King's-China Scholarship Council (K-CSC) Programme

Supervisor Catalogue 2019-20

Contents

About this Catalogue

This catalogue contains a list of academics at King's College London who are interested in supervising Chinese students for a PhD programme in 2019-20.

Tips for using this guide:

- The catalogue is organised by faculty and department, so you can browse through the proposed projects by subject area
- It may also be helpful to search using *Ctrl+F* to find a key word or subject area
- Each page contains information on a supervisor or co-supervisors and their research areas
- Some supervisors have proposed more than 1 project so please read through the list carefully
- If you do not find a project or supervisor in this catalogue which matches your interests, you may still find a potential supervisor by browsing through PURE, the university's research portal (https://kclpure.kcl.ac.uk/portal/), which you can also search using key words.

Once you have identified a potential supervisor(s):

1. Contact the supervisor using the email address provided in this catalogue or on the research portal: https://kclpure.kcl.ac.uk/portal/
2. Submit a draft research proposal to the potential supervisor to find out whether your interests match theirs. This proposal should be approximately 1 side of A4.
3. Once you have discussed your ideas and confirmed who your supervisor is, you can apply both for a PhD programme at King's College London and a K-CSC Scholarship (at the same time) through our application portal, by the deadline **11 January 2019.**
4. Further information on how to apply for the K-CSC scholarship scheme can be found here: www1.kcl.ac.uk/graduate/funding/database/index.php?action=view&id=308. Please note: you must have met our English language requirements by **31 January 2019**.

Faculty of Arts & Humanities

Centre for the Humanities & Health

Supervisors: Dr Michael Clark / Dr Victor Fan

E-mail: michael.clark@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/en/persons/ho-lok-victor-fan(dc64525f-25f6-48a6-860c-078ffe561125).html

Research areas/projects of interest:

- Chinese Film Studies

Description: In relation to Health & Medicine; Gender Studies; Cultural Studies; or Contemporary Chinese Society and Culture.

Supervisors: Dr Michael Clark / Professor Edgar Jones

E-mail: michael.clark@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/en/persons/edgar-jones(88673ca5-49ac-4d72-abd2-075a35d97e83).html

Research areas/projects of interest:

- History of Psychiatry, Psychology and Medicine, c. 1750 – c. 1960 (U.K., Europe, N. America, China)

Classics

Supervisor: Professor Hugh Bowden

E-mail: hugh.bowden@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/hugh.bowden.html

Research areas/projects of interest:

- Ancient Greek History

Description: A wide range of topics, including Alexander the Great, War and Politics in Archaic and Classical Greece, Ancient Greek society

- Ancient Religion

Description: A wide range of topics including divination in the ancient Mediterranean and Near East, Mystery Cults, Religion and Cognition, Orphism, and many other topics in the area of religion (

Supervisor: Dr James Corke-Webster

E-mail: james.corke-webster@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/james.corke-webster.html

Research areas/projects of interest:

- Early Christian history of the first four centuries AD, including historiography, apologetics, “persecution”, heresy, education, family etc etc
- Roman imperial historiography: ancient history writing of the first five centuries AD
- Late antique history: topics in the social and cultural history of the fourth, fifth and sixth centuries AD

Supervisor: Dr John Pearce

E-mail: john.pearce@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/john.pearce.html

Research areas/projects of interest:

- Roman archaeology

Description: The society, culture and economy of the Roman empire, especially the north-west provinces and the central Mediterranean, approached through archaeological evidence defined in its broadest sense (material culture, inscriptions, art). I would especially welcome topics concerned with funerary practice, religion, the epigraphic habit and literacy, Roman frontiers and landscapes but will consider all topics in Roman archaeology.

- Comparison of Roman imperial and Chinese imperial frontiers (Han and adjacent periods)

Description: The formation, role and setting of imperial frontiers, as analysed through material and textual evidence.

- Archaeological evidence for economic relationships between the ancient Mediterranean world and China

Description: Documenting the distribution and roles of objects exchanged between western and eastern Eurasia during classical antiquity and the Han dynasty and its immediate successors

Supervisor: Dr Irene Polinskaya

E-mail: Irene.polinskaya@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/irene.polinskaya.html

Research areas/projects of interest:

- Ancient Greek History, especially Archaic and Classical periods
- Ancient Greek religion
- Ancient Greek epigraphy and historiography

Supervisor: Professor Dominic Rathbone

E-mail: dominic.rathbone@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/dominic.rathbone.html

Research areas/projects of interest:

- Roman history, Republic and Empire
- Roman Egypt
- Ancient economic history (Greek, Hellenistic and Roman)

Supervisor: Dr Will Wootton

E-mail: will.wootton@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/will.wootton.html

Research areas/projects of interest:

- Art, craft and technology

Description: Investigating the intersection between crafts and their production exploring techniques and processes through archaeological materials, experimental archaeology and contemporary anthropological approaches.

- Makers and making

Description: Exploring the personal and social aspects of producing art in the classical period from learning through practising to the passing on of skill and knowledge.

Supervisor: Dr Dionysios Stathakopoulos

E-mail: Dionysios.stathakopoulos@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/dionysios.stathakopoulos.html

Research areas/projects of interest:

- Byzantine Studies
- History of ancient and medieval medicine

Digital Humanities

Supervisor: Dr Daniel Allington

E-mail: Daniel.Allington@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/daniel.allington.html / https://www.kcl.ac.uk/artshums/depts/ddh/people/academic/allingtond.aspx

Research areas/projects of interest:

- Social media

Description: I have experience in using both quantitative ('big data') and qualitative (ethnographic) methods to study a range of social media platforms.

- The publishing industry and reader behaviour

Description: I have been researching the publishing industry and reader behaviour for years, both from a historical and a contemporary point of view. This includes digital and conventional publishing.

- Fake news and conspiracy theories

Description: I am currently carrying out a major study of online conspiracy theories and other forms of 'fake news' or bogus information.

Film

Supervisor: Professor Chris Berry

E-mail: chris.berry@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/chris.berry.html

Research areas/projects of interest:

- Chinese-language Cinema

French

Supervisor: Dr Johanna Malt

E-mail: jo.malt@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/jo.malt.html

Research areas/projects of interest:

- Critical theory, aesthetics and art theory.

- Modern French and comparative literature.

- Modern French and comparative visual culture and text-image relations

History

Supervisor: Dr Berenice Guyot-Rechard

E-mail: Berenice.guyotrechard@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/berenice.guyotrechard.html

Research areas/projects of interest:

- Indian / South Asian history (esp. Sino-Indian relations) / Indian Ocean
- Frontiers and borderlands
- Decolonisation and international relations

Supervisor: Dr Chris Manias

E-mail: chris.manias@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/chris.manias.html

Research areas/projects of interest:

- International history of science in the 1860-1940 period

Description: This research will focus on the formation of international scientific organizations, and the relationship between science and nationalism and imperialism

- History and/or the wider cultural impact of the evolutionary and earth sciences

Description: This research will focus on the fields of biology, geology, human evolution, and palaeontology

- The history of anthropology and ideas of racial and cultural difference

Music

Supervisor: Professor Matthew Head

E-mail: matthew.head@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/matthew.head.html

Research areas/projects of interest:

- Western/European music c.1700 to c.1830: history, analysis, aesthetics

Description: We are investigating proteostasis and factors affecting protein aggregation in relation to damage to synapses in neurodegenerative disease. Synaptic dysfunction is one of the best correlates with disease progression in Alzheimer's disease and related disorders. Hence, it is important to understand the molecular mechanisms that when disrupted, lead to the loss of healthy synapses and the demise of neurons in dementia and other neurodegenerative disorders. We are investigating these processes in relevant cell and animal models of disease developed in our lab.

- The study of music by women composers

- Music and sound in the interdisciplinary area of 'eighteenth-century studies'

Theology & Religious Studies

Supervisor: Professor Kate Crosby

E-mail: henrietta.crosby@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/henrietta.crosby.html

Research areas/projects of interest:

- Theravada Buddhism

Description: Research areas include: Buddhist meditation, literature, practice, Sanskrit and Pali Buddhist texts, global/Western Buddhism. Historical and modern, textual. The project would be fieldwork based.

