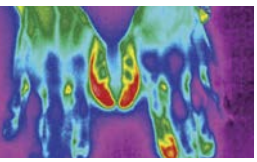
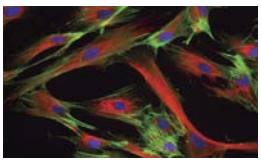
MANCHESTER 1824
The University of Manchester

Faculty of Medical and Human Sciences








Institute of Inflammation and Repair

Prospectus 2014

“Declare the past, diagnose the present, foretell the future.”

Hippocrates

Contents

Dean's introduction

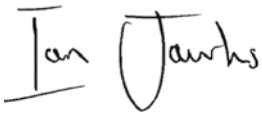
I am delighted to introduce the 2014 Prospectus for the Institute of Inflammation and Repair (IIR), part of the Faculty of Medical and Human Sciences (FMHS) at The University of Manchester.

Our Faculty has now implemented a new strategy and structure which are intended to transform our contribution to research and education in medicine and health. We aim to build on the reputation of Manchester as a world-leading centre for biomedical sciences and their clinical application.

The Faculty and the Institute of Inflammation and Repair are committed to achieving excellence through an ethos of collegiate and collaborative working involving all our Faculty Schools and Institutes. We also cultivate the highest quality interactions with other University of Manchester Faculties, our NHS partners via MAHSC (Manchester Academic Health Science Centre) and our broader higher education and NHS partners in the new GM-AHSN (Greater Manchester Academic Health Science Network).

Importantly, the Institute of Inflammation and Repair is part of a matrix structure (Figure 1) which is designed to break down barriers and encourage cross-cutting interactions with staff in other Schools and Institutes. Staff are encouraged to affiliate to other Faculty structures and a high level of interaction is being achieved as illustrated in Figure 2. This type of cross-linking is crucial to achieving the full benefits for education and research across our unusual breadth of health disciplines.

This document provides an overview of the Institute of Inflammation and Repair in 2014 and is a work in progress. In the near future the Institute will host a visit by an international external advisory panel to help guide further developments. The Institute already has a set of truly outstanding achievements and excellent staff but we have a lot more to do to achieve our ambitious objectives. I am grateful to all academic and support staff in the Institute for their contribution to its success to date and to the development of further plans.



Ian Jacobs
Dean, Faculty of Medical and Human Sciences
Vice President, The University of Manchester
Director of Manchester Academic Health Science Centre
Professor of Cancer and Women's Health

Faculty of Medical and Human Sciences Structure

Matrix of six Faculty Institutes and five Faculty Schools intended to facilitate cross cutting interactions

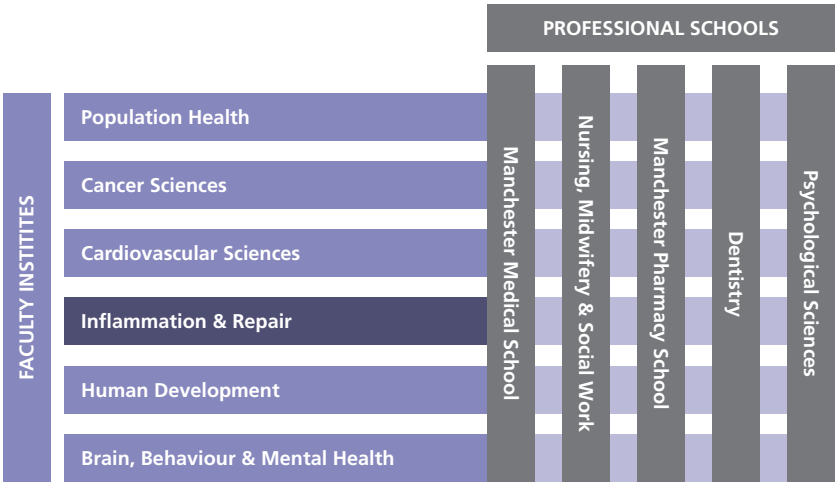


Figure 1

Faculty Structure – matrix of six Faculty Institutes and five Faculty Schools intended to facilitate cross-cutting interactions.

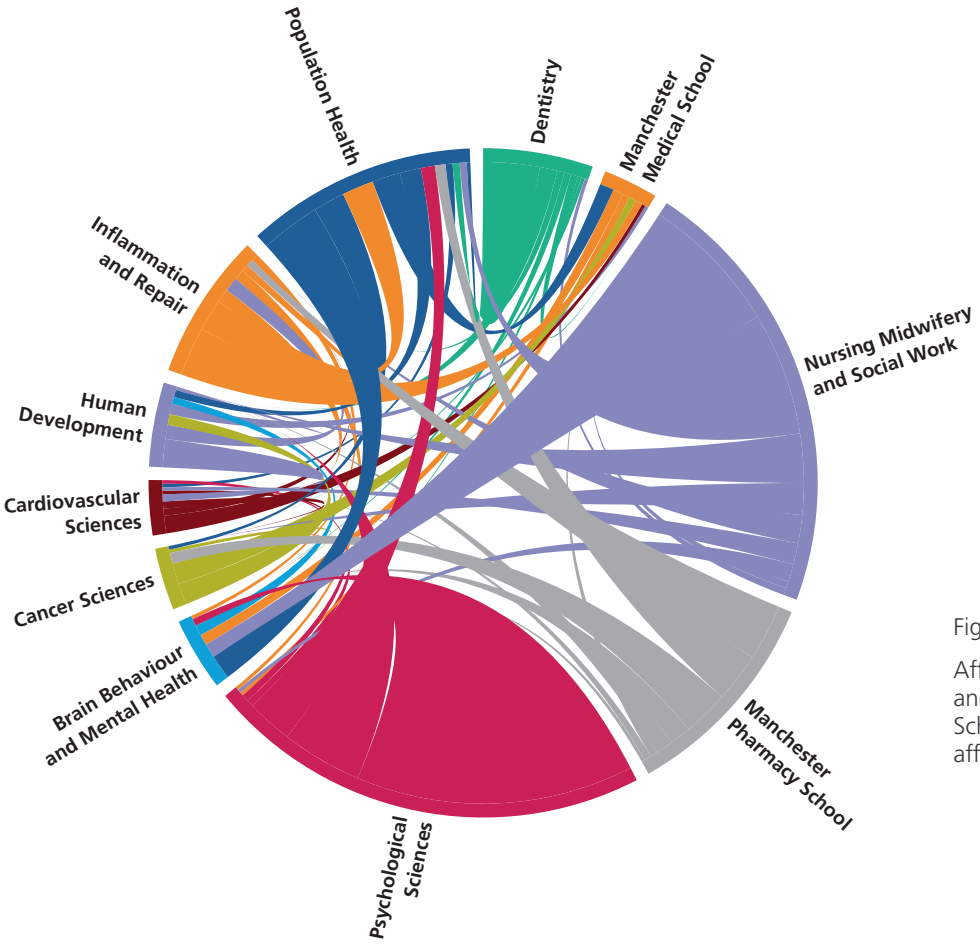


Figure 2

Affiliations across Faculty Schools and Institutes (showing the School/Institute providing the affiliation)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The University and Faculty

Our Academic and Support staff in the Faculty of Medical and Human Sciences (FMHS) number over 2,000 and work to deliver three core priorities:

- Development and delivery of the highest quality education and training for health professionals and scientists
- conducting outstanding, world-leading research in the biomedical and health sciences
- social responsibility to make a contribution to the 'greater good'.

Our University has a tradition of world-leading innovation which has led to a stepwise improvement in the health, wealth and wellbeing of populations across the world since the industrial revolution. Sitting at the heart of the City of Manchester, which is a global hub, excelling in arts, music, sport and commerce, the University is a beacon for research and education with a deep commitment to the economic transformation of Manchester and the North West of England. Tracing its origins back to John Dalton's Mechanic's Institute and John Owen's philanthropic desire to educate the local population, The University of Manchester was England's first 'civic' and now its largest campus-based university. No fewer than 25 Nobel Laureates have worked at the University and since the merger of the Victoria University of Manchester with UMIST in 2004 we have delivered in excess of 1,600 invention disclosures and formed 17 new companies attracting £117 million in third party benefit, demonstrating a formidable track record of commercialisation.

Each year we train over 400 doctors, 90 dentists, 150 pharmacists and 900 nurses, midwives and allied health professional staff. We are the largest supplier of healthcare graduates to the NHS within the North West of England but many of our graduates go on to deliver healthcare provision and scholarship in developed and developing health systems across the globe. Through the use of cutting edge technology, the highest quality workplace-learning environments and a highly trained educational faculty, we strive to deliver a personalised learning experience to each of our students so that they develop a real sense of identity and belonging to a world-class university. This in turn fully prepares them for life after graduation making the 'Manchester-made' graduate the first choice for healthcare employers. Our extensive postgraduate and continuing professional development programmes are hosted by our new Faculty Graduate School providing support and training to postgraduates undertaking a diverse range of study from short term professionally linked programmes through to research training in multidisciplinary areas. We believe that we are a complete resource for lifelong healthcare learning.

The scale, breadth and structure of our Faculty provide outstanding opportunities for basic biomedical research discoveries to be rapidly translated into effective new therapies with a strong emphasis on knowledge transfer and partnerships with industry. Our new matrix structure is designed to enhance opportunities for novel and multidisciplinary research (see figure 1 on page 4). The matrix involves five schools (Medicine, Dentistry, Pharmacy, Psychological Sciences and Nursing, Midwifery & Social Work) and six research institutes (Cancer Sciences, Cardiovascular Sciences, Population Health, Brain, Behaviour & Mental Health, Human Development, Inflammation & Repair) with an emphasis on affiliation across these structures. The leadership team for each of the Institutes involves clinicians, basic scientists and healthcare researchers from both our own Faculty and our sister Faculty of Life Sciences. Our academics have the benefit of access to the large, stable population in the North West providing unique opportunities to study and address most causes of disease and deprivation. The opportunities are further enhanced by strong links to our partner Faculties (Humanities, Engineering, Physical Sciences, and Life Sciences) and the NHS through the Manchester Academic Health Science Centre (MAHSC). These partnerships facilitate rapid translation into practice and targeted biomedical, technological and psychosocial research based on clinical need.

In addition to our research and education activity, the Faculty is committed to make a major contribution to the greater good for society by contributing to solutions of the major challenges of the 21st century and the social and economic success of our local, national and global communities. We will ensure that social responsibility is embedded within all of our education and research activities, ensuring the highest ethical standards of professional practice from our staff and students. We are committed to equality and diversity in all our activities and to building on successful programmes such as the Manchester Access Programme which targets talented students from underrepresented backgrounds and a wide ranging global health programme which will help deliver sustainable capacity building within the health systems of developing economies.

Whether you are a visitor or a prospective student, staff member or collaborator, we hope that you will be engaged by the enthusiasm and vibrancy of our students and staff, our commitment to improving health and quality of life and the diversity of opportunity in research, and education that our Faculty has to offer.


Visitors Centre

Introduction to the Institute of Inflammation and Repair

Translating cutting edge research to benefit patients

Professor Jane Worthington

Institute Director
Professor of Chronic Disease Genetics

Professor Chris Griffiths

Deputy Director, Professor of Dermatology

Centre Leads and Deputies

The Centre for Musculoskeletal Research

Lead: Professor Anne Barton
anne.barton@manchester.ac.uk

Deputy: Professor Wendy Thomson
wendy.thomson@manchester.ac.uk

The Centre for Respiratory Medicine and Allergy

Lead: Professor Angela Simpson
angela.simpson@manchester.ac.uk

Deputy: Dr Elaine Bignell
elaine.bignell@manchester.ac.uk

The Centre for Dermatology Research

Lead: Professor Chris Griffiths
christopher.griffiths@manchester.ac.uk

Deputy: Professor Ralf Paus
ralf.paus@manchester.ac.uk

The Centre for Gastrointestinal Sciences

Lead: Professor Shaheen Hamdy
shaheen.hamdy@manchester.ac.uk

Deputy: Professor John McLaughlin
john.mclaughlin@manchester.ac.uk

The Centre for Tissue Injury and Repair

Lead: Professor Judith Hoyland
judith.hoyland@manchester.ac.uk

Deputy: Professor Tony Freemont
tony.freemont@manchester.ac.uk

The Manchester Collaborative Centre for Inflammation Research

Lead: Professor Tracy Hussell
tracy.hussell@manchester.ac.uk

Deputy: Professor Dan Davis
daniel.davis@manchester.ac.uk

The Institute of Inflammation and Repair (IIR) is a large organisation with over 350 staff including 36 Professors and a budget of over £35 million per annum. It comprises six Centres, four of which carry out research in the clinical specialty areas of musculoskeletal, dermatology, gastrointestinal sciences and respiratory medicine and allergy, while the other two Centres are engaged in research in the cross-cutting themes of inflammation and tissue injury and repair.

The Senior Management Team (SMT) – comprising the Institute Director, six Centre Leads, Head of Administration, Senior Operations Manager, Leads for undergraduate and postgraduate teaching and postgraduate research and Leads for Health and Safety, Business Engagement and Social Responsibility – is responsible for development and delivery of the Institute strategy. The SMT meets monthly and is also attended by representatives from Faculty Finance, Human Resources, the Research Deanery and by the Faculty of Life Sciences (FLS) liaison person, as required. Each Centre has a management team that includes both academic and professional support services staff that meets regularly. In addition, all staff have the opportunity to attend Institute Board meetings three times each year.

Our aim is to deliver internationally leading research focused on translating breakthroughs in basic science through to improved treatment of patients with inflammatory diseases such as arthritis, psoriasis, asthma and many more.

To achieve this we use a multi-disciplinary, collaborative approach, which is supported by over £18 million funding from multiple sources including research councils, charities, NIHR, the European Union and industry. Much of our research is carried out in partnership with scientists in the Faculty of Life Sciences and with clinical colleagues within Manchester Academic Health Science Centre (MAHSC). Importantly, it often also involves national and international collaborations.

“We aim to be a world-leading centre, translating cutting edge scientific research in inflammation and repair into improved treatment for patients with chronic disabling diseases such as arthritis, psoriasis, asthma and many more.”

Professor Jane Worthington

The Institute is closely aligned with the MAHSC Domain of Inflammation and Repair led by Mike Deegan, Chief Executive of Central Manchester University Hospitals NHS Foundation Trust, with support from Professor Philip Turner, Domain Clinical Lead and Head of the School of Surgery at the North Western Deanery, and myself as Domain Academic Lead. The IIR Domain fully reflects the partnerships in MAHSC with staff based at three hospital sites: the University Hospital South Manchester, Salford Royal and Central Manchester, as well as on the University main campus.

We are particularly proud of our recently-launched Manchester Collaborative Centre for Inflammation Research (MCCIR), established with the support of £15 million funding from The University of Manchester, GlaxoSmithKline and AstraZeneca. In this unique venture, industry and academia work together in a pre-competitive environment to exploit blue-skies research to identify novel targets for the development of new therapies. This ‘Discovery to Care’ pathway is underpinned by the NIHR/Wellcome Trust Central Manchester Clinical Research Facility, NIHR/Wellcome Trust Clinical Research Facility at the University Hospital of South Manchester and the NIHR Manchester Musculoskeletal Biomedical Research Unit.

Academics within the Institute recognise the importance of contributing to the training of the next generation of researchers and healthcare professionals. We achieve this through delivery of teaching on both undergraduate and postgraduate Masters courses and through the training and supervision of over 150 postgraduate research students.

