

Faculty of Biology, Medicine and Health

Research and Innovation Strategy

2017-2022

Professor Nigel Hooper

Vice Dean for Research and Innovation

1. Executive Summary

The vision of the Faculty of Biology, Medicine and Health (FBMH) is to undertake world-class discovery science, develop effective clinical translation, produce high impact health services research and facilitate implementation of advances in health and social care for the benefit of society in Manchester, the UK and across the globe.

To achieve this vision we have developed a strategy that has three overarching goals:

1. We will support and develop our researchers to achieve their ambitions and our vision.
2. We will achieve international research excellence in key areas by building on our current research strengths and by identifying and developing emerging areas critical to our vision.
3. We will deliver positive societal impact from our research by maximising its translation and implementation.

Through focusing on the three goals above we will drive forward continually the quality and ambition of our research. Our existing research strengths and identified priority areas focus effort, and target resource, to address some of today's most important questions in biology, medicine and health. These research strengths and priorities are based on existing and/or emerging capability in which we have distinctiveness and strength, aligned to significant unmet need, whether scientific, clinical or societal. Through the quality and focus of our research and our researchers, coupled with the opportunities for translation in Manchester, we will create a beacon for investment from industry creating a virtuous cycle from discovery science to translational and applied research with real world impact.

Major themes running throughout the strategy exploit opportunities that are unique to Manchester, bring together different disciplines to solve problems, and build on our integrated 'One Manchester' approach. For example, through our NHS partners and Health Innovation Manchester (HInM) we will exploit opportunities presented by the devolved health and social care budget to Greater Manchester to address the problems faced by an ageing society that is living longer with disease, in a region with high levels of morbidity and health inequalities. We also recognise the significance of Patient and Public Involvement and Engagement to develop and deliver our research portfolio by understanding and addressing issues which are important to patients.

We are fortunate to benefit from the breadth and quality of research and facilities not only in FBMH but across the University at interfaces such as advanced materials and healthcare, mathematics and biology, health services research and policy, health economics and social sciences, business and health - some of the new frontiers for today's science. Thus enhanced integration, coordination and support across existing areas of strength, paired with investment in key emerging areas, is critical to deliver innovative, world-leading research programmes and maximise the translation and societal impact of our work.

Key to delivering this strategy is to develop a culture that enables research in a collegial environment that ensures equality, diversity and the development of bright minds without prejudice or favour. We will further enhance our world-class and highly sought after environment for training the next generation of scientists, clinicians and health care professionals. We will foster a common sense and transparent approach where our processes and policies support and enable research, and where research success is recognised and valued.

This document, which has had input from colleagues across the Faculty, sets out the research strategy for FBMH over the next few years. Inevitably our goals and priorities will evolve over time as success is delivered or as new opportunities emerge, so this is a dynamic "living" strategy – to be continually reviewed and refreshed.

2. Introduction

2.1 Vision and goals

The vision of the [Faculty of Biology, Medicine and Health \(FBMH\)](#) is to undertake world-class discovery science, develop effective clinical translation, produce high impact health services research and facilitate implementation of advances in health and social care for the benefit of society in Manchester, the UK and across the globe.

To achieve this vision we have developed a strategy that has three overarching goals (Fig. 1).



Fig. 1. The three overarching goals of the FBMH research strategy

Through focusing on these three goals we will invest in our workforce to build a vibrant and exciting research culture and a supportive environment where all our staff and students can realise their full research potential and deliver innovative, world-leading research with impact.

Our goals align with the strategic priorities of our partners, including our sister Faculties in the University and the local NHS trusts through the [Manchester Academic Health Science Centre \(MAHSC\)](#), and the wider [Greater Manchester Health & Social Care Partnership](#). Through [Health Innovation Manchester \(HiInM\)](#) we will drive an academic health sciences system impacting on the needs of Greater Manchester. This will enable us to take advantage of the unique opportunities presented by devolution of the health and social care budget to Greater Manchester to translate our research for patient and population benefit.

2.2 Context

The UoM is a world leading research-intensive University with a clear vision to be ranked in the top research institutions worldwide with concomitant growth in research income¹. There is a clear need therefore to increase the amount of research at the very highest levels of excellence and raise the aspiration of researchers to tackle ambitious research questions.

On the 1st August 2016, FBMH was established through the integration of the former Faculties of Life Sciences and Medical and Human Sciences, to optimally align our discovery science, translational research, clinical and applied health research capabilities. FBMH is now one of the largest such integrated faculties in Europe (with 3,200 staff, 11,000 students, £122m annual

¹ [University Research Strategy 2015](#)

research income) and combines basic life science researchers with biomedical, clinical and population health and health services researchers.

The Faculty is made up of [three Schools](#), each with six Divisions (see Annex 1). Cutting across this School and Division structure are eight strategic, interdisciplinary [Research Domains](#) (see Annex 1 and section 4.1). The Research Domains are dynamic, able to respond quickly and to evolve to facilitate a match between the scale, scope and quality of our research with the strategic goals, opportunities and priorities identified by patient and public involvement and set by our major partners and funders.

There is a considerable breadth and depth of research undertaken across FBMH that offers unrivalled opportunities to develop cutting-edge, collaborative multidisciplinary research to address questions of the highest scientific, clinical and societal importance.

Discoveries in basic science underpin medical, technological and societal development and growth. We have significant critical mass and excellence in life sciences research, with internationally recognised programmes in cell biology, developmental biology, biochemistry and genomics addressing the fundamental molecular and cellular processes that govern the functioning of living organisms and that begin to inform our mechanistic understanding of disease processes. These are epitomized by our [Wellcome Trust Centre for Cell-Matrix Research \(WTCCMR\)](#) which examines the cross-talk between cells and matrix to provide insights into the mechanisms that underpin tissue assembly and function and identify why tissue failure is a major factor in many chronic diseases. The [Manchester Collaborative Centre for Inflammation Research \(MCCIR\)](#) is another example of a multidisciplinary research centre that performs explorative research, in collaboration with industry, leading to step changes in our understanding of the molecular basis of immune health and its dysregulation in inflammation.

To underpin our discovery life sciences research, we have invested significantly in state-of-the-art [core research facilities](#) staffed by skilled experimental officers and technicians that provide an efficient and effective means of delivering key technologies and generating a skills repository, both of which are essential to maintain international research competitiveness. Our core research facilities, which are available to all researchers, include bioimaging, bioinformatics, biomolecular analysis, mass spectrometry, electron microscopy, flow cytometry, genomic technologies, DNA sequencing, histology, systems microscopy and a transgenic unit with expertise in CRISPR/Cas9 editing of the genomes in a range of model organisms.

We have world-leading expertise in cancer exemplified by our [Manchester Cancer Research Centre \(MCRC\)](#) and [Cancer Research UK \(CRUK\) Major Centre](#) (one of only two in the UK) and our partnership with the [Christie Hospital NHS Foundation Trust](#), the largest cancer hospital in Europe, that will have the first operational proton beam in the UK for therapy and research. We have outstanding expertise across a range of inflammatory disorders and host two Arthritis Research UK Centres of Excellence (in [Genetics and Genomics](#), and in [Epidemiology](#)) and three [MRC-funded stratified medicine consortia](#) ([MATURA](#), [PSORT](#), [STRATA](#)). Our outstanding [Maternal and Fetal Health Research Centre](#) has been externally funded by Tommy's the baby charity since 2000.

The [Stoller Biomarker Discovery Centre \(SBDC\)](#), the largest clinical proteomics centre in Europe, and the [MRC/EPSRC-funded Manchester Molecular Pathology Innovation Centre \(MMPaThIC\)](#) facilitate the translation of biomarkers from discovery science through to the clinic. Early stage translation, first-in-man studies and clinical trials are a key priority and strength and benefit from our superb [NIHR Clinical Research Facilities \(CRFs\)](#), clinical research infrastructure (including extensive magnetic resonance (MR) and positron emission tomography (PET) capability in the [Wolfson Molecular Imaging Centre \(WMIC\)](#) and our newly opened MR-PET scanner on the [Manchester University NHS Foundation Trust \(MFT\)](#) site), and [Clinical Trials Unit \(CTU\)](#).

The recent establishment of a major [NIHR Biomedical Research Centre \(BRC\)](#) with 7 programme themes (musculoskeletal, hearing health, respiratory medicine, dermatology, cancer prevention &

early detection, advanced radiotherapy, and cancer precision medicine) exemplifies what can be achieved through a coordinated, strategic partnership approach. The BRC puts us at the forefront of precision medicine through its P4 approach of 'Predict, Prevent, Personalise, and Participate'.

Pulling all of this together is our world-leading expertise in population health and applied health services research. Our expertise in health and bio-informatics enables us to develop novel approaches at the population level through our MRC-funded [Health e-Research centre \(HeRC\)](#) at the [Farr Institute](#) of Health Informatics Research. We host the [Cochrane Oral Health Group](#), [Cochrane Wounds Group](#) and the [Cochrane Bone, Joint and Muscle Trauma Group](#) and manage an [Evidence Synthesis Research Network in collaboration with NICE](#). We have great strengths in health policy research, for example in the [NIHR/DH-funded Policy Research Unit in Commissioning and The Health Care System \(PRUComm\)](#). We receive substantial funding through our membership of the NIHR [School for Primary Care Research \(SPCR\)](#) and [School for Social Care Research \(SSCR\)](#). We are home to the [NIHR Research Design Service \(RDS\) North West](#), which is supported by our methodologists from a diverse set of disciplines.

Our capability to ensure adoption and diffusion of our discoveries into the NHS and clinical settings is facilitated through our [NIHR Patient Safety Translational Research Centre \(PSTRC\)](#) and the [NIHR Collaboration for Leadership in Applied Health Research and Care \(CLARHC\)](#). Initiatives such as the [Salford Lung Study \(SLS\)](#) and the [Connected Health Cities \(CHC\)](#) programme allow us to observe in real time the impact of innovations on whole populations. Through MAHSC these are integrated into Health Innovation Manchester (HiM), creating an academic health sciences system for Greater Manchester delivering the whole discovery to care continuum with population impact.

2.3 Challenges and opportunities to delivering our research strategy

There are many challenges to overcome in delivering a strategic approach to research in a faculty of the size, diversity and complexity of FBMH. It is essential that our identified priorities align across our Research Domains, Schools and Divisions and with those of our major funders, so that all of our researchers are able to contribute effectively to the delivery of our research strategy. The greatest challenge is to develop a culture that enables research in a collegial environment, that supports and enables researchers at all career stages to develop to their full potential, that fosters a common sense and transparent approach where our processes and policies support and enable research, and where research success is recognised and valued.

Effective communication channels and a strong web presence will be crucial to enable the internal delivery of this strategy and the projection of our achievements and potential to the outside world.

To deliver our goals with finite resources we will focus and prioritise our investment according to strategic strength, need and opportunity. A focus on international excellence and success provides greater identity to the Faculty and aids with attracting and retaining the very best researchers and enabling them to thrive. We are particularly focused on attracting early career researchers of the highest calibre and developing them through externally-funded fellowships to become world-leading independent investigators.

Across the Faculty we will further improve our competitiveness for larger, programme and centre level, funding. We will ensure that our leaders and our most promising investigators with the potential to secure such funds have sufficient protected time, Professional Support Service (PSS) support and mentoring to allow them to fulfil their ambitions and produce competitive research of the highest quality. These measures will ensure that the Faculty provides the best opportunities and support to make it a career destination of choice for the research stars of the future.

By linking across UoM into the [Faculty of Science and Engineering \(FSE\)](#) we have the opportunity to synergistically address major challenges in discovery science and health by bringing together staff with diverse but relevant expertise in biomedicine, healthcare, engineering, physical sciences, mathematics, materials and computing. There is a huge and unique opportunity to lever the investment in the [Manchester Institute for Biotechnology \(MIB\)](#), the [National Graphene Institute](#)

[\(NGI\)](#), the [Graphene Engineering Innovation Centre \(GEIC\)](#) and the [Sir Henry Royce Institute](#) (the Royce) to apply new 'advanced materials', especially nanomaterials, to medicine and health care, attracting industry investment in health care technologies that will range from new devices to tissue engineering and regenerative medicine.

Through closer integration with colleagues in the [Faculty of Humanities](#) we have opportunities to address the social, economic, organisational and ethical implications of our research, for example, with the [Manchester Institute for Collaborative Research on Ageing \(MICRA\)](#) and the [Global Development Institute \(GDI\)](#), as well as the economic, organisational and workforce issues of our research with the [Alliance Manchester Business School \(AMBS\)](#).