Supervisor: Dr Lydia Schumacher

E-mail: Lydia.schumacher@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/lydia.schumacher.html

Research areas/projects of interest:

- Systematic theology
- Medieval theology and philosophy
- Philosophical theology

Supervisor: Dr Katherine Swancutt

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Website: https://kclpure.kcl.ac.uk/portal/katherine.swancutt.html

Research areas/projects of interest:

- The anthropology of religion, with long-term ethnographic fieldwork to be undertaken in China or elsewhere

- The anthropological study of ethnic groups (minzu) of China, including projects that focus upon the ethnic majority Han, with long-term ethnographic fieldwork to be undertaken in China or neighbouring countries

- Other topics within anthropology that fit with my research interests listed above, with long-term ethnographic fieldwork to be undertaken in China or elsewhere

Supervisor: Professor Catherine Bailey

E-mail: Catherine. bailey@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/en/persons/katie-bailey(2f686b21-727d-447f-8909-345db4f15d8b).html / https://www.kcl.ac.uk/business/people/katie-n%C3%A9e-truss-bailey.aspx

Research areas/projects of interest:

- Meaningful work

Description: Meaningful work: qualitative/quantitative studies on what makes work meaningful to individuals in different job roles or national contexts; power, autonomy, control and meaningful work; callings and the experience of work; employee engagement and meaningfulness; link between the 'meaning of' work and 'meaningful work'. Organisational interventions to manage meaningfulness or purpose at work.

- Temporality and work

Description: Temporality and work: qualitative studies of individuals' experience of time when working, eg waiting, delay, pace of work, control and autonomy over work scheduling; work intensity.

- Employee engagement

Description: Employee engagement: factors that influence engagement, the outcomes of engagement, analysis of interventions to support engagement in organisations.

Supervisor: Professor Crawford Spence

E-mail: Crawford.spence@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/crawford.spence.html

Research areas/projects of interest:

- The Accounting Profession in China

Description: Building upon my existing research looking at Big 4 accounting firms and local accounting firms in China, I would be interested in supervising PhD students who can chart the changing structure of the market for accounting services in China

- Technology and Financial Professions

Description: Complementing the work of the new Research Centre in KBS, FinWork Futures, I would be interested in supervising students looking at how technology is disrupting the nature of financial work in various domains, including audit, investment analysis, equity and currency trading and financial advice.

- The social aspects of economic exchange

Description: Adopting a sociological perspective, I am interested in exploring the ways in which Chinese cultural phenomena, e.g. guanxi, influence economic activity in China. Such an analysis could cover domains such as audit, investment banking, trading or any other area of financial activity.

Supervisor: Dr Mingzhu Wang

E-mail: mingzhu.wang@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/mingzhu.wang.html

Research areas/projects of interest:

- Bank Loans, Bank Risk-taking

- Capital Markets, Empirical Asset Pricing

- Gender Diversity, Sustainable Investment, Institutional Investors

Faculty of Dentistry, Oral & Craniofacial Sciences

Centre for Craniofacial and Regenerative Biology

Supervisor: Dr Ciro Chiappini

E-mail: ciro.chiappini@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/ciro.chiappini.html

Research areas/projects of interest:

- Engineering Extracellular Vescicle Payloads using Nanoneedles

Description: Extracellular vesicles (EVs) play an important yet poorly understood role for intracellular communication. They are attracting growing interest as effective nanodelivery platforms that reduce toxicity and improve targeting. Yet, the limited ability to engineer their payload composition hampers the potential of EVs as cell-instructive elements for cell biology, tissue engineering and oncotherapy. Here we engineer the payloads of EVs by leveraging the upregulation of endocytosis induced by nanoneedles. Combining our expertise in drug delivery with that in the isolation, formulation and characterisation of EV we aim to develop a step-changing strategy to formulate nanoparticle-enriched EVs for delivery of biologicals.

- Recapitulating the tooth mesenchymal stem cell niche in vitro.

Description: The ultimate goal of this project to develop a bioengineered niche that reproduces the in vivo cell transitions from mesenchymal stem cells to transient amplifying cells to odontoblast and fibroblasts, in a maintained, controllable way. To achieve this we will generate a microfluidic device hosting the engineered niche consisting of adjacent microenvironments. We envisage that four microenvironments will recapitulate the niche. In the first environment we will present the conditions to maintain stem cell self-renewal. In the second environment, adjacent the first, we will stimulate formation and maintenance of TACs. The third and fourth environments, both adjacent to the second, will induce differentiation towards odontoblasts and fibroblasts respectively.

- Cochlea-on-a-chip: An organotypic microfluidic system that models drug delivery to the inner ear in vitro.

Description: Approximately 10% of the world population is affected by hear impairment that constitutes disability. Potential drugs to slow the progression of hearing loss or restore hearing exist, but delivering them effectively to the inner ear and studying their pharmacokinetic therein remains a major challenge. Delivering drugs to the inner ear from circulation is prevented by the blood-perilymph barrier. Similarly, local delivery across the tympanic membrane is negatively affected by the limited permeability between the middle and inner ear. This project develops a microfluidic-based model of the cochlea that reproduces the key barriers to delivery and target cell types, and uses this model to evaluate the delivery of hearing loss drugs.

Supervisor: Professor Philippa Francis-West

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Research areas/projects of interest:

- Investigating how Fat4 and Dchs1 control skeletal development by analysing cell shapes and organization within developing bones and the identification of transcriptional targets of Fat4-Dchs1 signalling

Supervisor: Dr Robert Knight

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Website: https://kclpure.kcl.ac.uk/portal/robert.knight.html

Research areas/projects of interest:

- Identifying regulators of muscle stem cell function by in vivo imaging

Description: This project would aim to investigate the molecular regulation of muscle stem cell function using the zebrafish larvae as an in vivo model of tissue regeneration. Fluorescently labelled cells (muscle stem cells and immune cells) would be visualised as they respond to tissue injury by time-lapsed microscopy in animals in which gene function has been manipulated. By extracting information about cell shape and movement and by building models of cell behaviour the student will identify exciting new candidate regulators of muscle repair.

Supervisor: Dr Karen Liu

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Website: https://kclpure.kcl.ac.uk/portal/karen.liu.html

Research areas/projects of interest:

- Repair of the craniofacial skeleton

- Use of patient-derived human induced pluripotent stem cells (hiPSCs) to model neurocristopathies

- Identification and analysis of genes causing cranial-cardiac birth defects

Supervisor: Dr Maisa Seppala / Professor Martyn Cobourne

E-mail: maisa.seppala@kcl.ac.uk / martyn.cobourne@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/maisa.seppala.html / https://kclpure.kcl.ac.uk/portal/martyn.cobourne.html

Research areas/projects of interest:

- Searching for the Molecular Causes of Altered Tooth Number in Mouse

Description: Variations in tooth number are a common orthodontic problem and can be found in isolation or as part of a developmental syndrome. Transgenic mice with reduced Shh display fused molars and, in an opposite phenotype, Shh overactivity results in formation of supernumerary teeth indicating how important the correct Shh dosage is for determination of the correct tooth number. This project aims to define how loss of Gas1 affects the spatiotemporal levels of Shh expression resulting in numerical dental anomalies using single and compound Gas1, Shh-GFP and Gas1;Shh-GFP transgenic mice and how it further interacts with multiple molecular pathways especially Wnt and Fgf families that together coordinate crucial stages of dental development.

Supervisor: Professor Andrea Streit

E-mail: Andrea.streit@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/andrea.streit.html

Research areas/projects of interest:

- Molecular mechanisms of development, stem cell differentiation and disease in sensory systems.

Description: The eye, ear and olfactory epithelium connect us with the world allowing us to communicate with our environment. Any defects therefore have major impact on everyday life. We study the molecular mechanisms that direct multipotent progenitor cells towards eye, ear and olfactory identity using a combination of in vivo experiments, state-of-the-art molecular biology and bioinformatics/computational approaches. We have identified many new players, some of which are good candidates for human sensory disorders. Studying these will help us to design new treatments from stem cell and gene therapy to drug-based approaches.

- Evolution of sensory systems

Description: Complex sense organs are thought to be vertebrate inventions. However, recent evidence suggests that ear-like prototypes already exist in non-vertebrate chordates like sea squirts. Indeed, some of the molecular circuits that control vertebrate ear formation seem to be conserved across different phyla. We wish to determine the molecular architecture of this ancestral circuit and how new proteins were recruited into the circuit to make emergence of complex vertebrate ears possible.

- Regeneration, repair and stem cells in the ear

Description: In the cochlea, hair cells are critical for sound perception. They are easily damaged during ageing, by loud noise, drugs or other environmental influences, but cannot regenerate in mammals including humans. We study the epigenetic mechanisms that prevent hair cell regeneration using transcriptional and epigenome profiling combined with sophisticated imaging. This project will allow us to design new strategies for in vivo repair of hair cells, and to restore hearing.