Professor Jane Worthington

Links

www.inflammation-repair.manchester.ac.uk/

- Manchester Academic Health Science Centre
  www.mahsc.ac.uk
- Central Manchester University Hospitals NHS Foundation Trust
  www.cmft.nhs.uk
- University Hospital of South Manchester NHS Foundation Trust
  www.uhsm.nhs.uk
- Salford Royal NHS Foundation Trust
  www.srft.nhs.uk
- NIHR/Wellcome Trust Clinical Research Facility UHSM
  www.uhsm.nhs.uk/racrf
- NIHR/Wellcome Trust Clinical Research Facility CMFT
  www.wtcrf.nhs.uk

Institute Senior Management Team

As well as our Director and Centre Leads, we have a world class management team leading the way

Athena Swan Champion
Professor Deborah Symmons

EU Champions
Professor Clare Mills
Professor Jane Worthington

Head of School Administration
Dr Alison Howorth

Senior Operations Manager
Cheryl Holmes

Postgraduate Taught Lead
Dr Philip Padfield

Postgraduate Research Director
Dr Catherine O’Neill

Undergraduate Teaching Lead
Dr Paul Dark

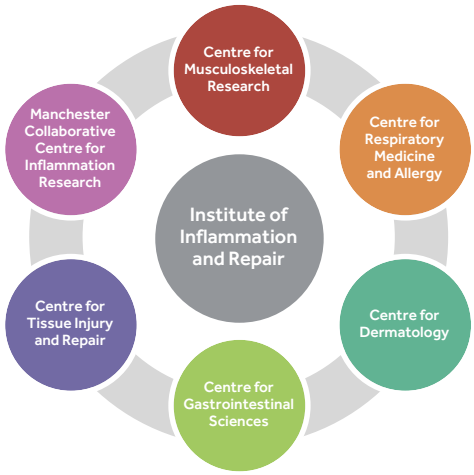
Research Excellence Framework Lead
Professor Shaheen Hamdy

Social Responsibility Lead
Professor Wendy Thomson

Business Engagement Lead
Dr Catherine O’Neill

Finance Manager
Rachael O’Grady

Health and Safety
Rachel Watson



Institute of Inflammation and Repair

Centre for Dermatology Research

Centre for Respiratory Medicine and Allergy

Centre for Musculoskeletal Research

Manchester Collaborative Centre for Inflammation Research

Centre for Tissue Injury and Repair

Centre for Gastrointestinal Sciences

Our Resources

The IIR occupies over 7000 square metres on the main campus in the Stopford Building and the Core Technology Facility. The University is undergoing a major building programme, including a new £300 million Medical School. We will bring the IIR into closer co-location as these developments take place in the next five years. The Institute has its clinical translational facilities on all three major Trust sites (Central Manchester University Hospitals NHS Foundation Trust, Salford Royal NHS Foundation Trust and University Hospital of South Manchester NHS Foundation Trust).

Our Administrative Team

The Head of Administration, Alison Howorth, is supported by a core senior team: Cheryl Holmes (Senior Operations Manager), Alex Sadler (UHSM,) and Sue Whiteside (Main Campus and Salford Royal) in addition to over 90 clerical, secretarial, technical, administrative and IT staff. All Professional Support Services staff participate in an annual Performance and Development Review, where training and development needs are identified and acted upon.

Our Academic Staff

There are over 260 academic staff within the IIR's six Centres who are actively involved in research and/or teaching. We place a strong emphasis on high quality performance and career development, both underpinned by implementation of the University's Performance and Enhancement Scheme. In addition, we offer a wide spectrum of in-house training opportunities, ranging from weekly or monthly journal clubs and seminars, to joint sessions with scientists in the Faculty of Life Sciences. Staff are encouraged to take advantage of University of Manchester training opportunities such as the New Academics Programme for newly-appointed academic staff and the Headstart programme for potential senior managers. Where appropriate, members of staff are encouraged to attend and disseminate research findings at national and international conferences.

The Institute's NHS Partnerships

Progress through collaboration

We have a strong relationship with the three major NHS Trusts, to deliver the MAHSC Experimental Medicine Strategy and to ensure that scientific research is translated directly into patient benefit. The Dean of the Faculty of Medical and Human Sciences, Professor Ian Jacobs, is Director of MAHSC, thus ensuring close relationships across the partner Trusts and the University.

MAHSC is a partnership between The University of Manchester and six NHS organisations. These include some of the most highly rated NHS Trusts in the country:

- Central Manchester University Hospitals NHS Foundation Trust
- Manchester Mental Health and Social Care Trust
- Salford CCG (formerly NHS Salford) as lead representative for GM CCGs
- Salford Royal NHS Foundation Trust
- The Christie NHS Foundation Trust
- University Hospital of South Manchester NHS Foundation Trust.

MAHSC is the only Academic Health Science Centre accredited by the Department of Health outside the South East. The Faculty's strong relationships with these outstanding NHS partners are critical in achieving our mission of facilitating excellent education, research and activities, building our links with the local community and demonstrating our commitment to social responsibility.

MAHSC provides unprecedented opportunities to carry out research and education that will have a far-reaching impact on clinical care. In this way we are able to contribute positively to the social, economic and health needs of the Greater Manchester region.

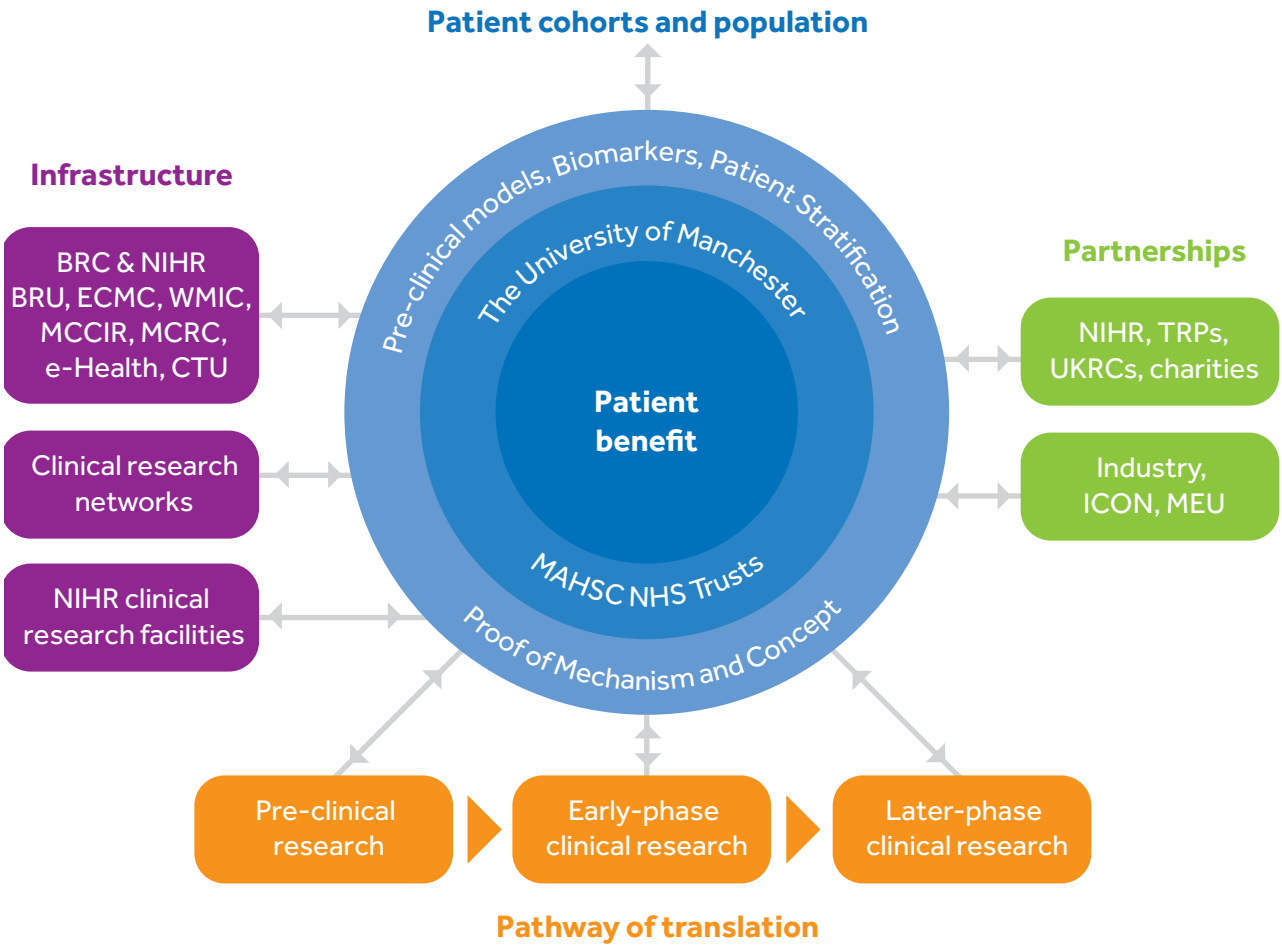
The MAHSC strategy is distinct from, but symbiotic with, that of the Faculty. The relationship is characterised by:

- alignment of the Faculty research priorities with MAHSC sections
- co-operative and collaborative working on a range of cross-cutting initiatives including fundraising, conference programmes, the Research Office and the 'Grand Challenge' themes
- integrated planning of undergraduate, postgraduate and continuing professional education across the Faculty and MAHSC
- expansion of interactions with other AHSCs both in the UK and overseas.

University Hospital of South Manchester NHS Foundation Trust

Central Manchester University Hospitals NHS Foundation Trust

The MAHSC Experimental Medicine System



Salford Royal NHS Foundation Trust

University Hospital of South Manchester NHS Foundation Trust

The Centre for Respiratory Medicine and Allergy is linked to the NIHR Respiratory and Allergy CRF, the NW Lung Research Centre and the new NIHR Clinical Research Building.

Central Manchester University Hospitals NHS Foundation Trust

The Centre for Musculoskeletal Research is linked to the NIHR Biomedical Research Unit and to the NIHR-supported Wellcome Trust Clinical Research Facility (CRF).

Salford Royal NHS Foundation Trust

The Greater Manchester Dermatology Centre will occupy newly-constructed space in 2019. This will bring together in one building the clinical service and clinical research components. The recent refurbishment and expansion of the Dermatopharmacology Unit provides clinical research infrastructure for funded programmes on psoriasis and ageing and complements the facilities of the photobiology research unit.

Our Centres at a glance

The Centre for Musculoskeletal Research

Treating arthritis 'right first time'

Since the establishment of the world's first centre for the study of chronic rheumatism at The Manchester Royal Infirmary in 1945, researchers in Manchester have been at the forefront of research on musculoskeletal diseases. Today the Centre for Musculoskeletal Research (CfMR) is an internationally recognised group of over 130 staff, working on a wide range of projects across many aspects of all the major musculoskeletal conditions.

Ten professors, all international leaders in their fields, direct research programmes ranging from basic laboratory-based science, through experimental medicine and onto clinical trials and implementation with the ultimate aim of delivering benefit to patients.

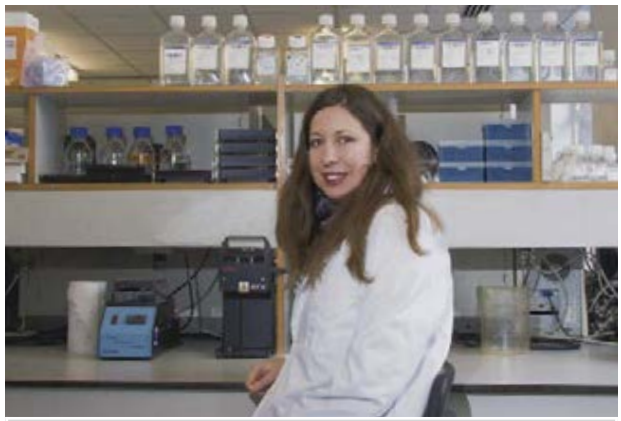
Research is carried out on all the major musculoskeletal diseases affecting people across the lifespan. These include juvenile idiopathic arthritis (JIA), rheumatoid arthritis (RA), the most common form of inflammatory arthritis and osteoarthritis (OA), the most common musculoskeletal condition affecting eight million people in the UK.

The keys to our success are our strong team ethic coupled with the breadth of expertise of our researchers; nine of our Principal Investigators (PIs) are clinical rheumatologists while others are scientists, statisticians, bioinformaticians, study-co-ordinators, nurses and physiotherapists.

The importance and quality of our research is reflected in the publication of approximately 100 journal articles per year and a track record of attracting income from all the major funders, including the Medical Research Council (MRC), National Institute for Health Research (NIHR), Arthritis Research UK, the Wellcome Trust, the European Union and a number of pharmaceutical companies.

Members of the group take active roles in national and international consortia as well as being highly committed to teaching, research and non-research activities at The University of Manchester, contributing to:

- the Joint and Related Inflammatory Disease Translational Research Partnership
- NIHR/Wellcome Manchester Clinical Research Facility
- the Athena Swan initiative
- University Clinical Trials Management Group
- MIMIT and MAHSC Health Technology
- UKCRN national speciality for musculoskeletal conditions.



Professor Anne Barton
Centre Lead, Professor of Rheumatology

Research Leads

Rheumatoid Arthritis Genetics
Professor Jane Worthington and Dr Stephen Eyre

Psoriatic Arthritis and Treatment Response
Professor Anne Barton

Connective Tissue Diseases
Professor Ian Bruce

Systemic Sclerosis
Professor Ariane Herrick

Osteoporosis and Osteoarthritis
Professor Terry O'Neill

Inflammatory Arthritis in Children
Professor Wendy Thomson and Dr Kimme Hyrich

Musculoskeletal Rehabilitation
Professor Jackie Oldham

Clinical Epidemiology
Professor Deborah Symmons and Dr Suzanne Verstappen

Pharmacoepidemiology
Dr Kimme Hyrich and Dr Will Dixon

eHealth
Dr Will Dixon

Osteoarthritis
Professor David Felson

Bioinformatics and statistics
Professor Soumya Raychaudhuri and Dr Mark Lunt

The remainder of the group is composed of seven clinical research fellows, nine post-doctoral scientists, 30 postgraduate students and eight affiliated senior investigators. A large team of over 75 staff provides infrastructure services including laboratory, database, computing and information services, study co-ordination and management. Our administration is provided by a research support manager and a team of clerical staff.

Organisation and Expertise

Three major funding awards underpin our research, providing support for key areas of shared infrastructure: The Arthritis Research UK Centre of Epidemiology, The Arthritis Research UK Centre for Genetics and Genomics and the NIHR Manchester Musculoskeletal Biomedical Research Unit (BRU).

Our Research

Arthritis Research UK Centre of Excellence for Epidemiology

Director: Professor Deborah Symmons

Our work on prospective cohorts for inflammatory arthritis (Symmons, Bruce, Verstappen) and JIA (Thomson, Hyrich) is unique. The Norfolk Arthritis Register (NOAR), a prospective primary care-based cohort of cases with early inflammatory arthritis, was established over 20 years ago and has provided invaluable information about cardiovascular risk in RA, effects of changing trends for treatment or classification of RA and risk factors for RA including diet, smoking, immunisations and pregnancy history.

The Children's Arthritis Prospective Study (CAPS) is a more recent study that is just beginning to analyse outcome data from children followed for over five years (Thomson, Hyrich). It is a flagship study for Arthritis Research UK. Our work on the Biologics Registers for RA is world-leading (Symmons, Hyrich, Dixon) and has led to many high-profile publications that have also informed NICE guidelines for the prescribing of biologic therapies (TA130 and TA195) and European guidelines for the establishment, analysis and reporting of register data (Dixon).

Similar registers around the world have been modelled on the BSR Biologics Register for RA and other diseases e.g. JIA (BCRD and BSPAR Etanercept register), psoriasis (BADBIR) and systemic lupus erythematosus (SLE) (BILAG-BR).

We are increasingly focusing on accessing and improving the quality of data available from routine clinical practice for our research led by Will Dixon and in collaboration with Iain Buchan and the Health eResearch Centre.

Arthritis Research UK Centre of Excellence in Genetics and Genomics

Director: Professor Jane Worthington

We are established international leaders in research on genetic epidemiology of RA (Worthington, Eyre, Barton), JIA (Thomson) and psoriatic arthritis (PsA) (Barton) and have a growing interest in myositis led by Hector Chinoy, who chairs the European Myositis Network (EuMyoNet).

We lead national and international consortia which have recently co-ordinated major studies to identify and fine-map risk loci for auto-immune diseases. For both RA and JIA this research has dramatically increased our knowledge of the genetic basis of these diseases (Eyre et al Nat Genet 2012 and Hinks et al Nat Genet 2013). It will form the basis of our future work to better understand the disease mechanisms and to use our knowledge of genetics to inform risk prediction for these conditions.

For all three diseases we are carrying out research to identify genetic, epigenetic, biomarkers profiles that can predict treatment response and long-term prognosis in a clinical setting.

Research on Osteoarthritis (OA) in Manchester (ROAM)

Principal Investigators: Felson and O'Neill

The research in this area focuses on developing improved imaging-based approaches to assess the efficacy of conservative approaches to treatment of knee OA. Our aim is to reduce the need for surgical intervention and to cut the timeframe for the evaluation of new treatments from years to months.

