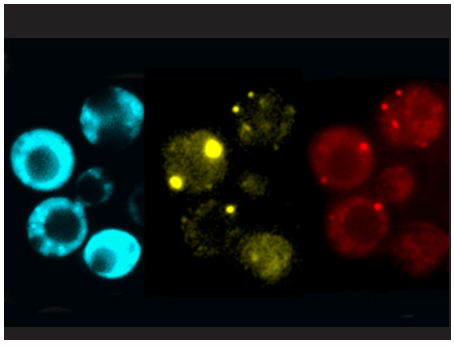
Research overview

RNAs and proteins are the functional products of the genome required for all forms of life. Our research group brings together researchers who study the production and modification of RNAs and proteins (transcription, splicing and translation) and the regulatory mechanisms that control these events (modifications, interactions and localisation). The group also has interests in (1) the impact of environmental cues and stresses on cellular functions and (2) applications of cells and products (RNA and protein) in relation to the applied industrial context of biotechnology, biopharmaceuticals and therapeutics. Our work integrates molecular biology, biochemistry, genetics, cell biology, cellular imaging and systems biology techniques. We utilise a wide variety of model organisms including yeast, the human fungal pathogen *Candida albicans*, the yeast probiotic strain *S. boulardii, Neurospora crassa,* plants and cultured mammalian cells. We investigate within cells the regulation of different aspects of RNA/protein production, including that of recombinant proteins. Our overall goal is to understand the molecular and cellular mechanisms underlying these essential cellular functions.

Group Leader: Dr Ray O'Keefe *(pictured)*







A diverse grouping working on common themes

The mechanistic and temporal control of gene expression is one common theme within our grouping. Prof Reece investigates mechanisms of gene transcription control in response to various cues. Dr O'Keefe explores how RNA produced by transcription is processed to mRNA for protein production and the function of noncoding RNAs. Drs Ashe and Pavitt are studying how mRNAs are utilised during the process of translation to produce proteins. Prof Dickson and Dr Day investigate aspects of gene structure/expression to determine how proteins are expressed in mammalian and plant cells. Drs Crosthwaite and Heintzen use *Neurospora crassa* to investigate how circadian clocks impose temporal order on cellular processes and are interested in clock-controlled pathways that influence development and cell cycle progression. Dr Stateva explores how yeast cell walls affect virulence of fungal pathogens and the use of yeast for biotechnological purposes. Dr Grant has interests in how cells protect themselves from oxidative stresses. Dr Rhodes is developing collaborative research proposals between academics and industry. While our group investigates and utilises diverse processes and systems, there are common themes where we collaborate. Additionally, we strive to collaborate with other research groups and outside the University as exemplified below.

Collaborations with industry and other disciplines

Industrial links are exemplified by Prof Dickson in the production of valuable therapeutic proteins in cultured mammalian cells. Through increased understanding of molecular events that determine amount and quality of recombinant proteins, production can be enhanced by cell engineering or optimisation of culture conditions. These approaches offer direct commercial advantages to industry and for health and society. This work is collaborative within the group and other faculties. International projects are funded by several government and industrial partners.

Drs Pavitt, Ashe and Grant with Prof Hubbard and Dr Sims (Structural & Functional Systems) were awarded £2.8M from the BBSRC to study 'how RNA interacting proteins modulate the translatability of mRNAs'. This interdisciplinary project addresses how individual mRNAs are selected for translation into protein from a global mRNA pool. This study draws upon combined expertise to use a concerted set of innovative technologies to characterise regulated mRNAs and protein partners that mediate their control in response to different stresses. The collaboration aims to achieve an improvement in understanding of translation controls in yeast, which will inform studies in other organisms.

Principal Investigators

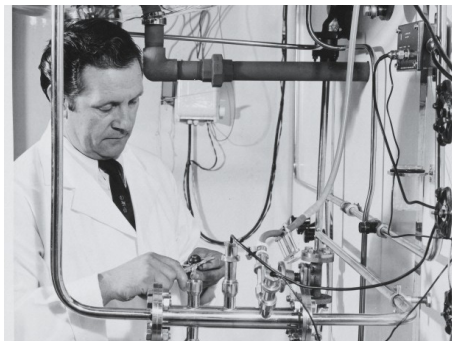
Dr Mark Ashe
Dr Sue Crosthwaite
Dr Anil Day
Prof Alan Dickson
Prof Chris Grant
Dr Christian Heintzen
Dr Ray O'Keefe
Dr Graham Pavitt
Prof Richard Reece
Dr Malcolm Rhodes
Dr Lubomira Stateva

www.manchester.ac.uk/grab

Research overview

The Centre for the History of Science, Technology and Medicine (CHSTM) is the largest research grouping in the UK dedicated to the integrated historical study of science, technology and medicine and their relationship with society. Founded in 1986, the Centre has a lively and supportive research culture, offering opportunities from research training at postgraduate level through to major individual and collaborative research projects. Research focuses predominantly on nineteenth and twentieth century history, mostly in Britain, Europe and the USA, but also on global issues. Strengths include the historical sociology of knowledge, institutional history in science and medicine, contemporary history and science communication. The Centre is home to the Wellcome Unit for the History of Medicine, which holds a Strategic Award for work on 'Medicine and Modernity' and established the National Archive for the History of Computing, a major research resource for information technology history and culture. CHSTM also collaborates broadly with colleagues across the University and in excellent museums, libraries and archives across the Manchester region.

Group Leader: Professor Michael Worboys *(pictured)*



Science, history and the public

The History of Urban Climate Change

Dr Vladimir Jankovic and Professor Michael Hebbert (Manchester Architecture Research Centre) received two years ESRC funding for the project 'Climate Science and Urban Design: A Historical and Comparative Study of Applied Urban Climatology'. The aim of the project is to review the international patterns of scientific activity in urban climatology since 1950 and to assess the outcomes of attempts to transfer such research to the design of the built environment of urban areas. We examine how the discipline of climatology has conceptualised the street canyon, planted landscape, building form and orientation and other design-related aspects of the urban environment. From the policy perspective, the project investigates how cities are making use of urban climatology in recent climate strategies, and how such knowledge is being translated into city plans and urban design. A project conference 'City Weathers' was held in Manchester in June 2011 and over fifty interviews with leading practitioners have been collected as part of our four city case studies of Manchester, Stuttgart, New York and Tokyo.

The History of Translational Medicine

Translational medicine (TM) is a fairly recent concept: few clinicians and researchers used the term before the new millennium. A 2008 editorial in the British Medical Journal characterised it as; "all the steps that are involved in getting a new remedy from the laboratory bench to the bedside as efficiently as possible, from basic research, through evaluation, to the clinical application and the development of practice guidelines". TM is now centre-stage in medical research policy. However, new goals and policies are being formulated without the benefit of rigorous historical studies of how 'bench and bedside' relations have operated in recent decades. A five-year Wellcome Trust Programme Grant commenced in January 2011. CHSTM is producing the first in-depth historical study of bench-clinic relations in British medical research in the second half of the twentieth Century, whilst developing new methods for studying recent and contemporary history and making history available to inform policy making and implementation.

Principal Investigators

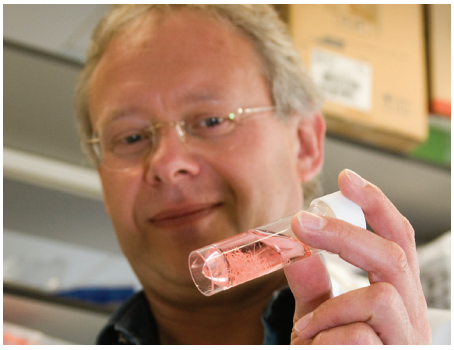
Dr Ian Burney
Dr Jeff Hughes
Dr Vladimir Jankovic
Dr David Kirby
Prof John Pickstone
Dr James Sumner
Dr Carsten Timmermann
Dr Simone Turchetti
Prof Michael Worboys

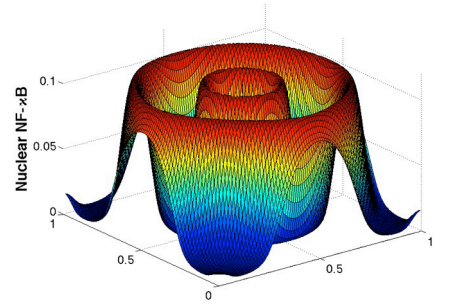
www.manchester.ac.uk/historyofscience **www.manchester.ac.uk/chstm**

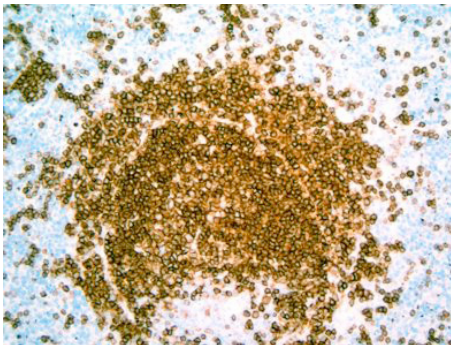
Research overview

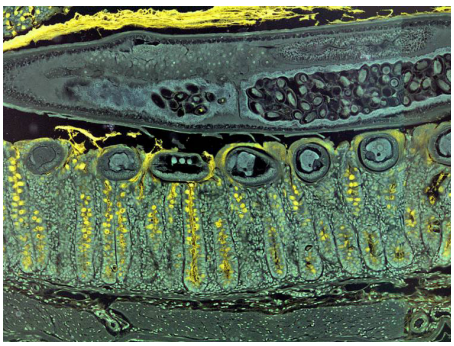
The Immunology and Molecular Microbiology group integrates fundamental research on the biology of infectious microbes, from bacteria through fungi and protozoa to multicellular parasites, with studies on the induction, regulation and resolution of innate and adaptive immunity including tumour immunology and autoimmunity. We are using an integrated multi-disciplinary approach to understand the mechanisms by which pathogens are able to colonise, survive in and damage the host. We are also studying how microbes survive, grow and behave in the natural environment, their interactions with other organisms, and their ability to colonise and recycle both natural and manmade materials. We are applying an integrated in silico, *in vitro* and *in vivo* approach to defining the mechanisms underlying disease processes. Areas of focus are the role of dendritic cells, the regulation and functional importance of cytokines, the role of commensals in infection and immunity and regulation at of mucosal barriers immunity. Our overall aim is to understand the molecular, cellular and particularly, the *in vivo* basis of immune responses to antigenic challenge.

Group Leader: Professor Richard Grencis *(pictured)*









Research highlights

Dendritic cells and immunoregulation

One current area aims to identify the important signals and mechanisms by which dendritic cells control immune responses. To this end, we have recently identified a critical pathway by which dendritic cells activate the important anti-inflammatory cytokine TGF-β via an integrin receptor, αvβ8. This mechanism is critical in maintaining immune homeostasis, as when this pathway is abrogated *in vivo*, spontaneous T-cell activation and colitis result, associated with a reduction in regulatory T-cells in the colon. Work is now focused on determining the role of this important immune checkpoint in response to infection, using models of parasitic and bacterial infections *in vivo*, and how different subsets of dendritic cells in different locations of the body use this pathway to control immune responses. Additionally, we are investigating important signalling events downstream of integrins involved in the control of dendritic cell biology. Such work will provide important insights into how dendritic cells communicate with T-cells to prevent autoimmunity but allow infection to be successfully cleared.

Metal acquisition and homeostasis in bacterial virulence

One of the major research areas in molecular microbiology is focused on the acquisition of essential metals and metal homeostasis in bacterial pathogens. Specifically at Manchester the research is focused on how intracellular pathogens *Salmonella entericaserovar Typhimurium* and *Listeria monocytogenes* respond to metal stress during intracellular growth. Recently we have shown that elevated copper is a feature of infected macrophage phagosomes and *Salmonella* copper-resistance is a requirement for intracellular survival. In addition, we have recently elucidated the mechanism of copper resistance in *L. monocytogenes* and shown that this organism has two zinc uptake systems both of which are required for virulence.

