



RESEARCH DIRECTORY

**Research Institute of Science and Technology in Medicine
Keele University**

Research areas

and

**Opportunities for Postgraduate Research and Training
PhD, MPhil, DM**

April 2011

OVERVIEW and INDEX

Biology, Biochemistry, Neuroscience, Biomedical Science

Research opportunities in the biological, biomedical and life sciences include a wide range of topics in mammalian molecular biology, molecular medicine, epigenetics, proteomics, physiology, structural biology and neuroscience. There is an emphasis on links to clinical and other complementary expertise across the four ISTM sites comprising the University Hospital of North Staffordshire, RJA Orthopaedic Hospital at Oswestry, the Haywood Hospital and Keele University campus. A wide range of research facilities and state-of-the-art equipment are available in purpose-built laboratories in the Huxley Building (School of Life Sciences), the Guy Hilton Research Centre (Hartshill, Hospital site) and RJA Oswestry. See the individual areas below for further details.

[Cell and Molecular biology](#)

[Molecular medicine](#)

[Apoptosis](#)

[Epigenetics](#)

[Proteomics](#)

[Cell physiology and pathology](#)

[Structural biology](#)

[Neuroscience](#)

[Glycobiology](#)

Bioengineering and Therapeutics, Cell and Tissue Engineering, Stem cells

The multidisciplinary *Bioengineering and Therapeutics* Group, led by [Professor Alicia El Haj](#), comprises a multi-disciplinary team linked to the University Hospital of North Staffordshire and RJA Orthopaedic Hospital at Oswestry with a major focus on enabling technologies involved in cell and tissue engineering and introduction to the clinic of cell therapies for regenerative medicine. Specific expertise includes active clinical cell therapies, enabling technology development associated with environmental chambers or bioreactor design, targeting and delivery vehicles and strategies using magnetic nanoparticles, control of differentiation of tissue specific stem cells and skeletal stem cells. The grouping holds an *EPSRC Doctoral Training Centre in Regenerative Medicine* since 2009 run jointly with Nottingham and Loughborough. The Institute has commenced the first *UK MRC multi-centre trial (ACTIVE)* into cell therapy in connective tissues. The two hospital sites have GMP cell therapy labs for culture and delivery of human cells on site. Recently, the group has been awarded as partner with Loughborough and Nottingham the first *EPSRC Innovative Manufacturing Centre in Regenerative Medicine* which aims to initiate and improve links to industry for taking cell therapies to market for clear patient benefit and the team is part of the *EXPERTISSUES EU FP6 NOE*. The BT group includes links to other research areas listed here such as *Respiratory Medicine, Pharmacy, Clinical Science, Imaging and Neurology*. The group has commenced a SP3 - People IRSES EU programme (*HYANJI*) establishing a research network to Universities in China, Tsinghua and Chengdu Universities, Schools of Pharmacy and Biotechnology.

[Regenerative mechanisms](#)

[Stem cells](#)

[Biomedical technologies](#)

[Biomaterials for tissue regeneration](#)

[Orthopaedic tissue engineering](#)

[Magnetic nanotechnologies](#)

[Rehabilitation engineering](#)

[Biomechanics and mechanobiology](#)

Pharmacy

The recent development of the *School of Pharmacy* at Keele has enabled expansion in the research areas of pharmaceuticals and pharmacology and the development of links to existing research programmes. The emphasis is on drug design and drug delivery systems, in areas such as malaria, ovarian cancer and HIV. See the individual areas below for further details.

[Pharmaceutics](#)[Pharmacology](#)**Clinical science**

The clinical science group supports a wide range of research ranging from the purely clinical setting through to basic science with an emphasis on the translational opportunities “from bench to bedside”. Research in clinical science within ISTM is based primarily at the University of North Staffordshire Hospital site and the associated Guy Hilton Research Centre, with well-established links to scientists working on Keele campus. Other clinical research, including that at the RJAH hospital in Oswestry, falls within the Bioengineering and Therapeutics area (see above). Further details of each of our clinical science research areas are given in the links below.

[Respiratory disease](#)[Metabolic disease](#)[Diabetes](#)[Stroke](#)[Rehabilitation](#)[Cancer studies](#)[Cardiology](#)[Neurology](#)[Multiple Sclerosis](#)[Trauma](#)[Obstetrics and Gynaecology](#)[Dementia](#)**Diagnostic science**

This is a field which holds great promise for future diagnostic techniques and equipment, conceived and developed through a close interaction between physicists, engineers, chemists, biologists and clinicians. In particular there is great potential arising from long-term work in ISTM for non-invasive analysis and diagnosis of a range of child and adult diseases. Specific research areas include Selected Ion Flow Tube mass spectrometry (SIFT-MS) for the trace gas analysis of breath and urine; Medical photonics; Medical diagnostics (including the use of biosensors, imaging and metabolic screening, the role of biominerals in neurodegenerative brain diseases); Early detection and monitoring of lung disease (optical coherence tomography, Fourier transform infrared spectroscopy). The Lung Research programme incorporates a multidisciplinary approach of cell pathology, molecular biology and bioengineering (see also Clinical Science: Respiratory disease)

[Trace gas analysis](#)[Biosensors, biomarkers and biomaterials](#)[Lung disease](#)**Imaging**

While imaging is a research theme that runs throughout our research programmes, the research opportunities described here relate to regenerative medicine, covering activities in two areas: fabrication/application of multifunctional biomaterials for tissue engineering (cornea, bone, tendon, nerve, cartilage) and exploitation of on-line, non-destructive characterisation techniques to monitor three dimensional scaffolds, tissues and constructs behaviour in vitro and in vivo.

[Non-destructive, optical and real time imaging](#)**Genetics**

The recent completion of the human genome project has afforded new and exciting avenues for research that define the genetic basis for human disease. The research seeks to define the molecular basis of diverse diseases and identification of genetic determinants that predispose individuals to particular disease outcomes. Frequently the research groups combine the strengths of collaborations between clinicians and basic scientists and are making significant advances in translational research areas. These types of studies increase

our understanding of basic disease mechanisms and provided new knowledge that may be employed in clinical management strategies. For other, related research areas see Biology, Biomedical and Life Sciences, Clinical Science and Pharmacy.

[Cancer genomics/epigenomics](#)
[Molecular epidemiology](#)

Entomology, Parasitology

The Centre for Applied Entomology and Parasitology (CAEP) is primarily situated within the buildings of the School of Life Sciences (Huxley Building) and the School of Physical and Geographical Sciences (Lennard-Jones Laboratories). It is an interdisciplinary research centre that offers a lively and stimulating atmosphere for advanced study and research. There are 40-50 members: professors, lecturers and their associated post-doctoral research assistants, postgraduate students and technicians. Members meet regularly for seminars, workshops, journal clubs and symposia. Research projects are supported by funding from a variety of Research Council, Charity and Industrial sources. The Centre is supported by a wide range of state-of-the-art equipment within newly refurbished and purpose-built laboratory space.

[Malaria, Mosquitoes and Man](#)
[Insect Ecology](#)
[Chemical Ecology](#)
[Parasite-Insect Interactions](#)
[Leishmaniasis](#)
[Fish diseases](#)

Inflammation, Infection, Immunology

This research area includes both basic and clinical research, including topics such as rheumatology, the structural immunology of innate immune proteins, fish immunology and apoptosis. The main objective of the research at the Staffordshire Rheumatology Centre (SRC) at the Haywood Hospital is to enable a better understanding of disease mechanisms involved in the development and progression of rheumatic diseases, and to identify factors predictive of disease outcome. This includes investigation of comorbid diseases (e.g. cardiovascular disease) and mortality as well as disease specific outcomes. Rheumatology research at the RJAH, Oswestry is focused on the mechanism of leukocyte migration into sites of inflammation. On Keele campus the Structural biology research group is studying the interaction between pathogens such as Haemophilus influenzae and influenza virus and lung surfactant protein D, as well as the structure, function and evolution of the serum pentraxins CRP and SAP. Apoptosis research includes the control of apoptosis (programmed cell death) in human cells, and on the ways in which this programme goes wrong to produce disease.