Centre for Dental Education

Supervisor: Professor Margaret Cox

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Website: https://kclpure.kcl.ac.uk/portal/mj.cox.html

Research areas/projects of interest:

- Technology enhanced learning in Dental Education
- Virtual Simulators in HealthCare Education (Dentistry, Medicine, Nursing)
- Impact of New Technologies in Higher Education

Mucosal & Salivary Biology

Supervisor: Dr Guy Carpenter

E-mail: Guy.carpenter@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/guy.carpenter.html

Research areas/projects of interest:

- Assessing the factors affecting the tribology of saliva and the delivery of tastants to electronic taste buds

Description: The taste of foods is modified by saliva which covers the taste buds located on the tongue. During oral processing of foods (ie eating and drinking) there are considerable shear forces generated by the tongue moving against the palate. These shear forces can be modelled experimentally by measuring tribology of real samples of saliva and food. In this project we will assess the factors affecting the tribology of saliva and the delivery of tastants to electronic taste buds. In the first instance we will examine the transport of salt but in further experiments the physical properties of artificial sweeteners will be assessed in order to replace sucrose. This project will use a range of techniques as well as tribology. Biochemical assessment of saliva and proteins, formulation of taste solutions and ultimately some in human experiments maybe used to validate any findings found experimentally. A good understanding of mathematics would be an advantage but no previous skills are necessary.

Population & Patient Health

Supervisor: Dr Suzanne Scott

E-mail: Suzanne.scott@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/suzanne.scott.html

Research areas/projects of interest:

- Dentist-Patient Communication

Description: Exploring the content and process of communication between patients and the dental team during routine dental consultations and how this relates to patient reported outcomes.

- Encouraging Early Diagnosis of Oral Cancer

Description: Working to develop and evaluate initiatives to encourage timely presentation of symptoms of oral cancer to healthcare professionals.

Tissue Engineering & Biophotonics

Supervisor: Dr Lorenzo Veschini

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Website: https://kclpure.kcl.ac.uk/portal/lorenzo.1.veschini.html

Research areas/projects of interest:

- Fast prototyping and fabricating microfluidic chips by addictive manufacturing (3D printing)

Description: Cell behaviour is affected by their micro-environments consisting of extra-cellular matrix, other cells and growth/morphogenetic factors dynamically regulated in space and time. It is essential to recreate these micro-environments in vitro to understand cell behaviour and signalling in response to stimuli. Cellular micro-environments can be recreated in vitro on small microchips employing microfluidic technology (lab-on-a-chip). Our research aims to develop a pipeline for fast prototyping and fabricating microfluidic chips by addictive manufacturing (3D printing). We aim to design LOC devices to grow blood vessels under defined morphogenetic fields allowing to investigate the dynamics of vessels growth and functions. Furthermore, the ACRS is eager to host translational projects in the fields of Bio-materials 3D printing, 3D technologies (including virtual reality and design) and Maxillo-facial rehabilitation. Details can be discussed with potential candidates.

Faculty of Life Sciences & Medicine

Basic & Medical Bioscience

Supervisor: Dr Simon Ameer-Beg

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Website: https://kclpure.kcl.ac.uk/portal/simon.ameer-beg.html

Research areas/projects of interest:

- High-speed fluorescence lifetime flow cytometry
- Optical FRET Biosensor development
- Selective Plane Fluorescence Lifetime Imaging

Supervisor: Professor Sasi Conte

E-mail: sasi.conte@kcl.ac.uk

Website: https://kclpure.kcl.ac.uk/portal/sasi.conte.html

Research areas/projects of interest:

- Investigation of La-related proteins (LARPs)

Description: LARPs are a newly discovered superfamily of RNA binding proteins with key roles in health and disease. The main aim of this project is to investigate LARP structures and mode of interactions to their RNA and protein targets in order to understand their cellular function and role in disease. Many LARPs have been implicated in cancer development. The proposed structural and biochemical studies will be conducted within the framework of the existing interdisciplinary collaborations and this will have a synergic effect, permitting the development of original and complementary approaches.

- Investigation on soluble Epoxide Hydrolase (sEH)

Description: sEH is an important regulator of cardiovascular physiology, involved in the metabolism of regulatory epoxy lipids. Its activity has marked consequences for blood pressure, heart failure and cardiovascular physiology. Over the years many small molecules inhibitors have been developed to target sEH, though none has yet to reach the market. The aim of our project is to elucidate at the molecular level the mechanism of a novel class of sEH inhibitors. This will improve our understanding of sEH modulation and pave the way for alternative therapeutics to target sEH and treat hypertension.

- Metabolomics of cancer cells

Description: Metastasis is responsible for over 90% of cancer deaths. Migration and invasion underlie metastasis, and physical interactions between cancer cells and the surrounding extracellular matrix guide these processes. We aim to elucidate the crosstalk between mechano-sensing and metabolic rewiring in tumour migrating cells: by analysing the metabolites of melanoma cells invading diverse 3D matrices we will uncover metabolomic and energetic pathways that are dysregulated in highly invasive versus poorly invasive phenotypes. We aim to gain a detailed picture of how invasive traits and metabolism of cancer cells are altered in response to tissue mechanics. A major goal is to uncover metabolic pathways that drive the primary tumour towards an invasive transformation.

Supervisor: Dr Deborah Cunninghame Graham

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Research areas/projects of interest:

- Unpicking the Functional Consequences of IKZF2 in T and B lymphocytes:

Description: We have shown that variants in the transcription factor IKZF2 (Helios) are associated with SLE. However, we do know know the underlying mechanism for disease susceptibility. However, Helios knock-out mice develop auto-inflammation and production of autoantibodies later in life. These mice have increased numbers of activated CD4+ and CD8+ T-cells, T-follicular helper cells, and germinal centre B-cells, implicating both T and B lymphocytes in autoimmune disease. Expression of Helios is correlated with the activation and cell division of multiple T cell subets and in B cells, Helios may be involved in the regulation of apoptosis through the B cell receptor by regulating the expression of multiple Protein Kinases C molecules. In order to understand how Helios may act in both B and T lymphocytes, we undertook IKZF2 ChIP-Seq in the Jurkat T cell line and the EBV-lymphoblastoid B cell line to identify how the binding sites of this transcription factor will compare between both cell lines. By using bioinformatic approaches, we will identify the genes closest to IKZF2 binding sites, discover which peaks are in enhancer/promotes by determing the overlap of epigenetic signals, determine the enrichment of IKZF2 target genes in biological pathways relevant to T and B cell function. We will also establish the nature of the TF clusters binding at IKZF2 binding sites and whether different binding motifs are enriched for different clusters. These analyses will allow us to establish how IKZF2 may contribute to the dysregulation of T and B cell function and provide clues as to the role of IKZF2 in SLE pathogenesis.

- Annotating risk loci for Systemic Lupus Erythematosus (SLE).

Description: At most risk loci, the causal genes remain elusive. Using bioinformatics approaches we will annotate each risk locus, to identify the most likely casual gene and functional variants. The student will use data from the major epigenetic, transcriptomic and genome datasets, in order to narrow down sets of most likely causal variants at each locus. The causal genes will be mapped onto biological pathways in order to pinpoint likely pathologic mechanisms. Through the identification of pathways enriched for risk genes for SLE, we may define novel pathogenic mechanisms for disease. For those loci that are either ligands themselves, or interact with known ligands, we will undertake

similarity-based bioinformatics approaches to identify small molecules which could be used for future translational studies.

Supervisor: Professor Ulrike Eggert

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Website: https://kclpure.kcl.ac.uk/portal/ulrike.eggert.html

Research areas/projects of interest:

- Cell biology, lipidomics, biophysics or chemical biology

Description: Lipids are essential but understudied biomolecules. They are key components of many cellular compartments such as the plasma membrane, Golgi, ER and nuclear envelope. Our group works to understand how lipids contribute to the proper function of these organelles. We use a combination of cell biology, imaging, mass spectrometry (lipidomics) and chemical biology.