Principal Investigators

Dr Jen Cavet
Dr Shiu-Wan Chan
Dr Sheena Cruickshank
Dr Rebecca Dearman
Prof Jeremy Derrick
Dr Curtis Dobson
Prof Kathryn Else
Prof Richard Grencis
Dr Finbarr Hayes
Dr Nicola High
Prof Ian Kimber
Dr Dennis Linton
Dr Douglas Millar
Prof Werner Muller
Dr Pawel Paszek
Prof Ian Roberts
Dr Geoff Robson
Dr Mark Travis

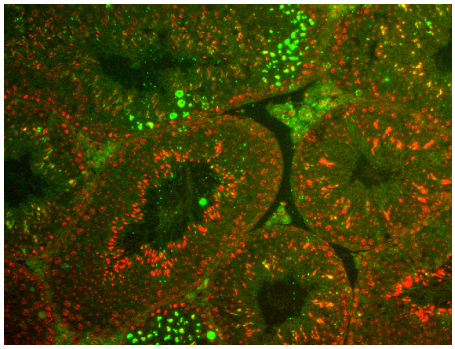
www.manchester.ac.uk/immunologyandmolecularmicrobiology

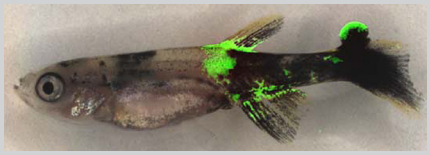
Molecular Cancer Studies

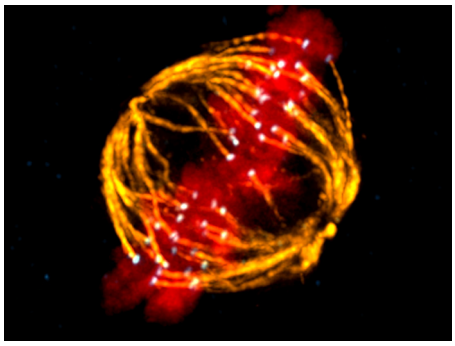
Research overview

Unlike normal cells, cancer cells fail to respond to signals that regulate proliferation in response to developmental cues that define cell fate. The resulting uncontrolled proliferation, a major hallmark of cancer, will often disrupt tissue homeostasis and eventually compromise essential functions within affected tissues. Research in Manchester is exploring the fundamental molecular mechanisms that are most frequently compromised during the development of cancer. Major emphasis is placed on understanding how cell signalling and cell cycle regulatory networks are subverted during the early events of carcinogenesis. In model organisms, we are investigating tumour evolution by exploring the molecular mechanisms that control how cancer cells manipulate the tissue micro-environment during cancer progression. In studying these processes, members of the Molecular Cancer Studies group are building the knowledge that is essential for developing novel therapeutic strategies.

Group Leader: Professor Dean Jackson *(pictured)*







Focussing on key strengths to build a comprehensive cancer group

Molecular Cancer Studies brings together scientists who are committed to understanding the behaviour of biological systems relevant to cancer.

Cell proliferation and cell cycle control

To understand cancer, it is essential to understand how extracellular signals are sensed by cells and transmitted to appropriate cytoplasmic and nuclear targets. The effects of growth factors, inflammatory cytokines and stress on intracellular signalling pathways and analysis of downstream alteration in gene expression are under study. Pathways that regulate cell proliferation and differentiation are frequently defective in cancer. In addition, the mechanisms that ensure the efficiency of cell growth and division are often compromised. Hence, a key focus of the Cancer group is to understand the molecular mechanisms that define the cell cycle checkpoints, which regulate S phase progression and chromosome segregation during mitosis. As cancer progression correlates with genetic changes, it is essential to understand the basis of genome instability and cellular responses to genotoxic stress.

Tumour microenvironment

While uncontrolled cell proliferation and survival are key hallmarks of cancer, mortality most often results from progression to metastasis. Tumour progression involves alterations in gene expression together with changes in cell communication within the tumour itself. Excellent tumour models (e.g. skin and breast) are being exploited by the Cancer group to study adhesion-dependent signalling within the tumour microenvironment and patterns of signalling that define tumour specificity. Molecular detail is being refined using *in vitro* tissue culture models and mouse and zebra fish as experimentally amenable model organisms.

Tumourigenesis is so complex that a detailed molecular understanding will inevitably demand the integration of knowledge from different research specialities. This drive towards multidisciplinary collaborations continues to strengthen research within the Cancer group through interactions with related research groups across the Faculty. In addition, the Cancer group has close ties with the Manchester Cancer Research Centre, the Manchester Breast Centre and a series of productive collaborations with major drug companies, in particular within the AstraZeneca Alliance.

Principal Investigators

Dr Adam Hurlstone
Prof Dean Jackson
Dr Marija Krstic-Demonacos
Dr Josip Lovric
Dr Catherine Millar
Dr Janni Petersen
Dr Gino Poulin
Prof Andrew Sharrocks
Dr Paul Shore
Dr Lydia Tabernero
Prof Stephen Taylor
Dr Cathy Tournier
Prof Richard Walmsley
Dr Claudia Wellbrock
Dr Alan Whitmarsh

www.manchester.ac.uk/mcrc

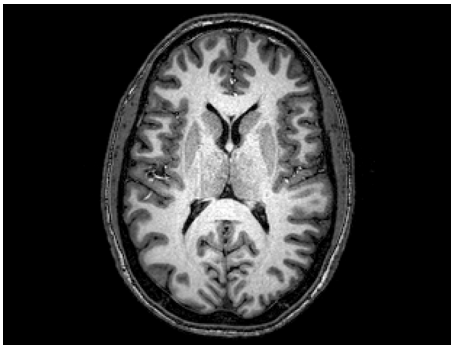
www.manchester.ac.uk/molecularcancer

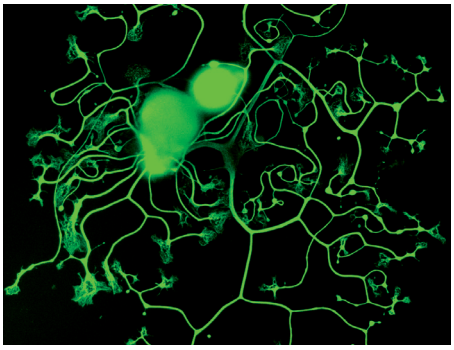
Neurosciences

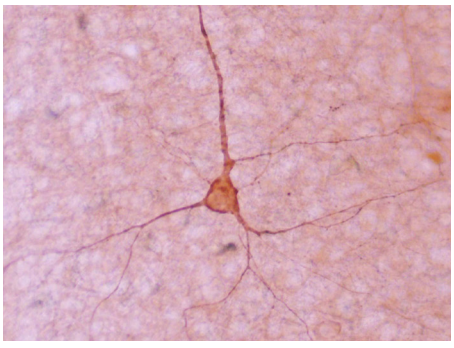
Research overview

A network of electrically active neurones is found in almost all multicellular animals. The function of this nervous system is to control physiology and behaviour by receiving and integrating sensory information and conveying executive commands to muscles and glands. Diversity in the fundamental properties of individual neurones and glia, and in the nature of their connectivity, provides the nervous system with unparalleled scope for complexity. This intricacy is central to its function and provides the substrate for advanced cognitive functions in higher vertebrates and man. Modern neuroscience research is characterised by the application of new technology to traditional behavioural, anatomical and physiological analyses, and the integration of contemporary molecular and post-genomic techniques. The Neurosciences group uses this multidisciplinary strategy along with advanced computational and modeling approaches to understand the development and normal activity of the nervous system, as well as the origins and mechanisms of degeneration and dysfunction.

Group Leader: Dr Stuart Allan *(pictured)*







Research highlights

The brain is our most complex organ and studying it requires all of the tools available to modern biology. The Neurosciences group (the Faculty's largest grouping) maintains excellence in a wide range of these approaches and has established multidisciplinary collaborations across the Faculty of Life Sciences and with local clinicians, mathematicians, physicists and engineers, a process facilitated by the Neuroscience Research Institute (www.neuroscience.manchester.ac.uk). This enables the group's efforts to range from the most fundamental scientific investigations all the way through to clinical trials. Recent discoveries include:

Brightness redefined

A key recent development in sensory biology is the discovery that light detection in the eye is not restricted to rod and cone cells, but extends to a subset of retinal neurones expressing the protein melanopsin (mRGCs). Until recently, these mRGCs were only thought to influence subconscious responses to light, such as changes in pupil size. Here, Dr Tim Brown, Prof Rob Lucas and others provide evidence that mRGCs in fact contribute extensively to visual pathways involved in conscious perception. Through multi-electrode recordings of brain activity they show that mRGCs allow the mouse visual system to faithfully encode brightness over at least a million-fold range and to continue to show light responses even in the absence of all rods and cones. Thus, mRGCs could make a significant contribution to brightness perception in people with advanced retinal degeneration. Brown *et al*. Melanopsin contributions to irradiance coding in the thalamo-cortical visual system. PLoS Biol (2010) 8:e1000558.

What do opioids do in the striatum?

Dr Enrico Bracci and his research group are interested in the function of neuronal circuits within the basal ganglia, which mediate motor control, action selection and reward-mediated learning. Projection neurones of the striatum are GABAergic and control the activity of the output nuclei of the basal ganglia. Half of these neurones also release enkephalin, an opioid neurotransmitter, though its role was unclear. Recording simultaneously from pairs of striatal projection neurons, while also stimulating corticostriatal axons, the Bracci lab show that action potentials in one neurone can strongly depress the corticostriatal inputs to the other neurone. This occurs via enkephalin-mediated activation of presynaptic mu opioid receptors located on cortical terminals, This inhibitory communication may underlie competitive dynamics in the striatum, allowing its circuits to select among competing cortical bids for action. Blomeley & Bracci. Opioidergic interactions between striatal projection neurons. J Neurosci (2011) 31:13346–13356.

Principal Investigators

Dr Stuart Allan
Prof Richard Baines
Dr David Bechtold
Dr Enrico Bracci
Dr David Brough
Dr Timothy Brown
Dr Maria Canal
Dr Fred Cody
Prof Alan Crossman
Dr Natalie Gardiner
Dr John Gigg
Dr Nicholas Glossop
Dr Ken Grieve
Prof Ruth Itzhaki
Dr Catherine Lawrence
Prof Andrew Loudon
Prof Rob Lucas
Prof Simon Luckman
Prof Catherine McCrohan
Dr Qing-Jun Meng
Dr Jaleel Miyan
Dr Marcelo Montemurro
Dr Rasmus Petersen
Prof Hugh Piggins
Dr Emmanuel Pinteaux
Prof Nancy Rothwell
Prof David Sattelle
Dr Ingo Schiessl
Dr Neil Todd
Dr Jon Turner
Prof Alexej Verkhratsky
Prof Anne White

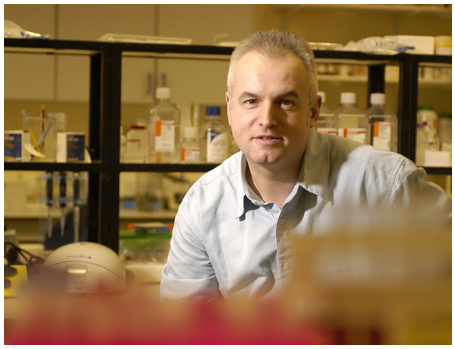
www.manchester.ac.uk/lifesciences/neurosciences

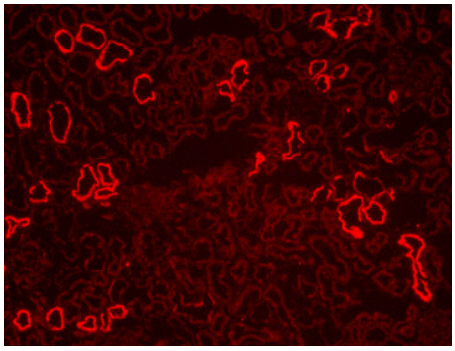
Physiological Systems and Disease

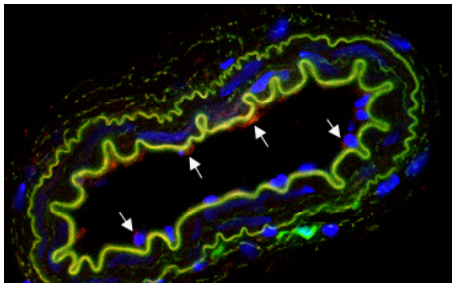
Research overview

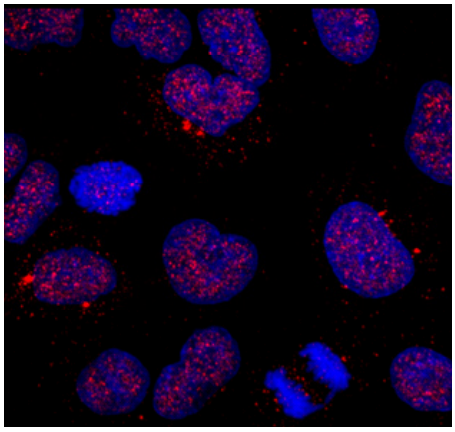
This research group is focussed on the functional integration of cell biology with human systems and disease. We have a range of technical expertise in the detection, measurement and modelling of cellular processes, and a critical mass in the fields of receptors and cellular signalling. We support these studies using gene expression studies, biochemical and molecular biology techniques, and cell imaging. Core projects involve understanding the regulation and dysregulation of intracellular and extracellular calcium ion homeostasis; the deorphanization of novel receptors; MAP kinase signalling and cardiac hypertrophy; the function and role of inositol lipids in cell biology; the control of differentiation of human stem and progenitor cells; the trafficking of ion channel subunits, and the role and regulation of ion channels and transporters in health and disease.