[Rheumatology](#)
[Structural immunology](#)
[Comparative Immunology](#)
[Apoptosis](#)

Human metabolism

The principal research interest in renal disease is peritoneal dialysis and the evaluation of fluid status in advanced renal failure. This links very closely to clinical work offering opportunities for projects translating basic science into direct relevance for patients.

[Lipid metabolism](#)
[Renal disease](#)

Statistics

[Medical Statistics](#)

This research includes the design of clinical trials in all specialties, modelling disease with an interest in the effect of genetic factors, with a particular interest in musculoskeletal conditions. Also included is the derivation and validation of models for predicting the probability of an outcome, with a particular interest in the survival of trauma and cancer patients, and research into the statistical aspects of nutritional screening.

RESEARCH AREAS and STAFF

Cell and Molecular biology

[Professor William Farrell](#)'s group comprises two postdoctoral scientists (one joint with Dr Derek Matthey) and two PhD students. Their primary interest is in epigenetic gene regulation in pituitary tumours and in the health of the unborn child. Understanding these changes in tumours will allow us to develop molecular pathology techniques to predict tumour behaviour and identify changes that convert normal cells into tumour cells. These whole-genome techniques are also being used to gain insight with respect to the health of the unborn child.

The focus of [Dr. Sheila Hope](#)'s research is viral control of apoptosis and differentiation. EBV infects B cell and epithelial cells and one of the two v-Bcl2s it encodes, BHRF1, suppresses apoptosis in B cells and delays epithelial cell differentiation, presumably to maximise viral replication. The role of EBV's second v-bcl-2 BALF1 is less well characterised but our results to date support the hypothesis that BALF1 is a novel v-bcl-2 in that it appears to be pro-apoptotic and accelerate epithelial cell differentiation. We have access to tissue culture, standard molecular biology and protein biochemistry and cell imaging equipment.

The focus of research for the [Prof. Gwyn Williams](#) Group is on the control of apoptosis (programmed cell death) in human cells, and on the ways in which this programme goes wrong to produce disease: too little apoptosis producing cancer and autoimmune disease; too much apoptosis producing neurodegenerative diseases. We are using a range of techniques in molecular cell biology to identify new apoptosis-controlling genes and to investigate their importance in cancer development and therapy, and in diseases of the immune system. Check GT Williams (Keele or Birmingham) for past work.

The human malarial parasite *Plasmodium falciparum* has a complex life-cycle underpinned by an extensive programme of developmentally-linked gene expression. [Dr. Paul Horrocks](#) is interested in determining the contribution of both genetic and epigenetic molecular mechanisms to this control. More recently, these studies have been expanded to determine whether lessons learnt are applicable to other apicomplexan parasites, many of which play roles as pathogens of veterinarian importance. Finally, in collaboration with the School of Chemistry, we are synthesising and evaluating plant-derived molecules for potential lead generation as novel antimalarial drugs.

[Dr. Rachel Berkson](#) is studying the regulation of cell growth by the tumour suppressor p53, and the oncogene c-Myc, via control and sensing of ribosome production. In addition to the basic science, a cell-based assay for potential drugs which could inhibit c-Myc's tumour-promoting effect on the ribosome pathway is under development. Dr. Berkson works on cancer cell lines, using techniques such as immunofluorescence, transcriptional assays and chromatin immunoprecipitation. Being a newly appointed lecturer looking to establish a research group, any PhD student would have significant autonomy.

Molecular medicine

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[Prof. Glenn Morris](#) studies the molecular pathogenesis of human inherited neuromuscular diseases, such as muscular dystrophies, mainly by using monoclonal antibodies that are produced and characterized in-house. The biochemistry lab has 4-5 postdoctoral members and 1-2 students and is part of the Wolfson Centre which has 6-8 additional clinical staff, many of whom are also involved in research. The group is located on the RJAH Oswestry site and has two confocal microscopes, two LC-mass spectrometers (part of the [Keele Proteomics Facility at RJAH](#)) and a BIAcore for protein interaction studies.

[Dr Alan Richardson](#), whose research group comprises 2-3 members, is focusing on ovarian cancer. The group are identifying the genes which cause resistance to chemotherapy as drugs which inhibit these have the potential to substantially improve treatment. The work also includes evaluation of novel drugs and assessment of the mechanism of action. A broad range of techniques encompassing cell biology, molecular biology, pharmacology and biochemistry are employed. This research has a strong translational component, because the results directly inform the design of clinical trials, and is ideally suited for anyone considering a career in the pharmaceutical industry.

Dr Ka-Wai Wan (Lecturer in Pharmaceutics, School of Pharmacy) is a registered pharmacist with research interests in the field of advanced drug delivery systems (polymers, liposomes and colloidal systems) for targeted therapy and delivery of macromolecules such as genes and proteins. Techniques include dissolution testing of solid dosage forms and percutaneous diffusion of drugs. Current PhD student research project involves the use of nanoparticulates for enhanced localisation and delivery of anti-infectives through the skin.

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[Prof. Dave Hoole](#) and his research group, which currently includes two PhD students and a postdoctoral fellow, specialise in the immunology of cultured fish particularly in relationship to parasitic diseases and water quality. Comparative immunology provides major insights into the mechanisms by which animals combat infectious diseases, and fish serve as useful models for such molecular biological studies. On-going studies include the immunological interactions between fish and major groups of pathogens. Recent work has concentrated on the application and mechanisms of action of immunostimulants on the innate immune response and the induction of cell death. This research is supported by a range of cell culture and molecular biological facilities in addition to an extensive aquarium

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too much apoptosis producing neurodegenerative diseases. We are using a range of techniques in molecular cell biology to identify new apoptosis-controlling genes and to investigate their importance in cancer development and therapy, and in diseases of the immune system. Check GT Williams (Keele or Birmingham) for past work.

Epigenetics

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Professor Farrell collaborates closely with [Prof. Tony Fryer](#) whose interests include using genetic biomarkers and clinical biochemistry to assess the impact of maternal folate supplementation during pregnancy on fetal epigenome.

Proteomics

[Dr Sarah Hart](#)'s research is focused on the applications of mass spectrometric methods to the understanding of complex biological systems in human health and disease. The use of biological mass spectrometry for protein and peptide analysis is conventionally termed proteomics, we also have a strong interest in improving our understanding of the gas-phase ion chemistry underpinning peptide and protein mass spectrometry. We work with mass spectrometry equipment at the [Keele Proteomics Facility at RJAH](#) Oswestry, and collaborate with the Michael Barber Centre, Manchester and the National Mass Spectrometry Facility, University of California, San Francisco, to undertake high-performance proteomics analyses.

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Cell physiology and pathology

[Dr. Divya Chari](#)'s laboratory studies the use of novel, nonviral vector systems employing magnetic iron oxide nanoparticles for cell tracking and targeting, biomolecule delivery (with use of novel static and oscillating 'magnetofection' approaches to enhance gene transfer) and magnetic resonance imaging of major neural cell transplant populations including astrocytes, neural stem cells and oligodendrocyte precursor cells [see Pickard M, Chari D. (2010) Enhancement of magnetic nanoparticle (MNP) mediated gene transfer to astrocytes by 'magnetofection' : Effects of static and oscillating fields. *Nanomedicine* 5(2):217-232]. A second major research interest is the mechanisms of effects of anti-inflammatory therapies on myelin genesis in the developing nervous system.