- Cell biology or chemical biology

Description: Correct cell division is required for life, growth and development. Our group is interested in understanding how a large number proteins work together to achieve correct division, with a focus on the cytokinesis step of division. We perturb these proteins using RNAi interference or small molecule treatments and analyse cellular phenotypes using live and fixed high resolution microscopy

Supervisor: Dr Alan Hodgkinson

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Website: https://kclpure.kcl.ac.uk/portal/alan.hodgkinson.html

Research areas/projects of interest:

- Cardiovascular Disease Risk

Description: Adipose tissue has limited capacity for the storage of triglycerides and glucose, and hypertrophic cells drive macrophage accumulation and inflammation in adipose tissue, leading to an increased risk of cardiovascular disease. In this project we aim to characterise the transcriptome from the adipose tissue of ~600 patients with coronary artery disease and use machine learning techniques to identify key components of disease progression. These models will then be validated with adipose gene expression profiles and associated intermediate phenotypes from the TwinsUK cohort that have been sampled at multiple time points across a 10 year period.

- Ribosome heterogeneity: a key unknown biological mechanism

Description: Ribosomes are the molecular machines that catalyse protein manufacture and exist in millions of copies in each mammalian cell. The multicopy genes which contribute core ribosomal components vary at the sequence level, even within a single genome/cell and variant forms are incorporated into mature and active ribosomes. However, it is not known if or how structural variation among ribosomes within the cellular pool influences function. This project will focus on computational analyses of sequencing and mass spectrometry data to elucidate if variant ribosomes have regulatory roles in protein production.

- Mitochondrial RNA processing in Coronary Artery Disease

Description: The formation of plaques inside arteries is caused by endothelial damage and the build-up of cholesterol and are often characterised by inflammation, DNA damage, cellular senescence and apoptosis. Mitochondria play a key role in these processes and increasing evidence suggests that mitochondrial dysfunction may contribute to disease risk. Here we aim to survey the mitochondrial genome and transcriptome of ~600 individuals with coronary artery disease. The project will focus on computational analysis of RNA sequencing data of seven tissues from these patients, including diseased and non-diseased arterial segments and non-arterial tissue.

Supervisor: Dr Michelle Holland / Dr Alan Hodgkinson

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Website: https://kclpure.kcl.ac.uk/portal/michelle.holland.html / https://kclpure.kcl.ac.uk/portal/alan.hodgkinson.html

Research areas/projects of interest:

- Ribosome heterogeneity: a key unknown biological mechanism

Description: Ribosomes are the molecular machines that catalyse protein manufacture and exist in millions of copies in each mammalian cell. The genes encoding RNA components of ribosomes exist in hundreds of copies and vary in sequence between copies in a single genome and between individuals. These genes have not been mapped into the genome and constitute genomic dark matter. It is not known how this group of genes contributes to ribosome structural and functional variation, which could be an important component of human diseases. This project will focus on computational analyses to elucidate the consequences of variant ribosomes.

- Epitranscriptomics, development and obesity

Description: Recently, a chemical modification to messenger RNA (mRNA) has been discovered which adds an additional layer of information that guides the behaviour and interactions of the mRNA. Very little has been elucidated so far, but it is known that this modification in some way is involved in obesity due to genetic association studies. This project will focus on looking at the role of this modification in the development of fat tissue. This will involve developing computational tools to analyse data generated using newly developed genome-wide, high throughput sequencing based approaches

- Protein translation fidelity as a mechanism of biological ageing

Description: There are a number of lines of evidence that suggest that protein translation changes as an organism ages and may in fact be primarily involved in the ageing process. This project will involve using computational approaches to analyse a diverse range of datasets profiling ribosome structure and behaviour to establish if protein translation fidelity is altered during ageing and if this is sufficient to give rise to the characteristics of ageing

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Research areas/projects of interest:

- Advanced live cell microscopy and CRISPR-Cas9 based analysis of novel, unexplored pathways controlling cancer cell migration and invasion

Description: In our lab (https://www.krauselab.org), we have been studying the Ras effector and regulator of the actin cytoskeleton, Lamellipodin, for several years and found that Lamellipodin promotes breast cancer invasion and metastasis through the actin regulators, Ena/VASP and the Scar/WAVE complex. Fittingly, we found that Lamellipodin serves as a prognostic marker for breast cancer progression (Carmona et al., Oncogene, 2016. Pat pending: US 62/304,243). In addition, Lamellipodin is also central to a novel clathrin-independent endocytosis mechanism (Wah Hak et al., Nature Cell Biology, 2018). Potential projects include: (1) The investigation of a novel, unexplored link between WNT signalling and regulators of the actin cytoskeleton in cancer cell migration. (2) Explore the role of a novel clathrin-independent endocytosis mechanism in regulating cancer cell migration. (3) Characterize a potentially unique, novel, and general mechanism

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Research areas/projects of interest:

- Genetic prediction models for Systemic Lupus Erythematosus (SLE).

Description: SLE is a heterogeneous disease with patients displaying a wide variety of clinical features. This project will develop a clinically useful predictive tool for SLE and SLE sub-phenotypes using statistical models. The statistical models for prediction will make use of variants identified as genetically associated that explain heritability. This project will be based in the leading laboratory in the genetics of SLE, and have access to the vast majority of the genetic data on SLE worldwide.

Supervisor: Dr David Morris / Dr Deborah Cunninghame Graham

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Research areas/projects of interest:

- Finding genetic variants causal for Systemic Lupus Erythematosus (SLE).

Description: Currently there are over 80 loci associated with SLE, yet in most we do not know the causal variants(s). This project has multiple SLE GWAS and a large Immunochip study across several populations. This will be the most powered study to-date on SLE association with cross-ancestral data. Through fine mapping associated loci, and additional genomic data, we will identify the majority of the causal variants for SLE in these genomic regions.

Supervisor: Dr Julien Ochala

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Research areas/projects of interest:

- Identifying how muscle fibres age
- Defining the mechanisms underlying congenital myopathies
- Understanding contractile protein regulation and dysfunction

Supervisor: Professor Snezhana Oliferenko

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Research areas/projects of interest:

- Nuclear envelope function and mitotic remodelling
- Regulation of cellular energy metabolism
- Cellular growth control

Supervisor: Professor Maddy Parsons

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Research areas/projects of interest:

- Defining novel cytoskeletal regulation of cancer cell invasion

Description: The cytoskeleton of cells is known to be essential to the behaviour of cancer cells and their ability to invade throughout the body. However, little is known about how the balance between cytoplasmic and nuclear actin contributes to metastatic behaviour. This project will define the contribution of newly identified molecular pathways that control the balance of local F-actin assembly within the cytoplasm and nucleus of human cancer cells. Cells within 3D environments will be analysed using state of the art microscopy methods to determine how these novel signalling pathways contribute to cell invasion with a view to defining new targets for therapeutic intervention.

- Identifying novel molecular mechanisms in fibrosis

Description: Cells within the dermis of the skin must precisely control matrix synthesis to regulate normal skin architecture and responses to injury. This project will characterise novel genes identified in patients with skin fibrosis and define the contribution of the proteins they encode to dermal homeostasis and fibrosis. Biochemical, biophysical and advanced microscopy approaches will be used to dissect the way in which these genes control fibroblast proliferation and matrix synthesis and their contribution to skin homeostasis and fibrotic disease.

- Epithelial receptor signals controlling lung inflammation

Description: The epithelium of the lung acts as a primary defence site to respond to respond to external insults and inflammation. We have identified novel receptors on the surface of lung epithelial cells that control barrier formation and immune cell infiltration during inflammatory responses such as asthma. This project will use state of the art in vitro model systems to determine how these receptors control signalling and cell-cell interactions to regulate lung inflammation. The identified pathways will be further developed to understand their potential role for therapeutic intervention in inflammatory lung disease.

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Research areas/projects of interest:

- Structural Biology (X-ray crystallography, cryoEM)

- Molecular motors (kinesins)

- Cellular cytoskeleton (microtubules)

Biomedical Engineering & Imaging Sciences

Supervisor: Dr Jordi Alastruey

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Research areas/projects of interest:

- In silico evaluation of cardiovascular indices

Description: Pulse wave signals such as blood pressure, flow and PPG waves contain a wealth of information on the cardiovascular system, since they are influenced by both the heart and the vasculature. Consequently, many indices have been proposed to infer the physiological state of the cardiovascular system by analysing pulse waves. Acquiring comprehensive datasets for assessing the performance of these indices is usually a complex task. We are generating populations of thousands of virtual subjects to perform this task in silico (www.haemod.uk/virtual-database).

- Estimating aortic blood pressure (ABP) using magnetic resonance imaging (MRI)

Description: This is a highly prognostic cardiovascular risk factor. It can be accurately assessed with catheterisation; however, this is costly and has associated risks due to its invasive nature. MRI provides non-invasive, accurate measurements of aortic blood flow and geometry, but it is unable to provide ABP. We would like to develop an algorithm for estimating ABP from aortic MRI data and test it using intra-aortic pressure data measured in patients undergoing cardiac catheterisation.