Group Leader: Professor Mark Dunne *(pictured)*









The interplay from cell to system

We have a strong focus on the functional context to our research and the impact of this for human development and disease. Our four thematic areas are: gastrointestinal and endocrine systems; the renal system; the nervous system; the cardiovascular system. Each theme has developed strong links across the University with the Faculty of Medicine and Human Sciences, the Faculty of Engineering and Physical Sciences, and the Central Manchester University Hospitals NHS Trust. We have initiatives, joint projects and translational research in the disease areas of diabetes, obesity, hyperinsulinism, epilepsy, hypertension, heart failure, pancreatic cancer, pancreatitis, osteoporosis and mineral disorders, and pain. Gastrointestinal and endocrine sciences work closely with hepatopancreatobiliary surgeons and paediatric endocrinologists respectively and have established a clinical trial for a novel adjunct to treat congenital hyperinsulism, and developed pancreatic stem cell lines for diabetes research. In the cardiovascular sciences theme we have impact projects from the identification of novel ion channels in human pulmonary vessels, to the mechanisms of cardiac hypertrophy and the influence of the environment on cardiac function in fish.

A particular strength of this group is our ability to incorporate different skills and techniques to advance our projects from computational predictions, to gene transcription and protein function, to whole organisms and human disease. This reflects our academic strengths in the complementary areas of cell biology, physiology and pharmacology and our technical skills base which runs from the molecular to *in vivo* function. We use a diverse range of cells, cell lines and acutely isolated tissues to support our work and use bioinformatics to evaluate genomic and proteomic expression profiles, and to construct computational representations of ion channels, biological pathways and the dynamics of ion transport. Our profile has been developed through funding from the MRC, the BBSRC, the British Heart Foundation, Diabetes UK, the Juvenile Diabetes Research Foundation, the Wellcome Trust, the Leverhulme Trust, Kidney Research UK, the Royal Society, CMFT and Manchester Biomedical Research Centre, the Australian NHMRC and industrial collaborations with AstraZeneca, and Ono Pharma.

Principal Investigators

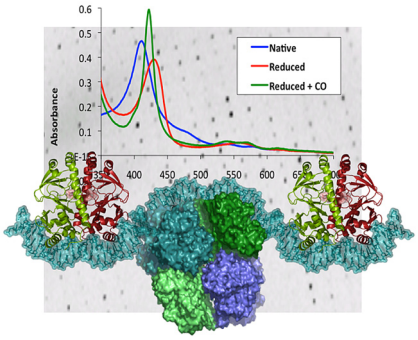
Dr Nick Ashton
Dr Peter Brown
Dr Jason Bruce
Dr Karen Cosgrove
Prof Mark Dunne
Dr Gillian Edwards
Dr Austin Elliott
Dr Liz Fitzgerald
Prof Alison Gurney
Dr Kath Hinchliffe
Dr Owen Jones
Dr Holly Shiels
Dr Craig Smith
Dr Martin Steward
Dr Paolo Tammaro
Dr Xin Wang
Dr Donald Ward
Dr Melissa Westwood

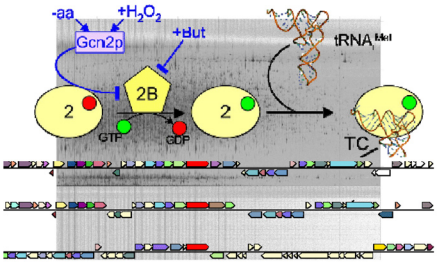
www.manchester.ac.uk/psd

Research overview

Understanding biological function by studying the dynamical and structural properties of biomolecules lies at the heart of the Structural and Functional Systems (SFS) research group. Biological molecules do not operate in isolation, and the remarkable complexity that arises from their interactions, spatial localisation and temporal expression underpins life. Research within the group is thus focussed both on the properties of the single molecule as well as the biological system(s) of which this molecule is part. It spans all the kingdoms of life, investigating the molecular basis of virus, plant, microbial, animal and human biology, and examines phenomena at a genome-wide level. The challenge in studying highly complex and dynamic biological systems is addressed by the interdisciplinary approaches used, combining the use of structural biology and functional genomics with advanced enzymological, spectroscopic and computational studies. Understanding biology at this level has many applications, ranging from drug discovery to synthetic biology.

Group Leader: Professor David Leys *(pictured)*





From fundamental research to industrial biotechnology

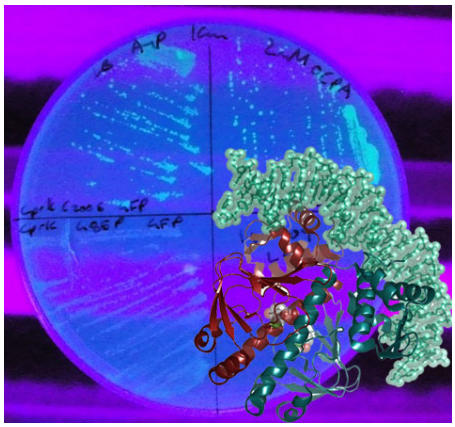
Recent publications by SFS members in high profile journals such as Nature (**465**, p736-745; **477**, p616-620) Science (**324**, p242-246) and PNAS (**107**, p2830-2835; p4555-6; p11644-11649; and **108** p4322-4327; p15780-15785) illustrate the scope and quality of our research, ranging from measurement of single-cell dynamics specifying cell fate to detailed structural insights into processes such as DNA-repair, CO toxicity or human tissue elasticity.

The interdisciplinary approach

The Manchester Interdisciplinary Biocentre (MIB) houses most of our principal investigators and is designed to foster and harvest the synergy that interdisciplinary research brings. The biocentre houses expertise across all key biochemical areas, from molecular biology to structural biology, synthetic chemistry, enzyme kinetics, computational analysis, and advanced spectroscopy. SFS members are thus strongly placed to translate this knowledge towards biotechnological application and are addressing key issues for the Knowledge-Based BioEconomy (KBBE) agenda and collaborating widely with UK industry to tackle global challenges. Major programmes in this area include industry and EU funded research on enzyme-based biofuel and fine chemical production, and BBSRC (BRIC) awards to enable improved bioprocessing of pharmaceuticals.

Spin-off success

Dr Andrew Almond's and Prof Andrew Doig's spin-off companies Conformetrix and Senexis are going from strength to strength. Conformetrix offers a new platform technology that can rapidly determine highly accurate and biologically-relevant 3D and 4D structures of any small soluble molecule, while Senexis is a small-molecule drug discovery and development company advancing a pipeline of novel treatments for diseases resulting from the toxicity of amyloid-like proteins.



Principal Investigators

Dr Andrew Almond
Dr Johanna Avis
Dr Jordi Bella
Dr Ewan Blanch
Prof Andrew Doig
Prof Bob Ford
Dr Alexander Golovanov
Dr Sam Hay
Prof Simon Hubbard
Dr Giles Johnson
Prof David Leys
Prof Andrew Munro
Dr Steve Prince
Dr Stephen Rigby
Dr Alan Roseman
Prof Nigel Scrutton
Dr Paul Sims
Prof Jon Waltho
Dr Jim Warwicker
Prof Mike White

www.manchester.ac.uk/structuralandfunctionalsystems

Research Centres and Institutes

Embedded within the Faculty of Life Sciences are a number of internationally renowned research centres. Receiving significant long-term funding, these centres of excellence form a focus for intra- and inter-university collaborative research.

Centre for Biological Timing

Mammalian physiology is rhythmically regulated by a network of internal clocks, driving sleep, temperature, hormones, and metabolic cycles. Within the Centre, we study how brain and peripheral tissue clocks interact to govern physiological processes, such as development, metabolism, and immunity, and how clock disruption leads to disease in man.

Centre for Integrative Mammalian Biology (CIMB) - www.cimb.ls.manchester.ac.uk

IMB is the study of how genes influence body function. It is central to the development of new therapeutic approaches to human and animal diseases. The CIMB delivers education, training and alliances in *in vivo* research to the highest scientific and ethical standards.

Centre for the History of Science, Technology and Medicine (CHSTM) - www.manchester.ac.uk/chstm

One of the largest research units in Britain devoted to the vibrant and interdisciplinary field of the history of science, technology and medicine, providing a hub for communication across institutional boundaries. See page 13 for further details.

Centre of Excellence in Biopharmaceuticals (COEBP) - www.manchester.ac.uk/coebp

With support from the Northwest Regional Development Agency and the European Regional Development Fund, 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 sector in the North West to accelerate progress towards the development of emerging medicine formats.

Healing Foundation Centre - www.manchester.ac.uk/hfctr

This Centre aims to advance our understanding of wound healing and tissue regeneration using a variety of model organisms. More details about the work of those involved in the Centre are given on page 9.

Institute for Science, Ethics and Innovation (iSEI) - www.manchester.ac.uk/isei

The Institute aims to analyse the process behind new scientific and technological developments and the scope and limitations of its regulation. It will explore the moral imperatives and public interests that underpins the theory and practice of science.

KNH Centre for Biomedical Egyptology - www.manchester.ac.uk/knhcentre

Established in 2003, the KNH Centre is the first specifically designated research centre of its kind for the investigation of Egyptian mummies. The centre is led by Prof Rosalie David (*OBE*).

Manchester Cancer Research Centre (MCRC) - www.manchester.ac.uk/mcrc

The MCRC partnership is made up of The University of Manchester (including the Paterson Institute for Cancer Research), The Christie (a specialist cancer hospital) and Cancer Research UK and was formed in January 2006.

Manchester Centre for Biophysics and Catalysis (MCBC) - www.manchester.ac.uk/mcbc

This is a state-of-the-art cross faculty platform technology centre integrating biophysical, structural, and computational methods to address contemporary problems in catalysis and the dynamical properties of biological macromolecules.

Manchester Collaborative Centre for Inflammation Research (MCCIR)

The University of Manchester, GlaxoSmithKline and AstraZeneca in a unique joint venture have established the MCCIR as a world beating centre for research on inflammation and inflammatory diseases

Manchester Interdisciplinary Biocentre (MIB) - www.manchester.ac.uk/mib

The MIB promotes interdisciplinary, challenge-oriented bioscience and biotechnology at the highest international level. Research themes include biomolecular mechanism & catalysis, systems biology, molecular bioengineering and enabling technology.

Neuroscience Research Institute - www.manchester.ac.uk/neuroscience

The Neuroscience Research Institute brings together researchers from science, engineering and medicine backgrounds to produce high quality research in the area of neuroscience. The aim is a seamless integration of bench-to-bedside research that will involve a free-flowing interchange between basic and clinical studies.

Northwest Embryonic Stem Cell Centre (NWESCC) - www.manchester.ac.uk/nwescc

A collaboration between The University of Manchester and the Central Manchester NHS Trust, the Centre has expertise in the isolation of viable stem cells from early human embryos under clean room laboratory conditions.

Systems Microscopy Centre (SMC)

The SMC uses timelapse imaging of living cells to measure dynamic cellular processes. Quantitative measurements of signalling, transcription and cell fate provide data for mathematical modelling of cells and tissues. The SMC is associated with the Bio-imaging Facility, Manchester Collaborative Centre for Inflammation Research and Centre for Biological Timing.