[Dr. Gordon Dent](#)'s research interests cover (i) human leukocyte signalling, including the roles of protein and lipid kinases in the activation of eosinophils, (ii) the role of epithelial cells in recruitment of leukocytes to sites of inflammation, and (iii) interactions between epithelial cells and leukocytes in inflammatory diseases. This work involves cell culture, transfection, *in vitro* leukocyte chemotaxis and secretion assays and ELISA. Collaborations are ongoing with partners within ISTM and the University Hospital of North Staffordshire.

[Dr Michael Evans](#)' research is centred on cochlear hair cells, and specifically on the inhibitory actions of acetylcholine (ACh). Outer hair cells are inhibited by efferent nerve fibres arising in the brainstem, and this system is thought to modulate the amplification that these cells

provide via their unique electromotility. Projects in my lab are likely to focus on understanding the mechanism of efferent inhibition, and how its role might change during development. I have two electrophysiological set-ups and we have access to a confocal and two-photon microscope as well as electron microscopes.

[Prof. Sally Roberts](#)' research interests are in several areas relating to the musculoskeletal system, both in terms of normal cell physiology and how this changes in disease and with ageing. Particular areas of interest and expertise are in the spine and joints. The work is mostly undertaken in RJAH Orthopaedic Hospital, Oswestry, with many collaborations worldwide. Members of the group are involved in several projects relating to cell therapy and regenerative medicine, both *in vitro* and in patients. We are establishing internationally recognised outcome measures for assessing the efficacy of treatments in the clinic.

[Dr Alan Harper's](#) research is focused on delineating the molecular and cellular mechanisms underlying the generation and shaping of calcium signals in human platelets exposed to physiological agonists. Calcium signalling in platelets is critical to their ability to clot the blood in response to vascular damage. However platelets can also be aberrantly activated in a number of cardiovascular diseases, therefore understanding the signalling mechanisms by which platelet activation occurs may also allow us to identify novel pharmacological mechanisms through which we can block the unwanted platelet activation that occurs in heart attack and stroke patients. Our work involves monitoring of cellular calcium fluxes utilising fluorescent indicators loaded into freshly-donated human platelets. Current projects include development of novel methodologies to measure calcium fluxes in platelets, as well as further investigating the possibility of an extracellular calcium recycling system in these cells.

Structural biology and Structural immunology

The Structural Biology/Immunology Research group includes [Prof. Trevor Greenhough](#) and [Dr. Annette Shrive](#) with, currently, six PhD students and a Research Technician. Infrastructure includes a purification and crystallisation laboratory, FPLC, HPLC, Xcalibur X-ray diffraction system and molecular graphics. The group leads the Midlands UK PX consortium at [Diamond](#). We aim to characterise the molecular mechanisms by which molecules of the innate immune system select, recognise and bind to their natural targets and effect clearance through immune system pathways. Structural immunology includes the structure, function and evolution of innate immune proteins with an emphasis on ligand/pathogen recognition by the pentraxins CRP and SAP and the collectins including hSP-D. Structural investigations utilise complementary techniques (SRCD, cryoEM) in addition to crystallography.

Neuroscience

See also [Neurology](#) under Clinical Science

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[Dr Rosemary Fricker-Gates](#)' group currently focuses on the ability of stem cells for neuronal differentiation, as prospective therapies for Parkinson's and Huntington's diseases. We work with neural and embryonic stem cells, and our research aims to discover both intrinsic and extrinsic factors that govern neuronal differentiation *in vitro* and *in vivo*. The group consists of 1-2 postdocs, and PhD, Masters and Undergraduate students. Our facilities include: cell culture; equipment for immunohistochemistry, protein and molecular techniques; a

microscopy suite for digital imaging, confocal microscopy and time-lapse recording; and access to proteomics and all central research facilities.

[Dr. Nigel Cooper](#)'s research interests are in the field of auditory biophysics and neuroscience. He works as part of the hearing research group on the main campus at Keele, and runs a laboratory with specialist laser interferometric, audiometric and neurophysiological measurement facilities. The main focus of his work is the mechanics of the cochlear amplifier, and the role that it plays in encoding simple and complex sounds.

[Dr. Dave Furness](#)' research group studies two aspects of the function of the inner ear (cochlea): (i) how sound detecting sensory hair cells work and (ii) possible stem cell strategies for preventing breakdown of the homeostatic mechanisms that lead to some forms of age-related deafness. Ultrastructural and immunocytochemical techniques are used for both confocal and electron microscopy to investigate cellular organization and explore the distribution of important proteins in the inner ear. The group consists of a Reader, post-doctoral researcher and technician, and has funding from Deafness Research UK, RNID and the University of Wisconsin Madison.

[Dr. Mary Palmer](#)'s research group is primarily interested in the cellular and molecular mechanisms underlying the transfer of visual information at synapses between neurons in the retina. We aim to determine how excitatory and inhibitory synapses in the inner retina are specialised for processing visual signals. We achieve this using electrophysiological recordings from individual neurons in semi-intact retinal tissue, including from the presynaptic terminals of bipolar cells, and through collaborations with other groups at Keele that use complimentary techniques such as immunocytochemistry and electron microscopy.

Research in [Dr. Monte Gates](#)' group is focused on understanding how immature neural cells establish appropriate links in the developing central nervous system. Knowledge of this process should be applicable to restoring neural functioning in the adult central nervous system, where diseases (e.g., Parkinson's disease) can often destroy neural connections. For this work we have substantial cell culture, and histological facilities, as well as modern photo- and video- microscopic imaging technology.

Glycobiology

[Dr. Mark Skidmore](#)'s general area of research interest is carbohydrate chemistry / biochemistry, in particular the role of anionic carbohydrates as dynamic cell regulators. The major focus of my current research is the study of carbohydrate:protein structure-functions, in particular the development of new tools and technologies for elucidating protein-carbohydrate interactions and their application to biomedical sciences and medicine. Current and ongoing research interests include the development of improved separation and detection techniques; novel coupling strategies at the ends of digested GAGs; the use of synchrotron radiation circular dichroism (SRCD) to study the conformation of carbohydrates (and GAGs), proteins and protein-carbohydrate interactions; the application of semi-synthetic carbohydrate libraries as potential therapeutics.

Regenerative mechanisms

[Professor Alicia El Haj](#) leads a multi-disciplinary team linked to the University Hospital of North Staffordshire and RJA Orthopaedic Hospital at Oswestry with a major focus on enabling technologies involved in cell and tissue engineering and introduction to the clinic of cell therapies for regenerative medicine. Specific expertise includes active clinical cell therapies, enabling technology development associated with environmental chambers or bioreactor design, targeting and delivery vehicles and strategies using magnetic nanoparticles, control of differentiation of tissue specific stem cells and skeletal stem cells and design of new materials for growth and delivery of stem cells. This work is funded by the EPSRC, BBSRC, ARUK, MRC and EU Framework. The two hospital sites have GMP cell therapy labs with culture and delivery of human cells being used for MRC trials.