Greater Manchester has an unprecedented opportunity to revolutionise its healthcare infrastructure and improve the well-being of its population with the devolution of the £8 billion health and social care budget ("[DevoManc](#)"). Working through its academic health science system, HInM, the Faculty will grasp this opportunity to translate and apply research to produce health and economic benefit for the 3 million people living in Greater Manchester. We will build on our symbiotic working partnership with the local NHS to ensure that epidemiological, public health, health behavioural and health systems research can yield benefits rapidly for the local population in Greater Manchester.

There have been significant changes in the funding landscape in recent times, with funders becoming increasingly more strategic in how they allocate new resource, often around longer, larger, multidisciplinary awards. This approach, together with uncertainties around the UK leaving the EU ("Brexit"), make it essential that we are able to anticipate new opportunities and ensure that FBMH is well prepared to exploit these when they arise.

3. Supporting and developing our researchers

Goal 1: "We will support and develop our researchers to achieve their ambitions and our vision"

Achieving our vision will only be possible by developing, supporting and empowering our people to deliver it. We need to invest in our workforce to build a vibrant and exciting research culture and a supportive, collegial environment where all our staff and students can be ambitious, realise their full research potential and deliver innovative, world-leading research with impact. We will commit to a common sense and transparent approach where our processes and policies support and enable research, and where research success is recognised and valued.

We must ensure that appropriate and coordinated support mechanisms are in place to help our researchers to submit competitive funding applications. We will develop and attract future research leaders capable of securing major funding awards (e.g. programme grants, senior fellowships) and leading large, interdisciplinary programmes of research and Centres of Excellence. A particular emphasis will therefore be placed on identifying those staff who have the potential to become future research leaders and providing them with tailored support, training and mentoring to achieve this.

Support for our researchers is provided by a range of Professional Support Services (PSS) including (further information on each of these can be found in Annex 2):

- the [Research, PGR and Business Support Services \(RBSS\)](#), which provides strategic guidance and practical support to academics in all aspects of research grant management;
- the [Strategic Funding Team \(SFT\)](#), which provides high-level strategic support, coordination and facilitation of large scale funding and fellowship applications;
- the [Doctoral Academy](#), which engenders a culture, amongst both staff and students, that recognises the value of PGR activity, incites aspirational goals and supports programme completion;

- the [Fellowship Academy](#), which provides advice and support for fellowship awards from doctoral studies through to senior levels through all stages of application from initial planning through to interview training;
- the [Centre for Academic and Researcher Development \(CARD\)](#), which delivers high quality programmes supporting the development of academic staff and early career researchers.

We will:

1.1) develop a research culture that is collegial, engaging and that embraces opportunities for interdisciplinary working

1.2) provide high quality support for researcher development across the career continuum and develop a proactive, strategic approach to developing new initiatives aimed at supporting career development of our research active staff and students

1.3) ensure the researcher development continuum is aligned closely to the Faculty's research strategy, with cross-fertilisation between the strategies of the Faculty's Research Domains and Schools, the annual performance review (APR), the operational plan, and the goals and key performance indicators of the University.

1.4) ensure that supportive Performance and Development Reviews (P&DR) are conducted annually for all staff members and make certain that:

a) sufficient time for research is protected²

b) training and mentoring opportunities are identified and that appropriate mentorship and training support are implemented

c) appropriate and ambitious targets for generation of research income and publication of outputs are established in line with the [FBMH Statement of Research Expectations](#) and discipline norms

d) staff with the potential to achieve major individual investigator awards are identified and provided with proactive RBSS support and academic mentoring

1.5) establish a staged research leadership development programme and monitor satisfaction of established leaders and ensure they are properly resourced to achieve their potential and motivated to remain at the University

1.6) provide a robust, fully resourced research support service that is flexible and can adapt to ensure provision of high quality support and service to research staff

1.7) ensure that our research infrastructure is state of the art and meets our researchers' current and future needs

1.8) ensure that our processes and policies that support and enable research are effective, efficient, robust and transparent

1.9) recognise, value and celebrate research success

1.10) engage and support our postgraduate researchers in delivering outstanding research and quality outputs and ensure they have access to appropriate research and transferrable skills training (in conjunction with CARD)

Key Performance Indicators (KPIs):

1.11) embed the Research Staff Development programme across the Faculty, supported by a Faculty-wide research staff representatives' network by the end of 2018

1.12) enhance the [New Academics Programme \(NAP\)](#), adapting the offering already provided to accommodate the time constraints and training needs of clinical academics and research fellows.

1.13) ensure all research staff are aware of the training and support provided by CARD, [Library Services](#), and [Staff Learning and Development \(SLD\)](#)

² [FBMH Policy on Academic leave in relation to research](#)

- 1.14) monitor uptake of P&DRs in the academic and research staff community aiming for 100% compliance by 2018
- 1.15) identify, target and encourage 10-15 researchers per annum (at the appropriate point in their funding renewal cycle) to apply for a period of sabbatical leave to enable focus on proposal development
- 1.16) work in partnership with SLD and CARD to support and establish Academic Leadership and PI programmes to build research leadership capacity
- 1.17) review annually the effectiveness and cost recovery of all core funded research facilities
- 1.18) horizon scan for new technology requirements (annually) and ensure advanced preparation of strategic/business cases for new technology
- 1.19) monitor adherence to processes, policies and research income recovery through quarterly review by the Faculty Leadership Team
- 1.20) raise awareness of research success through monthly publication of all significant (>£250k) research awards and other personal awards, prizes, etc in FBMH News

4. Developing our research strengths and priorities

Goal 2: “We will achieve international research excellence in key areas by building on our current research strengths and by identifying and developing emerging areas critical to our vision”

4.1 The Research Domains provide strategic coordination and leadership of our research

There has always been cooperation and collaboration across our internal ‘boundaries’, however, today’s research challenges require even greater levels of integration that extend beyond faculty and institutional boundaries. A major intent behind the creation of FBMH was to establish the Research Domains as the key vehicles to bring together critical mass and all relevant expertise from across the Faculty, University and partner organisations to address key challenges in biology, medicine and health today, and so provide enhanced strategic coordination of our research.

The specific Research Domains were selected on the basis that they were able to provide a match between our research strengths and capabilities and the challenges and priorities established by our partner organisations, funders and society as a whole. While the Research Domains will be sustainable over a prolonged period, they will evolve as science changes and needs change. As such change can be unpredictable and disruptive, often driven by new technologies, the domains have the ability to respond to such change and opportunity with flexible research themes. The current Research Domains are listed here (see Annex 3 for more detail on each domain):

- The [Cancer Domain](#) is committed to making a major contribution to understanding the biology and underlying causes of cancer, together with the development of new approaches for early detection, personalised treatment and prevention through seamless engagement and interaction with the MAHSC cancer domain, CRUK MI and the Manchester Cancer Research Centre (MCRC).
- Research within the [Cardiovascular, Endocrine and Metabolic Sciences Domain](#) spans the life course from developmental influences on subsequent health trajectories through to studies of ageing and disease risk. The domain adopts a multidisciplinary, integrative approach to these problems, grounded in mechanistic, cellular and molecular studies of the heart and circulation, the control of energy balance, and endocrine and metabolic systems.

- The [Cellular and Developmental Systems Domain](#) is focused on understanding how basic cell and developmental biology processes such as cell fate, cell division, cell-cell and cell-matrix interactions, and cell migration are achieved, and coordinated in space and time to make, maintain and repair complex multicellular organisms; processes that are fundamental to our understanding of life. The Domain is committed to bringing together multidisciplinary research groups using state-of-the art core facilities and model organisms to find answers to fundamental questions about human development, tissue repair, ageing and chronic diseases.
- The [Evolution, Systems and Genomics Domain](#) concerns itself with the understanding of gene and genome function, structure, sequence variation and long-term evolution, from bacteria to humans, in order to further our fundamental understanding of genetics and systems biology, as well as to assist in the understanding of medical genetics. The Domain is committed to furthering our understanding of fundamental genomic and genetic change and how change affects molecules, individuals, populations and species.
- The [Infection, Immunity, Inflammation and Repair Domain](#) is organised across four overlapping and complementary subdomains: Explorative immunology across the life course; Regenerative medicine including matrix biology; Chronic inflammatory diseases focusing primarily on musculoskeletal, dermatological and respiratory conditions; Infection including mycology, bacteriology and parasite immunology. Our aims are to understand: i) The fundamental processes driving and regulating immune health; ii) How immune health is perturbed by infection, underlying genetics, auto-reactive stimuli, biological timing and cancer; iii) The process of healthy repair and regeneration and the consequences of its dysregulation; iv) The optimal therapeutic, vaccination or delivery processes that alleviate inflammatory diseases.
- The [Neuroscience and Mental Health Domain](#) spans the large breadth of research in the neurosciences, psychology, nursing, healthcare sciences and psychiatry across the University. From studying brain function at the molecular, cellular and systems level, through to applied clinical research, the Domain is committed to supporting and developing the very best research to gain a greater understanding of the nervous system, ameliorate disease and promote health. The Domain is organised across eight core areas of research strength and critical mass: cognitive neuroscience; language, communication & hearing; mental health; neurodegeneration; neuro-oncology; stroke; systems & computational neuroscience; and vision research.
- The [Platform Sciences and Technologies Domain](#) aims to both promote the development of novel technologies and ensure that technology requirements are met across the Faculty. It brings together theory and experimental science and seeks to enhance and develop technology leadership. The Domain is organised around 3 main thematic areas: integrated computational and mathematical methodologies; materials in medicine; and imaging. The Domain is committed to the provision and enhancement of technology and methodology, and to providing support to the other domains.
- The [Population Health Domain](#) aims to understand the determinants of health and develop and evaluate interventions to improve health within defined populations. It will generate new knowledge to improve the health of populations, reduce inequalities and develop innovations to improve the effectiveness, efficiency and appropriateness of health and social care services. The Domain will develop and deploy novel methods of patient and public involvement and engagement to improve the quality, relevance and impact of our research. The Domain is home to the majority of the Faculty's methodologists, providing expertise in study design analysis and interpretation across a breadth of different disciplines. Therefore, effective collaboration with other Domains, our sister Faculties and the health and social care system across Greater Manchester is crucial to the success of the strategy.

The Research Domains are Director-led, deliver structure for the interdisciplinary areas that span basic, clinical and applied research, build a vibrant and supportive research environment, and work closely with the Schools and Divisions. They aim to nurture and foster collaboration and research innovation, build effective networks and lead major external funding bids. They lead partnership development across and outside of the University (e.g. with the other Faculties, MAHSC, other Universities, industry, national funding bodies, international partners) and provide the outward face of our research activities.