Wellcome Trust Centre for Cell-Matrix Research (WTCCMR) - www.wellcome-matrix.org

The Centre is home to a team of world-class principal investigators who are working in the areas of matrix assembly, adhesion signalling, cell fate determination and tissue regeneration. See page 6 for further details.

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

Faculty Buildings

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 ground breaking research. At the heart of the Faculty aerial walkways are in place connecting the Michael Smith, AV Hill, Stopford and Core Technology Facility buildings, thus creating a biomedical complex housing more than 300 research groups.


Michael Smith Building


Carys Bannister Building


Manchester Interdisciplinary Biocentre

Michael Smith Building

The £39M Michael Smith Building opened in January 2004. A further wing of the building was completed in 2007. The building houses the Wellcome Trust Centre for Cell-Matrix Research, the Healing Foundation Centre, the Centre of Excellence in Biopharmaceuticals and the Systems Microscopy Centre, as well as many of the Faculty's core research facilities.

AV Hill Building

This impressive building houses over 50 research groups, mainly focussing on neuroscience and immunology. The building is named after Archibald Vivian Hill, who won the Nobel Prize in Physiology of Medicine while he held the Chair in Physiology at The University of Manchester. Professor Hill shared the 1922 Nobel Prize with Otto Fritz Meyerhof for work on the generation of heat by muscles.

Carys Bannister Building

Opened in 2011, the building houses the Faculty's Optometry teaching and research group. This includes Eurolens Research, which provides clinical evaluation and consultancy services to the contact lens industry.

Manchester Interdisciplinary Biocentre (Garside Building)

Located in the southwest quadrant of the north campus is the £38M building opened in 2006. It houses research laboratories, core facilities, offices and meeting rooms over five floors, and can accommodate more than 600 research staff in up to 75 research groups. The building brings together biologists, physicists, chemists, mathematicians, engineers and computer scientists to undertake research and to develop technologies to meet current challenges in biology and medicine.

Core Technology Facility

This £25M facility is contiguous with the Manchester Incubator Building, which opened in 1999. Acknowledged as a leading UK bioincubator, this facility houses 16 fully-equipped laboratories for start-up businesses as well as offices and accommodation for the University's intellectual property and business development/incubation specialists.

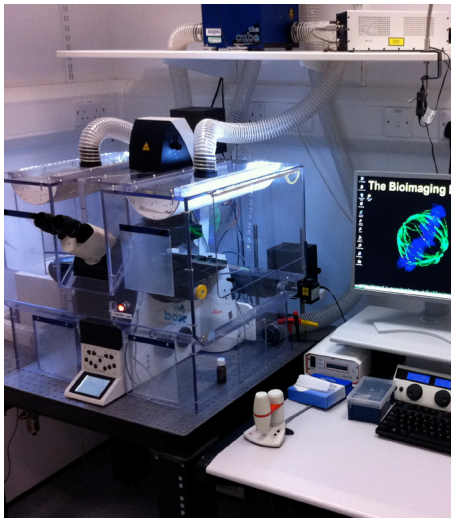

Michael Smith & AV HIll Buildings

www.manchester.ac.uk/aboutus/travel/maps

Analytical Research Facilities

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

Bioimaging



One of the largest and best-equipped core light microscopy facilities in the UK. The range of systems covers everything from fixed sample imaging through to prolonged live cell imaging. We currently have four point scanning confocals (one with multiphoton capabilities), three spinning disc confocals, four deconvolution systems, six widefield snapshot microscopes, two prolonged live cell imaging systems, a laser microdissection system and a high content screening system. The facility has three full-time members of staff who, in addition to giving full training on the system, will also provide advice on every aspect of imaging projects from initial experimental design through to image acquisition and processing.

Key output: Sustained Mps1 activity is required in mitosis to recruit O-Mad2 to the Mad1-C-Mad2 core complex. J Cell Biol (2010) 190:25–34.

Bioinformatics

The Bioinformatics Core Facility provides support to Faculty staff and users of the core analytical research facilities for a wide range of applications, and serves as the first port of call for the general bioinformatics needs of the Faculty. Routine support is provided to all users of the Genomic Technologies and Mass Spectrometry facilities. Support offered includes: data quality control, data processing, data visualisation, data mining and integration, statistical analysis, research programming, and advice on presentation of results for publication. Training of staff in analysis procedures is routinely given. The team also works closely with hardware specialists from FLS IT to offer research computing infrastructure necessary for custom data management or software requirements, and is closely associated with research groups working in the areas of bioinformatics and genomics.

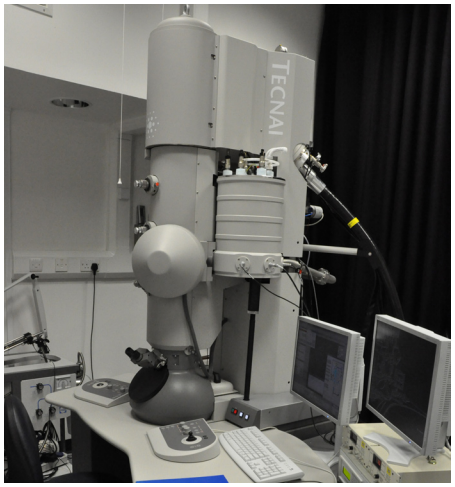
Key output: Glucose depletion inhibits translation initiation via eIF4A loss and subsequent 48S pre-initiation complex accumulation, while the pentose phosphate pathway is co-ordinately up-regulated. Mol Biol Cell (2011) 22:3379–3393.

Biomolecular Analysis

A state-of-the-art resource for the investigation of protein size, shape, interactions and dynamics. The facility has three full-time staff members who aim to provide the highest level of advice, training and expertise. Resources include analytical ultracentrifugation, calorimetry, circular dichroism, fluorescence, HPLC, multi-angle light scattering coupled to HPLC as well as dynamic light scattering. Our sensor suite contains instrumentation for the investigation of protein desorption and interactions with sensor surfaces and biological membranes. This suite includes surface plasmon resonance (including 2 Biacore 3000 instruments and the array format SPR Proteon XPR36), a quartz-crystal microbalance and dual polarization interferometry by Farfield. This exceptional and up-to-date resource generates multiple collaborations and technique development which helps maintain an outstanding publication record.

Key output: Molecular basis of coiled-coil oligomerization-state specificity. Proc Natl Acad Sci USA (2010) 107:19850–19855.

Electron Microscopy



Currently houses four transmission 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 Twin and Biotwin microscopes are both 120kV instruments and while the Biotwin is the instrument of choice for routine TEM, the Twin microscope is a research instrument specifically configured for STEM and 3-D tomography applications. The new Polara microscope is a high end instrument dedicated to cryo applications at liquid nitrogen or liquid helium temperatures and is ready for new applications like EFTEM (for analytical capabilities) or remote operation. FEI Quanta 250 with Gatan 3View system is the serial block face scanning electron microscope that allows automatic sectioning and image acquisition of relatively large volumes up to half of cubic millimeter.
The facility also provides a full range of sample preparation equipment including ultramicrotomes, cryo-ultramicrotomes, knife makers, coating units, high pressure freezing equipment such as the Leica EMPact and Baltec HPM010, an FEI Vitrobot plunge freezing unit, and the Leica freeze substitution systems.

Key output: A mutation in the mouse Amelx tri-tyrosyl domain results in impaired secretion of amelogenin and phenocopies human X-linked amelogenesis imperfecta. Hum Mol Genet (2010) 19:1230–1247.

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

Flow Cytometry

As the original high content analysis technique, flow cytometry is an essential tool for cellular analysis to reveal the heterogeneity in cell populations hidden in other techniques. A Beckman Coulter Cyan ADP is available for analysis and a BD Biosciences FACS Aria for sorting experiments.

Key output: rnaset2 mutant zebrafish model familial cystic leukoencephalopathy and reveal a role for RNase T2 in degrading ribosomal RNA. Proc Natl Acad Sci USA (2011) 108:1099–1103.

Fly Facility

The Drosophila Facility is one of the largest Fly facilities in the UK. Active users comprise 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 Drosophila related experiments.

Key output: Brat promotes stem cell differentiation via control of a bistable switch that restricts BMP signaling. Dev Cell (2011) 20:72–83.

Genomic Technologies

Funded largely from Wellcome Trust grants, the facility was established to provide access to cutting-edge, post-genomic technologies. The facility supports four main technology categories, namely: Next generation sequencing (Life Technologies SOLiD 4.0), Affymetrix GeneChip Microarrays, Real-time PCR instruments and RNAi library screening. Alongside automation for sample preparation, there is also extensive liquid handling and robotics capacity, together with instrumentation for quantification and sample QC. The facility operates in close association with the Bioinformatics facility to provide a complete service from experimental design through to bioinformatic analyses.

Key output: Tartrate-resistant acid phosphatase deficiency causes a bone dysplasia with autoimmunity and a type i interferon expression signature. Nat Genet (2011) 43:127–131.

Histology

The histology core facility houses modern equipment for producing high quality tissue sections for microscopy. The facility offers training and advice on preparation, processing, sectioning and staining of fixed or frozen tissue, and will undertake a range of histology service requests.

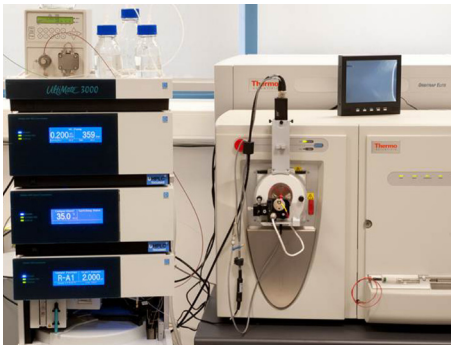
The facility has a suite of cryostats (for snap frozen tissue or fixed and frozen tissue sectioning), two automated tissue processors (for processing fixed tissue into paraffin blocks) and two associated paraffin embedding centers. For sectioning FFPE tissue we have four motorized microtomes available which can section as low as 1 micron, but routinely set at 5 microns. We offer a Varistain 24-4 for routine H&E staining, which is capable of staining 60 slides per run. For IHC staining we have a Sequenza staining station (capable of staining up to 50 per run) which uses slide coverplate technology to limit the amount of reagent used in the staining process.

Macromolecular X-Ray Crystallography

The high level of detailed insight and understanding of macromolecule structure and function offered by crystallography is unparalleled and underpins much of our present understanding of life at the cellular level. Located in the Manchester Interdisciplinary Biocentre (MIB), the facility contains state-of-the art instrumentation that supports the structural biology groups within the Faculty and offers a dedicated crystallisation and crystal characterisation service. Inquiries from other Faculties and external organisations are encouraged. The facility acts as a focal point for diverse crystallographic structural studies throughout the Faculty. User interaction is encouraged and hence knowledge sharing is at a premium. A formal 'structuring' service is available. Support and instruction is continually provided depending on level of user competence.

Key output: The structure and catalytic mechanism of poly(ADP-ribose) glycohydrolase. Nature (2011) 477:616–620.

Mass Spectrometry



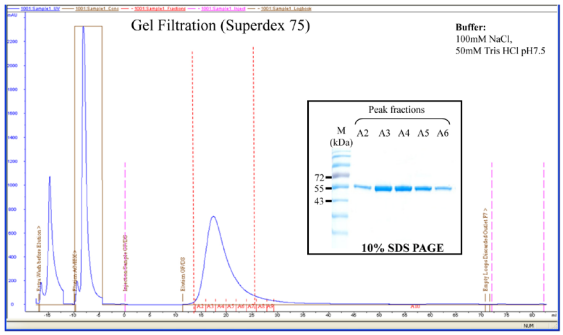
The facility consists of eight mass spectrometers including the latest Orbitrap Elite FT-MS system, an LTQ Velos Pro dual linear ion trap, Agilent 6520 Q-TOF, Bruker HCT Ultra 3D ion trap, Bruker Ultraflex II MALDI TOF-TOF, Applied Biosystems 4000 Q-Trap hybrid triple quadrupole, Waters LCT ESI time-of-flight and Agilent 7890/5975C GC-MS along with specialised software solutions such as Mascot, Scaffold and Progenesis LC-MS. It supports a wide range of biological applications of mass spectrometry including protein identification, characterisation and quantification. It also has a team of dedicated scientists to advise users on all aspects of analysis from problem definition and experimental design through to data analysis and interpretation.