Currently three trials for knee OA are being evaluated: a novel knee brace, shoe insoles and intra-articular steroid injections. A fourth trial is evaluating the effectiveness of hydroxychloroquine for hand OA.

NIHR Manchester Musculoskeletal Biomedical Research Unit

Principal Investigator: Professor Deborah Symmons

Established in April 2012 as a partnership between the CfMR at The University of Manchester and The Central Manchester Universities, this is one of only three musculoskeletal Biomedical Research Units in the UK. An investment of £6.3 million supports 22 projects across seven research areas, all working towards our aim of treating arthritis 'right first time'.

Systemic Sclerosis

Principal Investigator: Herrick

We have an interdisciplinary team based at The University of Manchester and Salford Royal NHS Foundation Trust with an active programme of clinical and scientific research investigating the pathophysiology, epidemiology, measurement and treatment of systemic sclerosis and Raynaud's phenomenon.

Research Highlights

- American College of Rheumatology 2012: Plenary presentation by Kimme Hyrich and eight additional oral presentations by members of the CfMR. Two of our publications were selected for the Year in Review.
- European League against Arthritis (EULAR) 2012: Six out of seven of the oral presentations in the genetics session were by members of CfMR. C Scire won Best Abstract Prize and two Young Investigator Awards for visiting international fellows.
- British Society for Rheumatology 2012: K Hyrich won the Michael Mason prize and Liz Camacho won the Garrod prize.
- In the last five years four articles led by Manchester and over 20 more with Centre PIs as authors, have been published in Nature Genetics.
- MRC/Arthritis Research UK stratified medicine initiative: funding awarded to MATURA (Maximising therapeutic utility in RA); £5.9 million, co-lead A Barton.
- Arthritis Research UK Clinical Trial (Trial of Rituximab for Refractory Extra-Renal SLE [TREES]) (IB) final total £1.1 million.
- NW England MRC Clinical Research Training Fellowship Programme in Clinical Pharmacology and Therapeutics: four Rheumatology Trainees are enrolled in the programme to expand clinical pharmacology manpower capacity in the UK.
- Awards of two Centres of Excellence by Arthritis Research UK: Centre for Genetics and Genomics and Centre for Clinical Epidemiology (£2.5 million each).

Impact and Importance

- British Society for Rheumatology Biologics Registry for Rheumatoid Arthritis, established and run in the CfMR, has provided vital data on 'real-world' effectiveness and safety of this class of drugs. Crucially, it has reversed guidance that women should cease anti-TNF therapies before trying to conceive.
- The Norfolk Arthritis Register (NOAR). Since 1990, the NOAR, led by D Symmons, has recruited and followed over 3,700 patients, making this the largest international cohort of patients with IP under continuous follow-up. The availability of long-term outcome data, meticulously collected and collated, coupled with biological samples, means that NOAR is uniquely placed to address vitally important clinical and scientific questions related to IP and rheumatoid arthritis (RA). Widely-cited data from over 90 peer-reviewed publications, some incorporated into NICE guidance, cover the incidence, prevalence and mortality of RA in the UK, information on genetic and environmental risk factors for the onset of IP, and key insights into the long-term outcome of IP in terms of disability and co-morbidity.
- The Steroids in Very Early Arthritis (STIVEA) trial was a randomised, double blind, placebo-controlled multicentre trial examining the effect of intramuscular (IM) glucocorticoids in patients with very early IP. This study showed that treatment with IM methylprednisolone, early in the course of the disease, postponed the need for disease modifying anti-rheumatic drugs in patients with IP from progressing into RA.
- Our studies have contributed to the development of guidelines for a strategy for risk factor management in SLE patients (Rheumatology 2004; 43:7-12). We have developed a patient-held shared care booklet focusing on the prevention of long-term complications (Primary Health Care 2010; 20:24-5).

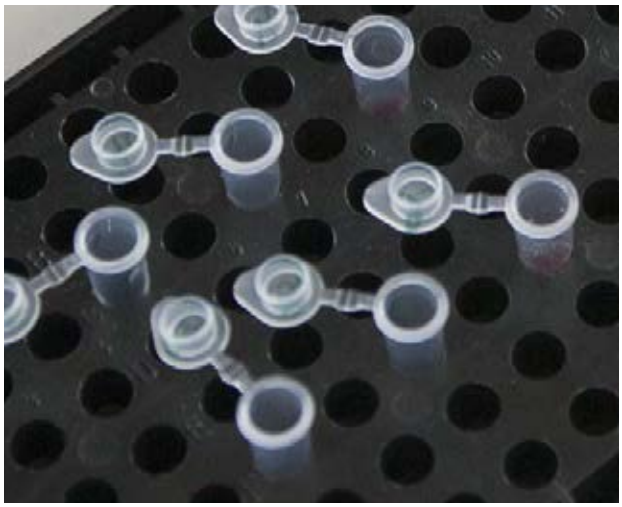
> *"All our research within the Centre for Musculoskeletal Research has the ultimate aim of achieving improvements in the quality of life of patients living with musculoskeletal conditions. Our work is already making a difference but our aim, over the next five years, is to accelerate this impact by better understanding the causes, consequences and treatment of these diseases."*

Professor Anne Barton

Vision for the Future

Our vision is to be the largest, most comprehensive and most productive centre for musculoskeletal science research in the UK by 2020. We aim to carry out research ranging from basic/discovery science (genetics/epidemiology/FLS), to experimental medicine (MCCIR/BRC), clinical trials, technology innovation and implementation and applied research.

To achieve our aims we will expand our work in existing areas of expertise (genetics and modern epidemiology for inflammatory arthritides) and in additional research areas such as imaging and stem cell research. We will also expand our experimental medicine capacity and capability in Phase 0-2b studies and trials.



Five year Strategic Goals

- Ensure a successful BRU and expansion towards a musculoskeletal BRC application for 2016.
- Translate our findings from genetic studies of susceptibility into drug development (re-positioning of existing drug or a drug that failed development or development of a novel therapy).
- Translate genetic studies of susceptibility to develop risk prediction models, including known environmental risk factors, as a prelude to testing preventative strategies in high-risk groups.
- Develop a stratified medicine approach to the treatment of inflammatory arthritis; developing a test/algorithm so that patients receive the drug they are most likely to respond to early in the disease process to prevent long-term disability.
- Develop outcome measures for Raynaud's phenomenon/systemic sclerosis-related digital vasculopathy.
- Improve pain reporting in childhood arthritis by developing a patient reported outcome measure (PROM) for paediatric pain using e-health technologies.
- Establish a national register of patients at high risk of developing RA.
- Maintain our established and ongoing trial of anti-CD20 in SLE.

The Centre for Respiratory Medicine and Allergy

Delivering new treatments to benefit the nation's health

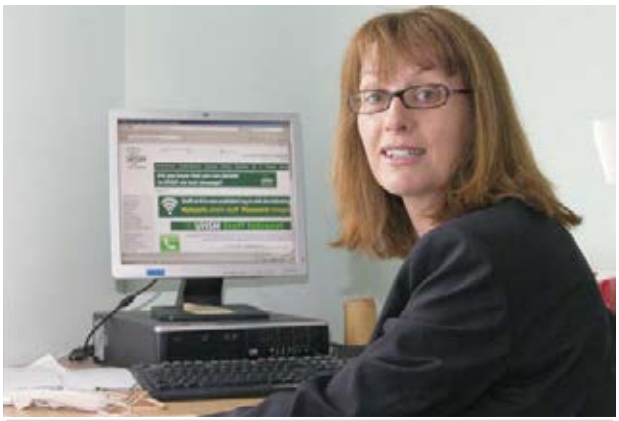
The Centre for Respiratory Medicine and Allergy has more than 170 staff and 40 postgraduate students, mostly based at the University Hospital of South Manchester (UHSM), with staff also working in the Core Technology Facility, Stopford Building and MIB. UHSM is an NHS Foundation Trust serving a local population of 350,000 which has a high burden of lung disease. Originally built as the Baguley Sanatorium in 1902, it became a tuberculosis sanatorium by 1912. Although services available at the site have expanded exponentially over the last 100 years, there has always remained a strong emphasis on treatment of and research into the causes of respiratory disease.

Eleven professors now lead research programmes across seven major themes; our work spans laboratory-based basic science through to experimental medicine and clinical trials in patients to ensure that discoveries are translated into patient care. We have major grant funding from MRC, the Wellcome Trust, NIHR and EU in addition to charitable support and industrial collaborations. Members of the group contribute to the development of national and international guidelines and to research consortia.

Organisation and Expertise

UHSM houses the North West Lung Centre (NWLC), providing secondary respiratory care to the local population and tertiary care for some six million people in the North West region and beyond, delivered by a team of 26 consultants (academic and NHS). The NWLC hosts the National Pilot Allergy Centre, National Aspergillosis Centre, the Manchester Centre for the British Thoracic Society Registry of Severe Asthma, the Manchester Adult Cystic Fibrosis Centre, the Regional Specialist Cough Clinic and the Regional Interstitial Lung Disease Clinic, amongst others.

The adjacent North West Lung Research Centre houses the NIHR Respiratory and Allergy Clinical Research Facility (RACRF; £2.5 million NIHR funding over five years) in addition to laboratories for close-to-patients sample handling and research clinic and ward facilities for clinical trials. Nearby, the NIHR Clinical Research Centre provides additional space for outpatient and day case research procedures. We have established a Research Tissue Bank (the Manchester Respiratory and Allergy Biobank, ManRAB). This infrastructure means we have the highest number of patients recruited in studies in respiratory medicine and allergy in the UKCRN portfolio.



Professor Angela Simpson
Centre Lead, Professor of Respiratory Medicine

Research Leads

Asthma
Professor Adnan Custovic

Food Allergy
Professor Clare Mills

Cough
Professor Jacky Smith

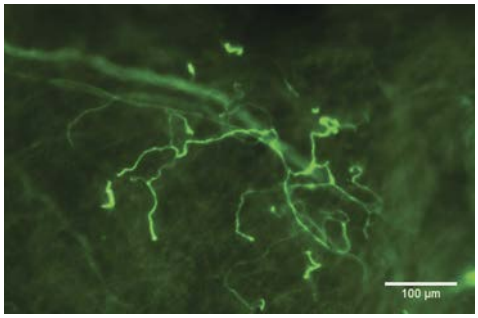
Infection
Professor David Denning

Airway Pharmacology
Professor Dave Singh

Chronic Obstructive Pulmonary Disease
Professor Jorgen Vestbo

Cystic Fibrosis
Professor Kevin Webb

> *"Our aim is to understand disease mechanisms and develop better diagnostic tests that allow us to deliver personalised medicine for patients with allergies and respiratory diseases."*
>
> Professor Angela Simpson



Additional clinical research takes place in a 36-bed early phase respiratory clinical trials facility with MHRA phase 1 accreditation (Medicines Evaluation Unit). We have collaborations with many industry partners and participate in the NIHR Translational Research Partnership in Inflammatory Respiratory Diseases. We also work with both biotech and major pharmaceutical companies to design and deliver clinical trials to test new treatments. We are part of the £3 million MRC Doctoral training programme in Clinical Pharmacology and Therapeutics (led jointly by the Universities of Liverpool and Manchester, in partnership with AstraZeneca, ICON, MEU and GSK).

Our Research

Asthma and Allergy

Principal Investigators: Custovic, Mills, Simpson

In asthma our goal is to identify different types of asthma (phenotypes), to improve diagnostic tests and to design treatments that can be offered only to those patients who are likely to benefit (so called stratified medicine). Much of our work centres on the Manchester Asthma and Allergy Study (www.maas.org), a population-based birth cohort of around 1000 children who were recruited during pregnancy in 1996/7. We are the co-ordinating centre for the MRC-funded UK network of asthma birth cohort studies (Study Team for Early Life Asthma Research or STELAR), which includes cohorts from Aberdeen, Isle of Wight, Bristol and Kent. In collaboration with The University of Manchester Centre for Health Informatics and Heath eResearch Centre, as well as our industrial partners, Microsoft Research, Cambridge, we are applying novel, computationally intensive statistical techniques to analyse the rich and complex datasets available in STELAR.

In food allergy, we have developed and manufactured blinded standardised material for oral food challenges. These are used for diagnosis, in pharmaceutical industry-funded clinical trials and for delivery of oral immunotherapy in Phase 1 trials. We will exploit our discovery platform in food allergy which integrates clinical infrastructure with fundamental science in animal models/cellular immunology and biochemistry/biophysics of allergens. In 2013 we were awarded the €9 million Integrated Food Allergy and Allergen Management (iFAAM) grant (with 38 academic and industry partners).

COPD and Airway Pharmacology

Principal Investigators: Singh, Vestbo

We have established a strong platform for drug development in COPD in partnership with industry; lung cells from specific subgroups of patients are used to develop novel biomarkers and to perform in vitro pharmacological investigations of new anti-inflammatory strategies (target identification and validation).

We are actively involved in industrial collaborations with GSK, AstraZeneca, Novartis, Almirall, Pulmagen, Trident, Chiesi and Merck to progress the development of their anti-inflammatory drugs through pre-clinical pharmacology studies.

Cough

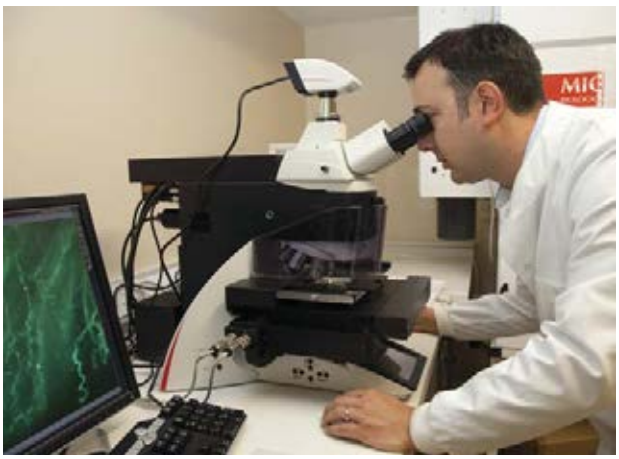
Principal Investigators: Smith, Woodcock

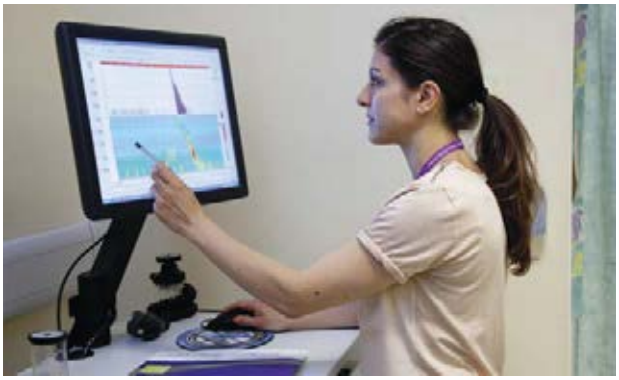
Our research focuses on understanding the peripheral and central neuronal mechanisms underlying human coughing. Our main strategy involves the translation of findings in animal models through to patients and we enjoy collaborations with John Hopkins Medical Institute, Baltimore (Canning) and Imperial College London (Belvisi). While there are currently no effective anti-tussive agents, we are engaged in proof of concept studies using novel and established therapies via pharmaceutical industry collaborations. Professor Smith has two collaborative MRC projects with AstraZeneca and Almirall.

Fungal Lung Disease

Principal Investigators: Denning, Read, Bignell, Bowyer

With our spin-out diagnostic partner Myconostica (winner of the North-West BioNow Biomedical Project of the Year Award) we have developed clinically-validated and CE-marked detection of Aspergillus and Pneumocystis DNA from clinical samples. We have used the extracted DNA to detect antifungal resistance mutations directly, even in culture negative samples, and this is being clinically implemented for the first time for a fungus. We have identified novel anti-fungal drugs, one of which is currently in Phase 2 studies.





Cystic Fibrosis (CF)
Principal Investigators: Horsley, Jones, Webb

We are at the forefront of refining and understanding new methods to assess lung function which provide sensitive measures of early lung disease. This technique can also be used to measure treatment response, and is being used to test exciting new CF treatments.