[Prof. Jon Dobson](#)'s research focuses on (i) nanomagnetic actuation to control cellular functions for regenerative medicine and stem cell research; (ii) magnetic nanoparticle-based gene transfection; (iii) magnetic nanoparticle-loaded cellular carriers for tumor targeting and tissue repair; (iv) magnetic nanoparticle synthesis and characterization; (v) development of imaging and characterization techniques for iron compounds in neurodegenerative diseases such as Alzheimer's to inform MRI-based diagnostic technique development. The group works at Keele and at international facilities including the US National High Magnetic Field Laboratory, Argonne National Laboratory (US) and the DIAMOND synchrotron (Oxfordshire).

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[Dr. Ying Yang](#)'s main research interests are in regenerative medicine covering activities in two areas: fabrication/application of multifunctional biomaterials for tissue engineering (cornea, bone, tendon, nerve, cartilage) and exploitation of on-line, non-destructive characterisation techniques to monitor three dimensional scaffolds, tissues and constructs behaviour in vitro and in vivo. The main facilities kept and used in the group include electrospinning, optical coherence tomography, long work distance microscope, polarization microscope, FTIR, TGA/DSC, and various bioreactors. The group currently comprises 6 PhD students and 3 postdoctorals.

Stem cells

[Prof. James Richardson](#) is an orthopaedic surgeon specialising in the treatment of early arthritis using stem cell and chondrocytes and orthopaedic osteotomy realignment procedures. Over 400 patients have been treated with chondrocyte and mesenchymal stem cells, and a novel trial using combined cells is due to commence soon. Prof. Richardson believes that the future is in a universal cell that can be cultured from the cord of a placenta, and funding for a new PhD position, to develop such a source of cells to treat people with sports injuries, skin loss, and early arthritis and problem fractures, has been identified.

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[Dr Nick Forsyth](#)'s current research group consists of 5 PhD students and 2 Research Assistants. Research covers stem cell biology (embryonic, cord, adult) for application in areas such as bioinformatics, biomaterials (nanofibers and polymers), cartilage repair, hypoxia, tendon repair, and respiratory function. Available facilities include state-of-the-art hypoxic control systems, microarray, FACS, quantitative PCR, confocal and fluorescence microscopy.

Biomedical technologies

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[Dr. Paul Roach](#) joined ISTM in late 2009 to carry out research between the physical sciences with the aim of developing new medical materials and/or coatings and diagnostic tools for the clinical environment. The interest in interdisciplinary topics is supported by a diverse background in synthetic organic chemistry, materials science, surface science, cell and tissue engineering and (bio)sensors. Projects within the lab may include chemical synthesis, UV-Vis and FT-IR spectroscopy, fluorimetry, lithographic processing, wettability measurement and cell culture.

[Dr. Josep Sule-Suso](#) employs Fourier Transform Infrared Spectroscopy and is presently studying with an infrared light single cells from biopsy samples in order to characterize biomarkers for the diagnosis of cancer. This should lead towards the development of an automated system for cancer screening (such as cervical cancer) and help pathologists in the diagnosis of cancer, thus reducing the number of biopsies and working hours in Pathology departments. He is also using the Selected Ion Flow Tube-Mass Spectrometry (SIFT-MS) to study the breath of patients with lung cancer. The aim is to find biomarkers that could help not only on lung cancer diagnosis and screening but also to assess tumour response to chemotherapy and radiotherapy.

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Biomaterials for tissue regeneration

[Dr. Ying Yang](#)'s main research interests are in regenerative medicine covering activities in two areas: fabrication/application of multifunctional biomaterials for tissue engineering (cornea, bone, tendon, nerve, cartilage) and exploitation of on-line, non-destructive characterisation techniques to monitor three dimensional scaffolds, tissues and constructs behaviour in vitro and in vivo. The main facilities kept and used in the group include electrospinning, optical coherence tomography, long work distance microscope, polarization microscope, FTIR, TGA/DSC, and various bioreactors. The group currently comprises 6 PhD students and 3 postdoctorals.

[Prof. Sally Roberts](#)' research interests are in several areas relating to the musculoskeletal system, both in terms of normal cell physiology and how this changes in disease and with ageing. Particular areas of interest and expertise are in the spine and joints. The work is mostly undertaken in RJAH Orthopaedic Hospital, Oswestry, with many collaborations worldwide. Members of the group are involved in several projects relating to cell therapy and regenerative medicine, both in vitro and in patients. We are establishing internationally recognised outcome measures for assessing the efficacy of treatments in the clinic.

[Dr. Paul Roach](#) joined ISTM in late 2009 to carry out research between the physical sciences with the aim of developing new medical materials and/or coatings and diagnostic tools for the clinical environment. The interest in interdisciplinary topics is supported by a diverse background in synthetic organic chemistry, materials science, surface science, cell and tissue engineering and (bio)sensors. Projects within the lab may include chemical synthesis, UV-Vis and FT-IR spectroscopy, fluorimetry, lithographic processing, wettability measurement and cell culture.

Orthopaedic tissue engineering

[Dr. Ying Yang](#)'s main research interests are in regenerative medicine covering activities in two areas: fabrication/application of multifunctional biomaterials for tissue engineering (cornea, bone, tendon, nerve, cartilage) and exploitation of on-line, non-destructive characterisation techniques to monitor three dimensional scaffolds, tissues and constructs behaviour in vitro and in vivo. The main facilities kept and used in the group include electrospinning, optical coherence tomography, long work distance microscope, polarization microscope, FTIR, TGA/DSC, and various bioreactors. The group currently comprises 6 PhD students and 3 postdoctorals.

[Prof. Sally Roberts](#)' research interests are in several areas relating to the musculoskeletal system, both in terms of normal cell physiology and how this changes in disease and with ageing. Particular areas of interest and expertise are in the spine and joints. The work is mostly undertaken in RJAH Orthopaedic Hospital, Oswestry, with many collaborations worldwide. Members of the group are involved in several projects relating to cell therapy and regenerative medicine, both in vitro and in patients. We are establishing internationally recognised outcome measures for assessing the efficacy of treatments in the clinic.

[Prof. James Richardson](#) is an orthopaedic surgeon specialising in the treatment of early arthritis using stem cell and chondrocytes and orthopaedic osteotomy realignment procedures. Over 400 patients have been treated with chondrocyte and mesenchymal stem cells, and a novel trial using combined cells is due to commence soon. Prof. Richardson

believes that the future is in a universal cell that can be cultured from the cord of a placenta, and funding for a new PhD position, to develop such a source of cells to treat people with sports injuries, skin loss, and early arthritis and problem fractures, has been identified.

Magnetic nanotechnologies

[Dr. Divya Chari](#)'s laboratory studies the use of novel, nonviral vector systems employing magnetic iron oxide nanoparticles for cell tracking and targeting, biomolecule delivery (with use of novel static and oscillating 'magnetofection' approaches to enhance gene transfer) and magnetic resonance imaging of major neural cell transplant populations including astrocytes, neural stem cells and oligodendrocyte precursor cells [see Pickard M, Chari D. (2010) Enhancement of magnetic nanoparticle (MNP) mediated gene transfer to astrocytes by 'magnetofection' : Effects of static and oscillating fields. *Nanomedicine* 5(2):217-232]. A second major research interest is the mechanisms of effects of anti-inflammatory therapies on myelin genesis in the developing nervous system.

[Prof. Jon Dobson](#)'s research focuses on (i) nanomagnetic actuation to control cellular functions for regenerative medicine and stem cell research; (ii) magnetic nanoparticle-based gene transfection; (iii) magnetic nanoparticle-loaded cellular carriers for tumor targeting and tissue repair; (iv) magnetic nanoparticle synthesis and characterization; (v) development of imaging and characterization techniques for iron compounds in neurodegenerative diseases such as Alzheimer's to inform MRI-based diagnostic technique development. The group works at Keele and at international facilities including the US National High Magnetic Field Laboratory, Argonne National Laboratory (US) and the DIAMOND synchrotron (Oxfordshire).