Key output: Defining elastic fiber interactions by molecular fishing: an affinity purification and mass spectrometry approach. Mol Cell Proteomics (2009) 8:2715–2732.

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

Protein Expression

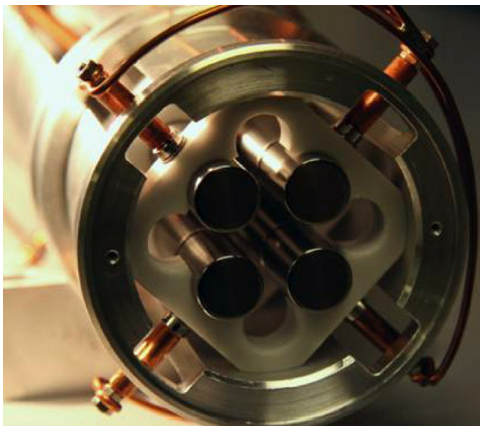
The facility provides a comprehensive resource for high level expression and scale-up production of recombinant proteins in four systems: bacterial, yeast (*pichia pastoris*) insect and mammalian. A molecular biology cloning service (starting from accession number or plasmid) is also available, enabling researchers to potentially obtain purified recombinant protein for any identified genes. The facility has extensive experience in troubleshooting and a range of in-house optimised vectors designed to improve protein solubility and expression levels.



Key output: Reaction of vascular adhesion protein-1 (VAP-1) with primary amines; Mechanistic insights from isotope effects and quantitative structure-activity relationships. J Biol Chem (2011) 286:29584–29593.

Transgenic Technologies

The Transgenic Unit supports the use of advanced transgenic technologies. Services include cryopreservation, embryo implantation and IVF based retrieval, expansion, and quality control. To generate de novo transgenic lines both ES cell blastocyst and DNA pronuclear injection have been established, to support this we also have access to dedicated embryonic stem (ES) cell culture facilities. We also offer project consultations and guidance regarding new and emerging transgenic methodologies and it is planned to introduce additional services such as genotyping and vector electorporation.



Manchester Interdisciplinary Biocentre (MIB)

The MIB has an impressive range of facilities that provide a strong foundation for research excellence. These include Biomolecular Analysis (SPR, ITC, CD), Metabolomics, Proteomics, High Resolution Imaging, Robotics, Rheology, Microarray analysis, Microfluidics, Mechanochemistry (including AFM and Laser Tweezers), NMR, EPR, X-Ray Crystallography, Electron Microscopy, Fast Reaction Spectroscopy (aerobic, anaerobic), Mass Spectrometry (including Secondary Ion Mass Spectrometry and Fourier Transform Ion Cyclotron Resonance), Infrared, Raman and Fluorescence Spectroscopy.

Highlight publications

The core research facilities contribute enormously to the discoveries made in the Faculty. Numerous high impact publications involve key contributions from staff in our core facilities. Key publications are included in individual facility descriptions (see above), and three of the most significant are highlighted below.

Boros J, Donaldson IJ, O'Donnell A, Odrowaz ZA, Zeef LAH, Lupien M, Meyer CA, Liu SS, Brown M, Sharrocks AD. Elucidation of the ELK1 target gene network reveals a role in the coordinate regulation of core components of the gene regulation machinery. Genome Research (2009) 19:1963–1973.
This paper used a combination of genomic technologies to decipher the target gene network for the ETS-domain transcription factor ELK1. This transcription factor is important as it is activated by the Ras-ERK pathway which is frequently upregulated in cancer cells. A fundamental discovery was that ELK1 controls the coordinate expression of many components of the core basal transcription factor complex. Key contributions came from the genomics technology facility in performing ChIP-chip and expression microarray experiments. Subsequently, the Bioinformatics core facility provided the key skills for interpreting and integrating the data produced.

Lone M, Kungl T, Koper A, Bottenberg W, Kammerer R, Klein M, Sweeney ST, Auburn RP, O'Kane CJ, Prokop A. The nuclear protein Waharan is required for endosomal-lysosomal trafficking in Drosophila. J Cell Sci. (2010) 123:2369–2374.
This paper used a combination of classical fly genetics, confocal microscopy and electron microscopy to unravel novel functions of the evolutionarily conserved nuclear factor Waharan in endocytic trafficking. This paper shows that Waharan function causes cell death, which correlates with unprecedented accumulations of electron dense, tubular structures that represent jammed endocytic compartments packed with ubiquitinated proteins. It essentially contributes to the evolving view that nuclear and endocytic compartments display close functional links in many cells. Key contributions came from the Bioimaging facility in performing confocal imaging, the Electron microscopy facility in performing standard transmission electron microscopy and electron tomography, and the Fly facility in performing Drosophila genetic experiments.

Humphries JD, Byron A, Bass MD, Craig SE, Pinney JW, Knight D, Humphries MJ. Proteomic analysis of integrin-associated complexes identifies RCC2 as a dual regulator of Rac1 and Arf6. Sci. Signal (2009) 2:ra51.
This paper reports the first successful isolation of signalling complexes associated with integrin adhesion receptors. The composition of the complexes was determined by mass spectrometry and hierarchical clustering and protein interaction analyses were carried out in conjunction with the Bioinformatics core facility. Together, these follow-up studies enabled the identification of RCC2 protein as a novel dual regulator of small GTPases.

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

Research Fellows

Welcoming Independent Research Fellows

A fellowship is an exciting opportunity to develop an independent research group. The Faculty of Life Sciences recognises the importance of this stage in a research career and provides help and guidance to all new fellows through a dedicated mentoring scheme and structured programme of training called the New Academics Programme (NAP).

The Faculty has an enduring record of recruiting outstanding scientists to undertake fellowships in Manchester, with an excellent track record in retaining independent fellows as permanent academic members of staff. Many of our staff hold, or have held, fellowships, and in 2011 three of the four nationally awarded BBSRC David Phillips Fellowships went to scientists in the Faculty of Life Sciences.

The Faculty offers an attractive new fellowship scheme for independent research fellows with substantive external funding to join the Faculty of Life Sciences as Principal Investigators. For Fellows bringing in 4-5 years of external funding, or mid-term fellows with at least 2 years remaining, the Faculty will top up fellowships with 1 to 2 years additional support and offer underwrites to fellows following a successful formal review. Throughout the 6-year period fellows benefit from close mentor support, with formal reviews at 3 and 5 years.

Contacting the Faculty

Anyone wishing to find out more about holding a fellowship within the Faculty should contact the specific Research Group Leader (see pages 6-18) or the Fellowship Recruitment Co-ordinator Professor Chris Grant.
More information, including contact details, can be found at: www.manchester.ac.uk/lifesciences/research/fellows

The New Academics Programme

The New Academics Programme (NAP) is an Higher Education Academy (HEA) 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.

Mentoring for new Fellows

All research fellows in the Faculty of Life Sciences 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 to career progression, and help with integration into the faculty and promote collaboration.

Case Study

Dr Sam Hay

In 2005, after a year as a visiting postdoc at Stockholm University, I moved to Manchester to work as a postdoc in the Faculty of Life Sciences (FLS). This went rather well, and in 2009 I decided to apply for a fellowship. I chose to stay in Manchester as I genuinely could not find anywhere better: the Molecular Enzymology group is world leading and the Manchester Interdisciplinary Biocentre (MIB) suits my collaborative research approach. A Research Support Manager helped while I was writing fellowship applications and, when I was shortlisted for a BBSRC David Phillips fellowship, senior staff helped me with valuable advice and a mock interview. Since taking up the fellowship in late 2010, I have received ongoing Faculty support such as a Wellcome VIP award and a targeted PhD studentship. The collaborative nature in FLS also quickly paid off when I received early additional grant funding as a co-investigator on a BBSRC IPA award.

Dr Pat Caswell

The Faculty of Life Sciences has a strong reputation for supporting high quality research, and viewing the facilities and resources available within the Wellcome Trust Centre for Cell-Matrix Research strengthened my opinion. For me the expanding proteomics facility and bioimaging capability coupled with current expertise in using both made it simple to see this as a place where my research could thrive.
Members of the Faculty were enthusiastic and supportive of my application, and gave me advice at every stage through the application process, from writing the proposal to preparing for interview with a mock interview. The support I have had since taking up my post has been critical in enabling me to get my lab up and running effectively: sharing well-equipped lab-space with a more established group; technical support to help me get my lab up and running; mentoring from more established investigators around me.

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

Research Staff Support

Excellence in research is only possible with excellent researchers. The Faculty of Life Sciences (FLS) recognises the importance of supporting developing researchers in their careers and provides a range of training and career development opportunities, enabling staff to achieve success both within and outside academia.

An excellent research environment

FLS has a wealth of technical expertise and offers open access to many of its 'core technical facilities'. Researchers from across the Faculty are encouraged to take an active part in weekly seminars, Faculty meetings and the annual Faculty Research Symposium. The quality of the Faculty research environment is recognised through the European Commission HR Excellence Award in recognition for the commitment of The University of Manchester to supporting the development of research staff. This award is given to institutions across Europe who are actively implementing the principles of the European Charter and Code for the support of researchers and the UK Concordat to support the career development of researchers.

Supporting career development

All staff within FLS 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 Research Staff Development Officer.

The Faculty provides a dedicated career and personal development programme that is developed in consultation with research staff representatives and academic staff. The Faculty career and personal development programme maps onto the UK Researcher Development Framework. FLS flagship workshops presented through this programme are: 'Fellowship Applications', 'Grant Reviewing' and 'Becoming a Biotech Entrepreneur'. There is also a tutorial mentoring scheme to train staff in teaching methods, providing key preparation for academic positions in Higher Education Institutions.

This Faculty level programme is augmented by University-wide support. In recognition of the commitment of the University to staff development, The University of Manchester has won the 2011 Times Higher Education Award for Outstanding Support for early career researchers. With over 1800 research staff, The University of Manchester is able to offer bespoke support to researchers that is unparalleled in other institutions. Three examples of this University-wide support include: the Institute of Leadership and Management (ILM)-accredited Researchers into Management programme; Micromentoring; Pathways (an annual three day career event).

Research staff training

The Faculty encourages research staff to undertake training from a variety of sources. Within the Faculty, workshops to improve research skills, increase the impact of publications, and develop professional contacts are offered. Additionally, the Faculty facilitates training in specialized techniques by funding competitive career development grants for staff to visit other laboratories and develop skills to advance their own research projects.

Supporting the socially responsible researcher

FLS and its staff are strongly committed to sharing their knowledge with the public. Researchers across the Faculty are provided with training and opportunities to take part in public engagement activities which include working with schools on schemes such as Researchers in Residence, and showcasing our research to the general public through collaborations with local museums or at the annual Faculty Open Day.

Case Study

"There are several workshop and training opportunities for researchers in the Faculty of Life Sciences, including a dedicated Research Staff Development Officer who is on hand to help with career development. I have participated in several workshops, including how to peer review journal manuscripts and how to prepare fellowship applications. Workshops are held regularly and were really useful for stimulating me to think about how to direct my career and where to go for advice.

I recently attended a Nature careers conference in London, which was funded by the FLS Researcher Training fund. This was a great series of workshops aimed at providing new ideas regarding career choices of postdocs and how to realise individual career goals, while also highlighting the transferable skills achieved from working in science.
In addition to career development support, FLS also encourages public engagement, for which there are several events throughout the year. I am an ambassador for the STEM (Science, Technology, Engineering and Maths) program and this year I have helped school children learn to 'science busk' as well as helping out at a cardiac physiology day at the Museum of Science and Industry. Public engagement has been really rewarding and helped me to reflect more about the relevance of my own research to society, as well as encourage young minds to study science. "

Dr Helena Bailes

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

Business Development

The Faculty of Life Sciences and the University of Manchester are committed to forging close and productive partnerships with industry, and to build on what is already an impressive track record of important industrial collaborations.

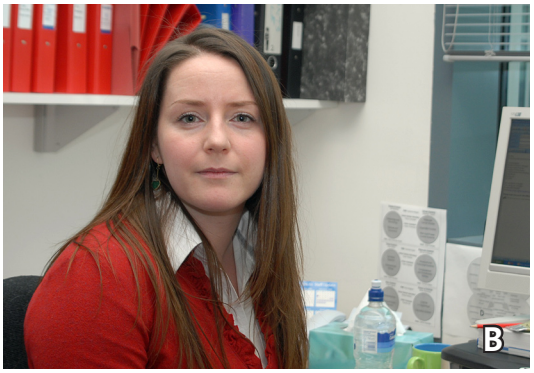
The vision is to be the partner of choice for companies seeking academic partnerships in the biomedical and related sciences.