Working at the interface of life sciences, digital health and physical sciences, we have the unique opportunity in Manchester to synergistically address major challenges in health. Cutting across the Research Domains are three areas that build on our current strengths and/or exploit unique opportunities available to us in Manchester (see Fig. 2):

- ❖ **Advanced materials in medicine** – exploiting our strength in advanced materials for biomarkers, targeted delivery, medical devices, sensors, diagnostics, nanomedicines
- ❖ **Integrated imaging technologies** - creating a link between bioimaging and medical imaging, imaging analysis linking with big data, imaging software development
- ❖ **Precision medicine** – linking big data (e-health), clinical genomics, quantitative biology, patient stratification, single cell ‘omics’

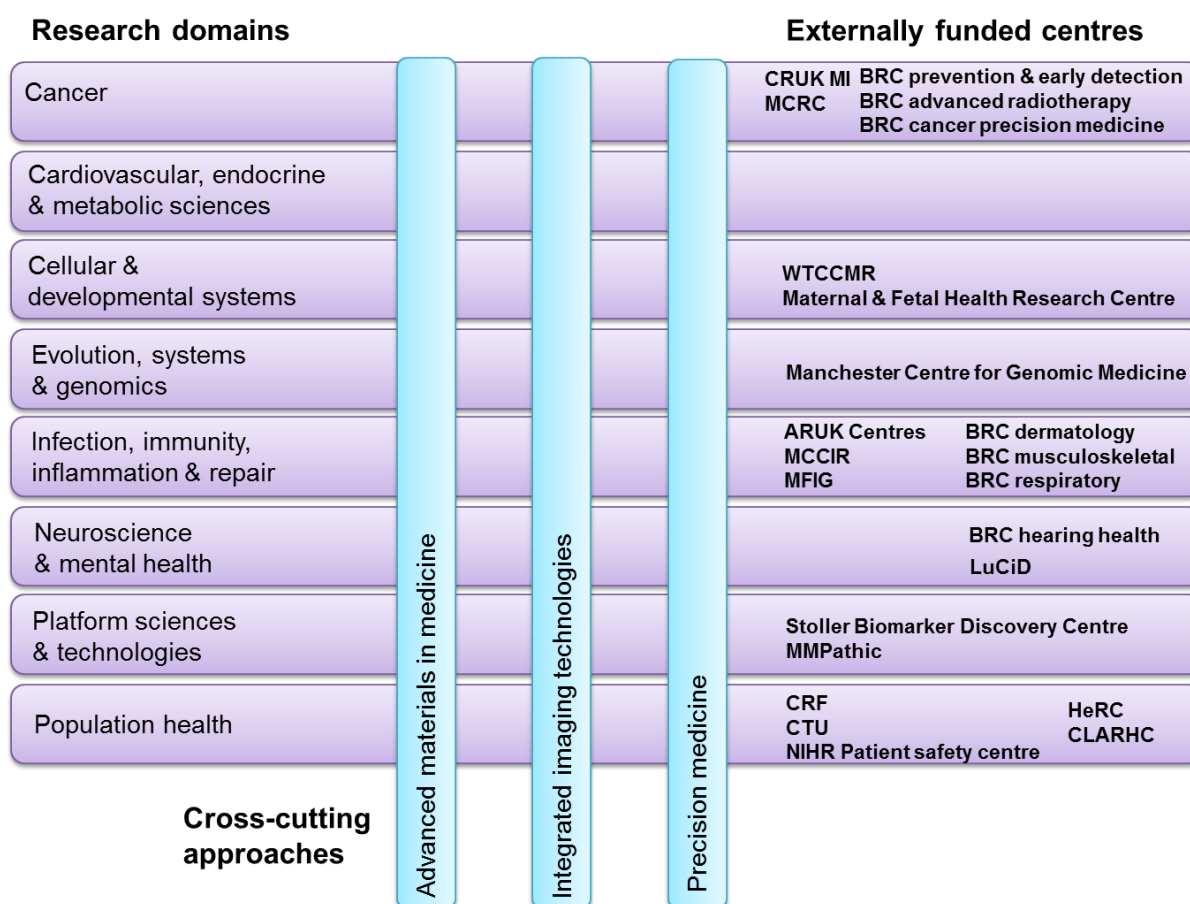


Fig. 2. Overview of FBMH research domains, externally funded centres of excellence and cross-cutting approaches

In addition to continued investment in our recognised areas of research strength, i.e. our externally funded centres of excellence (see pp.4-5 and Fig. 2), each Research Domain has identified a number of strategically important research priorities or opportunities (many of which are shared

across Domains) that it will develop over the coming years (Table 1). These have been selected against a range of criteria that include evidence of existing/emerging capability in which Manchester has international level leadership, and an element of distinctiveness, aligned to significant unmet need (scientific, clinical or societal). These areas will allow for interdisciplinary working, translation to impact, and will provide a focus around which to build strong teams, and nurture, retain and recruit the very best talent available. There is a high expectation that the areas identified will ultimately generate major research income and high-impact outputs. This does not mean that other research activities are not important, rather it reflects that at any one time we cannot prioritise all areas.

4.2 Role of Schools and Divisions in driving research strategy, culture, activity and performance

From a structural perspective, FBMH is comprised of 3 Schools, each with 6 Divisions (see Annex 1). The Divisions were formed from coherent groups of staff who have broadly shared research and/or teaching activities and so accordingly they are the natural vehicle for local line management and flow of finance. The Heads of School and Heads of Divisions have an important role to play in driving the research strategy, as well as helping to manage the ambitions and performance of their researchers and ensuring that they strive to meet the University expectations for research³.

Each School has its own Research Committee - with representation from each Division - whose goal is to ensure that there is a supportive research culture and local environment for staff and PGR students to deliver world-leading research. However, we must ensure that Schools and Divisions do not become isolated/siloed and that their staff play a full and integral part in driving the research strategy.

4.3 Governance of research activity

The Faculty Research Group (FRG) is responsible for the development and delivery of research culture, strategy and policy across FBMH. It is chaired by the Vice Dean for Research and Innovation and comprises Heads of School, School Research Directors, Research Domain Directors, Associate Deans for Business Engagement, Internationalisation, Postgraduate Research, REF and Impact, and Platform Technologies and Infrastructure, and senior PSS members. It meets monthly and ensures there is join up in both thinking and activity between the Research Domains and Schools/Divisions. It ensures that adequate policies and structures are available to support and improve the quality of research (e.g. costing and pricing policy, peer review policy, etc).

Domains are guided by Steering Groups and report through to FRG, as do Schools/Divisions through their own research committees. FRG is accountable through the University Research Group and University Research Strategy Group which bring together activity from across all three Faculties. There is also a direct link through to the domains within MAHSC and HInM.

We will:

2.1) review each Research Domain's progress annually through FRG to ensure they deliver against our vision and continue to develop activities in identified areas of strategic importance

2.2) embed greater connectivity with our partner organisations (HInM, MAHSC, other Faculties) to be able to tackle major research questions and to raise the internal and external profile of our research

2.3) embed a local supportive culture for peer review of funding proposals according to Faculty policy that is sufficiently timely and robust to allow iterative feedback and improvement and sharing of best practice

2.4) establish the Faculty Peer Review Compliance Monitoring Committee to oversee peer review culture and processes in the Faculty

³ [The University of Manchester Statement of Research Expectations document](#)

2.5) ensure that all large, strategic bids (>£1m) are provided with adequate support from the Strategic Funding Team and are internally reviewed by the [College of Experts](#) to provide constructive feedback and maximise the likelihood of success

2.6) give full recognition to NIHR project and programme grant income obtained under the MAHSC agreement and to the associated RCF income gained by our partner trusts

2.7) maximise cost recovery and ensure all research proposals are properly costed in line with Faculty and University policies (effective peer review will also enhance this)

2.8) increase the recruitment of high calibre home and overseas PhD students, and ensure appropriate recognition is given to staff who secure and supervise externally-funded PhD students (especially overseas students)

2.9) maintain our existing DTP/CDT portfolio and identify areas capable of developing competitive bids for new programmes

2.10) increase the number of externally-funded personal fellowships held in the Faculty and identify and support external and internal candidates to develop applications, with a particular emphasis on addressing the gender balance

Key Performance Indicators (KPIs)

2.11) increase the overall value of funded research projects by 10% each year

2.12) achieve a 50% increase in the number of large strategic awards (>£1m) in the Faculty by 2022 (from ~20 p.a currently to 30 p.a.)

2.13) increase the number of staff nominated for prizes, awards, membership of academies, etc

2.14) monitor peer review through the Faculty Peer Review Compliance Monitoring Committee via the PanMan form and ensure >90% compliance and appropriate use of the College of Experts

2.15) monitor cost recovery, the NIHR value of grants awarded and associated RCF funding received by NHS partners, and present quarterly data to the Faculty Leadership Team and ensure Heads of School enforce the policies

2.16) monitor the Strategic Funding Team portfolio through monthly reporting to FRG

2.17) increase the number of [HESA cost centres](#) with a student:staff ratio in the top 5 of [Russell Group universities](#) by 2022 (currently 2/7).

2.18) ensure 100% of Faculty-managed students are placed with research-active supervisory teams and aligned where possible to strategically important areas of research strength or priority

2.19) identify and establish 5 overseas alliances for new A*STAR-style PhD programmes by 2022 (currently 1); recruit 12 international students to the integrated 4 year PhD programme in 2017/18; grow by 20% / year thereafter

2.20) increase the number of intermediate and senior fellowship awards held in the Faculty

Table 1. Research Domain Priority areas The Research Domains have identified strategically important research priorities or opportunities, selected against a range of criteria including: existing/emerging capability; international level leadership; distinctiveness; and significant unmet need (scientific, clinical or societal) aligned to opportunity. These areas will allow for interdisciplinary working, translation to impact, and will provide a focus around which to build strong teams. The areas will be continually reviewed. More information on each priority can be found in the Research Domain sections in Annex 3.	Lead Research Domain
Prevention & early detection of cancer. <i>We will use a targeted, genomic-based approach to identify and study 'at risk' populations (e.g. smokers, obesity, COPD, metabolic syndrome) with the aim of earlier detection.</i>	Cancer
Living longer with cancer. <i>We will build on the opportunities afforded through DevoManc to study the physical and psychological implications of longer term cancer survival, for the individual (e.g. side effects of chemotherapy, early detection of recurrence), their relatives and for the population & health service as a whole.</i>	Cancer
Cardiovascular disease - mechanisms, treatment and prevention. <i>We will combine our expertise in hypertension, cardiac physiology/ heart failure and human genetics of CVD, and leverage our large population and high local disease prevalence, to establish Manchester as a leading centre for cardiovascular research.</i>	Cardiovascular, endocrine & metabolic sciences
Metabolic and endocrine disorders. <i>We will focus on central mechanisms for metabolic disease and in utero development of endocrine tissues and disorders and build on current translational programmes for type 1 diabetes, the prevention of diabetic complications and interventions that affect appetite and eating.</i>	Cardiovascular, endocrine & metabolic sciences
Biological clocks and timing. <i>We will bring together researchers studying biological clocks using model organisms to understand the underlying fundamental cellular events, with those attempting to use this knowledge for clinical intervention in human diseases, including diabetes and inflammatory arthritis.</i>	Cellular & developmental systems
Cell matrix biology and regenerative medicine. <i>We will develop new interdisciplinary research programmes from the mechanisms underpinning cell matrix interactions within tissue, to understanding tissue development, stem cell biology and regeneration, through to clinical application, developing engineered tissues utilising novel biomaterials and delivering novel cell and gene therapies for patient benefit.</i>	Cellular & developmental systems
Cell dynamics. <i>We will bring together researchers using imaging, genome editing, biochemistry, cellular and developmental biology approaches to understand fundamental aspects of cytoskeletal function, signalling and membrane dynamics and how they are integrated to drive cell behaviour from single cells through to organisms.</i>	Cellular & developmental systems
Gene Expression, Chromatin and Signalling. <i>Many clinical problems ultimately derive from errors in gene regulatory mechanisms, either directly or indirectly due to changes in the chromatin state of the cell or signalling pathways. We will bring together expertise in clinical medicine and basic science to address fundamental issues underlying gene expression, chromatin and signalling.</i>	Cellular & developmental systems
Antimicrobial resistance. <i>We will harness our tremendous research power in evolutionary biology, genomics and bioinformatics and bring this to bear on the huge problem of antimicrobial resistance with access to the vast array of clinical samples collected through the MAHSC partnership.</i>	Evolution, systems & genomics
Dynamical evolving systems. <i>We will unite our capabilities in genomics, evolutionary biology with computational science and mathematics, and facilitate the development of novel methods of analysis capable of handling the ever expanding deluge of data being generated in our experimental and model systems.</i>	Evolution, systems & genomics
Cancer immunology. <i>We will combine and our exploit our strengths in inflammatory disease and cancer biology to study the role of inflammation in the early development of many tumour types.</i>	Infection, immunity, inflammation & repair