Rehabilitation engineering

[Professor Anand Pandyan](#)'s bioengineering research interests are neurological rehabilitation in general, and stroke rehabilitation in particular. The primary research focus has been on (a) measuring and then modelling the relationship between impairment and activity and (b) identifying methods of reducing the impact of upper limb impairments on activity and participation, using technology whenever possible. MPhil and PhD projects relating to spasticity, rehabilitation and gait, and bioengineering solutions for rehabilitation problems, are offered to both therapy and bioengineering students. There are close links with the Stoke Stroke Research group, neuro-rehabilitation, and the Cerebral Palsy Research group in Oswestry.

Biomechanics and mechanobiology

[Dr. Jan Herman Kuiper](#)'s research interests are in the broad areas of biomechanics and mechanobiology. They range from mechanical guidance of tissue formation to development, pre-clinical and clinical testing of orthopaedic devices, implants and procedures. Dr. Kuiper works at all three ISTM sites (the Robert Jones and Agnes Hunt Orthopaedic Hospital in Oswestry, Keele campus and Hartshill). Major facilities are servo-hydraulic testing equipment in Oswestry and a super computer on Keele Campus. The research groups are interlinked with other groups in Oswestry and Hartshill, and the School of Computing and Mathematics in Keele.

Pharmaceutics

The human malarial parasite *Plasmodium falciparum* has a complex life-cycle underpinned by an extensive programme of developmentally-linked gene expression. [Dr. Paul Horrocks](#) is interested in determining the contribution of both genetic and epigenetic molecular mechanisms to this control. More recently, these studies have been expanded to determine whether lessons learnt are applicable to other apicomplexan parasites, many of which play roles as pathogens of veterinarian importance. Finally, in collaboration with the School of Chemistry, we are synthesising and evaluating plant-derived molecules for potential lead generation as novel antimalarial drugs.

Dr Ka-Wai Wan (Lecturer in Pharmaceutics, School of Pharmacy) is a registered pharmacist with research interests in the field of advanced drug delivery systems (polymers, liposomes and colloidal systems) for targeted therapy and delivery of macromolecules such as genes and proteins. Techniques include dissolution testing of solid dosage forms and percutaneous diffusion of drugs. Current PhD student research project involves the use of nanoparticles for enhanced localisation and delivery of anti-infectives through the skin.

[Jihong Han](#)'s research area covers colloidal drug delivery systems, including pharmaceutical emulsions and suspensions. Interests also include oral controlled drug delivery systems. General methods used include single particle optical sensing, rotary viscometer, high performance liquid chromatography, and dissolution testing etc. Research work is being done through collaboration with colleagues in other universities.

Pharmacology

[Dr Alan Richardson](#), whose research group comprises 2-3 members, is focusing on ovarian cancer. The group are identifying the genes which cause resistance to chemotherapy as drugs which inhibit these have the potential to substantially improve treatment. The work also includes evaluation of novel drugs and assessment of the mechanism of action. A broad range of techniques encompassing cell biology, molecular biology, pharmacology and biochemistry are employed. This research has a strong translational component, because the results directly inform the design of clinical trials, and is ideally suited for anyone considering a career in the pharmaceutical industry.

[Dr. Gordon Dent](#)'s research interests cover (i) human leukocyte signalling, including the roles of protein and lipid kinases in the activation of eosinophils, (ii) the role of epithelial cells in recruitment of leukocytes to sites of inflammation, and (iii) interactions between epithelial cells and leukocytes in inflammatory diseases. This work involves cell culture, transfection, *in vitro* leukocyte chemotaxis and secretion assays and ELISA. Collaborations are ongoing with partners within ISTM and the University Hospital of North Staffordshire.

[Dr. Dhaya Perumal](#) is Lecturer in Clinical Pharmacology with research interests in the area of formulation and evaluation of drug delivery systems, in particular, in the area of HIV vaccine development and in the prevention of HIV transmission. Techniques include development of plasmids and viral vectors encoded with HIV-1 genes, anti-HIV activity testing, flow cytometry, cell culture, PCR, ELISA, ELISpot, electroporation, liposome formulation and preparation UV, IR, in-vitro drug dissolution, drug stability and drug release modelling

Respiratory disease

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[Professor Monica Spiteri](#) directs the Lung Research programme, which incorporates a multidisciplinary approach of cell pathology, molecular biology and bioengineering. Her group has established international expertise in utilization of ex-vivo cell injury-repair models to explore mechanisms in tissue / airway wall remodelling in pulmonary fibrogenesis and rhinovirus-associated airway inflammation, and in explorative technology for early detection and monitoring of lung disease. Specific areas of interest include optical coherence tomography for early detection of in situ precancerous /malignant lesions within the respiratory epithelium, and use of FTIR for airway mucus analysis to identify individual healthy and disease onset-related sputum fingerprints.

[Prof. Warren Lenney](#) can offer support for a wide variety of respiratory research post-graduate degrees involving children. Interests include the genetics of asthma and its treatment in both acute and chronic forms, respiratory infections (both viral and bacterial), and other aspects of general paediatrics. Resources include full lung function facilities, the novel SIFT-MS instrument, an exhaled breath NO monitor and a large source of clinical material in children of all ages in the in-patient and out-patient settings. SIFT-MS is particularly useful in the discovery of specific markers of bacterial infection and this research is being pursued here in cystic fibrosis patients. Good connections/communications with the biochemistry and microbiology departments are in place for collaborative research as well as the genetic link.

Metabolic disease, Diabetes

[Professor Gordon Ferns](#) has a long standing interest in the mechanisms of atherosclerosis and biomarkers of cardiovascular disease and insulin resistance. He currently has 4 PhD students working in areas such as the role of autoimmunity in atherogenesis, trace elements, and models of atherosclerosis.

In collaboration with Dr Fahmy Hanna, consultant diabetologist, [Prof. Tony Fryer](#) has a clinical interest in developing pathology services and diagnostic tools for diabetes. Current projects include assessment of the appropriateness of pathology testing and impact of guidance to ensure the right test is requested for the right patient at the right time.

Stroke

[Dr. Simon Ellis](#) is Consultant Neurologist at the University Hospital of North Staffordshire. Research interests include neuropsychological deficits following stroke, handedness, neurological complications of hyponatraemia, stroke treatment, chronic fatigue syndrome, informing patients, patient decision making, training competencies as well as various phase II and phase III pharmacological trials.

[Professor Christine Roffe](#) is the clinical lead for the [West Midlands Stroke Local Research Network](#). Stoke is the hub of this network, which links stroke researchers in all hospitals throughout the region. The Stoke Stroke Research group itself is a multidisciplinary team supporting the development and conduct of clinical studies. There are active research programmes relating to acute stroke (in particular post-stroke hypoxia) and rehabilitation (spasticity, physiotherapy, occupational therapy, psychology), supporting MSc, MPhil, MD, and PhD students. As one of 8 Hyperacute Stroke Research Centres the University Hospital of North Staffordshire provides state of the art infrastructures for clinical stroke research.