In addition, we aim to ensure that wherever appropriate there is rapid and effective exploitation and commercialisation of our research.

The Faculty of Life Sciences is able to offer a very wide range of expertise and know how across the whole spectrum of biology, biochemistry and biotechnology and related disciplines. Coupled with this we have available state-of-the-art research facilities in modern well-equipped laboratories.

Our researchers have collaborated with companies including:

- AstraZeneca
- Aventis Pharma
- BASF
- Bayer Crop Science
- Boehringer-Ingelheim
- Eli Lilly and Company
- GlaxoSmithKline
- Johnson & Johnson
- Novartis
- Pfizer
- Proctor & Gamble
- Smith & Nephew
- Syngenta
- Syntaxin
- Unilever



The Faculty Business Development team is led by: Professor Ian Kimber, Associate Dean for Business Development (A), Dr Victoria Hand (B) and Dr Jo Flannelly (C). This 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.

Research partnerships

Current research partnerships with industry span a wide range of companies (more than 65 presently), including those in the following sectors: Pharmaceuticals, Biopharmaceuticals, Biotechnology and Bioprocessing, Agrochemicals, Industrial and Speciality Chemicals and Personal Care Products (see left).

The Faculty of Life Sciences is able to tailor agreements to meet the needs of industrial collaborators. We offer a complete range of possible partnerships from consultancy and contract research, through to substantial research collaborations. Moreover, there are in the Faculty a large number of PhD studentships that are either fully funded by industry, or supported through Research Council CASE awards.

Manchester Collaborative Centre for Inflammation Research

One example of a major research collaboration has been the agreement in 2011 to create the Manchester Collaborative Centre for Inflammation Research (MCCIR). This is a unique initiative that brings together industrial partners, GlaxoSmithKline and AstraZeneca, with The Faculties of Life Sciences and Medicine and Human Sciences at The University of Manchester. The aim of the MCCIR 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.

Commercial Exploitation

The Faculty of Life Sciences also encourages swift exploitation of our research. Each year Faculty scientists make many important disclosures and since 2006 staff in the Faculty have filed more than 18 patent families. There are currently in place 5 spin-out companies that have been founded on research conducted within the Faculty of Life Sciences.

Partnerships, Collaborations and Services

- Strategic alignments
- Research collaborations
- Joint studentships
- Collaborative projects supported by MRC, BBSRC, TSB and EU
- Contract research
- Consultancy
- Expert witness support

www.ls.manchester.ac.uk/business

The Faculty of Life Sciences is one of the world's leading research institutions in the area of biosciences. This is reflected in the quality of the technologies that have been developed in the Faculty, many of which have been successfully licensed or developed into standalone spin-out companies, such as:

Ai2
www.a-i-2.com
Conformetix
www.conformetrix.com
Epistem
www.epistem.co.uk
F2G Ltd
www.f2g.com
Gentronix Ltd
www.gentronix.co.uk
Motac Neuroscience Ltd
www.motac.com
Myconostica
www.myconostica.co.uk
Renovo
www.renovo.com
Senexis
www.senexis.com

University of Manchester Intellectual Property (UMIP)

www.umip.com

UMIP is the managing agent of the University for intellectual property commercialisation. UMIP's role is to enhance the scale and quality of the University's intellectual property development and commercialisation activities. UMIP has a flexible approach and aims to employ the most appropriate commercialisation strategies for each individual technology transfer project to maximise the benefits derived from each individual opportunity.

Dr Rich Ferrie (D) is Director of IP Commercialisation and Head of UMIP. UMIP'sBioMedica Operational Team is responsible for identifying, protecting and commercialising the University's biomedical intellectual property, primarily arising from the Faculties of Life Sciences and Medical and Human Sciences and their associated research institutes. The team comprises eight professionals who manage biotechnology business development projects on behalf of the University and act as an interface with biotechnology companies and investors to licence biotechnology, create and fund spin-out companies and secure mutually beneficial industrial collaborations around University IP assets.

Commercialisation Executives, Dr Arnaud Garçon and Dr Gillian Shuttleworth (E) work predominantly with the Faculty of Life Sciences, where they help researchers to identify new IP and assess its commercial potential. Where new IP appears to have strong commercial potential but lacks technical Proof-of-Principle data, UMIP may fund selected technology development projects using funds administered by its Investment Committee.

UMIP is a division of The University of Manchester I³ Limited (www.umi3.co.uk).

University of Manchester Innovation Centre Limited (UMIC)

www.umic.co.uk

UMIC provides high specification laboratory and office space, suitable for a variety of purposes, within its Manchester Incubator Building and Core Technology Facility. The Innovation Centre also boasts an exceptional conferencing facility for our academic/ professional workshops, seminars and events program in addition to onsite catering. Please see www.umic.co.uk/events for a comprehensive rolling events calendar.

UMIC is a division of The University of Manchester I³ Limited (www.umi3.co.uk).

UMIP Premier Fund

www.mtifirms.com

The UMIP Premier Fund (UPF) invests in businesses emerging from The University of Manchester through UMIP's stringent process of business development and technology transfer. The UPF is Europe's largest institutional fund to have a single university focus and is managed by the UK's leading technology investment manager, MTI Partners. MTI has a sustained performance record across more than two decades and five venture funds and is located on campus at The University of Manchester. The Fund will primarily make late-seed stage investments, in a total of 15 -20 companies, initially in the £250K - £750K range, with both the intention and capacity to provide follow-on investment up to £3M.

Postgraduate Study

Postgraduate opportunities within the Faculty of Life Sciences encompass all fields of life sciences, from molecules and cells, to whole organisms and environments. This is reflected in the number of programmes and courses on offer, with more than 30 different research programmes and over 15 taught courses.

Diverse research programmes and taught courses

Research projects (PhD, MPhil and MRes) are offered from a range of exciting and challenging research programmes, which map onto the Research Groups described in this brochure. In addition, specialist MSc programmes are taught in key areas that aim to prepare students for further PhD study or for careers in industry. In terms of career progression, the majority of our postgraduate students remain in research, while others move into related areas such as education, information technology, consultancy and management, helped by the comprehensive skills training they gain 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 supervisors often working in different areas, including from different Faculties within the University. This cross-disciplinary cooperation allows 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 programmes, including a range of Doctoral Training Centres.

Visit our postgraduate web pages (see links below) for full details of the research programmes and taught courses available in the Faculty of Life Sciences.

Top reasons to study within the Faculty of Life Sciences

- Ranked in the top three Universities in the UK for biological sciences in the latest government Research Assessment Exercise (RAE).
- Over 200 active research labs, more than 1000 members of research staff and over 2200 students working in the life sciences.
- Brand new purpose-built research complexes, costing £170 million, housing modern cutting-edge research facilities.
- More than 30 research programmes and 15 taught courses spanning the breadth of life sciences.
- One of the largest centres for BBSRC-funded PhD student training in the country.
- Around 500 scientific papers published in international research journals annually.
- Comprehensive research seminar series attracting world renowned speakers.
- One of the most comprehensive and innovative transferable skills training programmes in Europe, offering tailored support for each student.
- Academic literacy course as part of PhD study to help improve scientific writing skills.
- *New* PhD in Biotechnology with Enterprise available from September 2012.
- *New* joint Graduate Research Training Programme between the Faculty of Life Sciences and A*STAR Institutes in Singapore, commencing in September 2012.

Full integration into the academic research environment

The postgraduate student community within the Faculty is truly international, with more than 450 postgraduate students from more than 40 countries around the world. Each year the postgraduate community is joined by all members of the Faculty of Life Sciences to formally celebrate their substantial research achievements at the Faculty Research Symposium. During this important day in the Faculty calendar, a selection of postgraduate and postdoctoral researchers present their work, through talks and posters, to their peers, academic and support staff and invited guests. This event provides all of our postgraduates with an important opportunity to showcase their research.

Postgraduate Society

The Faculty has a very successful and active Postgraduate Society consisting of student representatives from across the Faculty. The Society organises annual events, social and academic, and aim to help and support new students in the Faculty. The Society have organised annual lectures, inviting eminent speakers of academic excellence, including Professor Lord Robert Winston and Sir Alec Jeffreys.

Research with industrial collaboration

The Faculty has strong links with industry and many postgraduate students work on projects that involve collaboration with industrial sponsors. Typically at any one time around 50 students are undertaking a CASE (Co-operative Awards in Science and Engineering) PhD programme, which allows them to work on a scientific problem that has direct industrial relevance. These PhD students have a supervisor at the University as well as at the collaborating industrial company and spend time working at both locations. The Faculty has links with over 30 different companies through CASE PhDs, including AstraZeneca, BASF, Boehringer-Ingelheim, Epistem, GlaxoSmithKline, Merck Serono, Novartis, and Smith and Nephew.

www.ls.manchester.ac.uk/phdprogrammes www.ls.manchester.ac.uk/masterscourses

Postgraduate Student of the Year

Each year the Faculty nominates the very best and brightest talent to receive an award for University Postgraduate Student of the Year. This prestigious medal is in recognition of outstanding academic achievement and is based on research output, publications and contribution to the life of the University. Previous winners include Karen Gascoigne (PhD Cell Biology). "I was extremely proud to receive the Postgraduate Student of the Year award. The award has given me the confidence to carry on with a career in science, as a post-doctoral researcher" says Karen.

Graduate Training Programme

The Faculty of Life Sciences is proud to have one of the largest and most innovative training and development programmes for postgraduate students in Europe. The Graduate Training Programme (GTP) comprises a series of compulsory and optional workshops, seminars, and skills training modules that are designed to complement a student's research laboratory training. The training is made up of both face-to-face workshops, conferences and on-line resources, offering a range of experiences and flexibility. Every student benefits not only from the outstanding academic environment, but also from the opportunity to acquire a broad and individualised range of personal and transferable skills that are of great value in future careers.

How to apply

An online application form for all postgraduate programmes and courses is available through our website.

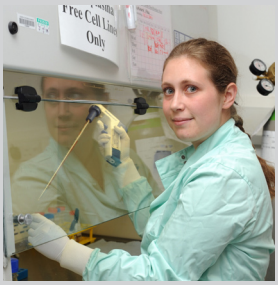
Contact us

For further information regarding postgraduate study within the Faculty of Life Sciences please contact the relevant office:

Research Programmes (PhD/MPhil)
Tel: +44 (0)161 275 5608
email: pgresearch.lifesciences@manchester.ac.uk
Address: Graduate Office
Faculty of Life Sciences
The University of Manchester
Carys Bannister Building
Manchester
M13 9PL UK

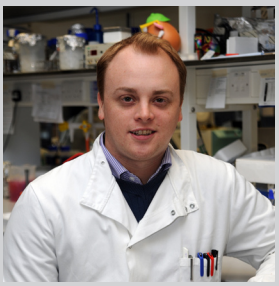
Taught Courses (MSc/MRes)
Tel: +44 (0)161 275 5032
email: pgtaught.lifesciences@manchester.ac.uk
Address: Recruitment & Admissions Office
Faculty of Life Sciences
The University of Manchester
Stopford Building
Oxford Road
Manchester
M13 9PT UK

What our Students Think



Claire Gaffney has just entered her second year studying for a PhD in Biotechnology, which is a CASE studentship with a biopharmaceutical company. Claire has just completed a 6 month intensive placement with the company. Clare commented that "during my placement I learnt many cutting-edge techniques including phage display technology and gained invaluable knowledge about my field through working with experts. I am now back in Manchester and part of a highly dynamic team where I can complete my research. There is excellent access to facilities and a tireless academic staff who are a fantastic support to my studies. I have found the University an exceptional place to study, both as an undergraduate and a postgraduate and would highly recommend it".

Mohammad Rahman from Bangladesh is studying his PhD in Sustainable Consumption and is funded by the Sustainable Consumption Institute (SCI). He was previously funded by the European Union for his MSc from the Technical University of Dresden, Germany and Bangor University, Wales. Mohammad commented "my PhD is interdisciplinary in nature and the Faculty of Life Sciences is the place which gives me the opportunity to work on the challenging field of climate change and urban ecology. Supervisors and other members of staff are really helpful and always encourage excellence in my research. Altogether, it's a fantastic working environment. I have published a paper as a first author in the Journal of Urban Forestry and Urban Greening".