Immunology. <i>We will establish a major research Institute spanning basic science, paediatric, infectious disease, respiratory, dermatology, autoimmunity, cancer, rare diseases, and geriatric and vaccine immunology that will enable us to tackle global unmet need in inflammatory conditions.</i>	Infection, immunity, inflammation & repair
Precision medicine. <i>We will build on our strengths in immune-mediated inflammatory diseases and the DevoManc opportunity to establish Manchester as an internationally leading centre for precision medicine and test-bed for the validation and verification of biomarker-based diagnostics.</i>	Infection, immunity, inflammation & repair
Wound healing. <i>We will bring together expertise in nursing, matrix biology, inflammation and regenerative medicine to develop novel interdisciplinary research activity, aimed at new discoveries in the initiation and treatment of complex, chronic wounds.</i>	Infection, immunity, inflammation & repair
Mechanistic understanding of brain function. <i>We will combine molecular and cellular approaches with systems and computational neuroscience to develop new interdisciplinary programmes to further our mechanistic understanding of brain function and create new models of neural complexity that may inform studies of disease and ill-health.</i>	Neuroscience & mental health
Early detection and therapeutic intervention for brain disorders. <i>We will exploit opportunities to improve early intervention for disorders of language, communication and hearing, vision, mental health (incl. psychosis, autism), neurovascular disease (stroke and dementia), neurodegeneration and also in neurooncology.</i>	Neuroscience & mental health
Translate knowledge on neurodevelopmental and neurological disease and mental health problems into policy and practice. <i>Taking advantage of DevoManc we will move our basic and translational research from across the whole Domain into practice within the health care system to bring early benefit to patients.</i>	Neuroscience & mental health
Integrated computational and mathematical methodologies. <i>We will lead a focussed effort to unite theory and experimentation through integration of computational and mathematical methodologies across the University, to develop novel methodologies for data analysis, and train the next generation of interdisciplinary researchers.</i>	Platform sciences & technologies
Advanced materials in biology, medicine and health. <i>We will develop a major cross-faculty, integrated effort to deliver novel applications of materials to translatable medical technology in application areas such as cancer therapy, new imaging diagnostics, novel medical devices and regenerative medicine and provide a major focal point for engagement with industry</i>	Platform sciences & technologies
Integrated imaging. <i>We will develop an integrated approach to biological, preclinical and clinical imaging and image analysis across Manchester.</i>	Platform sciences & technologies
Learning health systems. <i>We will combine theoretical with empirical approaches to create a world-leading critical mass of learning health systems research across Manchester's excellence in healthcare management, social policy, health economics, health services research, medical sociology, psychology and health informatics.</i>	Population health
Minimising health inequalities and addressing the North-South divide. <i>We will look to develop a partnership across the NHTA to address the divide in population health outcomes between the North and South of England and the disproportionate impact this has on health and social care services.</i>	Population health
Centre for a sustainable NHS. <i>Focused applied health research is required to develop and test innovations to reduce need, manage demand and improve efficiency if the NHS is to remain viable over the next 20 years. There is an opportunity to align the research from different professional and research groups across the Domain and work with senior decision makers in the NHS to help secure the future of the NHS.</i>	Population health

5. Maximising the translation and impact of our research

Goal 3: “We will deliver positive societal impact from our research by maximising its translation and implementation”

In tackling the major challenges posed by science and medicine, the Faculty aims to make a significant and positive difference to people's lives through the translation of research into practice, and impact on public policy, society, health outcomes and the economy. The Faculty provides dedicated support for our academics to realise the potential impact of their research (Business Engagement, section 5.2, and Impact Officers, section 5.4). Our ability to conduct research of outstanding quality allows us to continue to develop a culture in which achieving impact with our research is an integral part of our academic life that is institutionally acknowledged and supported.

5.1 Translation of our research

Translational research covers a spectrum of activity, originating from discoveries in fundamental science (including population health, methodological research, epidemiology, applied health research, etc) and then moving through a pipeline that encompasses hypothesis testing and elucidation of disease mechanisms, preclinical research in animal models, through to clinical trials in humans of new drugs, devices and diagnostic procedures and ultimately delivery and adoption within the NHS and third sector organisations (e.g. social care settings, prisons, schools).

A strong component of translational research encompasses experimental medicine (EM), as exemplified in the BRC and CRF, which is defined as an investigation in humans to identify the cause of disease and/or to test the validity and importance of new discoveries and treatments. Such investigations relate, where appropriate, to model systems to identify mechanisms of pathophysiology or disease, or to demonstrate proof-of-concept evidence of the validity and importance of new discoveries or treatments. EM precedes and informs the development of late-phase clinical trials and research questions on the potential impact of new innovations on population health and on the delivery and costs of health and social care services. EM is bidirectional, i.e. effective translation of results into later-phase clinical research is an important outcome as is the generation of new hypotheses to be explored in the laboratory.

Working with our NHS partners through MAHSC, the Faculty has a strong track record in this regard and can point to many translational breakthroughs over recent years, including:

- the BRACE Trial programme in osteoarthritis;
- Phase I-Phase II development of epidermal growth factor receptor inhibitor AZD9291 in cancer;
- the development of the anti-inflammatory properties of thioredoxin to treat cutaneous inflammatory disease; and
- the bench-to-Phase III development of IL-1Ra for stroke.

It is noteworthy that our major funders are increasingly targeting research funds towards strategic initiatives that promote translational working and ultimately impact, as evidenced by our recent successes with precision medicine awards, the NIHR BRC, CRF, NIHR Patient Safety Centre, etc.

A key objective in creating FBMH was to ensure greater integration and alignment of research activity to enhance opportunities for translation right across the spectrum from discovery to diffusion. The Faculty has all of the component parts to achieve this: strong discovery science, excellent core facilities, animal and cell models, engineering/prototyping solutions, biostatistical/informatics/clinical trials expertise and great strength in applied health research across all professional disciplines. Working with our translational research and EM infrastructure, especially the BRC, CRF and our CRUK Major Centre, we are ideally positioned to translate discoveries. Our strong interaction with HInM links us through to the city and region and allows us to evaluate adoption and diffusion within the NHS and influence health policy in priority areas.

Manchester has made great strides in the past 5 years to adopt an integrated 'One Manchester' approach. In some areas, the ethos of translation is part of the culture and the mechanisms to enable it are well established. Other areas are less developed and there is considerable potential yet to be realised and to ensure that all translational opportunities are taken and guided through into tangible health benefits for our population.

5.2 Knowledge transfer and business engagement

The growth of business engagement activity and partnering with business is becoming increasingly important across the University in terms of diversifying income streams and increasing the socioeconomic impact of our research. The Business Engagement team support a range of activities including strategic partnership developments, research collaboration, consultancy, and knowledge exchange. The Business Engagement team bridges the gap between academia and industry by facilitating interactions that will lead to mutual benefit. At the launch of the new Faculty in August 2016, Business Engagement across FBMH was well placed and in a strong position for growth and development. Following the development of key partnerships, and implementation of pricing policy, both income and recovery have improved steadily. Activities have significantly increased across the Faculty in terms of income, number of companies and academic engagement.

5.3 Internationalisation of our research

Our vision for internationalisation in FBMH is 'to be recognised globally as one of the top universities in the world for research, outstanding learning and student experience, social and economic impact, and cultural development' within the fields of biology, medicine and health. This international reputation will allow us to attract the best international staff and students to Manchester, whilst providing our staff and students with the opportunity to work and study elsewhere in the world. This movement of staff and students will lead to inward investment in the form of research grant income and business engagement. There is both a need and opportunity for FBMH to enhance our competitiveness and increase our market share of international research funding.

To achieve this, greater capacity and capability is needed to provide a deeper engagement with the academic community. There is a need for the Faculty to be able to work across research communities and to liaise closely with the Associate Vice President, International, and with the [International Office](#). The current situation with respect to future access to European Union funding post-Brexit is unclear, yet there are significant opportunities elsewhere (e.g. Newton Fund, Global Challenges Research Fund - GCRF). Additional support and dedicated focus of effort will enable us to realise ambitious goals to develop productive international partnerships with academic institutions and overseas companies, to significantly raise our research income, numbers of postgraduate overseas students and high quality publications/outputs with international co-authorship.

5.4 REF and Impact

Research quality and impact are critical to a successful funding environment, for QR funding (via REF performance), for major research grants, and as one of the key arguments for promoting public investment in research. [REF 2021](#) will continue to place most emphasis on the quality of research outputs, but the importance of impact will increase following the recommendations of the [Research Excellence Framework \(REF\) Review \(the 'Stern Review'\)](#).

Given the academic strengths at the UoM, there is a major opportunity to build on performance, as measured in REF2014, with a focus on quality, rigour and impact. To this end, the Faculty has instigated a programme of activities to: (i) maximise REF-assessed publication quality and; (ii) enhance the understanding and recognition of REF-defined research impact, and develop impact case studies. These activities will be driven by the Associate Deans for REF and Impact, working closely with Unit of Assessment (UoA) leads. Continual review and internal assessments (RRE) will provide the necessary intelligence for strategic planning to achieve the ambition of improving our REF performance and thus enhancing our position as a world-leading University. A number of

resources and activities will be developed with the specific aim of maximising the REF-assessed quality of our research outputs. In parallel, significant work is required to promote understanding of research impact, as defined by the REF, and to create supportive systems to develop impact cases that showcase our high-quality, high-impact research portfolio. The role of divisional Impact Ambassadors, working with UoA leads, will be pivotal, seeking to embed the importance of impact firmly within every level of our research culture.

We will:

3.1) maximise the potential for translation of our discovery science by adopting a more proactive approach to identifying opportunities, removing potential barriers and striving to ensure that the component parts of our translational pipeline are truly joined up and integrated (including convening a group of key stakeholders to review our translational research activities and identify solutions to address gaps, bottlenecks and barriers)

3.2) develop and strengthen our Patient and Public Involvement and Engagement infrastructure and capacity to ensure there is a strong patient voice in our translational activities

3.3) build on existing links at the interface with the Faculty of Science and Engineering to exploit our combined strengths around the juncture of data and computational science, maths, advanced materials, synthetic biology and medicine, and similarly with the Faculty of Humanities around digital & social sciences and devolution and the work already completed in CLAHRC I and CLAHRC II

3.4) enhance our interactions with industry and develop and present a joined up and coherent 'offering' to external partners, capturing demonstrable strength and differentiation across key priority areas

3.5) promote the internationalisation of our research and encourage and support staff to identify international collaborators to: (i) increase grant funding from UK and international sources (e.g. Global Challenges Research Fund (GCRF), Newton Fund, Horizon 2020, etc); and (ii) increase the citation impact of their publications

3.6) increase the quality of our research outputs and the impact of our research

3.7) enhance the visibility and profile of our research activity

3.8) increase our influence on the shape and future direction of research funding in the UK

Key Performance Indicators (KPIs):

3.9) increase the amount of funding received through translation-specific funding schemes by ~30% by 2022 (from current figure of £15.3m, industry funding £17.7m)

3.10) secure 5 MRC DPFS and 5 Wellcome Trust translational awards by 2022, and secure at least 2 EPSRC-led translational awards in the areas of advanced materials and targeted therapeutics

3.11) identify engagement of at least 10 new researchers in translational projects by 2022 through CiC, Wellcome Trust iPTA schemes, etc

3.12) secure ~£50m funding by 2022 to establish a world-leading research institute in healthcare technology and innovation

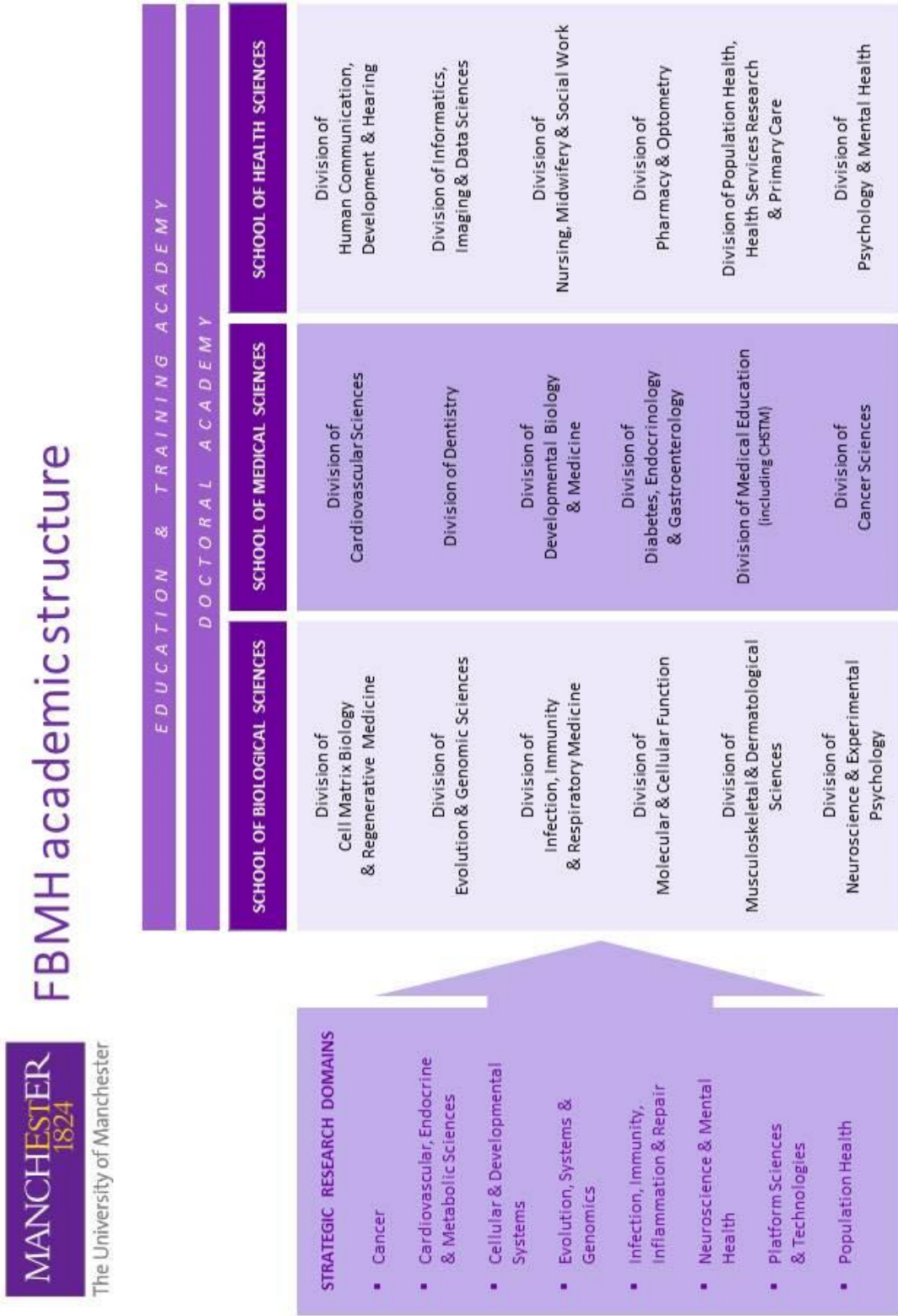
3.13) work with key research areas to drive business engagement activity and identify two areas per year to develop external partnerships relevant to industrial priorities