Research Highlights

- We lead the STELAR Consortium (£1.5 million, 2013-17) which will provide a secure web-based research environment (Asthma eLab) to support consistent recording, description and sharing of data and emerging findings across five existing UK asthma birth cohorts. This will use innovative computational statistical methods to identify novel endotypes of childhood asthma to enable investigation of endotype-specific pathophysiological mechanism (PI Professor Custovic).
- We have obtained funding from the MRC Mechanisms of Disease Programme (a collaboration between MRC and AstraZeneca) to investigate the effects of a novel GABAB agonist (Lesogaberan) in patients with chronic cough (£0.5 million, 2013-15, PI Professor Jaclyn Smith).
- We lead the largest European food allergy project (iFAAM), and were awarded €9 million (2013-17) to complete this exciting and innovative programme of research (PI Professor Mills).
- With our collaborators at Imperial College London, we have been awarded two major MRC grants: a Flagship Consortium in Systems Immunology of the Human Life Course, £2.2 million (Manchester PIs Professors Custovic and Simpson; collaborators Johnston and Rattray) and a £1 million MICA (industrial partner Almirall) to investigate the mechanisms that drive cough in health and disease (Manchester PI Professor Smith, collaborators Belvisi and Birrel).
- A research tissue bank (Manchester Respiratory and Allergy Biobank - ManRAB). All patients attending our specialist services are approached for recruitment into this HTA-approved RTB. Details of clinical assessments are stored in the bespoke database to facilitate careful phenotyping. Linked biological samples (blood, urine, DNA, biopsy samples) are stored for future use (PI Professor Simpson).
- Primary classification of aspergillosis in cystic fibrosis, highlighting a 30% undiscovered cohort with Aspergillus bronchitis.
- We have discovered two new mechanisms of azole resistance in Aspergillus (Professor Denning).
- We have for the first time estimated the global burden of allergic aspergillosis complicating asthma, and chronic pulmonary aspergillosis after TB: 4.8 million and 1.2 million respectively (2011, 2013).

Impact and Importance

Many of our key discoveries have a direct impact on diagnosis and patient care, including the description of Aspergillus bronchitis, gamma interferon deficiency, high rates of peripheral neuropathy with long-term therapy and the emerging problem of antifungal resistance (Denning, Read, Bignell). Our Fungal Group publishes the Aspergillus Website, the world's most comprehensive resource on this subject, supporting physicians, researchers, patients and carers, as evidenced by over one million pages and 70Gb of data downloaded per month, and the 212,000 other websites linked to it. The website includes an online database (and mobile app) to guide clinicians and patients on the 2,200 recognised antifungal drug interactions, 443 of which are potentially serious.

Through Myconostica Ltd (a spin-out company founded in 2006 by Professor Denning) we have developed MycAssay® Aspergillus and MycAssay® Pneumocystis (the world's first commercial PCR assays for fungal lung infections), which reduce the time needed to get a result from days to three hours. We have also developed the MycXtra® sample preparation kit, which is efficient in fungal cell breakage, DNA release and is fungal DNA free. Ongoing developments include new platforms, such as the fully automated BD MAX™ Molecular Testing System.

Our research has revealed that current methods of assessing peanut allergy are unreliable; many children are potentially receiving a false positive diagnosis. Professor Custovic and his team have demonstrated that the IgE response to the major peanut allergen Ara h 2 is far more predictive of true peanut allergy (100% sensitivity and 96.1% specificity) than currently used skin or blood tests. This component-resolved diagnostic tool is now available in clinical practice and has already had substantial impact on patient care. Academy of Medical Sciences cites this as an example of research with substantial impact on the health or wealth of the UK.

Professor Jaclyn Smith's team has developed and patented a first ambulatory system for objectively quantifying the frequency of coughing from acoustic recordings (VitaloJAK™). This system has attracted commercial funding for proof of concept studies of novel anti-tussive therapies, changing the standards by which cough treatments are assessed. It has also facilitated mechanistic studies providing insights into the factors influencing and driving coughing.

Professors Custovic and Woodcock and Dr Clare Murray led a key study which demonstrated that early use of inhaled corticosteroids for wheezing in pre-school children had no effect on the natural history of asthma or wheeze later in childhood. These findings changed national and international guidelines on asthma management.

Professors Woodcock and Custovic led a national study of allergen control in asthma using impermeable mattress and bedding covers (showing no effect). These results were of great practical significance: guidelines on the management of asthma and rhinitis were re-written.

Vision for the Future

We will develop our scientific research capacity, expanding our expert teams through recruitment and/or collaboration. The combination of genetic epidemiology and biomedical science will produce a step change in our programmes of work.

Our biobank of longitudinal biological samples will enable us to carry out research exploiting metabolomics/proteomics which we will link to clinical outcomes.

One of our greatest challenges and opportunities in the immediate future will be to expand our science platform through close working with Manchester Collaborative Centre for Inflammation Research within the IIR.

We will contribute to the strategic aims of the Institute by:

- increasing grant income from all funding streams with the emphasis on MRC and NIHR
- delivering a successful and expanded RACRF as a platform for a future BRU
- developing collaborative research projects with MCCIR and pharmaceutical industry partners
- translating basic research findings to patient benefit
- expanding and developing our experimental medicine capability in early phase studies and using the RACRF and ManRAB as platforms
- training and developing world class respiratory/allergy researchers
- expanding our expertise in the use of e-Health databases (local and national) and in record linkage
- aligning ourselves with the University's social responsibility agenda to ensure that the perspectives of the public and patients are fully integrated into our strategy.

Five year Strategic Goals

Our priorities are to:

- validate and implement our novel assessment tools for cough and use these to determine the effect of new peripherally- and centrally-acting in Phase 1/2a studies in healthy volunteers and patients
- develop improved diagnostics for peanut and other nut allergies
- establish cohorts of well phenotyped patients (funded by EU, MRC and industry) that are enrolled into early phase clinical trials for COPD
- expand our cohort of extremely well-characterised patients with fungal disease (in the UK National Aspergillosis Centre) for study with novel immunotherapies and anti-fungal drugs
- combine genotyping/phenotyping of patients with chronic and allergic aspergillosis to provide specific genetic fingerprints for each disease and develop prognostic and diagnostic tools, as well as a rich stratified clinical testing capability for novel anti-fungals and immunotherapy interventions
- help deliver the first of a completely new class of anti-fungal agents (with F2G)
- develop, validate and implement novel methodologies for cystic fibrosis diagnosis and for monitoring and prediction of outcomes.

The Centre for Dermatology Research

Tackling issues directly relevant to patient care

Clinical research studies take place at Salford Royal NHS Foundation Trust (SRFT) and at the University Hospital of South Manchester (UHSM), while laboratory research is based principally in the Stopford Building, the Manchester Interdisciplinary Biocentre and Michael Smith Building.

The Centre comprises approximately 80 people, including five professors, three clinical Senior Lecturers and one non-clinical Senior Lecturer. In addition there are 12 affiliated Senior Investigators, six of whom hold honorary Senior Lectureships in the Centre. The remainder of the Group comprises Clinical Research Fellows, Research Scientists, Research Technicians and Research Nurses.

The Centre has a strong cohort of future leaders in dermatology with the only NIHR Clinical Senior Lecturers in Dermatology (Young and Warren) in the country; one of only three dermatology ACF/ACL programmes (recently renewed), a good track record of MRC-funded Clinical Research Training Fellows and NIHR, MRC, BBSRC and industry-funded studentships.

Research funding is buoyant and the Centre holds programme grants with MRC, industry and NIHR.

Organisation and Expertise

The Centre's clinical research programme incorporates the hub for the Greater Manchester Dermatology Centre at SRFT (the largest in the UK) where over 30 Consultant Dermatologists conduct their clinics, ensuring access to dermatology patients across the Greater Manchester conurbation. Experimental dermatology research is run largely in laboratories on the main campus (Stopford Building).

We have large community and hospital-based patient populations, established databases, well-characterised patient cohorts and extensive collections of biological samples. The latter includes the national psoriasis biologics registry (the British Association of Dermatologists' Biologic Interventions Register) which is run from Manchester and is the gold standard for such registries worldwide. The dermatology clinical research based at SRFT and the plastic surgery clinical research based at UHSM provide an ideal setting for enhanced links between clinical service, translational research and technology transfer.

Crucial and overlapping areas of research are inflammatory skin disorders (psoriasis, urticaria, photodermatoses, hair follicle disorders) and environmental disorders (photosensitivity, photo-ageing, skin cancers), together with protection (nutriceuticals) and repair (stem cells, wound healing, bioengineering, psychodermatology and biologics).

Professor Chris Griffiths
Centre Lead, Professor of Dermatology

Professor Ralf Paus
Research Director

Research Leads

Angiogenesis
Dr Helen Young

Brain-skin Axis
Dr Elise Kleyn

Hair
Professor Ralf Paus

Immunology
Professor Silvia Bulfone-Paus

Psoriasis
Professor Chris Griffiths

Psychology
Dr Christine Bundy

Microbiome
Dr Catherine O'Neill

Pharmacogenetics
Dr Richard Warren

Photobiology
Professor Lesley Rhodes

Scarring
Dr Ardeshir Bayat

Skin Ageing
Dr Rachel Watson

Skin Cancer Epidemiology
Professor Adele Green

Honorary Senior Lecturers
Dr Tamara Griffiths, Dr Matthew Harries, Dr John Lear, Dr Stephanie Ogden, Dr Jason Wong

"The Centre performs multi-disciplinary studies with a focus on inflammatory skin disease and damage resulting from external stressors. It devises means for protection and repair ranging from stem cells and nutrition to bioengineering and psychological techniques. Using a bi-directional experimental medicine approach we address questions directly relevant to skin health and patient care."

Professor Chris Griffiths

Our Research

Psoriasis

Principal Investigators: Griffiths, Warren, Young, Bundy, Kleyn

The Manchester group is acknowledged as having the most comprehensive psoriasis research programme in the world (Nature 2012). Innate immune response genes in psoriasis are being explored through collaboration with the ARUK Genetics group, while novel therapies in psoriasis are being tested in the clinic.

This area is very well-funded through funding streams including NIHR, MRC, BBSRC, Psoriasis Association, industry and several collaborative PhD studentships. The psoriasis group leads two programme grants: the NIHR Identification and Management of Psoriasis Associated ComorbidiTy (IMPACT) and the MRC Psoriasis Stratification to Optimise Relevant Therapy (PSORT).

Biologics

Principal Investigators: Griffiths, Warren

The psoriasis research programme is complemented by the UK's leading, self-funding Dermatopharmacology Unit. This performs a range of high-profile clinical trials on the use of biologics in dermatology, has an excellent publication record and attracts a strong funding stream.

Langerhans' Cell Biology

Principal Investigators: Griffiths, Ogden

Close collaborations with Professor Ian Kimber's group in FLS have driven forward an understanding of the role of epidermal Langerhans' cells in health and disease. This has led to ground-breaking observations on Langerhans' cell function in psoriasis and in skin ageing and the development of a novel epidermal explant model.

Mast Cell Biology

Principal Investigators: Bulfone-Paus, Paus

Research foci include the role of mast cells in psoriasis and hair growth control, stress-induced exacerbation of common skin diseases through mast cell-dependent neurogenic inflammation, dermatopharmacology and skin ageing. This future focus also provides an excellent interface with ongoing clinical research at SRFT and with immunology research at FLS and MCCIR.

Photodermatology and Non-melanoma Skin Cancer

Principal Investigators: Rhodes, Green, Lear, Gibbs

Photosensitivity disorders affect around 20% of the population and non-melanoma skin cancer is the commonest cancer in the Western world. There is particular interest in the interactions between vitamin D synthesis, sun exposure and diet in ethnic minorities and the hormone's role in health. Research on diet and non-melanoma skin cancer and epidemiology of melanoma is an important and growing area for research with opportunities to collaborate more closely with the Paterson Institute for Cancer Research. Central Manchester has a large population of renal transplant patients and their susceptibility to skin cancer and its prevention and management is of clinical importance. These pivotal skin research frontiers are being targeted via recent BBSRC, CR UK, Wellcome Trust and industry-funded projects.

Skin Ageing and Photo-ageing

Principal Investigators: Watson, Gibbs, Griffiths, Langton, Rhodes, Griffiths

We have a highly successful long-term research programme which is rapidly becoming an international hub for skin ageing/photo-ageing research. This includes industry, MRC and a £3.9 million programme grant from Alliance Boots which has facilitated the establishment of research appointments including a senior lectureship in aesthetic dermatology. Areas of strength include extracellular matrix biology (fibrillin in particular) of ageing skin, the testing of novel anti-ageing products using the Manchester Patch Test Assay and the role of geographic ancestry in skin structure and ageing. A recently-launched MSc programme in aesthetic dermatology, led by T Griffiths and Singh, aims to become the market leader in this area.

Brain-skin Axis and Cutaneous Neuroendocrinology
Principal Investigators: Kleyn, Bundy, Griffiths, Griffiths, Paus

Understanding how stress can trigger and/or exacerbate skin and hair diseases and why human skin synthesises an unusually rich repertoire of stress response-associated neuropeptides and neurohormones represents an important frontier in skin research. Unique collaborations between psychologists, neuroradiologists, skin biologists and dermatologists have established our Dermatology Centre as one of the leading European research centres in this fast-moving field. The group is the European leader in the application of advanced scanning techniques, including fMRI and PET, to understand the brain-skin axis.

Hair Biology and Pathology and Hair Follicle Stem Cells
Principal Investigators: Paus, Harries

The Centre's BBSRC- and industry-funded hair research programme now leads the field in Europe. It explores molecular controls of hair growth and epithelial hair follicle stem cells, with special emphasis on their translational relevance to inflammatory hair loss disorders (such as alopecia areata and lichen planopilaris) and wound healing. We are also investigating immune privilege collapse, hair follicle neuroendocrinology and epithelial hair follicle stem cells.

Wound Healing
Principal Investigators: Bayat, Wong, Paus

A range of approaches to enhance wound healing is being explored. This includes research to better understand and potentially reduce skin scarring and fibrosis, including keloids, and the understanding and promotion of optimal healing. World class research in the use of stem cells in wound healing is now ongoing. We are also involved in the establishment of a novel human skin wound healing in vitro assay, as well as a frog skin organ culture model.

Research Highlights

Psoriasis
Principal Investigators: Griffiths, Warren, Young, Bundy, Kleyn

Research highlights include the discovery that polymorphisms in IL-1beta distinguish between early- and late-onset psoriasis; Langerhans' cell function in psoriasis is abnormal and that anti-cytokine biologic therapy restores it to normal. We have also achieved significant new insights into psoriasis epidemiology (all published in the leading skin research journal, Journal of Investigative Dermatology). The IMPACT programme has advanced understanding that psoriasis management is dependent on an informed biopsychosocial and individualised approach.

Biologics
Principal Investigators: Griffiths, Young, Warren

The Centre's high-profile clinical trials on the use of biologics in dermatology have led to landmark publications (e.g. Lancet, New England Journal of Medicine). They have also given the Centre the lead for the BADBIR biologics registry – the world-leading, gold standard pharmacovigilance register of systemic therapies for psoriasis. A key part of the Centre's strategy is stratified medicine and its application to skin therapeutics. We are developing a strong profile in pharmacogenetics and clinical pharmacology in inflammatory skin disease.

Photodermatology and Non-melanoma Skin Cancer
Principal Investigators: Rhodes, Green, Gibbs, Lear

Highlights include the exploration of the role of eicosanoids and demonstrating that photo-protective dietary supplements are beneficial in these conditions. The corresponding results have been published in leading dermatology, photobiology, and nutritional research journals.

Skin Ageing/Photo-ageing
Principal Investigators: Watson, Gibbs, Rhodes, Griffiths, Griffiths

Breakthroughs include the development of a fibrillin bioassay to test potential photo-ageing repair agents and biophysics assays to quantify direct ultraviolet radiation damage to dermal microfibrils. These results have been published in leading dermatology, gerontology or nutritional research journals and have led to University spin-out companies: CG ceutics and Curapel.

Brain-skin Axis and Cutaneous Neuroendocrinology
Principal Investigators: Kleyn, Bundy, Griffiths, Paus

In addition to highly innovative studies that link central nervous system activities (via fMRI brain scanning) to chronic inflammatory skin disorders and stress, the highly interdisciplinary research activities of this programme have culminated in key discoveries. These include: first fMRI brain studies in psoriasis; observation that acute stress induces epidermal Langerhans' cell migration; the identification of a novel neuroendocrine control of mitochondrial activity and biogenesis in human skin and the revelation that clock genes control human hair growth.