[Professor Anand Pandyan](#)'s bioengineering research interests are neurological rehabilitation in general, and stroke rehabilitation in particular. The primary research focus has been on (a) measuring and then modelling the relationship between impairment and activity and (b) identifying methods of reducing the impact of upper limb impairments on activity and participation, using technology whenever possible. MPhil and PhD projects relating to spasticity, rehabilitation and gait, and bioengineering solutions for rehabilitation problems, are offered to both therapy and bioengineering students. There are close links with the Stoke Stroke Research group, neuro-rehabilitation, and the Cerebral Palsy Research group in Oswestry.

Rehabilitation

[Professor Anand Pandyan](#)'s bioengineering research interests are neurological rehabilitation in general, and stroke rehabilitation in particular. The primary research focus has been on (a) measuring and then modelling the relationship between impairment and activity and (b) identifying methods of reducing the impact of upper limb impairments on activity and participation, using technology whenever possible. MPhil and PhD projects relating to spasticity, rehabilitation and gait, and bioengineering solutions for rehabilitation problems, are offered to both therapy and bioengineering students. There are close links with the Stoke

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Cancer studies

The focus of research for the [Prof. Gwyn Williams](#) Group is on the control of apoptosis (programmed cell death) in human cells, and on the ways in which this programme goes wrong to produce disease: too little apoptosis producing cancer and autoimmune disease; too much apoptosis producing neurodegenerative diseases. We are using a range of techniques in molecular cell biology to identify new apoptosis-controlling genes and to investigate their importance in cancer development and therapy, and in diseases of the immune system. Check GT Williams (Keele or Birmingham) for past work.

[Dr. Murray Brunt](#)'s research is in breast cancer, haematological malignancies (predominantly lymphomas), and skin cancer. It is conducted primarily through breast cancer clinical trials, on three levels (i) trial development, management, and publication of results, (ii) a principal investigator and recruiter to trials (iii) the practical application of clinical trials and patient interaction. The areas of breast cancer trials in which Dr Brunt is involved directly relate to his practice as a clinical oncologist: radiotherapy, chemotherapy, hormone therapy and targeted biological therapy.

[Dr. Josep Sule-Suso](#) employs Fourier Transform Infrared Spectroscopy and is presently studying with an infrared light single cells from biopsy samples in order to characterize biomarkers for the diagnosis of cancer. This should lead towards the development of an automated system for cancer screening (such as cervical cancer) and help pathologists in the diagnosis of cancer, thus reducing the number of biopsies and working hours in Pathology departments. He is also using the Selected Ion Flow Tube-Mass Spectrometry (SIFT-MS) to study the breath of patients with lung cancer. The aim is to find biomarkers that could help not only on lung cancer diagnosis and screening but also to assess tumour response to chemotherapy and radiotherapy.

[Professor William Farrell](#)'s group comprises two postdoctoral scientists (one joint with Dr Derek Matthey) and two PhD students. Their primary interest is in epigenetic gene regulation in pituitary tumours and in the health of the unborn child. Understanding these changes in tumours will allow us to develop molecular pathology techniques to predict tumour behaviour and identify changes that convert normal cells into tumour cells. These whole-genome techniques are also being used to gain insight with respect to the health of the unborn child.

Cardiology, Lipid metabolism

[Professor Gordon Ferns](#) has a long standing interest in the mechanisms of atherosclerosis and biomarkers of cardiovascular disease and insulin resistance. He currently has 4 PhD students working in areas such as the role of autoimmunity in atherogenesis, trace elements, and models of atherosclerosis. He currently has research collaborations on the epidemiology of cardiovascular disease, diabetes and metabolic syndrome in Saudi Arabia and Iran, and is working on the role of autoimmune mechanisms in atherogenesis with colleagues in Surrey, funded by the British Heart Foundation. Recent clinical research has included the assessment of insulin resistance, and novel biomarkers of coronary risk.

Neurology

[Professor Clive Hawkins](#) is Professor of Clinical Neurology at Keele, and Consultant Neurologist to the Regional Neuroscience Centre, University Hospital of North Staffordshire. Research interests include (i) Molecular genetics in MS, with regard to susceptibility and outcome/disability. Over 80 genetic polymorphisms have been analysed, current work focusing on haplotype interactions of candidate genes involved in inflammation and axonal loss. (ii) Vision studies to compare functional deficit by psychophysics with pathophysiology and MRI of the optic nerve and visual pathway in the brain. Current work includes studying two types of bilateral optic neuritis using psychophysics. There are 3 PG research students, Lecturer/ research registrars studying for a PhD/MD in molecular genetics or vision studies.

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[Prof. Glenn Morris](#) studies the molecular pathogenesis of human inherited neuromuscular diseases, such as muscular dystrophies, mainly by using monoclonal antibodies that are produced and characterized in-house. The biochemistry lab has 4-5 postdoctoral members and 1-2 students and is part of the Wolfson Centre which has 6-8 additional clinical staff, many of whom are also involved in research. The group is located on the RJAH Oswestry site and has two confocal microscopes, two LC-mass spectrometers (part of the [Keele Proteomics Facility at RJAH](#)) and a BIAcore for protein interaction studies.

[Dr Rosemary Fricker-Gates'](#) group currently focuses on the ability of stem cells for neuronal differentiation, as prospective therapies for Parkinson's and Huntington's diseases. We work with neural and embryonic stem cells, and our research aims to discover both intrinsic and extrinsic factors that govern neuronal differentiation *in vitro* and *in vivo*. The group consists of 1-2 postdocs, and PhD, Masters and Undergraduate students. Our facilities include: cell culture; equipment for immunohistochemistry, protein and molecular techniques; a microscopy suite for digital imaging, confocal microscopy and time-lapse recording; and access to proteomics and all central research facilities.

Multiple Sclerosis

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Trauma, Dementia

[Professor Clive Hawkins](#) is Professor of Clinical Neurology at Keele, and Consultant Neurologist to the Regional Neuroscience Centre, University Hospital of North Staffordshire. Research interests include (i) Molecular genetics in MS, with regard to susceptibility and outcome/disability. Over 80 genetic polymorphisms have been analysed, current work focusing on haplotype interactions of candidate genes involved in inflammation and axonal loss. (ii) Vision studies to compare functional deficit by psychophysics with pathophysiology and MRI of the optic nerve and visual pathway in the brain. Current work includes studying two types of bilateral optic neuritis using psychophysics. There are 3 PG research students, Lecturer/ research registrars studying for a PhD/MD in molecular genetics or vision studies.

Obstetrics and Gynaecology

[Professor Shaughn O'Brien](#)'s primary research focuses are the diagnosis and quantification of menstrual disorders, in particular, premenstrual syndrome (PMS), premenstrual dysphoric disorder (PMDD) and heavy menstrual bleeding, the genetics of PMS, diagnosis of endometriosis and the non-fertility aspects of polycystic ovary syndrome (PCOS). My research team currently comprises a clinical research fellow, postdoctoral research associate, biomedical scientist, two research midwives and both undergraduate and postgraduate students. We are based at the purpose built Guy-Hilton Research Centre which provides a laboratory, consulting rooms and office space for our team.

[Professor Khaled M. K. Ismail](#) is a senior lecturer / consultant Obstetrician and Gynaecologist in Keele University and the University Hospital of North Staffordshire. The underlying theme of his research work is improving pregnancy related maternal and fetal outcomes both at the short and longer term. The main focus of the research programme falls into two broad categories (i) prediction, recognition and management of childbirth-related perineal trauma and (ii) effects of maternal nutrition and medications on the fetal epigenome and susceptibility to disease later on in life.

Professor Ismail collaborates closely with [Professor William Farrell](#) and [Prof. Tony Fryer](#) whose interests include using epigenomic tools, genetic biomarkers and clinical biochemistry to assess the impact of maternal folate supplementation during pregnancy on fetal epigenome.