3.14) increase the number of research staff and students involved in business engagement activity each year by between 9 and 12 people within the current academic year

3.15) secure 2 major GCRF awards by 2022

3.16) develop 4 new strategic links with international universities and international business partners that have research interests that map to our research priorities by 2022

- 3.17) coordinate our PPI\PPE activities across the Faculty and HInM by centralising the overview and management of these activities
- 3.18) increase the number of staff on external funding panels and advisory boards (from 50 currently to 60 by 2022)
- 3.19) re-establish a Faculty Output Group to develop and implement strategies to maximise the REF-assessed quality of research publications and ensure that all staff are aware of the REF2021 requirements for outputs and impact
- 3.20) ensure each School/Division develops a portfolio of outstanding potential REF impact case studies to be monitored, developed and evidenced throughout the REF period



Annex 2 Support for researchers

Research, PGR and Business Support Services (RBSS)

The RBSS team provides strategic guidance and practical support to academics in all aspects of research grant management. It comprises five operational teams:

- **Research Support Services Delivery Team (RSS)** is comprised of the Research Support and Research Finance teams who provide an integrated and highly effective level of service that maximises our research income, delivers high quality research and exploits our research outcomes. The team has an in depth knowledge of funding bodies, works closely with academic colleagues to ensure accurate, appropriate and timely costing of research proposals and contracts, extensive support for all aspects of post award financial management and internal/external reporting exercises, alongside research development support to Divisions.
- **Strategic Funding Team (SFT)** (see below)
- **[Research Governance, Policy, REF and Impact and Policy Team](#)** provides a breadth of expertise in key areas of research strategy, research policy development, and research governance. The team also provide full support to the Associate Deans for REF and Impact for all areas of research assessment as we begin our preparations for the next REF submission. Furthermore, the team oversee and foster strong working interactions with partner NHS Trusts.
- **[Business Engagement \(BE\) Team](#)** support a range of activities including strategic partnerships, research projects, consultancy, knowledge exchange, sharing facilities, professional development and recruiting talent. The team aims to bridge the gap between academia and industry by facilitating interactions that will lead to mutual benefit.
- **Doctoral Academy** (PGR Services, see below)

Strategic Funding Team (SFT)

The SFT was established to provide a professional service to support the development and implementation of the Faculty's research strategy. It works closely with the academic community to provide high-level strategic support, coordination and facilitation of large scale research and fellowship funding applications (typically of >£1m+ value), multidisciplinary research activity and proposals for funding. Through its team of Strategic Funding Managers (SFMs), it provides executive support to the Research Domains and facilitates the development of novel collaborative and multidisciplinary research activity in areas of strategic importance. The SFT also plays an important role in capturing and disseminating strategic funding intelligence, and the generation and analysis of datasets to inform strategic developments (e.g. research income, bibliometric data) and benchmarking in competitor analyses. It also serves as the focal coordinating point for the Faculty's involvement in securing funding from the European Union. The SFT manages the allocation of internal strategic funding schemes (e.g. MRC Confidence in Concept, Wellcome Institutional Translational Partnership Award, [Wellcome Institutional Strategic Support Fund \(ISSF\)](#), etc) and is responsible for the management of the portfolios created by them. The SFT also hosts and administers the Faculty Fellowship Academy.

Doctoral Academy (Postgraduate Research Services)

The Doctoral Academy engenders a culture, amongst both staff and students, that recognises the value of PGR activity, incites aspirational goals and supports programme completion by taking responsibility for:

- obtaining funding, and developing programmes, to enable the recruitment of high calibre home and overseas students;
- ensuring our PGR students are supervised and progress appropriately by overseeing the day-to-day management of PGR activity within the Schools/Divisions;
- enabling our PGR students to achieve their full potential by facilitating the provision of training in research and professional skills;

- developing and implementing strategies that enhance our PGR students' contribution to the Faculty's research agenda;
- ensuring our PGR students are integrated into their local, and relevant wider, research environments and that they are connected to the activities designed to support, engage and develop early career researchers;
- ensuring that supervisory activity and contribution is fully recognised and that our supervisors are appropriately trained and supported.
- ensuring that the PSS team are accessible and appropriately trained in order to provide an outstanding service to students and staff.

Fellowship Academy

The Faculty Fellowship Academy was established to increase the number, quality and successful acquisition of external fellowship awards from doctoral studies through to senior levels. It provides advice and support from senior academics through all stages of application from initial planning through to interview training.

Centre for Academic and Researcher Development (CARD)

The Centre for Academic and Researcher Development (CARD) has an international reputation for the delivery of high quality programmes supporting the development of academic staff and early career researchers. The centre is committed to producing flexible experiential learning environments that encourage and support our staff and students to excel in research.

Annex 3

Research Domains

Cancer

Director: Professor Sir Salvador Moncada

Despite the recent advances made in our understanding of the causes of cancer and how to treat it, cancer remains the single largest cause of premature death in the UK, accounting for more than 150,000 lives each year⁴. Of the 360,000 cases diagnosed annually, 42% are likely to be preventable⁵. The problem is particularly acute in the North West of England where incidence and mortality rates are significantly higher than the national average.

About the Domain

The University of Manchester has a strong heritage of conducting world-leading cancer research, rooted in an established and productive partnership with Cancer Research UK and the Christie Hospital NHS Trust, the largest single site cancer hospital in Europe. The Cancer Domain brings together basic, translational and clinical research from across the University (in particular the [Division of Cancer Sciences](#), Cancer Research UK Manchester Institute (CRUK MI), CRUK Lung Cancer Centre of Excellence, Movember Centre of Excellence in Prostate Cancer, Manchester Cancer Research Centre (MCRC) and the [Division of Pharmacy & Optometry](#)) and extends out through our NHS partner Trusts across Greater Manchester. It brings together a community of over 200 researchers with research grant funding in excess of £200m. It covers research dedicated to understanding the aetiology of the disease through to the provision of all aspects of treatment and care for the patients and the follow up and long term care of those who survive. The Domain provides an important mechanism to bring together and link key researchers based in different sites across Manchester, but also will help building and facilitating collaborations between basic and clinical scientists as well as cross faculty links to the Faculties of Humanities and Science & Engineering.

The main objective of the domain is to ensure the most effective interaction between scientists and clinicians working on cancer related problems in order to maximise synergisms and achieve high quality scientific output, which will be translated into patient benefit. The Domain is organised in a matrix-like fashion, and brings together individuals working on all aspects of the major tumour types (Lung, Melanoma, Prostate, Ovarian, Breast and Haematological) from across the North West region and also facilitates cross-cutting research across several themes, including: experimental cancer medicine; biomarker discovery, validation and qualification; radiation-related research; molecular pathology and tissue acquisition; and prevention and early detection.

Strengths

The Cancer Domain has been highly successful in attracting substantive research funding over the past few years, and in 2016 was awarded funding of £42m (over 5 years) to be a CRUK Major Centre (one of only two in the UK), along with £12m funding from NIHR to develop three cancer themes (screening, prevention and early detection; advanced radiotherapy; personalised medicine) within the Manchester Biomedical Research Centre (BRC). In 2018, our Proton Beam Facility will open (one of only two in the UK and the first to become operational) and the MR Linac advanced radiotherapy machine will be up and running in 2017, providing not only new advances for treatment of cancers but opportunities for novel and niche research activity. The Domain is host to a nationally leading biobank tumour specimen collection which underpins our biomarker programme. The Domain also benefits from strong links with industry.

⁴ NHS [Living Well for Longer](#) report

⁵ Cancer Research UK website, [Data for Health Professionals](#)

Research Opportunities and Priorities

The Domain is committed to making a major contribution to understanding the biology and underlying causes of cancer, together with the development of new approaches for early detection, personalised treatment and prevention through seamless engagement and interaction with the MAHSC cancer domain and MCRC. The Domain will:

1. develop novel, interdisciplinary research programmes aimed at improving prevention and early detection of cancer

Particular opportunities exist to develop cancer immunology as a discipline at Manchester. Inflammation has a key, early role to play in the development of many tumour types. The University has strong credentials in inflammatory disease research and closer, integrated working between these two communities is a key aim. Linked to this will be a targeted, genomic-based approach to identify and study at risk populations (e.g. smokers, obesity, COPD, metabolic syndrome) with the aim of earlier detection. These programmes will be run jointly with our other Strategic Research Domains as appropriate.

2. develop studies aimed at tertiary care and people living longer with cancer.

Advances in early detection and improved therapeutic regimens have led to an increase in cancer survival such that 50% of those diagnosed can now expect to survive for 10 years or more. Managing side effects of cancer chemotherapy and early detection of recurrence will be necessary in these patients. Moreover this has profound implications for the physical and the psychological well-being of the survivors and their relatives and also for the population and the Health Service as a whole. These issues are currently under-researched and poorly understood and the DevoManc agenda provides the perfect opportunity to study them.

Domain Steering Group Membership

The Cancer Domain Research Strategy has been developed and is overseen by:

Professor Sir Salvador Moncada – Cancer Domain Director

Professor Tim Illidge – Head of Division, Molecular and Clinical Cancer Sciences

Mrs Pip Peakman – Head of Research Operations, Manchester Cancer Research Centre

Dr David Shackley – Clinical Lead, MAHSC Cancer Domain & Christie Hospital NHS Trust

Cardiovascular, Endocrine and Metabolic Sciences

Director: Professor Bernard Keavney

Cardiovascular disease, stroke, nutritional and metabolic diseases will account for the largest proportion of deaths this century. This will be chiefly driven by the explosive worldwide increase in the prevalence of obesity and diabetes. Ischaemic heart disease and stroke account for a combined 15 million deaths worldwide at present.

About the Domain

The Domain unites the diverse expertise of over 200 researchers working across closely-linked scientific areas and diseases. The Domain's strong track record in basic science and strong clinical links through NHS partners (Manchester University Foundation Trust and [Salford Royal NHS Foundation Trust](#)) positions it well to conduct both "bench to bedside" research but also "reverse translation" from clinical observations to biological insights. Domain members conduct experimental medicine studies, clinical trials and implementation science with our NHS partners in the cardiovascular/metabolic domain of MAHSC, and population-based studies of genetic, environmental, and behavioural determinants of risk.

The Domain is organised into three interacting subdomains: Cardiovascular Medicine and Science; Endocrinology and Metabolism; and [Biological Timing](#). Research within the Domain spans the life course from developmental influences on subsequent health trajectories through to studies of ageing and disease risk. The domain adopts a multidisciplinary, integrative approach to these problems, grounded in our internationally leading mechanistic, cellular and molecular studies of the heart and circulation, the control of energy balance, and endocrine and metabolic systems. The common thread running through research in the domain is to deliver novel therapies by improving our mechanistic understanding of health and disease. The domain also has a strong international dimension, and conducts studies in collaboration with colleagues in low- and middle-income countries that have seen significant increases in disease prevalence.