Mast Cell Biology

Principal Investigators: Bulfone-Paus, Paus

This relatively new programme is making major contributions to understanding mast cell tolerance, mast cell-CD8+ T cell interactions and the neuroendocrinology/neuropharmacology of human mast cell activation and maturation. It also explores the key role of mast cells in stress-triggered neurogenic skin inflammation, skin ageing, photodermatology and hair growth control.

Hair Biology and Pathology and Hair Follicle Stem Cells

Principal Investigators: Paus, Harries

The Centre's hair research programme has made major recent contributions to understanding epithelial stem cell damage in the human hair follicle (during scarring alopecia) to hair cycle regulation, the neuroendocrine control of keratin expression as well as to hair follicle neuroendocrinology and energy metabolism. It continues and extends its systematic charting of human hair follicle stem cells.

Impact and Importance

The work of the Dermatology Centre has had significant national and international impact on the understanding of psoriasis, hair, photodermatology, skin ageing, epithelial stem cells in human skin, the brain-skin axis and cutaneous neuroendocrinology.

In addition, the Centre's longstanding commitment to research excellence in photodermatology, skin ageing, adult human epithelial stem cell and brain-skin axis ensures we are ideally placed to adopt an internationally leading role in these areas.

Crucial to our continuing success will be translationally relevant co-operative research with both the FLS and the MCCIR.

Vision for the Future

Our vision is to become a world-leading centre for translational research in skin health and disease.

One key opportunity is our close relationship with the MCCIR. Many skin diseases are inflammatory in nature and our expertise in psoriasis, UV-induced inflammation, neuroinflammation and immune responses in ageing skin means we are ideally placed to capitalise on this partnership.

We will progress our longstanding relationship with musculoskeletal research, particularly in the area of genetics/genomics. Faculty cross-cutting themes of stratified medicine and ageing are important, as are collaborations with psychology, pharmacy and primary care. The brain-skin group will continue its strong collaboration with members of the Brain, Behaviour and Mental Health Institute and the new Manchester Centre for Health Psychology, and will extend its collaboration with neuroendocrinology research within the University. The hair growth group is currently extending its collaboration with stem cell researchers on campus.

The Centre will actively welcome intensified interactions with the Regenerative Medicine Centre, namely with wound healing research, as this field holds the greatest promise for translational-research at the dermatology-plastic surgery interface. An interdisciplinary focus on translational skin wound healing research also offers excellent collaboration options with FLS and Material Sciences.

We will continue to grow our collaborations and partnerships with other Faculties and will maximise our use of core platforms including NIHR CRFs and e-Health. The experimental medicine strength in dermatology will be harnessed to contribute strongly to the metrics for MAHSC success.

Five year Strategic Goals

- Perform sustained world class health research consistent with The University of Manchester and MAHSC strategy, building on our world leading/international excellence in a variety of areas.
- Work together to maximise collaborative research across the group, including opportunities arising from recent professorial appointments, and taking advantage of inter-School/Institute and inter-Faculty opportunities.
- Maximise volume of high quality, high impact research publications.
- Maximise NIHR funding, CLRN portfolio study activity and industrial funding, in addition to research council, with an emphasis on MRC and charitable funding.
- Foster technology transfer to increase translation of research findings to the clinic.
- Foster effective working practices and a team ethos across the group, through improved communication channels, appropriate infrastructure and accommodation.
- Develop postgraduate taught courses on various aspects of skin biology.
- Publicise and foster understanding of our research – through public engagement, undergraduate and postgraduate education and by raising our profile both internally and externally.

The Centre for Gastrointestinal Sciences

An internationally recognised research centre

The Centre for Gastrointestinal (GI) Sciences in Manchester has been a nationally and internationally recognised gastroenterology research and academic centre since its formation in 1975 under Lord Leslie Turnberg, one of the first Professors of Gastroenterology and Medicine.

Manchester has become a hub for GI clinical and scientific research and now encompasses interests including neurogastroenterology, functional gastrointestinal disorders, appetite regulation, epithelial biology, inflammatory gut conditions (specifically focusing on models of inflammatory bowel disease) and gut endocrine modulation.

In addition to these key areas, the Centre has a long-standing interest in Health Services Research, looking at both epidemiological aspects of GI diseases alongside developmental programmes to influence healthcare practice in functional GI disorder and inflammatory GI disorders.

The group has an established and active senior academic membership with four Professors, a non-clinical Reader, a non-clinical Lecturer and a team of administrative staff. This is complemented by six Clinical Research Fellows, a post-doctoral Stepping Stones Fellow, three Academic Clinical Fellows, four MD/PhD students and two MRes students.

The Centre for GI Sciences has benefited from the NIHR Academic Clinical Training Programme and is one of only three centres in the country to have a Gastroenterology ACF and ACL portfolio. This has been expanded and through the recent bidding process a further five years of yearly ACFs and bi-annual ACLs will continue until 2018.

Professor Shaheen Hamdy
Centre Lead, Professor of Neurogastroenterology

Research Leads

Brain-gut Axis/ Neurogastroenterology
Professor Shaheen Hamdy

Epithelial Endocrinology and Gut Signalling
Professor John McLaughlin

Appetite and Satiety Regulation
Professor David Thompson

Functional Bowel Disorders
Professor Peter Whorwell

Immune Mechanisms in GI Disease
Professor John McLaughlin
Dr Joanne Pennock

In addition we have a number of PhD/MD students, Honorary Senior Lecturers with NHS contracts and teaching staff.

> *"Our success is built on the breadth of gastroenterology research that we cover, from basic cellular mechanisms to population-based science, all with a strong emphasis on clinical translational physiology. Our future goal is to see the Centre develop into the premier location for basic, physiologic and clinical research excellence in the study and management of neurofunctional, nutritional and inflammatory GI disorders."*
>
> Professor Shaheen Hamdy

Organisation and Expertise

The current focus of the Centre's expertise is mainly within luminal gastroenterology. There are clear strengths in the areas of neurogastroenterology, brain-gut dysfunction, appetite and satiety regulation, epithelial endocrinology, gut signalling and in early stage models of gut inflammation.

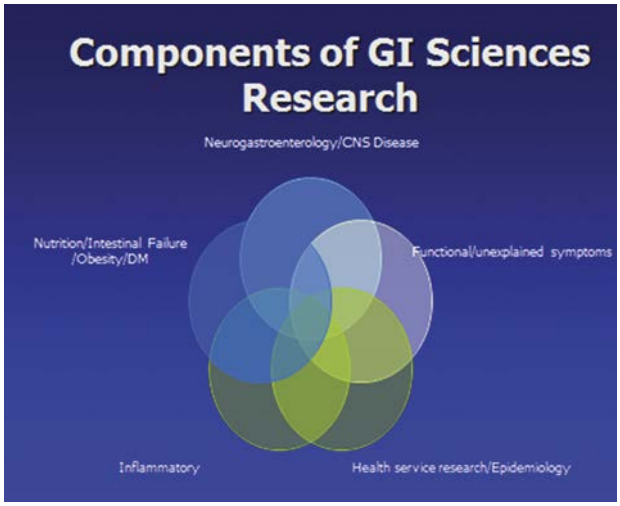
In addition, we have significant strength in gut neurophysiology (neuro-enterology) and in the management of functional gastrointestinal disorders.

Professors Hamdy, McLaughlin, Thompson and Whorwell are recognised leaders in their respective fields and all have international reputations for their work in neurogenic dysphagia, appetite and feeding regulation, neurogastroenterology and motility and functional gastrointestinal disorders.

The Centre has developed a number of significant collaborations within the UK and beyond. Our international collaborators include partnership projects in Spain, Australia and the USA.

These collaborations have supported activity of all Principal Investigators in GI Sciences and have led to 20% appointments in the past. Publications from these collaborations are ongoing and active.

Dovetailing with the above collaboration, GI Sciences has for the last 10 years hosted the Diet, Digestion and Health (DDH) club that contributes to the objectives of the Institute by allowing cross-faculty activity to flourish within the affiliation programme. The work of the Centre for GI Sciences overlaps with that of the Institutes of Brain Behaviour and Mental Health, Human Development and Population Health, and we are involved in active collaborations with all of these.



Our Research

Brain-gut Axis/Neurogastroenterology

Principal Investigator: Hamdy

Our programme of work exploring the central regulation of the brain-gut axis has focused on studies which use brain imaging to understand the role of cortical organisation of swallowing and anorectal function in health and disease. A common clinical consequence of brain disorganisation is difficulty with swallowing (dysphagia) after a stroke, which is associated with damage in the hemisphere dominant for swallowing. Many dysphagic stroke patients recover their ability to swallow over time. Unlike limb recovery, this is clearly associated with compensatory brain reorganisation in the non-dominant hemisphere.

The brain-gut axis thus provides an important opportunity for studying brain function and recovery, with the potential for greater insight into the clinical relevance of neuroplasticity using a human experimental model of midline motor control (gut).

Epithelial Endocrinology and Gut Signalling

Principal Investigators: McLaughlin, Padfield

The day-to-day functioning of the gut is orchestrated by enteroendocrine-enteric nervous system interactions. Dysfunction within this organisation can arise from inflammation and/or changes in gut microflora. We are currently exploring the role of microflora in gut dysfunction and in symptoms such as abdominal pain and bloating. This includes investigating how modulating gut microflora with agents such as probiotics can improve symptoms in patients with functional GI disorders.

We are also investigating how enteroendocrine cell release of amines such as serotonin relates to symptomatology and pathophysiology.

Appetite and Satiety Regulation

Principal Investigators: Thompson, McLaughlin

The gut is the first point of contact for ingested nutrients and their presence is detected by the gut, evoking signals that control the physiological response to food and the short-term regulation of food intake.

These processes are largely mediated by the enteroendocrine-vagus nerve axis. We are actively exploring these mechanisms in health and disease, with a key focus on the regulation of gastric function, the biological basis for sensations and symptoms arising from the gut and the central neural correlates of gastrointestinal nutrient sensing.

These studies are conducted in healthy volunteers and patient

groups. We are particularly interested in developing non-invasive techniques for the investigation of gut physiology (such as breath testing by stable isotope spectrophotometry and functional magnetic resonance imaging). This work is enhanced by applying a genomics-based approach to physiological variability and is fully integrated with the research mission of the epithelial biology group.

Functional Bowel Disorders

Principal Investigators: Whorwell, Thompson, Hamdy and McLaughlin

Disease areas of particular interest include functional GI disorders, such as irritable bowel syndrome, functional dyspepsia and non-cardiac chest pain.

All research is carried out with both healthy volunteers and patients with functional GI disorders, and is enhanced by parallel programmes which help us to delineate more clearly the significance of abdominal symptoms to patients. We have, for example, demonstrated that the symptom of bloating (often described by functional GI patients as their most frequent and bothersome) is not always associated with an increase in abdominal girth (i.e. distension) and that the mechanisms responsible for the sensation of bloating and for objective distension may differ, possibly between patient groups.

We enjoy close collaborative links with other research groups within IIR, including Musculoskeletal Medicine (Pain) and Respiratory Medicine (Cough) and with the pharmaceutical and food industries.

Immune Mechanisms and Early Stage Models of Gut Inflammation

Principal Investigators: McLaughlin, Pennock

This branch of GI research is based at the main University campus (Stopford Building) in order to foster partnerships and collaborations with other biomedical researchers in Medicine and Life Sciences.

State-of-the-art facilities now established on campus enable us to undertake cutting edge interdisciplinary research, which complements experimental physiology and medicine undertaken on the hospital site. We have a particular interest in mucosal immunology and inflammatory bowel disease.

Research Highlights

- Success within the NIHR programme, in particular five RfPB awards, an NIHR Programme award and the DRiNC I programme.
- Our research in neurogastroenterology has been highlighted on Radio 4's 'Case Notes' programme and featured at the Royal Society.
- The successful application of neurogastroenterology brain/gut research has led to a University spin-out company – Phagenesis Ltd – which is now listed in the top 10% of spin-out companies in Europe. This has been linked to a £1 million Wellcome Trust Translational Award.
- One of the largest programmes on functional GI disorders in Europe, assessing physiology, microbiome, and clinical research based at University Hospital of South Manchester.
- The only national intestinal failure unit in the North of England, with extensive research activity in gut failure, novel treatments for small bowel lengthening and Quality Improvement.

Impact and Importance

The Centre for GI Sciences has had a positive impact on health via the NIHR programme grant which is looking at delivery of care packages for functional gastrointestinal disorders and irritable bowel syndrome. This will show that care packages that are already delivered through the NHS via GPs and secondary care are not inferior to focused packages including hypnotherapy and self-directed management.

Phagenesis Ltd. has now received a CE mark and following Venture Capital funding of over €9 million is initiating sales of its medical technology. Over the next three years revenues of at least £1.5 million will be generated via distributor sales to the UAE and Ireland.

It is anticipated that this innovation will be recognised by the National Institute for Clinical Excellence (NICE) and ultimately adopted by a larger medical technology industry partner by 2014/15 with significant financial benefit for The University of Manchester (one of the largest shareholders in the company).

The Centre for GI Sciences has successfully bid for further ACFs and ACLs, enhancing opportunities for both education and delivery of training in academic gastroenterology.

We will continue to support the undergraduate and postgraduate education programme in FMHS, while continuing to play a key role within leading national organisations such as the British Society of Gastroenterology and NICE.

Vision for the Future

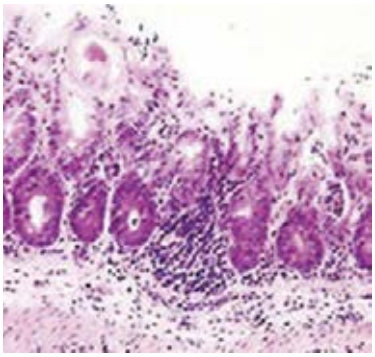
Our vision is to become a leading Centre for Gastrointestinal Diseases both nationally and internationally, with a continuing emphasis on academic excellence and collaborative strength. This will focus on the four Clinical Professors heading Gastroenterology, all of whom are recognised as leaders in their fields.

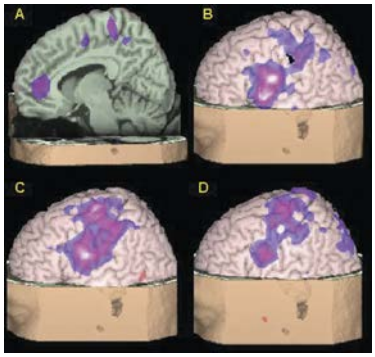
Our vision for the Centre as a whole is exemplified by the success of our Diet, Digestion and Health Programme which has existed for over seven years. The programme enjoys a number of interdisciplinary collaborations, including Life Sciences, Medical and Human Sciences and a number of institutes in the UK, North America and Europe.

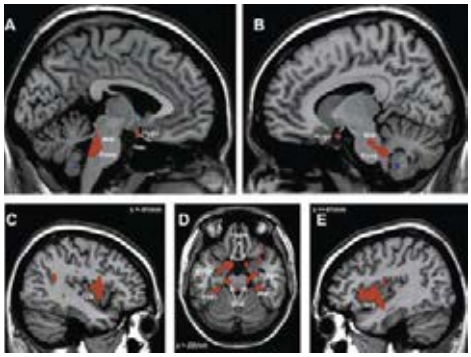
Five year Strategic Goals

GI Sciences is a dynamic and forward-thinking group, committed to achieving continued success over the next five years. This will be achieved by:

- increasing grant income by 50%, including two programme grants, by 2018
- active recruitment of additional staff, including two Senior Lecturers and two Professors
- development of a nutrition programme taking advantage of the national intestinal failure unit – including obesity and eating disorder research
- appointment and development of a strong hepatology research stream which will interact with FLS and with academic appointments in both basic and clinical sciences
- strengthening the NIHR-funded integrated academic training programme, supported by a successful five-year renewal bid for Integrated Academic Training in GI Sciences
- obtaining Centre of Excellence status in GI disorders, with BRU and Research Council support, to establish Manchester as the UK's premier centre for Gastroenterology Research.







The Centre for Tissue Injury and Repair

Developing multi-disciplinary approaches to tissue repair and regeneration

The Centre for Tissue Injury and Repair focuses on human tissue development/structure, homeostasis, regeneration and characterisation from the level of cellular and molecular mechanisms of injury and repair through to clinical impact.

It is a cohesive interdisciplinary team with well-established and productive collaborations in the Faculty of Life Sciences (FLS) and the Faculty of Engineering and Physical Sciences (EPS). This, together with interactions with a number of companies and world-leading institutions, ensures a multi-faceted research focus and a drive towards the development and clinical application of novel cell-based (primarily adult stem cell) tissue engineering/regenerative medicine therapies.