- Pulse wave analysis algorithms for smart wearables

Description: The increasing use of smart wearables provides opportunity to continuously track peoples' health. Devices such as smart watches use an optical sensor to measure the pulse wave and monitor heart rate. However, the pulse wave contains a wealth of additional information on the heart and blood vessels which is not currently exploited. We would like to develop a suite of pulse wave analysis algorithms to expand the capabilities of smart wearables. Datasets of wearable sensor signals will be available.

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Research areas/projects of interest:

- Modelling of Cardiac Electrophysiology & Arrhythmias

Description: Cardiac disease is number 1 healthcare problem worldwide. To address it, we develop detailed, cell-to-organ 3D models of the heart, and apply them to simulate scenarios of cardiac arrhythmogenesis, to understand complex underlying mechanisms and to design relevant clinical treatments.

- Modelling of Blood Flow & Thrombus Generation

Description: All arrhythmias results in the reduction of cardiac blood flow, directly facilitating morbidity and mortality. Moreover, slow/static blood flow facilitates blood coagulation and the development of thrombi and stroke. Our 3D models of blood flow enable the prediction of thrombus formation risks.

- Magnetic Resonance Imaging of Cardiac Structure

Description: Building cardiac models that are relevant to patients and their specific cardiac conditions requires patient-specific data. We develop and apply protocols for collecting such data from patient Magnetic Resonance Imaging (MRI), including LGE MRI for cardiac structure and Cine MRI for cardiac motion.

Supervisor: Dr Christos Bergeles

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Research areas/projects of interest:

- Design, development, and engineering of micro-surgical robots for dexterous interventions

- VR-guided computational robot design for safe and effective intraluminal navigation

- Force and shape sensing for continuum robots

Supervisor: Dr Martin Bishop

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Research areas/projects of interest:

- Risk stratification of cardiac arrhythmias

Description: Detailed analysis of cardiac imaging and functional data, to obtain key features which can be incorporated into an automated algorithm (within a machine learning environment) to identify patients at most high risk of suffering from lethal arrhythmias, and thus requiring interventional therapy. Complex signal and image processing techniques will be applied to cardiac ECG signals and MR images to identify and extract these features. Additional idealised computational simulations of functional cardiac electrical activity will also be performed to identify additional features for incorporation within the algorithm

- Biophysically-detailed modelling of cardiac optogenetics

Description: Cardiac optogenetics uses specialised genetically-adjusted cells which cause internal electrical excitation upon illumination of light. They have thus been suggested as a means of externally electrically stimulating the heart, using only a source of light. High-resolution imaging data from a number of different sources (MRI, 2-photon) will be used to construct anatomically-detailed models of the ventricles. A detailed model of light scattering in cardiac tissue will then be implemented within these models to simulate the penetration of external light along with the stimulating effect of this light source within an optogenetic context.

- Optimising Anti-Tachycardia Pacing

Description: Many forms of potentially lethal cardiac arrhythmias are treated with a particular type of electrical pacing strategy, delivered from an implanted cardioverter defibrillator (ICD), called Anti-Tachycardia Pacing (ATP). However, ATP is a non-optimal therapy and frequently fails. We will aim to construct a series of biophysically-detailed patient-specific computational cardiac models from detailed imaging (MR, CT) and functional (ECG) data, and performed detailed simulations of ATP to better understand how it actually works and also how it may be optimised. Both different pacing strategies and novel ICD configurations will be tested.

Supervisor: Professor René Botnar

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Research areas/projects of interest:

- Investigating and developing deep learning methods to perform both motion correction and undersampled reconstruction using convolutional neural networks or similar approaches

Description: We have been pioneers in the development of high-resolution motion corrected 3D coronary artery imaging with magnetic resonance (MR) and radiation free alternative to cardiac CT and X-ray angiography. Recently we have developed a motion corrected reconstruction framework that allows to correct for the complex motion of the heart and to accelerate the scan using compressed sensing reconstruction.

- Development and evaluation of a novel radiation free metabolic imaging method using deuterium (2H) labelling

Description: We have been pioneers in the development and pre-clinical / clinical validation of novel and existing MR molecular imaging agents for the early assessment and treatment guidance of atherosclerosis, myocardial remodelling post infarction, aortic aneurysm formation and deep venous thrombosis. Here we propose to develop and evaluate a novel radiation free metabolic imaging method using deuterium (2H) labelling. This approach will allow to image e.g. glucose or acetate metabolism of the heart and brain non-invasively without the need to inject radioactive tracers such as 18F-FDG

- Myocardial tissue characterization and perfusion assessment using MRI

Description: Myocardial tissue characterization and perfusion assessment using MRI has become the reference standard using late gadolinium enhancement MRI, T1 mapping and first pass perfusion imaging. However, these techniques require the use of potentially nephrotoxic contrast agents. Here we therefore propose to develop and investigate alternative contrast free approaches based on e.g. T1rho and diffusion mapping and arterial spin labelling. All investigated approaches will be combined with our novel motion corrected reconstruction framework to allow for high-resolution 3D myocardial tissue characterization with whole heart coverage

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Research areas/projects of interest:

- Predicting neurocognitive delays and behavioural disorders in children using MRI: a machine learning approach

Description: Neurocognitive and behavioural delays at school age may be associated with altered brain development in utero and in the neonatal period. We will model brain development using >1500 fetal and neonatal brain MRIs that have already been acquired. Parametric and non-parametric approaches will be used and machine learning approaches applied to identify outliers and cluster cases. This project has the potential to stratify infants at risk of neurodevelopmental disorders during development when there may be a window of opportunity for therapeutic intervention to improve outcome.

Supervisor: Dr Rafael de Rosales

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Research areas/projects of interest:

- Nanomedicine
- PET Imaging
- Cancer Immunotherapy

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Research areas/projects of interest:

- SiMPLeR: Single-sequence Multi-dimensional Prostate MRI with Deep Learning for enhanced image guided Radiotherapy Treatment

Description: Radiotherapy is essential for cure or treatment of ~ 40% of all cancer patients in the UK. This research aims to achieve 'personalised' radiotherapy by combining a new Magnetic Resonance Imaging (MRI) method with deep learning analysis. This will enable a radiotherapy treatment plan precisely adapted to the individual patient's tumor profile to 'boost' the dose to malignant areas and spare healthy tissue.

- "Functional" imaging biomarkers for cancer – quantifying perfusion and hypoxia

Description: Intratumoral hypoxia and perfusion have been shown to correlate with tumour invasiveness, progression, and resistance to therapy. This research aims to develop advanced Magnetic Resonance Imaging (MRI) techniques to quantify "functional" tumour information.

- Quantitative imaging biomarkers using deep learning of Magnetic Resonance Imaging (MRI) signals

Description: Imaging plays a key role in the diagnostic pathway of cancer patients. In clinical practice diagnosis primarily relies on radiologist's assessment of different contrast-weighted images. If instead images contained 'quantitative' data about underlying tissue parameters, this would provide more accurate and reproducible information. This research proposes "deepMRI": 1) A single-sequence MRI protocol to rapidly acquire multi-contrast data, and 2) A deep learning analysis framework as an efficient nonlinear inverse mapping approach to extract quantitative information.

Supervisor: Professor Anthony Gee

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Research areas/projects of interest:

- Development of new radiochemistry methods using cyclotron-produced positron-emitting radionuclides, e.g. 11C and 18F (radioactive half-lives 20 and 110 mins, respectively) for labelling PET imaging biomarkers.

- Design synthesis and testing of radiolabelled molecules (autradiography and cell based assays) in preparation for in vivo molecular imaging using Positron Emission Tomography (PET)

- Biological and preclinical evaluation of new radiolabelled biomarkers in vivo and in vitro, and their translation to PET imaging to investigate human in vivo biology/pharmacology in health and disease

Supervisor: Professor Jo Hajnal

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Research areas/projects of interest:

- MRI acquisition, reconstruction and motion correction, including quantitative MRI.

Description: My research group focuses on how to use MR physics and emerging technologies to achieve enhanced capabilities to image subjects who cannot comply

- Fetal and Neonatal MRI and US.