Strengths

Our researchers in **cardiovascular medicine and science** have made seminal observations regarding the role of small arteries and perivascular adipose tissue in blood pressure regulation, mechanistic and clinical studies of inflammation in stroke, the role of treatment adherence in resistant hypertension, cardiac calcium signalling in health and disease, ultrastructural alterations influencing excitation-contraction coupling in heart failure, and human genetics of hypertension, atherosclerosis and congenital heart disease. **Endocrinology and Metabolism** includes a number of renowned and well-funded (current live funding £33.5m) basic as well as clinical scientists working directly on metabolic and endocrine diseases. A particular strength is that the group works at the basic/clinical interface and has strong interactions not only with the other two CEM subdomains but also with other domains, notably Neuroscience & Mental Health. We have the largest group of investigators in Europe working on **biological timing** (shared priority with the Cellular and Developmental Systems Domain). Timing is a central feature of all living organisms and disruptions to temporal control mechanisms have been linked to many diseases. Colleagues in the Domain have brought highly novel insights into the role of the circadian clock in the development of cardiometabolic disease.

Research in the Domain is a major beneficiary of British Heart Foundation (BHF), Wellcome Trust and MRC funding, and we have been very successful in attracting numerous external personal awards over the last couple of years including BHF Chairs, Wellcome Investigators in Science, Stroke Association Reader and Lectureships and numerous senior and intermediate fellowships (MRC, BBSRC, BHF, NIHR, Wellcome, etc.). Several programme and numerous project grants (RCUK and charities) are held by domain affiliates and the prestigious BHF 4 year PhD programme was renewed in 2016.

Research Opportunities and Priorities

The Domain will:

1. seek to enhance our mechanistic understanding and develop novel treatment and prevention strategies for some of the most serious cardiovascular conditions affecting our local population.

We have particular strengths in three areas: hypertension and its complications; cardiac physiology and heart failure; and human genetics of cardiovascular disease. We will bring together our expertise in these areas, leveraging our large population and high local disease prevalence, to establish Manchester as a leading centre for cardiovascular research.

2. establish major new interdisciplinary programmes of research into important metabolic and endocrine disorders.

We will build upon our internationally leading expertise in central mechanisms underlying metabolic and endocrine disease, gut-brain interactions, and genetic circuits key to the in utero development of endocrine tissues and endocrine disorders. We will continue research at the basic/clinical science interface, including internationally leading work in insulin pump therapy for type 1 diabetes, the prevention of diabetic complications and interventions that affect appetite and eating.

3. establish biological clocks and timing research as a major interdisciplinary and translational research centre of excellence (shared priority with Cellular & Developmental Systems Domain)

The Clocks grouping links an understanding of the role of cellular timers and circadian clocks at multi-scale in biological systems to the possibility of treating a wide range of health issues associated with disruption of circadian rhythms. Potential areas of application are wide, from inflammatory diseases to sleep disorders, and prominently feature cardiovascular and metabolic disease.

Domain Steering Group Membership

The Domain Research Strategy has been developed and is overseen by:

Professor Bernard Keavney – Domain Director

Dr Elizabeth Cartwright – Division of Cardiovascular Sciences

Professor David Eisner – Division of Cardiovascular Sciences

Professor Anthony Heagerty – Head of Division, Cardiovascular Sciences

Professor Andrew Loudon – Division of Diabetes, Endocrinology and Gastroenterology

Professor Simon Luckman – Division of Diabetes, Endocrinology and Gastroenterology

Professor John McLaughlin – Head of Division, Diabetes, Endocrinology and Gastroenterology

Professor David Ray – Division of Diabetes, Endocrinology and Gastroenterology

Professor Andrew Trafford – Division of Cardiovascular Sciences

Cellular and Developmental Systems

Director: Professor Karl Kadler

Understanding the mechanistic basis of cellular and developmental processes will shed light on the biology of life, whilst understanding how they are perturbed in disease will be crucial for disease diagnosis and the development of novel therapeutics.

About the Domain

The Cellular and Developmental Systems Domain is concerned with the understanding of how basic cell and developmental biology processes such as cell fate, division, cell-cell and cell-matrix interactions and cell migration are achieved, and coordinated in space and time to make, maintain and repair complex multicellular organisms; processes that are fundamental to our understanding of life. In many instances, disease is caused by cellular dysfunction and inappropriate or inadequate responses of cells to external stimuli. Consequently our ability to treat disease has, and will continue to be, greatly enhanced by understanding how cells sense their environment and respond accordingly. Investigating the fundamental mechanisms underlying normal cell function and development thereby offers a route to understand disease mechanism and to discover novel therapeutic strategies for regeneration and repair.

Strengths

The Domain is organised across a number of overlapping areas of research strength, in which cross fertilisation of ideas plays a crucial role. **Rhythmic oscillations** (timing) in gene, protein and cell behaviour are central features of living organisms and disruptions to temporal control mechanisms have been linked to many diseases (including cardiovascular and metabolic diseases, inflammatory conditions, neurodegeneration, mental health, and cancer) and hence we have established major programmes of research activity focused on developing understanding of the role of biological timing in normal physiology and disease. **Cell matrix biology** is an essential feature for multicellular life. Our Wellcome Trust Centre for Cell-Matrix Research aims both to study the mechanisms that underpin tissue assembly and function, development and healthy ageing and also identify why tissue failure is a major factor in many chronic diseases and identify novel targets for disease intervention. **Development and disease** is another important area of research activity in which we study the complex mechanisms by which embryonic development and cell behaviours are so precisely controlled and how tissue regeneration and wound healing is achieved. The **gene expression, chromatin and signalling** grouping aims to understand the molecular basis of gene expression control during development, disease and evolution. Virtually all cellular functions – including cell division, cell migration, intracellular trafficking, adhesion, and signalling – are dependent on **cytoskeletal and membrane dynamics** and so we have established research programmes that examine the machineries regulating the cytoskeleton and membranes that are closely linked to numerous diseases including developmental disorders, cancer and neurodegeneration. **Regenerative medicine** builds upon our understanding of the basic mechanisms in cell and developmental biology with the ultimate aim of translating this knowledge to improve the repair, replacement or regeneration of damaged tissues and organs.

Research Opportunities and Priorities

The Domain is committed to the study of cellular systems in relation to fundamental questions of biology and disease. The Domain will:

1. Build upon strengths in cell matrix biology and bioscience of regenerative medicine to facilitate new interdisciplinary research and clinical translation of novel therapies.

By bringing together interdisciplinary researchers, both academics and clinicians in areas of cell matrix biology and regenerative medicine our research ranges from the mechanisms underpinning cell matrix interactions within tissue, to understanding tissue development, stem cell biology and regeneration, through to clinical application, developing engineered tissues utilising novel biomaterials and delivering novel cell and gene therapies for patient benefit. This is facilitated by our outwardly engaging workshops and initiatives, through the [Manchester Regenerative Medicine](#)

[Network \(MaRM\).](#)

2. Establish biological clocks and timing research as a major interdisciplinary and translational research centre of excellence

To bring together the breadth of researchers studying biological timing from those using model organisms to understand the underlying fundamental cellular events, through to those attempting to use this knowledge for clinical intervention in human diseases, including diabetes and inflammatory arthritis.

3. Encourage Cell Dynamics to become an externally-funded multidisciplinary research centre incorporating high-end live-cell imaging to study key questions in cellular developmental biology.

To bring together a strong and collaborative group of researchers using imaging, genome editing, biochemistry, cellular and developmental biology approaches to understand fundamental aspects of cytoskeletal function, signalling and membrane dynamics and how they are integrated to drive cell behaviour from single cells through to organisms. To use this new knowledge for clinical and translational benefit.

4. Capitalise on our strengths in basic science, new technologies and computational interface to establish an emerging area of Quantitative and Dynamic Biology.

New approaches in biomedical research are increasingly reliant on statistical and mathematical modelling, as well as biophysics and bioinformatics. In addition, new technologies with the power of absolute molecular quantification, live imaging, transcriptomic, epigenomic analysis, all at the single cell level, have led an revolution to our mechanistic understanding of cell state transitions and signalling, which are key to normal development, regeneration and cancer. Developing Quantitative and Dynamic Biology as a strategic area now, will capitalise on the Faculty restructuring by bringing together an elite group of experimentalists and theoreticians from across Faculties that together can address the challenges in this new era of Biology. This emerging strategic area will envelop our new Wellcome Trust 4-yr PhD programme in Quantitative and Biophysical Biology (£2.5m until 2020).

5. We aim to be the UK's premier integrated research group in Gene Expression, Chromatin and Signalling (GECS) stretching from pure science through to disease mechanisms.

We will integrate activities in bioinformatics, single cell research, chromatin biology and RNA biology to understand how errors in gene regulatory mechanisms and developmental processes lead to disease. These approaches will be combined for basic science, clinical and translational benefit.

Domain Steering Group membership

The Domain Research Strategy has been developed and is overseen by:

Professor Karl Kadler – Domain lead

Professor Viki Allan - Division of Molecular and Cellular Function

Professor Enrique Amaya – Division of Cell Matrix Biology and Regenerative Medicine

Dr David Bechtold – Division of Diabetes, Endocrinology and Gastroenterology

Professor Peter Clayton – Head of School of Medical Sciences

Dr Chiara Francavilla – Division of Molecular and Cellular Function

Professor Judith Hoyland – Division of Cell Matrix Biology and Regenerative Medicine

Professor Sue Kimber – Division of Cell Matrix Biology and Regenerative Medicine

Professor Andy Sharrocks – Division of Molecular and Cellular Function

Professor Jane Worthington – Head of School of Biological Sciences

Evolution, Systems and Genomics

Director: Professor James McInerney

The Evolution, Systems and Genomics Domain concerns itself with the understanding of gene and genome function, structure, sequence variation and long-term evolution, from bacteria to humans, in order to further our fundamental understanding of genetics and systems biology, as well as to assist in the understanding of medical genetics.

About the Domain

We use highly-interdisciplinary experimental, statistical and computational methods. The domain encompasses the broad scope of genetic diversity from viruses and bacteria, fungi and protozoans, plants and animals, including humans. Genetic and genomic work includes neonatal testing through the [Women and Children domain of MAHSC](#) and working with data from millions of completed genomes. We assemble genomes, carry out annotation and analysis, and develop algorithms and computer code for data analytics. The domain is not only concerned with basic science, but also the practical applications of this understanding as it relates to issues of global importance such as the spread of antibiotic resistance, the impact of human genetic variation and the underlying causes of disease. Methodological approaches range from studies on the control and functions of individual genes to models of how whole systems operate and evolve.

Membership of the Domain is drawn broadly from across FBMH and also has strong engagement from the Faculty of Science and Engineering (particularly Computer Science, Mathematics and Environmental Studies). It connects strongly with many of the other Faculty domains especially via its strong bioinformatics core, but particularly with the Infection, Immunity, Inflammation and Repair domain (around infection, antibiotic resistance), the Neuroscience and Mental Health domain (around mental health), and the Cancer domain (around genomic technologies).

Strengths

The real potential of this domain lies in the integration and synergy achieved through bringing together our significant expertise in experimental research, clinical science, genomics, evolutionary biology and bioinformatics.

The [Manchester Centre for Genomic Medicine \(MANGEN\)](#), which sits within the domain, is well regarded internationally with strong research groupings covering cancer, ophthalmology, neurodegeneration, neurogenetics, audiology, rare diseases and the development of genomic technology. A coordinated approach provides a focus on the discovery of new genes to inform diagnosis of disease and improvement of clinical care, and guide the implementation of novel therapeutics. The Centre also plays a major role in training of the next generation of genome scientists and clinicians. Major opportunities exist through the 100,000 genomes project in which the Centre is extensively involved.

The Domain brings significant critical mass to the study of dynamical evolving systems, bringing together expertise from evolutionary biology, with molecular epidemiology, antimicrobial resistance, metagenomes, organismal behaviour and evolution, protein structure evolution, modelling, secondary metabolite evolution (incl. directed evolution), and evolutionary medicine.

Manchester has a long and high-profile record in computational biology – bioinformatics, databases, modelling and discovery. Core strengths include big data analysis, software of the future for biomedicine and biology, bioinformatics for cancer, bioinformatics for single cell sequencing, algorithm development, bioinformatics for diagnostics, integration of bioinformatics with patient records. Computational biology is also a core priority for the Platform Technologies domain.

Research Opportunities and Priorities

The Domain is committed to furthering our understanding of fundamental genomic and genetic change and how change affects molecules, individuals, populations and species and will:

1. develop and lead a major research initiative on the development of antibiotic resistance.