It is a highly active research group as evidenced by an excellent grant income (including funding from BBSRC, EPSRC, EU and industry) and high-quality interdisciplinary publications in leading journals.

The centre has a strong scientific and laboratory base (principally located in the Stopford, Smith and AV Hill Buildings) and applies a range of molecular, cellular and structural approaches to its current strategy of i) understanding fundamental aspects of tissue structure, homeostasis and fibrosis/scarring and ii) developing new multi-disciplinary approaches to tissue repair and regeneration, including the use of stem/progenitor cells and novel biomaterials.

> *"We are integrating cutting-edge biomedical research on healthy and diseased tissues, stem/progenitor cells and biomaterials to develop tomorrow's tissue regeneration therapies."*
>
> Professor Judith Hoyland

Professor Judith Hoyland
Centre Lead, Professor of Molecular Pathology

Research Leads

Non-clinical Lecturer in Nanosafety
Dr Cyrill Bussy

Professor of Osteoarticular Pathology
Professor Anthony Freemont

Professor of Regenerative Medicine
Professor Giulio Cosso

Non-clinical Lecturer in Tissue Injury and Repair
Dr Sarah Herrick

Professor of Nanomedicine
Professor Kostas Kostarelos

NIHR Clinical Lecturer in Plastic Surgery
Dr Adam Reid

Non-clinical Lecturer in Cell and Tissue Engineering
Dr Stephen Richardson

Non-clinical Lecturer in Molecular Biochemistry
Dr Michael Sherratt

Honorary Professor of Tissue Engineering
Professor Giorgio Terenghi

Professor of Polymers and Biomaterials
Professor Nicola Tirelli

All PIs have highly successful and well-funded research groups with a large number of active post-doctoral researchers contributing to overall research activity. There are also approximately 20 postgraduate students undertaking PhD, MD, MPhil research degrees.

The interests of the Centre fall into three main areas:

- tissue injury resulting from age-related and degenerative processes, exogenous factors (e.g. trauma/surgery) and endogenous factors (e.g. inflammation, fibrosis)
- tissue engineering and stem/progenitor cell-based regenerative medicine therapies for a number of diseases, particularly musculoskeletal/connective tissue and muscle disorders and peripheral nerve injuries
- pre-clinical development of nanomedicine constructs based on novel synthetic and biological nanomaterials for therapeutic and diagnostic applications.

Organisation and Expertise

Our current areas of expertise include:

- adult (particularly mesenchymal) stem cell biology and application to musculoskeletal disorders, particularly intervertebral disc (IVD) degeneration and cartilage and bone defects (Hoyland, Freemont, Richardson) and peripheral nerve injuries/repair (Reid, Terenghi)
- development of cell-based therapies with both donor and autologous, genetically corrected, stem/progenitor cells for genetic diseases of muscle (muscular dystrophies) and connective tissue (Cossu)
- clinically-driven research, particularly around the understanding and regulation of the normal and ageing extracellular matrix and diseased tissue environment (niche) into which 'regenerates' will be implanted (Sherratt, Hoyland, Freemont, Richardson)
- design of novel biomaterials, polymer science for application in tissue engineering strategies (Tirelli)
- molecular imaging and tissue micromechanics (BioAFM facility) (Sherratt)
- 'drug' delivery, specifically the use of biologics to alter disease mechanisms, stem cell differentiation and function, including inflammation responsive therapies (Hoyland, Richardson, Tirelli, Kostarelos)
- development of nanomedicine constructs for therapeutic and diagnostic purposes (Kostarelos, Bussy)
- induced pluripotent stem (iPS) cell technology (Kostarelos).

Our Research

There are a number of research themes within the Centre which include IVD degeneration and musculoskeletal tissue regeneration; peripheral nerve injury/nerve regeneration; adult stem cell biology and interaction with biomaterials for tissue engineering applications; cell therapies for genetic disorders of muscle and connective tissue; tissue fibrosis; micro- and nano-mechanical characterisation of tissue and engineered constructs; polymers and biomaterials for tissue engineering and regenerative medicine therapies and the application of novel nanomaterials for biomedical and clinical applications. Key themes are detailed below.

IVD Degeneration and Regeneration

Principal Investigators: Hoyland, Freemont, Richardson

The group is investigating the pathobiology of IVD degeneration. Our recent application of novel cell-based therapies to repair the degenerate IVD is internationally leading.

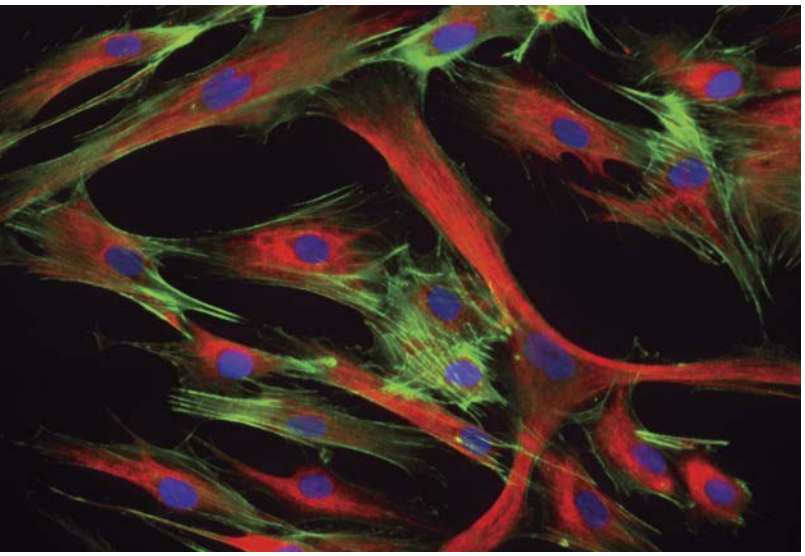
We were the first group to identify the phenotype of IVD cells, thus informing MSC-based tissue engineering strategies. The group has produced over 60 papers in the field and in the last seven years has led or participated in grants totalling more than £5 million.

Work from the group and its collaborator Professor Brian Saunders (EPS) has resulted in three patent applications and in the formation of a spin-out company (Gelexir Healthcare Ltd) which is attracting interest and funding from industry.

Peripheral Nerve Injury and Regeneration

Principal Investigators: Reid, Terenghi

The science of neuroprotection following a peripheral nerve injury has been undertaken in the Blond McIndoe Laboratories over a period of more than 10 years. The team is leading the world in this area of research and pre-clinical work. Our collaboration with EPS is at an advanced pre-clinical phase and has attracted funding from NIHR i4i to take the work (including a patented product) into a clinical trial (clinical centres would be in Manchester, Glasgow and Umea, Sweden). This could be the first real advance in the management of peripheral nerve injuries for 40 years.



Nanomedicine

Principal Investigators: Kostarelos, Bussy

The nanomedicine laboratory is one of the first research laboratories dedicated to the pre-clinical development of nanomedicine constructs based on novel synthetic and biological nanomaterials for therapeutic and diagnostic applications. The team led by Professor Kostarelos is internationally renowned for:

- engineering and pharmacological development of carbon nanomaterials (fullerenes, nanotubes, graphene)
- development of novel viral and non-viral gene therapy vectors
- engineering and pharmacological development of liposomes, colloidal nanoparticulates (polymeric microspheres, solid nanoparticles)
- delivery and genetic manipulation of embryonic, progenitor and induced pluripotent stem cells
- pharmacological and toxicological profile of novel nanomaterials.

The laboratory is engineering delivery systems for drugs, cells, proteins, radionuclides and genes that are able to alter the biological profiles (biodistribution, tissue uptake, pharmacokinetic and histology) of potential therapeutic or diagnostic agents. Great emphasis is placed on the interface between in vitro and in vivo studies and how rationally designed and engineered delivery systems can be translated into clinically effective therapeutics and diagnostics. The environment is ideal for translational pharmaceutical research and has already led to two spin-out companies.

Cell Therapies for Genetic Disorders of Muscle and Connective Tissues

Principal Investigator: Cossu

The group led by internationally renowned Professor Giulio Cossu focuses on developing cell-based therapies with both donor and autologous, genetically corrected, stem/progenitor cells for genetic diseases of muscle and connective tissue. Different biomaterials are tested to enhance engraftment of cells in the tissues of a number of different pre-clinical models. Additionally, work is being undertaken to increase knowledge of the fetal and post-natal stages of mesoderm development in order to increase the efficacy of cell therapies for a variety of musculoskeletal and connective tissue disorders.

Research Highlights

- Design of novel biomaterials and nanomaterials for drug delivery and connective tissue replacement/supplementation (funded by EPSRC and BBSRC) (Tirelli, Hoyland, Richardson, Freemont and Kostarelos).
- The biological mechanism of nerve injury and regeneration and tissue engineering of nerve conduits and their functionalisation has yielded substantial IP and funding for clinical trials (Reid, Terenghi).
- Development and application of methodology to assess tissue micromechanics of aged and diseased tissues (successful EPSRC, Wellcome Trust and MRC LLHW grants totalling over £1.8 million since January 2007) (Sherratt).
- Development of novel hydrogels for tissue engineering of the degenerate IVD (successful BBSRC, EPRSC grants; patents and spin-out company) (Hoyland, Richardson and Freemont).
- First-in-man phase I/II trial of cell therapy with HLA-matched donor stem cells in patients with Duchenne Muscular Dystrophy (Cossu).

Impact and Importance

Our research has broken new ground in several areas, including the development of novel regenerative/tissue engineering therapies (from research through to translation), the commercial expansion of these therapies (through numerous collaborations with industry) and the delivery of leading postgraduate programmes.

Peripheral Nerve Repair

Current research is exploring nerve regeneration and the development of an artificial nerve as an alternative clinical approach to nerve reconstruction. This tissue engineering construct can be grafted onto an injured nerve, bridging the gap and guiding the re-growth of the nerve between the two severed ends. The addition of stem cells, growth factors and other molecules within the conduit results in improved regeneration and restoration of sensory and motor functions. Researchers are working towards delivering this intervention to nerve-injured patients in Manchester.

Skeletal Muscle Regeneration

Professor Cossu has considerable experience in skeletal muscle development and regeneration. He has carried out a first-in-man phase I/II trial of cell therapy with HLA-matched donor stem cells in patients with Duchenne Muscular Dystrophy. He is now working to implement the protocol to reach clinical efficacy and to extend this strategy to other forms of muscular dystrophies and also to genetic, recessive diseases of connective tissue.

Intervertebral Disc Regeneration

Research is focusing on adult stem cell based tissue engineering and regenerative strategies, including the development of novel biomaterials that can be used as appropriate scaffolds. Widely-cited publications have shown that adipose stem cells are the most appropriate cell source for this application. The university's spin-out company Gelexir Healthcare Ltd (established by researchers within the group) has developed an innovative approach which involves the use of injectable novel biomaterials that are designed to restore the normal functioning and biomechanical properties of the disc. Pre-clinical studies are currently being undertaken following Venture Capital funding.

Collaborations with Industry

The group enjoys several collaborations and links with industry, including Novartis, UCB, Smith and Nephew, Depuy Spine and Boots.

Education and Training

Staff at the Centre contribute substantially to the education and training of the next generation of scientists/clinicians in tissue engineering and regenerative medicine (recognised as a major unmet need by UK industry). Postgraduate programmes include the MRes Tissue Engineering for Regenerative Medicine (Programme Director Dr Sarah Herrick), the NowNano Doctoral Training Centre and the College of Doctoral Training in Regenerative Medicine (Programme Co-director Professor Nicola Tirelli).

Vision for the Future

Our vision is to be an internationally renowned Centre for conducting and integrating biomedical research on healthy and diseased tissues, stem/progenitor cells and biomaterials to develop novel tissue regeneration therapies for clinical translation.

To realise our vision we will increase the critical mass of lead researchers within the Centre and expand the areas of expertise in the group to complement current activities.

Additional growth/expansion will not be targeted to specific clinical disorders or organs. Instead it will be implemented to diversify the clinical settings in which the Centre works and to strengthen the core science which will give the Centre flexibility to expand and respond to innovative developments in biomedical science and new needs in clinical medicine.

Additionally, we wish to integrate our work more fully with all the relevant disciplines within The University of Manchester particularly around biomedicine (FMHS, FLS), biomaterials (EPS) and imaging (FMHS, EPS). We also aim to liaise more effectively with our surrounding MAHSC NHS Trust partners to produce the key technological and medical advances needed to develop regenerative medicine therapies and change patient care/management.

Five year Strategic Goals

- Attract and recruit world-leading clinical academics and scientists and build critical mass.
- Establish an MRC-funded Centre in Regenerative Medicine in collaboration with colleagues in FLS.
- Expand our collaborative projects and forge new links with affiliate members, staff in MCCIR and NIHR Musculoskeletal Biomedical Research Unit and other Faculties.
- Exploit opportunities in materials through collaborations involving the application of novel (nano)- materials (including graphene) in biomedicine applications.
- Substantially expand our funding base through responses to funding initiatives from the Research Councils.
- Educate and train the next generation of scientists/clinicians in tissue engineering and regenerative medicine by driving nationally leading postgraduate programmes.

The Manchester Collaborative Centre for Inflammation Research

At the cutting edge of research into inflammatory disease

The University of Manchester, GlaxoSmithKline and AstraZeneca have together created the Manchester Collaborative Centre for Inflammation Research (MCCIR). This is a unique partnership between academia and industry, including two major pharmaceutical companies, to establish a world-leading centre for basic and translational research in inflammation and inflammatory disease.

The MCCIR aims to be at the cutting edge of basic and translational research into inflammatory diseases. We are committed to fostering a collaborative environment that recognises the importance of understanding immune health in addition to its deregulation in inflammatory disease.

The Centre's unique approach to pathway identification aims to lead to the generation of new therapeutic concepts and pathways in the treatment of inflammatory conditions.

Organisation and Expertise

The MCCIR was established in October 2012 to address current priorities in inflammatory disease in a pre-competitive collaboration between academia and the pharmaceutical industry.

The Centre has recruited exceptional scientists for its scientific advisory board: Professor Peter Doherty (Nobel Prize Laureate), Professor Michael Dustin, Professor Sir Marc Feldmann and Professor William Paul, M.D.

GlaxoSmithKline, AstraZeneca and The University of Manchester have each invested £5 million to promote cutting edge research over the next five years. Our mission is to bring together clinical, industrial and academic scientists and to innovate in what is a uniquely interactive environment.

Professor Tracy Hussell
Centre Lead, Professor of Inflammatory Disease

Research Leads

Professors of Immunology
Professor Andrew MacDonald
Professor Dan Davis
Professor Mark Exley

Senior Lecturer in Translational Immunology
Dr James Fildes

Lecturer
Dr Mark Travis

MCCIR Prize Postdoctoral Fellows
Dr Amy Saunders
Dr Gloria Lopez-Castejon

> *"We have an unmissable opportunity to brainstorm new concepts in inflammatory disease with industrial and clinical scientists. If our goal is to translate great science for the benefit of patients, industrial scientists should be involved at the very beginning of the discovery process. The MCCIR embodies a new model of partnership – a model that I believe will overcome former constraints on our understanding of inflammatory diseases."*
>
> Professor Tracy Hussell

The MCCIR:

- is a bespoke group of dynamic and renowned scientists
- combines explorative and targeted research relevant to inflammatory disease
- allows us to take risks beyond the confines of typical three-year funding streams
- is connected with a rich diversity of patient cohorts
- provides investors with a network of expertise and state-of-the-art inflammatory models.

Our Research

In the year since the Centre was launched we have recruited eight Principal Investigators with expertise in explorative research in inflammation. We now have a team of 64 personnel.

Our expertise includes the lung in health and inflammation, ex-vivo perfusion models of human heart and lung, visualisation of cell communication using super-resolution microscopy, skin health and inflammation, oral health, mast, dendritic cell and NKT cell biology, inflammasome regulation and activation and gastrointestinal immunology.

Our overriding aim is to contribute to the generation of new therapeutic concepts which will benefit patients both nationally and internationally.

Research Highlights

Lung Immunity in Health and Disease

Principal Investigator: Hussell

The group has carried out internationally competitive research in a range of areas.

We have investigated how immunological homeostasis is maintained in the respiratory tract, a programme that feeds into all aspects of inflammatory disease. We have published evidence that the default state of lung innate immunity is activation and that it is restrained by the local microenvironment, predominantly by factors expressed or secreted by the respiratory epithelium.