Description: My research group focuses on novel methods for imaging the developing brain and heart

- Investigating brain development in neonates using ultrahigh field MR

Description: Ultrahigh field (UHF) MRI (>=7T) offers increased sensitivity and research has shown significant potential improvements in data quality for a number of applications in adults. However few studies scanned children at 7T so far, with the youngest subjects being 5 years old. We aim to pioneer the investigation of brain development in normal and ex-preterm infants with UHF 7T MRI, pushing spatial resolution limits and exploring novel high field contrast to visualise their small developing structures. This is a highly technical challenge that will involve: electromagnetic modelling of babies in the scanner to determine how to examine them safely; novel MRI acquisition development to optimize imaging of the neonatal brain; and the first studies of babies at UHF.

Supervisor: Professor Alexander Hammers

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Research areas/projects of interest:

- Imaging and epilepsy: Mechanisms

Description: Using PET and MRI, investigating e.g. inflammation, drug resistance, seizures starting and stopping.

- Imaging and epilepsy: Clinical imaging

Description: Studies to improve the usefulness of standard clinical imaging, i.e. MRI and FDG PET, in the presurgical evaluation. Patients whose seizures do not stop with medication can sometimes be cured by removing a small part of the brain causing the seizures, identified by imaging.

- Imaging methodology: atlases, machine learning, reconstruction, attenuation correction, etc.

Description: We have created the world's largest single-investigator database of manually created atlases (the "Hammers_mith atlases") which have become standard tools in PET and MRI analyses, incorporated e.g. into the PMOD commercial software. We continue to expand this database and apply it via multi-atlasing and machine learning techniques to diseases like epilepsy and neurodegeneration. We are also interested pushing methodological boundaries for the relatively novel technology of simultaneous PET-MR, e.g. in MR-informed PET reconstruction, and methods for MR-based PET attenuation correction.

Supervisor: Dr Andrew King

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Research areas/projects of interest:

- Interpretable deep learning for medical imaging

Description: Deep learning techniques have achieved impressive results in areas such as disease diagnosis from medical images, but most high-performing deep learning models are complex in nature and are effectively "black boxes" that cannot explain in intuitive terms how their output was produced. In medicine there is a strong need for explanations of automated decisions, to improve the trust of clinicians in such systems, as well as for legal reasons. Research in this area would focus on developing novel deep learning methods that are able to produce such explanations.

- Machine learning for automated interpretation of ultrasound images

Description: Acquiring and interpreting ultrasound images is a highly skilled task. In many areas of the developing world, such skills are in short supply, and as a result ultrasound imaging is under-utilised. There is therefore a need for algorithms that can perform automated measurements and even diagnoses from acquired images. Research in this area would focus on developing such algorithms for clinical applications such as management of sickle cell disease, thalassaemia, cardiology, obstetrics and tuberculosis.

Supervisor: Dr Pablo Lamata

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Research areas/projects of interest:

- Computational Cardiac Physiology

Description: The Cardiac Modelling and Imaging Biomarkers (CMIB) group develops technological advances in medical imaging and computational physiological modelling in order to propose novel biomarkers that will enable a better management of cardiovascular diseases. We sit in St Thomas' Hospital, in the heart of London.

Supervisor: Dr Jack Lee

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Research areas/projects of interest:

- Cardiac perfusion computational modelling

Description: We are a leading group in the theoretical and simulation software development for studying myocardial blood flow mechanics. Our approach combines 3D+1D poromechanics and finite element simulations with high-resolution coronary imaging. Current research focuses on investigating physiologically realistic simulation setups based on detailed coronary anatomy, and analysing MRI perfusion imaging data to validate the model.

- Coronary flow mechanics

Description: We focus on computational modelling of patient data for coronary disease diagnosis and clinical translation, in collaboration with interventional cardiologists. The broader work involves developing the full simulation workflow including medical image analysis and fluid mechanics enhanced by machine learning/deep learning, end-user software design and prototyping, and interfacing with medical professionals for clinical trials and development.

- Cardiac mechanics modelling

Description: Personalised computational models of cardiac electromechanics are used for diagnosing and predicting therapy outcome in heart failure and cardiomyopathies, as well as investigating fundamental questions in cardiac structure-function and motion. Patient data is obtained from MRI and echocardiographic imaging, and processed using advanced algorithms in collaboration with industrial partners. We develop in-house software for multiphysics finite element simulation and visualisation. Model personalisation is achieved via solving inverse problems.

Supervisor: Dr Shaihan Malik

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Research areas/projects of interest:

- Ultrahigh Field Magnetic Resonance Imaging

Description: KCL is currently installing the first 7T MRI scanner in London. 7T MRI potentially offers very high resolution imaging, however there are still remaining technical challenges to making this work well. Research could be focused on making such technological development (involving software and hardware). Alternatively students may undertake projects with clinical partners, focused on taking this new technology (currently used only for research) towards clinical investigation of many health issues, from neurological disorders to cancer and joint imaging, or even

imaging of young children and babies. Potential co-supervisors could be clinical or other technical researchers.

- MRI using Parallel Radio Frequency (RF) transmission for interventions

Description: RF fields used for MRI can be a problem as they will induce currents on any metal items that might be inside the patients' bodies, potentially causing damaging heating to their tissue. This is an issue for the growing number of patients with metallic implants such as prosthetic joins, and for wires that might be used during surgical interventional procedures. Our research is looking at using multiple parallel transmitters to generate the fields, using interference between them to cancel out unwanted induced currents. This could help to make MRI guided surgical intervention a reality, or improve safety when imaging people with implants.

Supervisor: Dr Alkystis Phinikaridou / Professor René Botnar

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Research areas/projects of interest:

- Molecular imaging of extracellular matrix turnover in cardiovascular diseases

- Molecular Imaging of vascular permeability in atherosclerosis

- Multi-sequence thrombus characterisation in deep vein thrombosis

Supervisor: Dr Claudia Prieto

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Research areas/projects of interest:

- Cardiac Magnetic Resonance Fingerprinting

Description: Magnetic Resonance Imaging (MRI) is an important non-invasive tool for risk assessment and treatment monitoring of cardiovascular disease. Conventional MR images are qualitative measurements. Recently, quantitative mapping techniques are emerging to provide objective assessment of myocardial tissue properties. However, clinically used cardiac parametric mapping methods still present several limitations in terms of accuracy, precision, robustness, reproducibility, coverage, spatial-resolution and acquisition times. Magnetic Resonance

Fingerprinting (MRF) is a novel technique that promises to alleviate most of these problems. Several challenges are yet to be investigated to allow the application of MRF to whole-heart cardiac imaging. Several PhD projects can be formulated to address some of these challenges.

- Deep learning based Cardiac MR Reconstruction and Motion Correction

Description: Deep learning based reconstruction and motion-compensated techniques have been recently proposed for Magnetic Resonance Imaging. This project aims to extend and apply this kind of technology to 3D coronary magnetic resonance angiography to enable highly accelerated scans with reduced reconstruction times.

- Cardiac PET-MR imaging

Description: In this project we aim to develop, implement and test the clinical feasibility of novel acquisition and reconstruction methods for cardiac Positron Emission Tomography/Magnetic resonance (PET-MR) imaging. This approach should enable a comprehensive multi-modal assessment of cardiovascular disease.

Supervisor: Dr Andrew Reader

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Research areas/projects of interest:

- Image reconstruction via machine learning for low-dose and synergistic simultaneous PET-MR imaging.

Description: This project would involve combining the latest research in artificial neural network (ANN) architectures, including generative models such as generative adversarial networks (GANs) and variational auto-encoders (VAEs) with state of the art image reconstruction and analysis algorithms to deliver lower-dose and synergistically-enhanced PET-MR images for use in brain, heart and cancer imaging.

- Multi-radiotracer PET image reconstruction and kinetic analysis through deep learning

Description: Using existing radiotracers, this research would explore multi-radiotracer administration strategies with deep learning methodologies in both image reconstruction and kinetic analysis in order to extract multi-molecular and multi-physiological information for precision characterisation and diagnostics.

- Synergistic intelligent imaging and medical language processing

Description: This research area concerns simultaneous reconstruction (with integration of machine learning techniques) and production of multi-level and multi-user diagnostic radiological reports for PET imaging data. This will involve natural and medical language processing and generation.