Manchester has a unique opportunity to harness its tremendous research power in evolutionary biology, genomics and bioinformatics and bring this to bear on the huge problem of antimicrobial resistance with access to the vast array of clinical samples collected through the MAHSC partnership. This will link effectively with other Domains (e.g. infection – wound healing, immunology, population epidemiology).

2. develop a major centre of research excellence in the study of dynamical evolving systems.

Such a Centre would unite our capabilities in genomics, evolutionary biology with computational science and mathematics, and facilitate the development of novel methods of analysis capable of handling the ever expanding deluge of data being generated in our experimental and model systems. Systems could also include measuring changes in metabolism, behaviour or responses to drugs, infections, or other insults.

3. develop a major centre for computational biology/ bioinformatics research (shared priority with the Platform Sciences and Technologies Domain).

The University has significant critical mass in this area already and a key goal of the Domain is to provide the structure needed to interface more effectively with the Faculty of Science and Engineering and facilitate major programmes of activity. In particular, to focus and centralise our efforts across the Faculty and University in the computational analysis of molecular data. To use these data to further our understanding of genes, genomes and proteomes. To interface with other data science initiatives such as the Turing Institute and other large-scale bioinformatics institutes. To develop new algorithms, databases and software to turn the deluge of molecular data into useful human knowledge.

Domain Steering Group membership

The Domain Research Strategy has been developed and is overseen by:

Professor James McInerney – Domain lead (evolutionary biology)

Dr. Siddharth Banka - Division of Evolution and Genomic Sciences (clinical genetics)

Dr Tracy Briggs – Division of Evolution and Genomic Sciences (genomic medicine)

Professor Simon Hubbard - Head of Division of Evolution and Genomic Sciences

Professor Simon Lovell - Division of Evolution and Genomic Sciences (computational biology)

Professor Graham Pavitt - Division of Molecular and Cellular Function (molecular biology)

Professor Magnus Rattray - Division of Informatics, Imaging and Data Sciences (data science)

Dr Suzanne Schultz – School of Earth and Atmospheric Sciences, FSE (organismal biology)

Infection, immunity, inflammation & repair

Director: Professor Tracy Hussell

Inflammatory diseases affect most parts of the body and cause a vast range of disorders. Whether acute or chronic, caused by pathogens, self-proteins or innocuous antigens, these diseases are characterised by abnormal immune responses that lead to inflammation. Repair and regeneration of affected tissues is essential to maintain vital organ function. In many diseases the repair process is also aberrant leading to long term consequences for human health. Obesity, mental health, exercise, diet and time of day all affect the immune system, making this one of the largest interactive domains. It is impossible to put a value on the costs involved or the number of people affected by inflammatory diseases. However, whether infectious, allergic, autoimmune or cancerous, all diseases drive high resource utilization, account for the majority of death and disability worldwide and carry the greatest unmet clinical need.

About the Domain

The domain spans basic, clinical and translational innovation at the interface of infection, immunity, inflammation and repair. It unites researchers from across the University, links seamlessly with the MAHSC domain for Inflammation and Repair, and benefits from strong partnerships with the University Hospital of South Manchester (respiratory medicine), Salford Royal NHS Foundation Trust (including neurovascular disease, stroke and dermatology) and Central Manchester University Hospitals NHS Foundation Trust (including rheumatology and cancer).

The Domain is organised across four overlapping and complementary subdomains: **Explorative immunology across the life course**; **Regenerative medicine** including matrix biology; **Chronic inflammatory diseases** focusing primarily on musculoskeletal, dermatological and respiratory conditions; **Infection** including mycology, bacteriology and parasite immunology. Our aims are to understand: i) The fundamental processes driving and regulating immune health; ii) How immune health is perturbed by infection, underlying genetics, auto-reactive stimuli, biological timing and cancer; iii) The process of healthy repair and regeneration and the consequences of its dysregulation; iv) The optimal therapeutic, vaccination or delivery processes that alleviate inflammatory diseases.

Strengths

The domain includes internationally recognised strength in genetics and epidemiology of **musculoskeletal research** with two Arthritis Research UK-funded Centres of Excellence and prominence within the NIHR Biomedical Research Centre. The Domain is host to one of the largest **dermatology** research centres in Europe, also a BRC theme and with a strong track record of NIHR funding and high throughput of clinical trials. Similarly, **respiratory medicine** is a key area and a feature of our BRC, and is home to the Salford Lung Study, the world's largest real world effectiveness study. We have significant strengths in **regenerative medicine** (joint with Cellular and Developmental Systems Domain) in, for example, cell matrix biology, neural and musculoskeletal tissue regeneration, and wound healing. Our investigators in **fungal molecular biology**, brought together by the Manchester Fungal Infection group (MFIG), are global leaders in interdisciplinary clinical, experimental and translational research related to aspergillosis (a group of conditions caused by a mould called aspergillus). The Domain also has one of the largest groupings of internationally recognised researchers worldwide in **parasite immunology**. The University is at the forefront of developing **precision medicine approaches for the treatment of immune-mediated inflammatory diseases**, leading several MRC-funded national stratified medicine consortia (MATURA, PSORT, MASTERPLANS). The development of the **Manchester Collaborative Centre for Inflammation Research (MCCIR)**, a jointly funded initiative with GSK and Astra Zeneca, has received wide attention with respect to the funding model and the movement of key academics to Manchester and provides a major focal point for strong clinical interaction with respiratory, dermatology, gastroenterology, paediatrics, anaesthesiology, surgery

and oncology. The Domain has strong industry partnerships, and it has over recent years produced numerous spin-out companies including Curapel, F2G, Microsensor and Gelexir.

Research Opportunities and Priorities

The Domain will:

1. Establish the Institute of Immunology at The University of Manchester

Our immunological coverage spans basic science, paediatric, infectious disease, respiratory, dermatology, autoimmunity, cancer, rare diseases, and geriatric and vaccine immunology. Furthermore we excel in supporting early career fellows and our immunology expertise is embedded throughout the current BRC. Development of an externally visible immunology institute provides critical visibility that would propel UoM to the forefront of this discipline in the UK and Europe. Cohesive immunological expertise and unification would make us the obvious University to lead strategic funding bids that tackle global unmet need in inflammatory conditions.

2. Develop cancer immunology as a core strength (with the Cancer Domain)

Cancer Research UK and the MRC have identified a need to strengthen expertise in cancer immunology. We have all the ingredients to compete at an international level, but require scientists to work at the interface between inflammation and oncology. There is a significant opportunity to bring together our oncology and immunology communities with a view to developing joint research programmes aimed at identifying disease mechanisms and new approaches to earlier detection. Joint research is already accelerating in the areas of the early detection of lung cancer, the immunobiology of head and neck cancer, and the toxicities associated with checkpoint inhibitors.

3. Establish UoM as an internationally leading centre for precision medicine and test-bed for the validation and verification of biomarker-based diagnostics

The aim is to establish Manchester as an internationally leading centre for precision medicine built around a pipeline to take research from discovery to refinement and validation of biomarkers, leading to the identification of patient stratifiers to inform clinical studies and treatment. Our work will play to Manchester's strengths in immune-mediated inflammatory diseases (e.g. musculoskeletal, psoriasis) and it will capitalise on the volume and high quality of clinical research and care and the unique opportunity of the Health & Social Care Devolution ("DevoManc") in Greater Manchester.

4. Develop novel interdisciplinary research activity aimed at new discoveries in the initiation and treatment of complex, chronic wounds

Pressure ulcers are one of the most prevalent of all preventable harms that can occur both inside and outside the hospital setting. There is a paucity of research into the management of chronic wounds in a hospital setting and wound care decisions lack a scientific basis. Our solution is to draw together a multidisciplinary grouping with expertise in nursing, matrix biology, inflammation and regenerative medicine to address particular nursing interventions at the molecular level, and to generate evidence to support wound care decisions.

Domain Steering Group membership

The Domain Research Strategy has been developed and is overseen by:

Professor Tracy Hussell – Domain Director

Professor Anne Barton – Head of Musculoskeletal and Dermatological Sciences Division

Dr Elaine Bignell - Division of Infection, Immunity and Respiratory Medicine

Dr Dave Brough – Division of Neuroscience and Experimental Psychology

Professor Jeremy Derrick – Division of Infection, Immunity and Respiratory Medicine

Professor Richard Grecis – Division of Infection, Immunity and Respiratory Medicine

Professor Chris Griffiths – Division of Musculoskeletal and Dermatological Sciences

Professor Judith Hoyland – Head of Cell Matrix and Regenerative Medicine Division

Professor Andrew Macdonald – Division of Infection, Immunity and Respiratory Medicine

Professor Werner Muller – Division of Infection, Immunity and Respiratory Medicine

Professor Angela Simpson – Head of Infection, Immunity and Respiratory Medicine Division

Dr Mark Travis – Division of Infection, Immunity and Respiratory Medicine

Professor Jane Worthington – Head of School of Biological Sciences

Neuroscience and Mental Health

Director: Professor Stuart Allan

The human brain is the most complex organ in the body and remains the least well understood. When functioning normally, the brain acts as the body's centre for sensation, cognition, communication, emotion, movement and the functional regulation of many organs. There are however many (often devastating) conditions associated with abnormal functioning of the brain including stroke, neurodegeneration, mental-ill health, and disorders of development, language, hearing and vision, that represent a major global burden and challenge. Understanding these conditions, alongside normal brain function, and the complex interplay between genetic, social, environmental and psychological factors in determining behaviour makes neuroscience and mental health one of the most important areas of current and future research.

About the Domain

The Neuroscience and Mental Health Domain spans the large breadth of research in the neurosciences, psychology, nursing, healthcare sciences and psychiatry across the University. From studying brain function at the molecular, cellular and systems level, through to applied clinical research, the Domain is committed to supporting and developing the very best research to gain a greater understanding of the nervous system, ameliorate disease and promote health. It brings together a community of ~300 research investigators and aims to address fundamental questions in neuroscience, psychology and psychiatry, and to improve the treatment, management and care of the large number of individuals who have neurodevelopmental and neurological disease or mental ill-health. Linking seamlessly with the [MAHSC domain for Mental Health](#) and through strong partnerships with the Clinical Neurosciences Centre at [Salford Royal NHS Foundation Trust](#) and the [Greater Manchester Mental Health NHS Foundation Trust](#) the overall ambition of the Domain is for Manchester to be a leading centre of neuroscience and mental health research both nationally and internationally. The Domain is organised across eight core areas of research strength and critical mass: cognitive neuroscience; language, communication & hearing; mental health; neurodegeneration; neurooncology; stroke; systems & computational neuroscience; and vision research. Additionally the Faculty's research on biological timing is also a key area of activity and strong links exist with other Domains, notably Cardiovascular, Endocrine and Metabolic Sciences, Infection, Immunity, Inflammation & Repair and Population Health & Ecosystems. Neuroimaging and other advanced technologies are important aspects of research in Neuroscience and Mental Health and there are therefore close links with the Platform Sciences & Technologies Domain.

Strengths

A major strength of the Domain is the breadth of research activity, from basic discovery science through to applied health. Such wide ranging expertise including significant service user and carer development provides the fantastic opportunity to bring together academics from a range of disciplines, including cell neurobiology, neuropharmacology, neuroimmunology, sensory neuroscience, computational neuroscience, cognitive neuroscience, experimental psychology, psychiatry and nursing to address fundamental questions in a multidisciplinary manner using the latest approaches and methods. Several of the research areas in the Domain are underpinned by major external funding, for example: the ESRC International Centre for Language and Communicative Development ([LuCiD](#)); NIHR Manchester Biomedical Research Centre (BRC) [Hearing Health](#) theme; [NIHR CLAHRC Greater Manchester](#); EC Horizon 2020 '[Sense-Cog](#)'; ERC CAPRI projects. These major awards are in addition to support at various levels from a diverse range of funding bodies, including the BBSRC, ERC, Innovate UK, MRC, NIHR/DOH, the pharmaceutical industry and several major UK charities.

Research Opportunities and Priorities

The Domain will:

1. develop new, interdisciplinary research programmes aimed at furthering our mechanistic understanding of brain function.

This area brings together researchers addressing fundamental questions of molecular and cellular neuroscience with systems and computational neuroscience and enables the development of new models of neural complexity that could inform studies of disease and mental ill-health. Initial focus is in supporting major individual awards in systems and computational neuroscience, with a longer-term aim of establishing a Centre.