Warren Flood is a dual national, Norwegian-American, from Norway. Warren originally decided to come to study Medical Biochemisty in Manchester "based on their 5 star (international class) research rating from the British Council and recommendations from the British Council staff in Norway. I received funding from the Norwegian government for both my BSc and later my MSc in Immunology and Immunogenetics. It was first as a postgraduate that I fully realised what the University had to offer, especially with the Faculty's excellent core research facilities, wide variety of seminar series and vast spread of world class researchers. After a great Masters experience I am currently doing a PhD in Microbiology investigating the innate immune response to *Helicobacter pylori*. The open and friendly research environment here has immeasurably aided my PhD as I have been able to take advantage of assistance and collaboration from leading researchers in immunology and cancer research. The experts and technicians within the core facilities have given me excellent training in a variety of techniques which has allowed me to employ approaches that typically belong to separate disciplines, everything from mass spec and biochemical techniques, to bioimaging with immunofluorescence, to cell sorting with FACs. All in all Manchester has been an excellent place to do research and I doubt it would have been possible to get to know so many different researchers in different fields and get the diversity of training and education I have received in many other places".

www.ls.manchester.ac.uk/phdprogrammes www.ls.manchester.ac.uk/masterscourses

A highly trained workforce is crucial to the success of UK industry. The Faculty of Life Sciences is ideally placed to provide training, with world-renowned expert researchers across the field of the biological sciences and housing specialist equipment found in only a handful of institutes. The Faculty runs a number of courses that can give employees the latest skills and motivation to compete in an ever evolving workplace.

Undertaking Continuing Professional Development (CPD) in the Faculty

We have a number of stand-alone courses for which individuals can register. The mechanisms of learning and qualifications gained vary amongst the different courses, with programmes of study that can involve workshops, distance learning or formal examination. The Faculty is happy to discuss proposals for bespoke courses, to suit particular employers' needs. Please contact us on the email address below.

Further Information

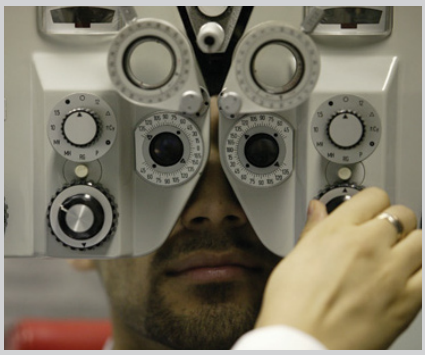
Website: *www.ls.manchester.ac.uk/furtherstudy*
Email: *fls-shortcourses@manchester.ac.uk*

Case Study - Immunology and Immunogenetics

A properly functioning immune system is essential for health by providing resistance to infection and eliminating malignancy. Increasingly, it is appreciated that malfunction of the immune system is involved in a wide variety of disease states including autoimmunity, allergies and immunodeficiency. An exciting new development in applied immunology is the attempt to harness the immune system for treatments for cancer. It is now accepted that a detailed understanding of the immune system is required for the design of effective vaccines and treatment of diseases in both industrialised and developing countries. These modules aim to provide a thorough knowledge of contemporary immunology at the cellular and molecular level and an insight into the ways in which this can help in immunodiagnosis and the control and treatment of disease. The modules are delivered entirely on-line, and so are accessible to students worldwide. The modules provide stimulating and attractive learning materials, tutor support and contact with other students through online discussion boards. Each module uses a combination of online teaching techniques including recorded audio lectures, interactive tutorials, discussions, quizzes and presentations.

Case Study - Experimental Design

Good experimental design that allow us to get the most from our experiments while using the least amount of limited resources is something for which we all strive . Our Experimental Design CPD unit provides training in applied experimental design for researchers. We begin the unit with introductory topics, such as control groups and replication, and go through the main topics in experimental design up to power analysis and optimized factorial designs. Our team of expert tutors and the extensive workshops enable participants to customise training to their own research needs.



Case Study - Independent Prescribing for Optometrists

Changes in legislation have extended independent prescribing rights to optometrists, subject to the satisfactory completion of an accredited training course. Achieving registration as an independent prescriber enables the optometrist to treat patients with appropriate therapeutic agents, without having to refer them to a medical prescriber colleague. This course is largely distance learning and is therefore ideal for the busy optometrist who wishes to learn at their own pace. It is a joint initiative between The University of Manchester and Aston University and is accredited by the General Optical Council.

www.ls.manchester.ac.uk/furtherstudy

The Faculty of Life Sciences is committed to engaging with the public, be it through its schools outreach work, Faculty open days or by alerting the world to its research breakthroughs via the media. Its scientists take a proactive approach to communicating their work, understanding the importance of explaining their research, not only to justify continued funding but also to excite and inspire the young people who will be the groundbreaking scientists of the future.

We are involved in a whole variety of activities throughout the North West. Our dedicated scientists have developed activities, workshops and research stands to suit people of all ages, backgrounds and levels of knowledge. It is important that we communicate the success and potential of our work in an accessible way in order that this is truly understood by the wider community.

Science Spectacular at Manchester Science Festival 2011

Over 2000 visitors came to the University's Whitworth Hall and the Manchester Museum on Saturday 28th October for our Science Spectacular, a day of interactive exhibitions put on by The University of Manchester as part of the city wide Manchester Science Festival.

It was a fantastic day, which gave the public the opportunity to meet and talk to the scientists who are usually hidden away in their labs. Around 30 research groups from The University of Manchester were showcasing their work and the Faculty of Life Sciences played a major role in the event.

At the Fly Station visitors discovered how flies get drunk, suffer from jet lag and have stem cells, as well as being shown how these animals play a vital role in researching human diseases such as cancer and epilepsy.

The Manchester Skin Research group had a stall showing just how important your skin is. They had a special camera set up that allowed you to see how much your own skin had aged, as well as showing how the sun causes aging and wrinkling of the skin.

There was plenty of slime on offer with visitors being invited to explore the human gut. At the Eye Station there were demonstrations to show how the cells in the eye work and how that allows you to see, and those visitors who were not too squeamish could even have a picture taken of the back of their own eye.

The very messy hands-on Heart Station staffed by the researchers from the British Heart Foundation here at the University showed how the heart pumps blood around the body, and had quizzes and demonstrations on how the heart keeps pumping and how this keeps us alive.

Our bodies are made up of many different cell types, each with different shapes and functions. The Living Cells Station showed how these cells work together to make up our organs, there was also the opportunity to view the sub-cellular organelle structures which in turn enable the cells to do their jobs.

As well as the Faculty of Life Sciences, many other parts of the University showcased their research with stalls on nuclear energy, astronomy and even glow in the dark ice cubes courtesy of the School of Chemistry!

As the day drew to a close it was clear that children, teenagers and adults alike had enjoyed a fantastic time which was only made possible by the hard work of the staff, students and volunteers who organised and participated in the event.

www.ls.manchester.ac.uk/schoolsandcommunity

Opening the Doors to our Community!

In July 2011, the Faculty opened its doors to the public and hosted our very first Community Open Day. The people of Manchester were invited to meet creepy crawlies and the scientists who study them, as well as have look inside our labs – over 700 people came through the door.

Both children and adults were able to get hands on to make music with DNA, take a journey around the human body and feed the University's very own bug-eating plants. Visitors were given the chance to see robots at work and watch living things through million-pound microscopes. Our guests were invited to try their hand at maggot painting, make creature crafts and have their face painted.

University scientists were available to talk about their work, including everything from cancer research and obesity busting to brain imaging and biofuel development. There were also tours of our research labs where scientists work every day.
A talk was given by from Dr Liz Sheffield on "The Good, the Bad and the Ugly" science in some well known animated films.

The Open Day was a huge success welcoming families from across Manchester.

Discover Days

Over 100 school and college pupils visited the Faculty over the summer to take part in Discover Days. Discover Days give Year 12 pupils a chance to learn more about a specific life sciences subject area by spending a day at the University and attending lectures and practical sessions in the labs. A range of days were on offer covering different aspects of the life sciences; Biomedical Sciences, Anatomical Sciences, Immunology, Pharmacology, Physiology, Cell Biology and Microbiology.

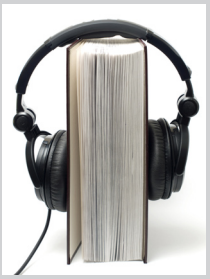
Students undertook a range of experimental techniques in activities which included; testing for high cholesterol, fluorescence microscopy, restriction endonuclease digest of bacterial DNA, detecting worm infection by dissection of mouse intestines, building a model knee joint and analysing 'blood' and 'urine' samples to detect diabetes.
Quotes received from visitors were extremely positive:

"It was informative and showed you more than an Open Day would."

"Really enjoyed talking to experts and finding out about their careers as that's what I really wanted to know."

Pupils also had the opportunity to look around the University and chat with student ambassadors to get a feel for life as a science undergraduate.

Faculty Podcast



Launched in September 2011, the Life Sciences Podcast provides fortnightly updates of the most recent and exciting biological discoveries from the world of life sciences. Written, presented and recorded by Dr Ceri Harrop and Greg Counsell, and edited by Prof Matthew Cobb, the podcast includes content and comment from research and researchers across the Faculty, as well as the ever-popular and entertaining Voxpop: asking members of the public their views on a whole host of topics from eyebrows to yawning!

The podcast is available at: *www.ls.manchester.ac.uk/schoolsandcommunity/newsandevents/podcast*

www.ls.manchester.ac.uk/schoolsandcommunity

For more information, including individual staff profiles (research interests, publications, PhD projects, contact details), visit our website

General enquiries

Dr Ann Fretwell
Head of Faculty Research Business Support
Faculty of Life Sciences
The University of Manchester
1.21 Simon Building
Brunswick Street
Manchester
M13 9PL
Tel +44 (0)161 275 1407

Research

Professor Cay Kielty (B)
Associate Dean for Research
Faculty of Life Sciences
The University of Manchester
Michael Smith Building
Oxford Road
Manchester
M13 9PT
Tel +44 (0)161 275 5739
cay.kielty@manchester.ac.uk

Business Development

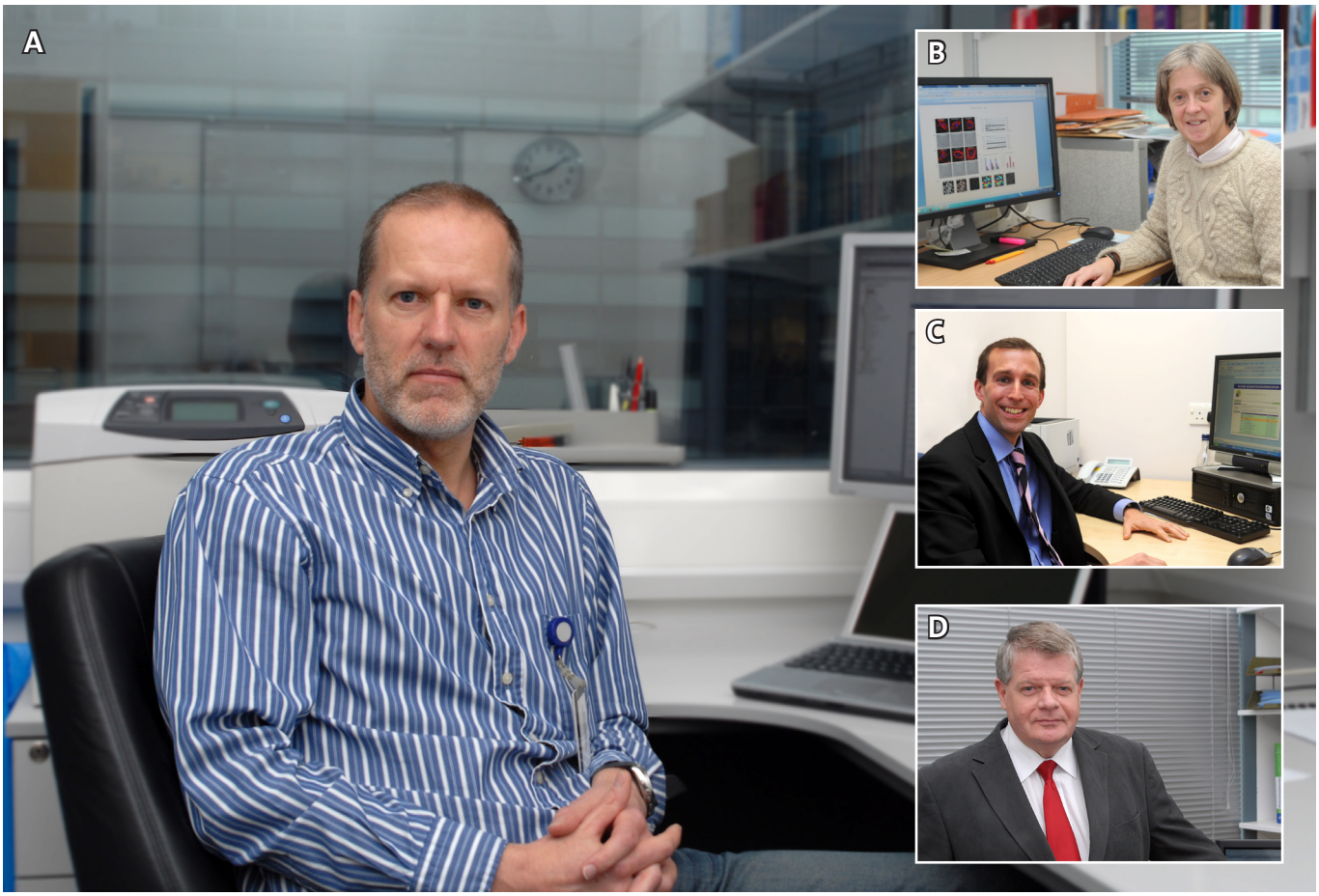
Professor Ian Kimber (D)
Associate Dean for Business Development
Faculty of Life Sciences
The University of Manchester
Michael Smith Building
Oxford Road
Manchester
M13 9PT
Tel +44 (0)161 275 1587
ian.kimber@manchester.ac.uk