Trace gas analysis

The research interests of [Professor David Smith FRS](#) include the physics and chemistry of ionised gases with special reference to ion-molecule reaction, and the development of analytical instruments that exploit gas phase ionic reactions for the analysis of trace gases in air (for environmental monitoring) and breath analysis (for non-invasive clinical diagnosis and therapeutic monitoring). Current projects include (i) Quantification of metabolites in breath of patients with end-stage renal failure, pre- and post-dialysis. (ii) Determination of total body water by measuring the deuterium content of single breath exhalations following ingestion of D₂O (iii) Identifying and quantifying metabolites emitted by tumour cells in vivo and in vitro

Biosensors, biomarkers and biomaterials

[Dr. Paul Roach](#) joined ISTM in late 2009 to carry out research between the physical sciences with the aim of developing new medical materials and/or coatings and diagnostic tools for the clinical environment. The interest in interdisciplinary topics is supported by a diverse background in synthetic organic chemistry, materials science, surface science, cell and tissue engineering and (bio)sensors. Projects within the lab may include chemical synthesis, UV-Vis and FT-IR spectroscopy, fluorimetry, lithographic processing, wettability measurement and cell culture.

[Dr Sarah Hart](#)'s research is focused on the applications of mass spectrometric methods to the understanding of complex biological systems in human health and disease. The use of biological mass spectrometry for protein and peptide analysis is conventionally termed

proteomics, we also have a strong interest in improving our understanding of the gas-phase ion chemistry underpinning peptide and protein mass spectrometry. We work with mass spectrometry equipment at the [Keele Proteomics Facility at RJAH](#) Oswestry, and collaborate with the Michael Barber Centre, Manchester and the National Mass Spectrometry Facility, University of California, San Francisco, to undertake high-performance proteomics analyses.

[Dr. Josep Sule-Suso](#) employs Fourier Transform Infrared Spectroscopy and is presently studying with an infrared light single cells from biopsy samples in order to characterize biomarkers for the diagnosis of cancer. This should lead towards the development of an automated system for cancer screening (such as cervical cancer) and help pathologists in the diagnosis of cancer, thus reducing the number of biopsies and working hours in Pathology departments. He is also using the Selected Ion Flow Tube-Mass Spectrometry (SIFT-MS) to study the breath of patients with lung cancer. The aim is to find biomarkers that could help not only on lung cancer diagnosis and screening but also to assess tumour response to chemotherapy and radiotherapy.

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Lung disease

[Prof. Warren Lenney](#) can offer support for a wide variety of respiratory research post-graduate degrees involving children. Interests include the genetics of asthma and its treatment in both acute and chronic forms, respiratory infections (both viral and bacterial), and other aspects of general paediatrics. Resources include full lung function facilities, the novel SIFT-MS instrument, an exhaled breath NO monitor and a large source of clinical material in children of all ages in the in-patient and out-patient settings. SIFT-MS is particularly useful in the discovery of specific markers of bacterial infection and this research is being pursued here in cystic fibrosis patients. Good connections/communications with the biochemistry and microbiology departments are in place for collaborative research as well as the genetic link.

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Non-destructive, optical and real time imaging

[Dr. Ying Yang](#)'s main research interests are in regenerative medicine covering activities in two areas: fabrication/application of multifunctional biomaterials for tissue engineering (cornea, bone, tendon, nerve, cartilage) and exploitation of on-line, non-destructive characterisation techniques to monitor three dimensional scaffolds, tissues and constructs behaviour in vitro and in vivo. The main facilities kept and used in the group include electrospinning, optical coherence tomography, long work distance microscope, polarization microscope, FTIR, TGA/DSC, and various bioreactors. The group currently comprises 6 PhD students and 3 postdoctorals.

Cancer genomics / epigenomics

There are several groups within this field investigating the genome for aberrations leading to disease and/or predisposition toward disease. These studies rely on close collaboration between basic scientists and clinicians where investigations focus on primary tissue or patient derived samples. The studies undertaken encompass both genetics and epigenetics aspects of multiple disease. For example, funded research projects are focused on a range of disease including, cancers (breast, pituitary, ovarian), diabetes, multiple sclerosis, rheumatoid arthritis. In addition, funding from the World Cancer Research Cancer Fund has enabled a study of fetal epigenetics as determined from cord-blood samples at term. Increasingly these types of studies adopt a "whole-genome" approach looking at more than 40,000 genes in single experiments. The equipment housed within our genomics lab and through collaborations allows us to perform these types of studies. In addition these studies are reliant on in-house expertise in medical statistics and bioinformatics.

[Dr Alan Richardson](#), whose research group comprises 2-3 members, is focusing on ovarian cancer. The group are identifying the genes which cause resistance to chemotherapy as drugs which inhibit these have the potential to substantially improve treatment. The work also includes evaluation of novel drugs and assessment of the mechanism of action. A broad range of techniques encompassing cell biology, molecular biology, pharmacology and biochemistry are employed. This research has a strong translational component, because the results directly inform the design of clinical trials, and is ideally suited for anyone considering a career in the pharmaceutical industry.

[Professor William Farrell](#)'s group comprises two postdoctoral scientists (one joint with Dr Derek Matthey) and two PhD students. Their primary interest is in epigenetic gene regulation in pituitary tumours and in the health of the unborn child. Understanding these changes in tumours will allow us to develop molecular pathology techniques to predict tumour behaviour and identify changes that convert normal cells into tumour cells. These whole-genome techniques are also being used to gain insight with respect to the health of the unborn child.

Molecular epidemiology

The molecular epidemiology group have published many "first past the post" research papers and have for many years investigated patients' predisposition toward particular disease or clinical outcomes. These types of studies are heavily reliant on a stable population and we are fortunate in that the West Midlands fulfil these criteria. Investigation makes use of single nucleotide polymorphisms (SNPs). Their study and determination of their frequency in populations and individuals can often be correlated with disease risk and phenotype.

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[Dr Derek L Matthey](#)'s main research interests are; (1) influence of genetic factors on development and severity of rheumatoid arthritis (2) predictors of co-morbid disease and survival in RA (3) gene-environment interactions in rheumatic diseases (4) biomarker profiling in inflammatory arthritis (5) role of epigenetic factors in RA. The equipment and facilities we use include Luminex suspension array technology for biomarker analysis, ELISA, immunofluorescence microscopy, PCR, cell culture, FACS analysis. Our research group consists of a senior scientist, postdoctoral researcher, 2 PhD students, 2 research technicians and 2 research nurses.

[Professor Clive Hawkins](#) is Professor of Clinical Neurology at Keele, and Consultant Neurologist to the Regional Neuroscience Centre, University Hospital of North Staffordshire. Research interests include (i) Molecular genetics in MS, with regard to susceptibility and outcome/disability. Over 80 genetic polymorphisms have been analysed, current work focusing on haplotype interactions of candidate genes involved in inflammation and axonal loss. (ii) Vision studies to compare functional deficit by psychophysics with pathophysiology and MRI of the optic nerve and visual pathway in the brain. Current work includes studying two types of bilateral optic neuritis using psychophysics. There are 3 PG research students, Lecturer/ research registrars studying for a PhD/MD in molecular genetics or vision studies.

Malaria, Mosquitoes and Man

[Professor Paul Eggleston](#) studies the molecular genetics of mosquitoes and their interactions with pathogens such as malaria. Current projects include the development of site-directed transgene integration, the creation of GM mosquitoes that are incompetent disease vectors, stage and tissue-specific regulation of transgene expression and the analysis of fitness associated with genetic modification. The group, which currently comprises 2 postdoctoral researchers, 3 postgraduate students (two co-supervised) and 3 technicians, has modern facilities for molecular genetic research and dedicated laboratories for tissue culture, insect transformation, fluorescence microscopy, image analysis and mosquito husbandry.