2. develop novel, interdisciplinary research programmes aimed at significantly improving early detection and earlier therapeutic intervention for some of the most common and devastating brain disorders and mental health problems affecting society, and functioning, disability and health more generally.

Opportunities exist to improve early intervention for disorders of language, communication and hearing, vision, mental health (incl. psychosis, autism), neurovascular disease (stroke and dementia), neurodegeneration and also in neurooncology, where links with the Cancer domain are being established to create a Centre of Excellence in Brain Tumour Research. Other priorities include establishing a Centre of Vision Research, further development of an internationally leading Stroke Research Group and continued major funding of Language, Communication and Hearing.

3. translate emerging knowledge of neurodevelopmental and neurological disease and mental health problems into policy and practice to bring early benefit to patients.

Taking advantage of DevoManc we will move our basic and translational research from across the whole Domain into practice within the health care system. Implementation of our research will bring about real impact in improving lives.

Domain Steering Group Membership

The Domain Research Strategy has been developed and is overseen by:

Professor Stuart Allan – Domain Lead (neurovascular & neuroinflammation)

Professor Audrey Bowen - Division of Neuroscience and Experimental Psychology (stroke)

Dr David Brough – Division of Neuroscience and Experimental Psychology (neuroinflammation)

Professor Bill Deakin - Division of Neuroscience and Experimental Psychology (psychiatry)

Professor Gillian Haddock – Head of Division of Psychology and Mental Health (psychology)

Dr Mark Humphries - Division of Neuroscience and Experimental Psychology (systems & computational)

Professor Elena Lieven – Division of Human Communication, Development and Hearing (human communication and development)

Professor Karina Lovell – Division of Nursing, Midwifery and Social Work (mental health)

Professor Rob Lucas - Division of Neuroscience and Experimental Psychology (vision)

Professor Daniela Montaldi – Head of Division of Neuroscience and Experimental Psychology (cognitive neuroscience)

Professor Kevin Munro - Division of Human Communication, Development and Hearing (hearing)

Professor Joanna Neill – Division of Pharmacy and Optometry (psychopharmacology)

Professor Stuart Pickering-Brown -Division of Neuroscience and Experimental Psychology (neurodegeneration)

Delyth Roberts – Head of Philanthropy (health)

Naomi Chandler – Business Engagement

Dr Federico Roncaroli - Division of Neuroscience and Experimental Psychology (neurooncology)

Professor Alison Yung – Division of Psychology and Mental Health (psychiatry)

Platform Sciences and Technologies

Director: Professor Mike White

The Platform Sciences and Technologies Domain aims to both promote the development of novel technologies and ensure that technology requirements are met across the Faculty. It brings together theory and experimental science and seeks to enhance and develop technology leadership.

About the Domain

New technologies and methodologies play a central role in cutting-edge biomedical research. The Platform Sciences and Technologies Domain provides a strategy for integration and development of central technologies that are important for both discovery and clinical sciences. Activities involve dissemination and training in novel technologies and methodologies, as well as building and supporting teams to take on new cross-disciplinary challenges. The Domain integrates central quantitative theory work covering systems medicine, modelling, inference and informatics. It also coordinates the development of novel experimental approaches, equipment and facilities for discovery and clinical sciences. This provides a route for the development of interdisciplinary quantitative new technologies that can have a major impact at any stage in the process from discovery biology through to clinical translation.

The Domain pulls together ~200 academics from across the Faculty and provides multiple interfaces for strong interactions with the Faculty of Science and Engineering. The Domain is broadly organised around 3 main thematic areas to ensure a seamless join up of activity across this boundary: integrated computational and mathematical methodologies; materials in medicine; and imaging.

Strengths

Integrated computational and mathematical methodologies. FBMH has great strengths in broad areas of quantitative theory approaches for biomedical research. These include, health- and bio-informatics data analytics, systems medicine and biostatistics (e.g. the Health eResearch Centre, HeRC). FSE has widely acknowledged strengths in the underlying areas of computational science, mathematics, text-mining, and software engineering. Strategic coordination of these groups will establish a critical mass of well-funded researchers that offer significant opportunities for future development of novel methodologies and complex models. Development of these approaches will help to cope with the ever-expanding volume and complexity of datasets generated in biological and clinical studies. In addition, the integration of these approaches will offer new predictive modelling approaches for quantitative biology and medicine.

Materials in Medicine. UoM's strengths in Advanced Materials are widely acknowledged through multiple significant investments such as the National Graphene Institute (NGI), the Graphene Engineering and Innovation Centre (GEIC) and more recently the Sir Henry Royce Institute for Advanced Materials (Royce). The University has major research programmes aimed at introducing emerging nanomaterials into medicine and healthcare and has a major focus on nanosafety and toxicity. Further development of this area will involve the development of greater integration between basic materials science and translational medicine.

Integrated Imaging. Imaging is a major strength at Manchester. Our capability spans the breadth from single molecule/cell analysis through to human studies. Imaging is increasingly important in biology and medicine. Its efficient application and provision will support many of the research priorities of the other FBMH research domains. The required technology includes electron and optical microscopy through to whole body scanning (e.g. MR-PET). Many of the equipment facilities in this area are already centrally located and coordinated and this area will require efficient and flexible provision of academic and expert technical support for experimental design and operation. For human imaging there is a requirement to work closely with our partner NHS trusts

and the Manchester Cancer Research Centre. There is a cross-cutting focus on development of novel strategies for image analysis that spans from discovery biology to clinical medicine.

Research Opportunities and Priorities

The Domain is committed to the provision and enhancement of technology and methodology and to provide support to the other domains. It will:

1. lead a focussed effort on uniting theory and experimentation through integration of computational and mathematical methodologies.

There is a pressing need to develop novel methodologies to cope with the data deluge and to provide more quantitative approaches in order to deliver excellent scientific and clinical research. There is an associated urgent need to train the next generation of researchers in interdisciplinary skills. We will develop novel, quantitative approaches for interdisciplinary biomedical research, giving more integrated coordination of theory research and training an increasingly high priority alongside experimental and clinical research.

2. develop a major cross faculty, integrated research effort to deliver novel applications of materials in biology, medicine and health.

The creation of a new interdisciplinary research and innovation initiative will enable full exploitation of our strengths in this area. This will provide a major focal point for engagement with industry. Our aim will be to provide seamless translation from worldclass materials science to translatable medical technology. This has the potential for a broad impact in application areas including cancer therapy, new imaging diagnostics, novel medical devices and regenerative medicine.

3. develop an integrated approach to biological, preclinical and clinical imaging

Imaging is increasingly a central technology in biology and medicine and provides a direct link between discovery biology and clinical treatment and diagnosis. We aim to exploit and integrate strengths in basic bioimaging, preclinical imaging, clinical imaging and image analysis across Manchester

Domain Steering Group membership

The Domain strategy has been developed and is overseen by:

Professor Mike White – Domain Director

Professor Ian Bruce – Division of Musculoskeletal & Dermatological Sciences

Professor Antony Freemont – Division of Cell Matrix Biology & Regenerative Medicine

Professor Douglas Kell – School of Chemistry, FSE

Professor Kostas Kostarelos – Division of Pharmacy and Optometry

Professor Kay Marshall – Head of School of Health Sciences

Professor Magnus Rattray – Division of Informatics, Imaging and Data Sciences

Professor Nigel Scrutton – Director, Manchester Institute of Biotechnology

Professor Chris Taylor – Division of Informatics, Imaging and Data Sciences

Professor Anthony Whetton – Division of Molecular and Clinical Cancer Studies

Population Health

Interim Director: Professor Martin Tickle

Population Health research seeks to understand the determinants of health and develop and evaluate interventions to improve health within defined populations. It is applied in nature with a focus on producing new knowledge leading to affordable improvements in health in line with NIHR's wishes to produce tangible benefits within relatively short timescales. Researchers in the Domain have two sets of interests and expertise 1) world-leading expertise in a variety of health topic areas within health policy, public health, health services delivery and health technology assessment, 2) world-renowned expertise in methodology. In addition to advancing the portfolio of the Domain's researchers in health policy and health service delivery the Domain has a pivotal role in collaborating with: other Domains to maximise the impact of new innovations; as the primary contact with our sister Faculties on health-related research programmes; and overseeing the University's contribution to the Devolution project in Greater Manchester.

About the Domain

The Domain has cross-University representation, with colleagues from the Faculty of Humanities and the Faculty of Science and Engineering as affiliates, and benefits from GM Health and Social Care System senior leadership representation. The Domain's principal source of income is NIHR which brings with it substantial, matched NIHR-RCF funding to MAHSC partner trusts to subsidise their research support infrastructure. The Domain has a number of key functions including:

- Providing cross-University strategic oversight and priority setting in population health research
- Initiation, team assembly and support for large multi-disciplinary grant applications
- Providing a conducive environment for new collaborations within the Domain, cross-Domain, cross-Faculty, with the GM health and social care partnership, and with commercial concerns.
- Providing the academic rigour for population health activities in Health Innovation Manchester (HInM)
- Promotion of Population Health Research in Manchester both internally and externally

Population Health research, whilst harbouring the content and methodological skills to support translational research, usually asks research questions that do not start at the discovery science, left-hand end of the "translational pipeline", for example: How do you change the behaviour of GPs with contractual incentives? Is a national screening programme cost-effective? How do you prevent elderly people having falls at home? How should the NHS provide affordable and compassionate end-of-life care? Domain researchers have produced world-leading, high-impact research on each of these questions.

Strengths

The key strengths of population health research at Manchester are its world-leading quality as exemplified by our top-ranked UoA3 REF2014 return, and its international reputation in applied health research. Additional strengths are size, diversity of interests, multi-professional representation, methodological breadth and its collaborations with Greater Manchester local authorities, NHS and social care. These collaborations provide access to the 3 million population of Greater Manchester and its health and social care services. The Domain has strong connections to NIHR and produces high quality, impact-delivering outputs. It is cross-cutting and interfaces with many different parts of the University, these collaborations can be mobilised to maximise the University's contribution to the GM Health & Social Care system, and to work in partnership with the other Domains to evaluate the costs and effects of new innovations. The Domain provides expertise and infrastructure vital to the Faculty's research; it has broad expertise and great experience in patient and public involvement/engagement and is well-positioned to coordinate this activity across the Faculty and HInM. Domain researchers have cutting-edge methodological skills in: evidence synthesis, clinical trials, study design, biostatistics, informatics, health economics, behavioural and social sciences. The Domain's affiliates run national centres including, two MRC Centres, a DH Policy Research Unit, the NIHR Patient Safety Centre, the GM CLAHRC, DoH

Connected Health Cities programme, two Cochrane Review Groups and membership of the NIHR Schools of Social and Primary Care.

Research Opportunities and Priorities

1. Minimising health inequalities and addressing the North-South divide

We will look to develop a partnership across the NHSA to address the divide in population health outcomes between the North and South of England and the disproportionate impact this has on health and social care services. Through developing new partnerships we will make the case, via the Northern Powerhouse project, for substantial funding for research to improve the health and wealth of the North of England relative to the more prosperous and healthy South.

2. Centre for a Sustainable NHS

The future of the NHS as we know it is under threat. It faces unprecedented demands and financial challenges. Focused applied health research is required to develop and test innovations to reduce need, manage demand and improve efficiency if the NHS is to remain viable over the next 20 years. The Domain has great expertise and has completed world-leading research of great relevance to this issue. There is an opportunity to align the research from different professional and research groups across the Domain and work with senior decision makers in the NHS to help secure the future of the NHS. The Domain and the GM Devolution partnership can lead this aspiration.

3. Combine theoretical with empirical approaches to “learning health systems”

We will create a world-leading exemplar of a data-driven learning health system across Greater Manchester. To achieve this goal we need to forge new collaborations within the Domain and Health Innovation Manchester to ensure researchers representing different professional groups and with content and methodological expertise in areas such as healthcare management (including implementation science), health and social policy, health economics, health services research, medical sociology, and behavioural sciences work effectively with our informaticians and data scientists. Manchester can take a lead on this challenge, drawing upon the University’s research strengths, the high profile changes arising from Greater Manchester’s devolution and the Department of Health Connected Health Cities programme.

Domain Development Team membership

The Population Health agenda is very large and diverse. Following the recent change in leadership the Domain is in the process of reconfiguring its structure and management arrangements. This will be achieved through consultation and consensus according to the following principles: an inclusive approach with light-touch management and flexible structures, with a focus on strategy and supporting new, larger projects that would not otherwise happen through current research groups.