Further research investigates the consequences of altered homeostasis following resolution of acute inflammation or during allergy. We have established models for numerous infections, namely Influenza virus (H1N1, H3N2 and H5N1), Respiratory Syncytial virus, Streptococcus pneumoniae, Haemophilus influenzae and Pseudomonas aeruginosa, Cryptococcus neoformans and Aspergillus.

We are also part of the MOSAIC consortium analysing the pathogenesis of recent avian influenza viruses in humans. The projects leading on from resolution of these acute infections are identifying novel pathways and targets for therapeutics.

Imaging Immunology

Principal Investigator: Davis

The key focus of this research is to address important problems in cell biology and immunology using state-of-the-art and novel imaging techniques. Recent imaging of just a few types of proteins has already led to several new ideas about how immune cells communicate with each other and how they recognise signs of disease.

High-resolution microscope images of immune cells contacting other cells have revealed temporary membrane structures, often called immune synapses, where proteins commonly segregate into specific regions. Exploring how such changing arrangements of proteins occur and how they control immune cell communication is the new science opened up by the immune synapse concept.

Various cell types, including immune cells, can also be connected by thin membrane tethers termed membrane nanotubes. Membrane nanotubes may facilitate a new mechanism for intercellular communication and can also contribute to pathologies e.g. by directing the spread of HIV-1 to distant uninfected cells. We aim to continue this line of research following three overlapping themes of understanding molecular recognition by 'Natural Killer' cells, developing novel imaging technologies and probing aspects of immune cell biology that are broadly applicable such as the intercellular transfer of proteins and RNA.

Dendritic Cells and Type 2 Inflammation

Principal Investigator: Macdonald

This research project focuses on investigating dendritic cell (DC) involvement in immune response induction and development using a combination of in vivo and in vitro model systems. During active murine infection, we are focusing particularly on the parasitic helminth Schistosoma mansoni.

We have developed a model system to assess DC function in vivo by exposing murine DCs to Ag from helminth or bacterial pathogens in vitro, transferring these cells into recipient mice, then characterising the nature of the immune response induced. The flexibility of this cell transfer system makes it a powerful technique for trying to understand the role of DCs in the immune response to any given pathogen or Ag. Many of our results have challenged conventional thinking about how DCs become activated by pathogens, and how they function during T cell response polarisation.

Our goal is to identify the molecular mechanisms underlying the ability of DCs to direct polarised immune responses against

pathogens. Further understanding of this area is a vital step towards informed design of vaccines and immunotherapeutics against diseases that are dominated by immune-driven pathology.

The Role of Integrins and TGF-beta in Regulating Immune Responses

Principal Investigator: Travis

Understanding the factors and pathways that are important in the regulation of the immune system is crucial to understanding pathologies caused by aberrant immune responses.

Transforming growth factor-beta (TGF-beta) is a key regulator of the immune system and is secreted from cells in an inactive form that needs to be activated to exert effects on TGF-beta receptor-expressing cells. We have recently identified the integrin receptor, alphavbetaeight, as an important activator of TGF-beta in the immune system. Disruption of this pathway results in a loss of immune homeostasis, resulting in self-harmful immune responses.

Our current research focuses on understanding the mechanisms and important biological outcomes of integrin-mediated TGFbeta activation in the immune system. Specifically, how is integrin-mediated TGF-beta activation controlled? How does this process affect other immune cell types in order to mediate its function? What other biological outcomes are controlled by integrin-mediated TGF-beta activation?

Answering these questions will provide important insights into how TGF-beta functions and the pathways by which TGF-beta tightly regulates immune responses.

Chronic Cardiothoracic Diseases

Principal Investigator: Fildes

This research aims to understand the regulation of the immune response to organ-specific injury, with a focus on the heart and lungs. We believe the central nexus of the immune response to injury is the tissue-dependent differentiation of monocytes to dendritic cell (DC) phenotypes which then orchestrate specific T cell responsiveness. This first process is dictated by the tissue environment via presentation (of endogenous stress proteins, foreign antigen, allergen, and alloantigen) to organ infiltrating monocytes.

Using ex-vivo lung perfusion, we have isolated human lungs and characterised the extravasation of immune cells, identifying a reservoir of marginated non-classical monocytes that represent 80% of the lung immune cell repertoire. Using an in vitro lung model, we have demonstrated that this cell type can polarise to an inflammatory or regulatory dendritic cell (DC) according to the local tissue environment. Furthermore, acute and chronic injury directs the differentiation of non-classical monocytes into inflammatory DC, which induce T cell polarisation and subsequent antigen specific responsiveness to endogenous injury. This process is reversible following monocyte/DC stimulation via specific receptor ligation.

A major component of our research aims to delineate this phenomenon during normal homeostasis and in different disease states, including severe/allergic asthma, infection and following transplantation. Our ultimate aim is to identify the activating and inhibitory receptors required for monocyte differentiation, and assess therapeutic interventions to control responsiveness to endogenous injury.

Inflammatory Skin Disease

Principal Investigator: Saunders,
MCCIR Prize Post-Doctoral Fellow

Current research focuses on examining the mechanisms which actively maintain the homeostasis of the skin immune system and reserve the impassivity to microflora. A further area of interest is to investigate the deregulation of these mechanisms in the chronic inflammatory disease, psoriasis. This work aims to determine novel pathways involved in regulating the skin immune system which may uncover potential therapeutic targets for the treatment of psoriasis and other inflammatory skin diseases.

Inflammatory Mediators

Principal Investigator: Castejon,
MCCIR Prize Post-Doctoral Fellow

Inflammation is the response of the body to infection or injury that is initiated when immune cells sense the presence of danger signals. These signals can have a pathogenic origin caused by an infection but can also have an endogenous nature, being molecules that in healthy conditions should not be present outside the cells.

This research targets the mechanisms by which these signals trigger the release of inflammatory mediators as well the identification of new endogenous danger signals and how these contribute to inflammation and disease.

Impact and Importance

- Professor Davis's most recent research uses super-resolution microscopy to study immune cell biology – a notable high profile publication was in 'Science Signalling' in June 2013 – and his work in this area was included in the Top Discoveries of 2013 published in 'Discover' magazine.
- In August 2013, Professor Davis published his popular book about the immune system entitled "The Compatibility Gene." This received huge media attention in, for example, The Times, New York Times, The Guardian, New Scientist, New Statesman, BBC Focus and Nature. It was also picked by Bill Bryson in The Guardian's 'Books of the Year' feature.

- The MCCIR has developed cutting-edge microscopy, which provides a rare opportunity to carry out interdisciplinary research using molecular and cellular biology, photophysics and microscopy – desirable for both commercial and academic science. Our continuous-wave gated STimulated Emission Depletion (STED) microscope enables confocal imaging with the power to resolve features in living cells to 40 nanometres. With even greater resolving power, our Ground State Depletion (GSD) microscope maps the location of individual molecules within a cell – one by one – to reconstruct an image to 20 nanometres resolution.
- We have established the MCCIR Flow Cytometry Facility, housing four multicolour analysis systems of various configurations (BD FACSCanto II, BD LSR II, BD LSR Fortessa SORP and BD FACS Verse).
- The MCCIR has developed unique state-of-the-art facilities for ex-vivo modelling of the human lung. This includes air-liquid interface models using precision cut tissue sections from healthy and diseased lungs. Cultures are generated from specific locations of the lung, including tracheobronchial, bronchial and bronchiolar regions, ensuring accurate cellular architecture is in place.
- The MCCIR (Hussell, Saunders) is part of a new strategic alliance with Unilever and has secured £401,716 for a programme of work entitled "Characterisation of immune and inflammatory reactions in the development of dandruff".

Vision for the Future

We will maintain effective communication with all our industry partners by employing joint post-doctoral scientists and PhD students in projects designed by the academic and industrial leads. Students will spend at least six months with industry partners and will be carefully mentored.

We will also enable groups of relevant academics and industrialists to meet for 'away-days' in order to brainstorm key issues. A virtual seminar series will be set up for MCCIR research and webexed to industry partners.

We aim to recruit one or two major funding bodies as equal members and to expand the scope of the MCCIR's work to include other relevant investigators within The University of Manchester. This will be facilitated by joint grant applications and, once further partner funding has been secured, the provision of joint PhD studentships.

We will maintain scientific excellence, asking agenda-setting questions and publishing in the highest impact journals.

Five year Strategic Goals

- To become a Centre showing successful and novel interaction with industry.
- To attract interest from additional industrial collaborators.
- Translation of the concept of defective repair and regulation defining severe disease in lung inflammation.
- Development of a cleaved receptor and extracellular matrix biomarker assay to stratify patients with inflammatory disease.
- Translation of research programmes in gastroenterology, hepatology, neuroinflammation and skin inflammation.
- To make all Principal Investigators financially independent, so they are running successful research programmes benefiting from external funding.
- To publish papers in high impact publications containing industrial co-authors.

Teaching and Education programmes

Undergraduate Teaching

> *We aim to contribute to the delivery of doctors into the NHS who are capable of taking responsibility for difficult decisions in situations of clinical complexity and uncertainty.*
>
> Dr Paul Dark

Dr Paul Dark
Institute Lead in Undergraduate Teaching and Learning, Manchester Medical School's GMC Vertical Theme Lead in 'Doctor as Scholar and Scientist'

Institute Undergraduate Leadership Team

Dr Christine Bundy
Lead, Scholarship in Education, Faculty Education Academy

Dr Liz Cordingley

Dr Rachelle Donn

Dr Stephen Fowler

Professor Judith Hoyland

Professor Philip Padfield

Dr Riina Richardson

Professor David Thompson

Dr Helen Young

Links

- Manchester Medical School
  www.mms.manchester.ac.uk
- Faculty Education Academy
  www.mhs.manchester.ac.uk/about-us/structure/educationacademy

Our Institute is closely affiliated with NHS service providers in Greater Manchester and Lancashire, providing strategic leadership roles across the undergraduate medical curriculum and programme. A key priority is GMC's planned vertical learning outcomes united under the theme of 'Doctor as Scholar and Scientist'.

The Institute's main focus in undergraduate teaching and learning is to assist the Manchester Medical School in the planning, delivery and quality assurance of its medical curriculum and programme.

The Institute's portfolio of translational biomedical research provides a crucial context for the undergraduate Personal Excellence Pathway (PEP), where medical students choose to develop their interests, curiosity and learning as 'Doctor as Scholar and Scientist'.

We provide leadership for half the early year modules and provide a third of science mentors. All our clinical academics are trained Academic Advisors – taking groups of students from secondary education transition through to graduation. We provide significant leadership in guiding medical students through BSc, Masters and MRes programmes and we are leading on developing innovative intercalated degrees in partnership with Manchester Business School.

We also lead on the planning and delivery of summative clinical examinations on three of four major Trust sites and provide clinical academic leadership in all University of Manchester affiliated teaching hospitals, delivering 'bedside' teaching. We also lead the delivery of summative clinical examinations on behalf of our NHS partners.

These clinical academic activities provide an opportunity for us to integrate our focus on scholarship and science with clinical learning relevant for future medical practice in the modern NHS.

Postgraduate Teaching

Active engagement with a learning community

The Institute is a major contributor to the Faculty's postgraduate teaching provision and has established the Healthcare Science Masters Alliance, which provides postgraduate education in the healthcare sciences to NHS staff and individuals from overseas.

The Institute provides programmes to three of the four School of Medicine Masters Alliances, as well as nine of the 25 Masters programmes delivered by the School of Medicine.

Taught Masters Degrees are an important component of the educational portfolio of the Faculty of Medical and Human Sciences. The Institute of Inflammation and Repair is committed to delivering high quality postgraduate taught education combined with an outstanding student experience. We believe that learning is both context- and culture-specific and occurs through active engagement with other learners in a community of practice.

While much of the learning will take place in the academic environment, clinical partners also play a vital role. Working in partnership with NHS healthcare professionals, clinical and non-clinical academics provide students with underpinning knowledge and guidance to facilitate the development of critical thinking, reflective practice and problem-solving skills. These are all vital prerequisites of high quality healthcare delivered by a lifelong learner.

The Institute delivers nine Masters Programmes, with a primary focus on the healthcare sciences. We currently have over 200 students – a number that is projected to increase to more than 300 over the next three years. The Institute has secured funds to create new state-of-the-art teaching laboratories within the Stopford Building.

Planned developments include the adoption of a blended learning format for our programmes with the introduction of new interactive online learning resources leading to the creation of a 'virtual campus' for the healthcare sciences.

Professor Philip Padfield
Institute Lead in Postgraduate Taught Education

Programme Directors

Dr Hector Chinoy
Dr Sarah Herrick
Professor Paul Klapper
Dr Catherine O'Neill
Professor Philip Padfield
Dr Riina Richardson
Dr Carol Yates
Dr Helen Young

Inflammation and Repair Programmes

MSc Clinical Biochemistry
MSc Clinical Sciences (Blood Sciences)
MSc Clinical Science (Clinical Bioinformatics)
MSc Clinical Rheumatology
MSc Medical Microbiology
MSc Medical Mycology
MSc Medical Virology
MSc Skin Ageing and Aesthetic Medicine
MRes Medical Sciences
MRes Tissue Engineering and Regenerative Medicine

> *"We aim to produce highly educated, expertly trained, highly competent and caring health care professionals, whose skills and expertise will have a beneficial impact on the health of the general population both nationally and internationally."*

Professor Philip Padfield

Manchester Academy for Healthcare Scientist Education (MAHSE)

Modernising scientific careers

MAHSE is a unique community of education and practice consisting of university-based educators and researchers, leading healthcare professionals and professional bodies. The Academy supports 'Modernising Scientific Careers', the new education and training framework for NHS healthcare scientists. It does so by promoting the development and facilitating the delivery of the academic components of the NHS practitioner and scientist training programmes.

MAHSE currently oversees the delivery of three undergraduate programmes (life sciences; neurosensory sciences and physiological sciences) and seven Masters programmes (blood sciences; cardiac, critical care, vascular, respiratory and sleep sciences; cellular sciences; clinical bioinformatics; clinical pharmaceutical sciences; neurosensory sciences and reconstructive sciences).

These are delivered via a multi-institutional and multi-professional network comprising academics from five universities (The University of Manchester, Manchester Metropolitan University, University of Salford, University of Liverpool and King's College London) and healthcare professionals from over 35 NHS Trusts across England and Wales. MAHSE represents one of the largest educational networks in the UK and is the largest single educator of healthcare scientists in Europe.

Postgraduate Research Training

Offering the very best research experience

> *"Our vision is to become a leading centre for postgraduate research training. We pride ourselves on recognising the needs of students and responding to them in a way that enables them to gain the skills they need in today's competitive job market."*
>
> Dr Catherine O'Neill

Postgraduate research education within the Institute offers programmes leading to the degree of PhD, MD or MPhil. Currently we have over 150 students with a ratio of home to overseas students of approximately 9:1.

We are committed to the continuous audit and improvement of student experience and have initiated a forum, led by students and providing direct access to the Institute's PGR management team. We have acted on feedback, for example via initiatives such as 'Ethics and Research Passport training'.

A new student-led website includes a database of techniques available throughout the Institute, and is a valuable marketing tool, helping us to recruit high quality students from the UK and overseas. Our well-funded research laboratories offer the very best research experience and students benefit from comprehensive support in both research and transferable skills.

Dr Catherine O' Neill
Director of Postgraduate Research Education

Tutors

Dr Hector Chinoy
Dr Sarah Herrick
Professor Paul Klapper
Dr Catherine O'Neill
Professor Philip Padfield
Dr Riina Richardson
Dr Carol Yates
Dr Helen Young

Transferable Skills Trainer

Dr Steve Richardson

Administrators

Mrs Christine Burns
Mrs Alex Sadler

All students are assigned at least two expert supervisors. Many of our academics have established links with partners who can further enhance student development by offering placements in commercial laboratories.

The postgraduate management team provides a range of events to foster networking and transferable skills and ensure that these are applied in a supportive environment. Examples of this include 'Showcase' events, a rolling programme of oral presentations for students and an annual poster presentation day.

All students complete an exit questionnaire when they have submitted their thesis and we are proud that the results are consistently high. Our success is exemplified by our high submission rate and by our high first-time pass rate – both of which are the best in the Faculty.