[Dr. Srabasti J. Chakravorty](#) is interested in sequestration of *Plasmodium falciparum*-infected red blood cells in microvasculature in Severe Malaria with a focus on the inflammatory responses induced by PRBC, which is the basis of Severe Malaria pathology. Current work is focused on human brain endothelial cells (HBEC, obtained through an ongoing collaboration with Monique Stins at Johns Hopkins University, USA.), which is an established *in vitro* model of blood-brain barrier (BBB) disruption in Cerebral Malaria. BBB disruption is analysed using the ENDOHM/EVOM apparatus for measuring trans-endothelial electrical resistance.

The laboratory of [Dr. Frederic Tripet](#) focuses on integrative biology of arthropods that transmit major human diseases, such as mosquitoes, sandflies and kissing bugs. Research projects combine studies in molecular ecology, ecological genomics, population genetics and behaviour in order to generate results of broad ecological importance that feed back on our understanding of vector population structure, pathogen transmission and vector control. The research group is usually 4-8 strong (technician, PhDs, Msc, and undergrad students) and is housed in the newly refurbished Haldane suite of laboratories in the Huxley building on Keele Campus.

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Insect Ecology

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[Professor Gordon Hamilton](#)'s research group has major programmes of work to isolate and identify the chemicals involved in insect interactions. The group aims to develop novel applied tools and strategies to reduce human and animal disease burden and where relevant, crop damage. Facilities in the lab include GC/MS, GC, HPLC, behavioural assay, insectary and electrophysiology, the group also has access to field sites in Brazil, Tunisia, Spain and the UK. The group, which currently comprises synthetic and analytical chemists, entomologist and behavioural ecologists, is funded by the Wellcome Trust, UK Government, EU and Industry.

The main research of [Dr William Kirk](#)'s group is the biology and ecology of thrips, which are major insect pests in agriculture and horticulture. The group has identified the first aggregation pheromone in thrips and the main focus is to identify further pheromones, understand how they are used and develop their potential for pest management in crops around the world. The group includes one post-doctoral student and two PhD students. We run a continuous thrips culture and have advanced GC-MS facilities for chemical ecology.

Chemical Ecology

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[Professor Gordon Hamilton](#)'s research group has major programmes of work to isolate and identify the chemicals involved in insect interactions. The group aims to develop novel applied tools and strategies to reduce human and animal disease burden and where relevant, crop damage. Facilities in the lab include GC/MS, GC, HPLC, behavioural assay, insectary and electrophysiology, the group also has access to field sites in Brazil, Tunisia, Spain and the UK. The group, which currently comprises synthetic and analytical chemists, entomologist and behavioural ecologists, is funded by the Wellcome Trust, UK Government, EU and Industry.

[Dr. Falko Drijfhout](#)'s research is within chemical ecology, in which chemicals are identified that are involved in behavioural activities in insects. It is very much a hybrid between (analytical) chemistry and entomology. Current interests include work on cuticular hydrocarbons involved in kin-recognition within social insects as well as the biosynthesis of these hydrocarbons. The main technique used for analysis and identification is gas-chromatography coupled to Mass spectrometry (GC-MS), although Liquid Chromatography coupled to Mass spectrometry (LC-MS) is more suitable for the larger polar chemicals in the research programme. The group is currently two PhD students and one research assistant.

Parasite-Insect Interactions

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The laboratory of [Dr. Frederic Tripet](#) focuses on integrative biology of arthropods that transmit major human diseases, such as mosquitoes, sandflies and kissing bugs. Research projects combine studies in molecular ecology, ecological genomics, population genetics and behaviour in order to generate results of broad ecological importance that feed back on our understanding of vector population structure, pathogen transmission and vector control. The research group is usually 4-8 strong (technician, PhDs, Msc, and undergrad students) and is housed in the newly refurbished Haldane suite of laboratories in the Huxley building on Keele Campus.

[Professor Paul Eggleston](#) studies the molecular genetics of mosquitoes and their interactions with pathogens such as malaria. Current projects include the development of site-directed transgene integration, the creation of GM mosquitoes that are incompetent disease vectors, stage and tissue-specific regulation of transgene expression and the analysis of fitness associated with genetic modification. The group, which currently comprises 2 postdoctoral researchers, 3 postgraduate students (two co-supervised) and 3 technicians, has modern facilities for molecular genetic research and dedicated laboratories for tissue culture, insect transformation, fluorescence microscopy, image analysis and mosquito husbandry.

Leishmaniasis

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Leishmania infection ranges from asymptomatic to fatal if untreated visceral leishmaniasis. [Dr. Rhayza Maingon](#) is investigating parasite as well as possible sand fly derived factors that might contribute to clinical outcome in patients with leishmaniasis due to *Leishmania chagasi/infantum*, a parasite transmitted by *Lutzomyia longipalpis* s.l sand flies in Central and South America. Techniques used include real-time PCR, multi-locus genotype analyses, and proteomics. Current collaborations are within ISTM and with other UK and Brazilian institutions.

Fish diseases, Comparative immunology

[Prof. Dave Hoole](#) and his research group, which currently includes two PhD students and a postdoctoral fellow, specialise in the immunology of cultured fish particularly in relationship to parasitic diseases and water quality. Comparative immunology provides major insights into the mechanisms by which animals combat infectious diseases, and fish serve as useful models for such molecular biological studies. On-going studies include the immunological interactions between fish and major groups of pathogens. Recent work has concentrated on the application and mechanisms of action of immunostimulants on the innate immune response and the induction of cell death. This research is supported by a range of cell culture and molecular biological facilities in addition to an extensive aquarium

Rheumatology

[Dr Derek L Matthey](#)'s main research interests are; (1) influence of genetic factors on development and severity of rheumatoid arthritis (2) predictors of co-morbid disease and

survival in RA (3) gene-environment interactions in rheumatic diseases (4) biomarker profiling in inflammatory arthritis (5) role of epigenetic factors in RA. The equipment and facilities we use include Luminex suspension array technology for biomarker analysis, ELISA, immunofluorescence microscopy, PCR, cell culture, FACS analysis. Our research group consists of a senior scientist, postdoctoral researcher, 2 PhD students, 2 research technicians and 2 research nurses.

Renal disease

[Prof. Simon Davies](#)' principal research interests are in peritoneal dialysis and the evaluation of fluid status in advanced renal failure. These link very closely to clinical work as a consultant nephrologist, offering opportunities for projects translating basic science into direct relevance for patients. New techniques in bedside body composition using breath analysis for deuterium abundance are currently being developed, for application in the haemodialysis unit, intensive care setting and in heart failure. Professor Davies has supervised several PhD, DM and MPhil students in his research team and plays a key role in medical training.

Medical Statistics

[Prof. Peter Jones](#) research interest is Medical Statistics: design of clinical trials in all specialties, modelling disease with an interest in the effect of genetic factors, particular interest in musculoskeletal conditions.

[Dr Mary Jones](#)' research relates to the application of statistics in medical research, including clinical trials. Principal research interests include the derivation and validation of models for predicting the probability of an outcome, with a particular interest in the survival of trauma and cancer patients. Research into the statistical aspects of nutritional screening has concentrated on the development of tools using multivariate techniques, together with in-depth methodology relating to the design and analysis of studies to evaluate the reliability and validity of a tool.