Supervisor: Dr Sébastien Roujol

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Research areas/projects of interest:

- Magnetic resonance imaging (MRI) guidance of cardiac catheterisation procedures

Description: The incidence of congenital heart disease (CHD) has been estimated at 1% of live births. Cardiac catheterisation is a common procedure in these patients where a catheter, a thin hollow flexible tube, is inserted and navigated into the cardiovascular system under fluoroscopic guidance for diagnostic or interventional purpose. However, the radiation dose associated with fluoroscopy remains a significant concern due to attendant risk of cancer, especially in children requiring long and repeat procedures. Furthermore, the lack of soft tissue visualisation using fluoroscopy may increase the risk of complications such as perforations. Magnetic resonance imaging (MRI)-guidance of cardiac catheterisation procedures is a promising alternative to fluoroscopy as it avoids ionising radiation and has excellent soft tissue contrast. In this project, the next generation tools for advanced real-time MR-guided cardiac catheterisation procedures will be developed and will involve new MRI-acquisition, reconstruction, and post-processing developments.

- Magnetic resonance imaging (MRI) guided ablation of cardiac arrhythmias

Description: Cardiac arrhythmias are associated with increased risk of stroke and are responsible for 80% of sudden cardiac deaths, one of the worldwide leading cause of death. Radio-frequency (RF) ablation (RFA) procedures are clinically available to treat these arrhythmias but are unable to monitor tissue temperature and extent of permanent RFA lesions and fail in 30-50% of the cases. Magnetic resonance (MR)-thermometry is a non-invasive MRI technique which enables real time tissue temperature assessment and show promise for predicting the extent of permanent RFA lesions and guidance of these procedures. In this project, the next generation tools for advanced real-time MR-thermometry will be developed and will involve new MRI-acquisition, reconstruction, and post-processing developments.

Supervisor: Professor Tom Vercauteren

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Research areas/projects of interest:

- Interactive deep learning for brain tumour segmentation

Description: Interactive deep learning for brain tumour segmentation. We will deliver flexible deep-learning based interactive image segmentation algorithm which can exploit multimodal neuroimaging data acquired from different vendors with variable numbers of modalities, variable resolutions across channels and variable quality across datasets. The project will leverage Prof Vercauteren's team track record on interactive deep learning while collaborating with King's College Hospital and the National Hospital for Neurology and Neurosurgery in the UK as well as the

University of Electronic Science and Technology of China. This research will contribute to the development of NiftyNet, a flagship toolbox for deep learning-based medical image computing

- Real-time deep learning for endoscopy.

Description: Real-time deep learning for endoscopy. Computer vision and artificial intelligence methods for endoscopic image analysis have the potential for large patient impact in screening and minimally invasive interventions. We will explore endoscopic image deep representation learning from large-scale datasets as well as high precision and robust model inferences in real time. The clinical feasibility and impact of the methods will be tested at University College London Hospital as well as Guy's and St Thomas' Hospitals and using the interventional systems developed within the group.

- Computational hyperspectral imaging (HSI).

Description: Computational hyperspectral imaging (HSI). HSI is a macroscopic optical imaging modality with a wide range of applications in healthcare. Different biological tissues or pathological conditions have unique 'fingerprints' in their respective optical absorption spectra, giving distinct features in hyperspectral images. HSI coupled with computational learning-based algorithms will eventually allow us to perform tissue characterisation for either disease diagnostics or surgical guidance. Our research will focus on hardware and software system integration to embed HSI devices in surgical applications. Novel sensors will allow for compact real-time HIS devices while state-of-the-art deep learning will facilitate tissue map reconstruction with augmented reality overlays.

Supervisor: Dr Wenfeng Xia

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Research areas/projects of interest:

- Developing key innovations on photoacoustic sensing and imaging techniques and their clinical applications on guiding surgical and interventional procedures

Description: Photoacoustic imaging has been one of the fastest growing fields in biomedical imaging. This hybrid imaging modality combines advantages from both optical and ultrasound imaging, based on contrast that derives from optical absorption by haemoglobin, lipids, and other chromophores. Utilising excitation light with multiple wavelengths, multispectral photoacoustic images can be acquired to obtain spatial distributions of absorbing chromophores. One of my research interests is centred on developing key innovations on photoacoustic sensing and imaging techniques and their clinical applications on guiding surgical and interventional procedures.

- Development, and clinical translation of medical device tracking systems based on smart needles that can communicate with external ultrasound imaging probes

Description: A long-standing problem in minimally invasive procedures guided with ultrasound imaging is the identification of the medical device tip within the body. Ultrasonic visualisation of

medical devices such as needles can be very challenging when the devices are inserted at large angles and/or depths. This problem is experienced acutely during percutaneous interventions in many clinical fields. Serious complications can arise from loss of visibility of the medical device. A second focus of my research is on the development, and clinical translation of medical device tracking systems based on smart needles that can communicate with external ultrasound imaging probes

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Research areas/projects of interest:

- Dual Labelled Antibodies, Diabodies for Integrin αvβ6 Expressing Carcinoma Positron Emission Tomography Imaging and Fluorescence-guided Surgery

Description: Integrin αvβ6 over-expressing carcinomas such as ovarian, breast, and non-small cell lung et al. are highly invasive and metastatic resulting in poor prognostics of cancer patients. There is an unmet clinical need for the early diagnosis and treatment of this type of cancer. For example, the small peritoneal ovarian carcinoma deposits are challenging for both pre-surgical mapping with conventional imaging techniques (e.g. MRI and 18F-FDG PET/CT) and intra-surgical detection. This interdisciplinary project aims to develop multifunctional theranostic tools basing on the dual labelled integrin αvβ6 targeting antibodies and diabodies for the positron emission tomography (PET) imaging and fluorescence-guided surgery of integrin αvβ6 over-expressing carcinomas.

- Dual Nuclear and Fluorescence Imaging reagents for the In vivo Tracking of Therapeutic Cells

Description: Cell-based therapies have shown great promise in cancer treatment, stem cell regenerative medicine, and immune tolerance in organ transplantation. One of fundamental challenges in both medical research and clinical applications of cell therapy is to understand the in vivo behaviour of the infused cells. This project is focused on developing generic dual nuclear and fluorescent imaging methods to track the therapeutic cells in vivo. The nuclear imaging method can dynamically monitor the migration and proliferation of the cells in the whole body, and ex vivo fluorescent imaging will unveil the final fate of the cells in the target sites.

- Novel 18F-Molecular Probes for Direct Detection of Oxidative Stress in Diseases with Positron Emission Tomography

Description: Reactive oxygen species (ROS) induced oxidative stress closely associates with many pathological conditions such as cardiovascular and neurodegenerative diseases, cancer, and the cardiotoxicity as the major side effect of cancer chemotherapy. It would be highly desirable to have a non-invasive means of visualising and quantifying the pathologically elevated ROS in patients for both diagnostic and prognostic purposes. In this research program, we aim to develop 18F-labelled molecular probes for direct measurement of the overproduced ROS in vivo. Such novel imaging reagents would have broad clinical applications for the early detection of the cardiovascular and neurodegenerative diseases, and evaluate the response to cancer chemotherapies using positron emission tomography.

Cancer & Pharmaceutical Science

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Research areas/projects of interest:

- Antimicrobial resistance

Description: Research in this area will focus on developing chemical biology tools to study antimicrobial resistance. We are particularly interested in efflux-mediated resistance. The group has recently developed a new antibiotic resistance breaker technology that has been patented by KCL. The student will explore the phenomenon of efflux transporter-associated resistance and the regulation of these transporters using various chemical tools. The findings from the study could help the researchers to develop targeted therapies to overcome efflux-mediated resistance.

- Drug Discovery

Description: Research in this area will focus on the application of advanced computational chemistry, synthetic medicinal chemistry and chemical biology techniques to the design, synthesis and evaluation of novel drug-like chemical scaffolds as anticancer and anti-infective agents. The student will work on a synthetic medicinal chemistry project develop new generation Aurora B kinase inhibitors. We have identified a novel pharmacophore using computational techniques, and the project will expand the chemical space of the pharmacophore to establish the structure-activity relationship.

- Antibody-drug conjugate

Description: The research group has developed new generation payloads for antibody-drug conjugates that selectively work on transcription factor inhibitors. Research in this area has led to the formation of a University spin-out company Femtogenix Limited in 2015. The student will explore new chemical scaffolds that can be linked to tumour specific antibodies to develop new antibody drug conjugates. The ADC payloads will be for their sequence selectivity using a range of biophysical techniques including ADC-specific LCMS techniques.

Supervisor: Dr Driton Vllasaliu

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Research areas/projects of interest:

- Mucosal delivery of biologics for inflammatory bowel disease.