Future Plans

- We will continue to maintain high submission rates through diligent management of students.
- We will achieve a steady increase in student numbers.
- We will forge links between taught and research graduate programmes. In particular, we will produce a bespoke programme for overseas students, incorporating taught elements such as entrepreneurship and research business management.

We are also working closely with the MCCIR to integrate PHS Studentships. The Centre offers unique opportunities for students to experience research within a group with a strong translational ethos. The Institute will work closely with MCCIR to maximise studentship opportunities for excellent candidates.

MRC Research Training Programme in Clinical Pharmacology and Therapeutics

Harnessing the strength of two universities

The £3 million, North West England Clinical Research Training Fellowship Programme in Clinical Pharmacology and Therapeutics, awarded in 2010 to the Universities of Liverpool and Manchester, is jointly funded by the MRC and industry partners including AstraZeneca, GlaxoSmithKline, ICON and the Medicines Evaluation Unit.

The Programme has appointed 12 clinical research fellows in open competition and harnesses the combined strengths of the two universities by focusing on the broad themes of Stratified Medicines and Drug Safety in the clinical areas of:

- paediatrics
- infectious diseases
- inflammation and repair (e.g. respiratory medicine, inflammatory skin disease, diabetes and endocrine sciences).

All fellows are working towards PhDs and receive modular training in Clinical Pharmacology. A significant strength of the programme is its links with organ specialities and themes in both universities. These provide trainees with access to patients with a variety of diseases, as well as to:

- clinical research facilities at the Royal Liverpool Hospital and at the NIHR /Wellcome Trust Clinical Research Facility in Manchester
- accredited clinical trials units
- state-of-the-art technologies and research facilities in industry.

Professor Chris Griffiths
Co-director for The University of Manchester

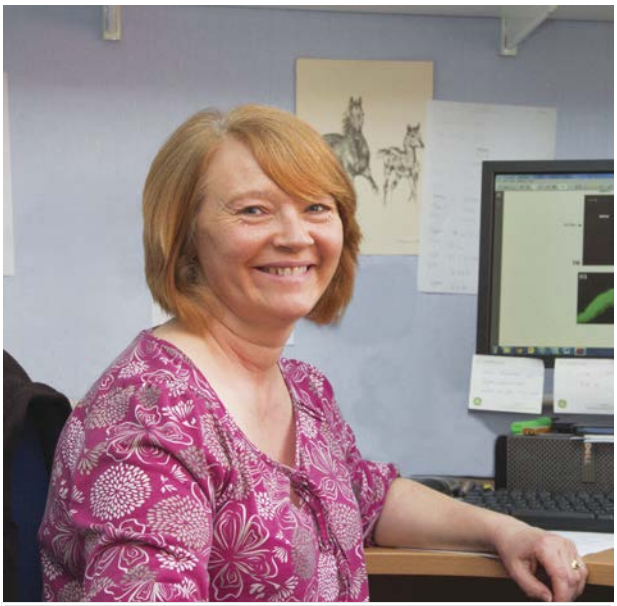
Professor Munir Pirmohamed
Co-director for University of Liverpool

MANCHESTER 1824
The University of Manchester

UNIVERSITY OF LIVERPOOL

Business Engagement

Increasing the health and wealth of the nation through translation of high quality research



Dr Catherine O'Neill
Business Engagement Lead

The Government views innovation as a major mechanism by which the UK can benefit in both health and wealth. A major focus of the IIR is the translation of our research into healthcare products and new therapeutics, not only through contract research but also through generation and commercialisation of our own intellectual property.

The IIR has fostered numerous spin-out companies and a number of licencing deals with multinational companies. Additionally, many of our researchers are actively engaged in contract research and in the last five years the Institute has secured industry funding of over £234 million, including clinical trials funding. A major goal for the next three to five years will be to increase engagement with SMEs.

Case study: Phagenesis

Phagenesis: this is a spin-out from the GI Sciences research group and was founded by Professor Shaheen Hamdy. The company makes 'Phagenyx'- a revolutionary new technology for the treatment of dysphagia following stroke. The technology is based on 20 years of research and is clinically proven to improve swallow function by restoring neurological control.

Phagenesis was originally funded by £220,000 of pump-priming Venture Capital money from UMIP and The Liverpool Seed Fund, Merseyside Investment Group but has now entered into an exclusive funding arrangement with Angloscientific, a technology-based investment company. A second tranche investment of £9 million will take Phagenesis and its products to clinical trial ready CE marking and independent testing. The expectation is that this increased capital will take the products to European and US markets.

Despite being a micro-company, the key skills needed to manage this programme sit within the organisation itself. The senior management team has several decades of experience in the devices and biotech sectors encompassing product development, project management, clinical trials, business development and sales and marketing. A lean operating model will keep infrastructure and overhead costs to a minimum, thus maximising the value of the funding awarded. This approach is the most effective way of ensuring that activities are carried out to the appropriate industry standards, are driven and shaped by the validated needs of the marketplace and are compatible with our vision for commercial exploitation.

As industry lead, Phagenesis will take responsibility for delivering the commercial business based on the technology and so must be responsible for the management of the programme from the outset. The project manager has over 10 years' experience in managing the successful development of devices for the bio and healthcare markets. Building on this expertise in design strategy, we anticipate that a developmental model will significantly enhance adoption of the technology leading to its implementation as a routine hospital-based therapy, and resulting in downstream royalties.

Case study: MIMIT – Manchester

MIMIT – Manchester: Integrating Medicine and Innovative Technology is the first international affiliate of CIMIT®, a collaborative initiative of world-renowned academic and healthcare delivery organisations in Boston, US. MIMIT forms a cornerstone of the Manchester Academic Health Science Centre (MAHSC) Health Technology Hub. The MAHSC partnership comprises The University of Manchester, three acute Trusts, two specialist Trusts (cancer and mental health) and a Clinical Commissioning Group. The integrated asset base of MAHSC makes a major contribution to the UK's North West, one of the country's two most successful bio health clusters housing more than 450 companies. The sector provides £1.6 billion to the economy and has demonstrated 19% growth over the last 10 years (Bionow 2012). The major academic partner, The University of Manchester, has the largest number of industry collaborations of any university in the UK (ABPI 2012). Via its commercialisation company UMIP, it has secured £220 million in investments for its spin-out companies and completed more than 300 license deals. It has also attracted Europe's largest venture fund based on a single university.

Drawing upon these assets, the primary aim of MIMIT is to drive innovation on the basis of unmet clinical need and to improve patient care. Clinicians, scientists, engineers, industry, tech transfer organisations, health economists and investors are brought together in a structured way to catalyse development of innovative healthcare technologies through rigorous scoping/validation of unmet clinical need and de-risking of investment. MIMIT provides pump-priming project investment, project management expertise and links with relevant industry partners. In addition MIMIT facilitates leverage of follow-on investment.

This approach attracts investment that would not otherwise be realised. The ability to attract investment has been evidenced from a review of existing projects and discussions with Venture Capital and corporate entities.

MIMIT technology development projects are many and varied. Examples include repairing severed nerves, replacing damaged discs in the spine, next generation colostomy bags, home monitoring and reducing ventilator associated lung injury in children and adults.

Over a six year period MIMIT has developed 43 projects identified by the MIMIT site miners. These projects were identified from 182 unmet needs scoped from across the MAHSC NHS ecosystem.

MIMIT projects have now led to three new spin-out companies, a third has been taken up by an SME and MIMIT is directly supporting two SMEs in a joint project. Four projects are in commercial negotiations with a further four in the pipeline. In addition, we have contracted with three global companies to scope and validate unmet healthcare needs and have joint-funded a further project with Johnson & Johnson. Seven other projects have led to joint industry initiatives ranging from design to implementation.

Case study: Skinbiotics

Skinbiotics: a co-development and licencing deal with Johnson & Johnson (J&J). This is a new platform technology recently invented within the Centre for Dermatology Research. The technology harnesses the power of probiotic bacteria used topically for skin in health and disease. The technology began as a £60,000 project funded through UMIP but has now been licensed by Johnson & Johnson for further commercial development in collaboration with researchers at Manchester. The vision is that IIR academics will work in close collaboration with J&J scientists to co-develop a number of technologies for the consumer and healthcare markets. The project will be run jointly via steering committee consisting of J&J in-house experts and IIR academics, supplemented by external experts. This model of co-development is viewed as an extremely attractive 'middle ground' between contract research and formation of a spin-out and allows all parties to play to their strengths.

These examples demonstrate that innovation is thriving within our Institute. Academics are engaging with industry at all levels including clinical trials, contract research and co-development of University of Manchester- and industry-owned IP.

Social Responsibility

Making a difference nationally and internationally

MAKING A **DIFFERENCE**

Professor Wendy Thomson
Social Responsibility Lead

In line with the University and Faculty Strategy for Social Responsibility, we are committed to ensuring that the activities of the Institute have a positive impact on others. Through high-quality research and education, focused on translational medicine, we are well-placed to contribute to improving health and healthcare delivery – not only for the local population but also nationally and internationally. We endeavour to publish our research in leading journals and present data at international conferences. Dissemination of our findings is enhanced through regular press releases and TV and radio interviews.

Translating research findings into patient benefit often requires changes to policy and guidelines by working with NICE and collaborating with industry partners. It can also involve the establishment of spin-out companies to help accelerate the development of new technologies or treatments. We are committed to educating the next generation of health professionals and increasingly look for opportunities to support healthcare education activities in developing countries.

We depend on the commitment and collaboration of patients and the public for our research and all the Centres in the Institute use a variety of strategies to achieve engagement and involvement. Activities include patient user groups, focus groups, Open Days for patients and the public, together with talks in schools and at public meetings. We also make an active contribution to the Faculty Centre for Engagement and Involvement http://www.mhs.manchester.ac.uk/public/cei/

The Institute supports the University's environmental and sustainability campaign and we have two main challenges in this respect: to reduce unnecessary travel and to minimise the amount of paper that is used. Institute staff are based on a number of sites across the city and we are keen for investment in video-conferencing facilities so people can participate in meetings and lectures without the need to travel.

Case study: Leading International Fungal Education (LIFE)

Over 300 million people are acutely or chronically infected by fungi, leading to death, long-term illness, blindness, psychological problems and reduced work capacity. Many recent improvements in diagnostics and treatment have not reached treating clinicians in all countries, and access to appropriate diagnostics and simple antifungal agents is far from universal.

LIFE is an organisation led by Professor David Denning who has been caring for patients with fungal infection for 25 years. LIFE aims to facilitate high-quality diagnostics, patient care and educational resources for fungal infections everywhere. LIFE is therefore flexible in its approach to achieving its overarching goals but focuses on improving clinical expertise and access to both diagnostic facilities and appropriate treatments. LIFE also promotes public awareness and education about fungal disease with the aim of creating a more sympathetic environment for implementation of care improvements.

http://life-worldwide.org/

Case study: Patient Involvement in Musculoskeletal Research

"I have seen many research projects discussed, altered and agreed with such enthusiasm and commitment it gives me great hope for the future."

Susan, Rheumatoid Arthritis patient and Research User Group Chair

Since 2009, patients and carers with a range of musculoskeletal diseases have been members of a Research User Group (RUG) which is now part of the NIHR Manchester Musculoskeletal Biomedical Research Unit (BRU). The group advises the BRU on all aspects of its research – from initial ideas, review of grant applications and study protocols to dissemination of results. The RUG aims to provide a "reality check" for researchers whilst simultaneously empowering its 15 members. The group meets three times a year and its influence is spreading; recent activities include work towards the development and patenting of a new medical device and involvement in a Priority Setting Partnership with the James Lind Alliance and the University of Oxford.

Case study: Open Day for Children with Arthritis and their Families

In 2012 we held our first Open Day for children with juvenile idiopathic arthritis (JIA) and their families who participate in the Childhood Arthritis Prospective Study (CAPS). This included informative talks from CAPS researchers, interactive activities, laboratory demonstrations and poster displays. For families there was also the opportunity to tell the researchers what research they were most interested in. These days are valuable for study participants as it provides a better understanding of how the information they provide is used. Researchers learn what other topics may be important from a patient's perspective, often leading to new research projects.

Following feedback from the Open Day we have established a website for CAPS participants and their families:

http://www.caps-childhoodarthritisprospectivestudy.co.uk

Case study: Launch of a New Website

The RegenX (www.re-gen-x.com) website is a much-needed resource for schools and colleges in the field of regenerative medicine. It has been developed by Dr Stephen Richardson (Centre for Tissue Injury and Repair) with funding from the BBSRC and The University of Manchester Investing in Success scheme and is aimed primarily at GCSE and A-level students, but accessible to all. It offers the opportunity to learn more about stem cells and how they can be used in regenerative medicine, through text, animations and videos covering a broad range of stem cell related topics. It includes talks from scientists focusing on the world-class research being undertaken within The University of Manchester and a teacher pack with classroom activities based around the videos and animations.

Access to up-to-date information and discussions in this ever-expanding field is provided through Facebook (https://www.facebook.com/RegenxMcr) and Twitter (https://twitter.com/RegenX1) pages

The Institute of Inflammation and Repair

Our Vision for the Future

Since its formation in 2013 the IIR has established a reputation as a successful organisation with six Centres delivering excellent research and a dedicated team of staff making major contributions to teaching and learning. All this is underpinned by a strong professional and support services team. We are, however, ambitious for far greater success.

To facilitate further evolution and to ensure recognition as a world-leading Institute for Inflammation and Repair Research, we have invited an External Advisory Board of international experts to visit during 2014 and review our Institute in order to help us develop a strategic plan for the next five years.

Many of our aims and aspirations (outlined below) are already clear and are being actively pursued. We will develop plans for the future which aim to achieve greater connectivity and enhanced interactions within our Institute and with parts of the University and our partners in MAHSC. This will be achieved through collaborative grant applications leading to jointly-authored publications and through the activities of research students, fellows and research staff working at the interfaces of our Centres and with other groups within the wider University. We will seek to maximise the strengths in Manchester so that more of our research is internationally leading. We have recently appointed leads for Business Engagement and Social Responsibility to facilitate the sharing of best practice and to support further developments. We will ensure our strategic plan fully incorporates activities in these areas.

Aims and Aspirations

- To be a world-leading Institute for research and education in the field of inflammation and repair, translating scientific research into patient benefit in each of our clinical Centres.
- To be a key component of the Manchester Academic Health Science Centre (MAHSC), with a direct link to the Inflammation and Repair Domain.
- To underpin the MAHSC Experimental Medicine Strategy, through the Experimental Medicine Strategy Board (EMSB; lead Professor Chris Griffiths).
- To harness the research power and discoveries of the Faculties of Medical and Human Sciences, Life Sciences and Engineering and Physical Sciences and rapidly translate them for the benefit of patients with inflammatory disease. This 'Discovery to Care' pathway is enabled by NIHR-funded Trust facilities and programmes.
- To expand the unique £15 million Manchester Collaborative Centre for Inflammation Research (MCCIR) jointly funded by AstraZeneca, GlaxoSmithKline and The University of Manchester, as a platform to underpin and expand our world class translational Research Centres.
- To support and mentor clinical and non-clinical researchers as they establish and develop their research careers. In collaboration with the Faculty Academy (Lead Professor Neil Hanley), we will encourage our researchers to obtain Fellowship funding at all levels from Research Councils and charities.
- To provide undergraduate teaching (lead Dr Paul Dark) of the highest quality. For the undergraduate medical course, we provide leadership for six of eight early year modules and 10 of 35 science mentors. Every senior clinical academic also acts as a long-term student mentor.
- To provide postgraduate teaching of the highest quality. The Institute is the largest provider of postgraduate education in the healthcare sciences in the UK with an annual intake of over 80 students. Phil Padfield is Director of the Manchester Academy for Healthcare Scientist Education.
- To provide postgraduate research training (lead Dr Catherine O'Neill) of the highest quality. We have over 150 closely-mentored PhD and MD students, with an in-time completion rate of over 90%.
- To run a transparent and fiscally responsible budget in excess of £35 million, of which over £18 million is externally-funded research income.
- To enable staff in other Faculty institutes, University Schools and NHS partner Trusts to collaborate with the Institute through meaningful affiliation and shared programmes of work.
- To facilitate translation of our research into patient benefit through collaboration with industrial partners and commercialisation activities (Business Engagement lead Dr Catherine O'Neill).
- To contribute to global health and well-being, public and patient engagement and involvement, and sustainability activities according to the University's Social Responsibility Policy.


UNIVERSITY OF MANCHESTER

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