Vice-President and Dean

Professor Martin Humphries (A)
Faculty of Life Sciences
The University of Manchester
Michael Smith Building
Oxford Road
Manchester
M13 9PT
Tel +44 (0)161 275 5777
martin.humphries@manchester.ac.uk

Administration

Dr Simon Merrywest (C)
Head of Faculty Administration
Faculty of Life Sciences
The University of Manchester
Carys Bannister Building
Brunswick Street
Manchester
M13 9PL
Tel +44 (0)161 275 1573
simon.merrywest@manchester.ac.uk



www.manchester.ac.uk/lifesciences

The annual Science-based art competition is commissioned in the Faculty of Life Sciences by Professor Charles Streuli and funded by Carl Zeiss Ltd. Previous finalists are shown here.

A - Robin Beaven
A neuronal growth cone sets out on its journey

B - Federico Dajas-Bailador
Cortical neurons grown in microfluidic chambers which functionally separate the axons and cell bodies

C - Nigel Hammond
Fluorescent images with neon effect showing successive proliferation within the bulb of a hair follicle

D - Neil Humphreys
Pronuclear microinjection of 4 hour old mammalian IVF embryos

E - Nicholas Johnson
***In vitro* translation of preprocecropin A and Cytochrome b5 using reticulocyte lysate and S35 methionine in the presence of pancreatic microsomes**

F - Annick Sawala
Early Drosophila embryo stained for phospho-Mad (stripe along dorsal midline), ftz-driven beta-Galactosidase transgene (seven stripes) and DNA

G - Kelly Hayes
Histological section of a mammalian caecum showing a *Trichuris muris* worm in the lumen of the gut

H - Siwei Zhang
Confocal image of a transgenic *Xenopus laevis* tadpole showing the expression of fluorescent proteins driven by tissue specific promoters

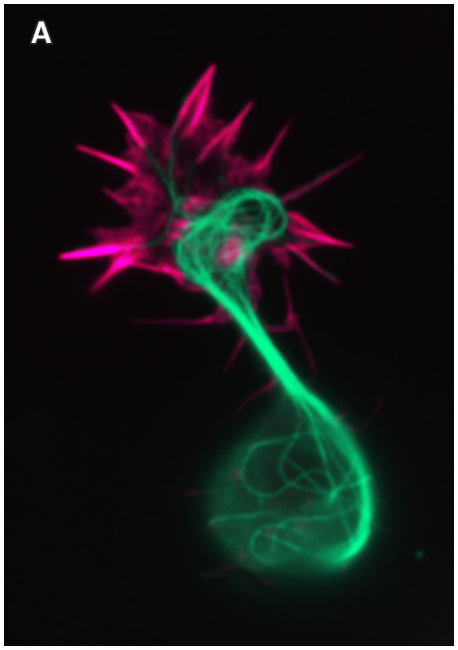
I - Natalia Sanchez-Soriano
Drosophila cell in culture in which the organisation of the microtubule cytoskeleton can be viewed

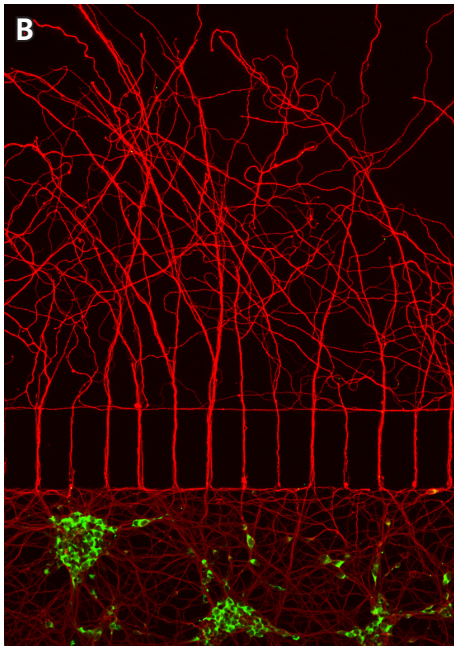
Front Cover Images

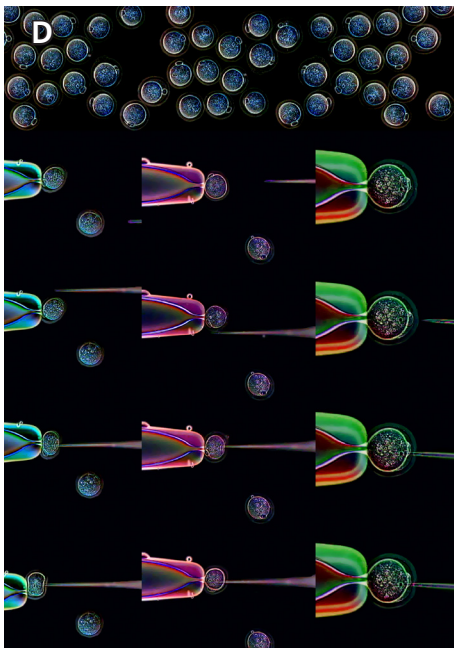
Main Image - Joanna Williams:
Immunofluorescent staining of a pre-ovulatory murine ovarian follicle

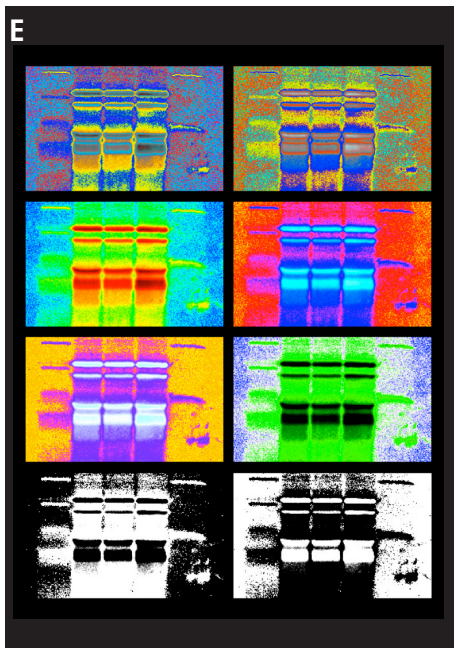
Top Right - Johan Oldekop & Richard Preziosi:
Adiantum sp. fern from Sumaco National Park in Ecuadorian Amazonia

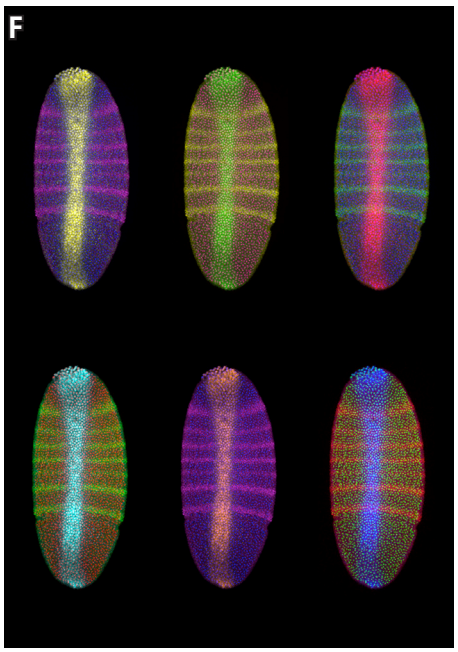
Bottom Right - Charlotte Allen & Toby Starborg:
Transmigrated neutrophil alongside neuronal processes

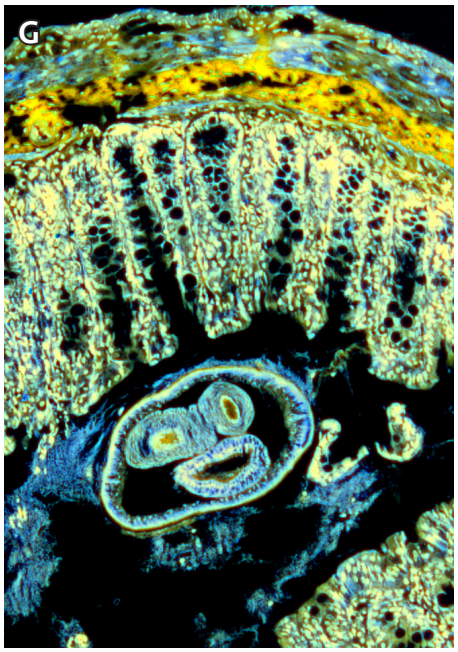


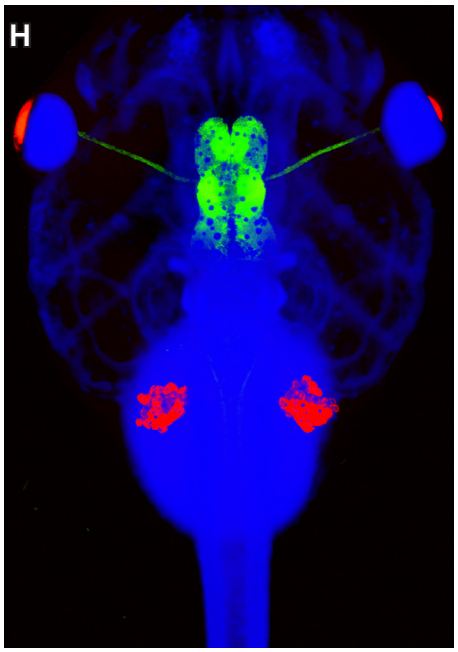


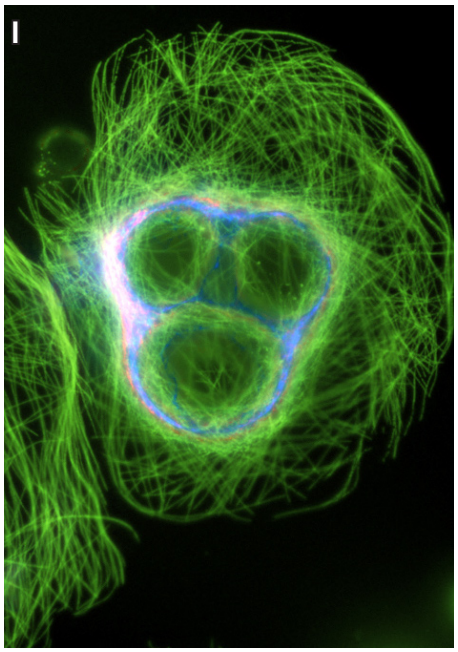












Science-based Art Competition

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

Royal Charter Number: RC000797