Description: Inflammatory bowel disease (IBD) affects an estimated 10 million people worldwide and accounts for substantial healthcare/society costs (€4.6–5.6 bn/year in Europe). Non-biologic therapy fails to influence the underlying inflammation and disease course. Biologics have changed IBD management, but injection-mediated administration has serious limitations of systemic toxicity and loss of therapeutic response. Locally-delivered biologics have significant therapeutic potential in IBD, however, intestinal delivery is challenging. This project will develop novel drug delivery systems for intestinal delivery of biologics in IBD. The project combines nanomedicine, novel tissue culture and imaging. The student should have a materials or pharmaceutical background.

- Interaction of nanomedicines with the biological environment in the gastrointestinal tract

Description: The biomolecular corona (layer of adsorbed material) formed around nanoparticles in biofluids is crucial in dictating particle-cell interactions. Nanoparticle biomolecular corona has been characterised at the molecular level in human plasma and respiratory lining fluid. However, characterisation of nanoparticle biomolecular corona formed in the gastrointestinal environment and the resulting effect on the biological activity has not been reported. The proposed project will characterise the nanoparticle biomolecular corona in the gastrointestinal tract and determine its impact on nanoparticle biological activity (intestinal epithelial toxicity, cell uptake and absorption). Project's outcomes will inform the development of orally-administered nanomedicines and novel foods.

- Development of electrospun nanofibre-based basement membrane for intestinal epithelial models

Description: Predictive in vitro intestinal models would significantly benefit academic research and drug development. Currently-used systems have limitations and questionable predictive value, e.g. in studies of gastrointestinal disease. They consist of epithelial cells grown directly on plastic membranes. However, in vivo epithelial cells are supported by basement membranes (BMs). BMs are thin, specialised sheets of extracellular matrix that regulate cell adhesion, differentiation, and motility. Importantly, BMs also regulate epithelial barrier property. Using electrospinning, this project will fabricate nanofibres as synthetic basement membrane mimetics to improve in vitro intestinal models.

Supervisor: Dr Julie Tzu-Wen Wang / Professor Khuloud Al-Jamal

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Research areas/projects of interest:

- Development of theranostic nanomedicines for cancer

- Brain drug delivery

Supervisor: Dr Cecile Ayako Dreiss

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Research areas/projects of interest:

- Developing a mechanistic understanding of the role played by bile salts and dietary fibres, and how to engineer better food emulsifiers

Description: The intake of dietary fat and its effects on health has become a pressing issue; fat digestion and subsequent absorption occurs through the action of lipase, and is facilitated by bile salts, biosurfactants present in the gastrointestinal tract. This PhD project aims to achieve a mechanistic understanding of the role played by bile salts and dietary fibres, and how to engineer better food emulsifiers to slow down lipid digestion and regulate fat uptake. It combines advanced structural techniques (neutron scattering) and colloid science to expertise in gut physiology, biophysical techniques and animal models .

- Determining how physical characteristics of hydrogels can direct stem cells for tissue repair

Description: Tissue engineering (TE) aims to transform medicine by creating living tissue replacements that can repair or replace diseased or damaged tissues. Recent studies have shown that, in addition to growth factors, the physical characteristics of the polymeric hydrogel scaffold (nanoscale features, mechanical properties) can direct stem cell behaviour. This interdisciplinary project combines polymer synthesis, mechanobiology, peptide chemistry, stem cell biology, small-angle neutron scattering (SANS), rheology and mechanics to determine how physical characteristics of hydrogels can direct stem cells for tissue repair.

- Nanocomposite gels for biosensing

Description: Nanocomposite gels for biosensing. The demand for functional soft materials has fuelled the research into nanocomposite hydrogels, namely, nanoparticles embedded within a hydrated, polymeric gel matrix. The combination of the soft matrix with nanoparticles offers a

simple, yet versatile, platform to design materials with specific and tunable properties. This PhD project will explore the formation and stabilization of copper sulfide nanoparticles (CuS QDs) in a gel matrix. CuS QDs present interesting optical and electronic properties and have applications in optical devices, as sensors for diagnostics, displays etc.

Supervisor: Dr Bahijja Raimi-Abraham / Dr Cecile Dreiss

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Research areas/projects of interest:

- Engineering Polymer-Free Nanofibres for Regenerative Medicine

Description: The design of stem cell scaffolds can greatly influence proliferation and differentiation. Stem cells cultured on nanofibre scaffolds differ in morphology, viability and migration behaviour compared with cultures grown on traditional substrates. There is a drive to prepare scaffolds from non-polymeric materials to overcome some drawbacks polymers can have, such as induce an immune response, toxicity, use of non-environmentally friendly solvents. This academia and industry collaborative project will engineer novel polymer-free nanofibres using nanofabrication process such as electrospinning and evaluate their potential as stem cell scaffolds.

Supervisor: Professor Ben Forbes

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Research areas/projects of interest:

- Nanomedicine-based therapy for lung disease

Description: This research area includes (i) development of inhaled nanomedicines for the treatment of rapidly progressive fatal lung diseases, (ii) the design and engineering of respirable nanoformulations and their evaluation by preclinical testing for safety and efficacy, (iii) product optimisation using physiologically-based pharmacokinetic modelling, (iv) deally the formulation will translate to the clinic through development as an investigational medicinal product compliant with requirements for first-in-man clinical evaluation. In particular students are invited to investigate the hypothesis that albumin-drug interactions can be utilised to engineer nanoformulations that will selectively target potent drug to the lungs.

- Advanced inhaled therapy

Description: This research area includes (i) design and manufacture of pharmacokinetic-modifying formulations for pressurised metered dose inhalers using non-volatile excipients such as sugar

alcohols to adjust delivered dose, aerosol physical chemistry, drug dissolution and permeability in the lungs, (ii) pre-clinical proof of concept studies using Design of Experiments approaches to understand and demonstrate the principles by which therapeutic aerosols can be manipulated to tailor drug delivery. In particular students are invited to test the hypothesis that non-volatile excipients can be used to alter the dynamics of particle formation during aerosolisation resulting in modified biopharmaceutical performance.

- Aerosol medicine quality attributes

Description: This research area includes (i) dissolution testing as a critical product attribute of inhaled medicines, (ii) evaluating methods for aerosol collection, dissolution and mathematical interpretation to inform proposed guidelines for the developers of innovative products and generic formulations regarding factors affecting absorptive clearance from the lungs. Projects can be designed that will encompass close cooperation with international pharmaceutical industry partners working through the Product Quality Regulatory Institute. In particular students are invited to investigate the hypothesis that dissolution in the lungs is a critical determinant of systemic pharmacokinetics after respiratory drug delivery.

Supervisor: Dr Grant Lewison

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Research areas/projects of interest:

- Bibliometric study of Chinese and other East Asian country research outputs in cancer and other medical subject areas, and comparison with national burdens of disease, and changes over time.

Description: It would also be possible to study the application of such research through the references on clinical practice guidelines, supplemented with data on the results of treatment, if available.

- Analysis of Chinese newspaper stories about medical research advances, and comparison with coverage of the same subject areas by UK newspapers

Description: This would show which disease areas were of greatest interest to the mass media in the two countries, and how they were covered, such as a focus on means of prevention, or of treatment, and which countries' research was reported.

Supervisor: Dr Barry Panaretou

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Research areas/projects of interest:

- Characterizing the function of Hsp90, a chaperone that controls the activity of key proteins involved in development and signal transduction.

Description: Exploiting the tractable genetics of the yeast model to determine the biological significance of interactions that occur between Hsp90 and its binding partners that have been revealed by proteome-wide interaction studies.

- Use of the yeast model to understand the cellular role of the mitochondrial Voltage Dependant Anion Channel (VDAC), the gate-keeper of mitochondrial metabolism

Description: Use of metabolomics to discover the pathways disturbed when VDAC is deleted or over-expressed. Subsequent use of molecular genetic tools to discover how these pathways interact with VDAC

- Understanding the role of UTP21, a gene that is frequently mutated in glaucoma

Description: This protein is a component of a complex that drives early steps in the genesis of ribosomes. The components of the complex are all found in yeast and this model will be used to understand how the proteins in the complex co-operate to ensure ribosome biosynthesis. In particular, we seek to understand how Utp21 recruits the Hsp90 chaperosome, a complex that has been implicated in ribosome biology

Supervisor: Dr Daniele Castagnolo

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Research areas/projects of interest:

- Design and identification of novel antitubercular drugs through drug hybridization and drug repurposing approaches

Description: We are currently working on the identification of novel antibacterial agents and development of new strategies to tackle antimicrobial drug-resistance. We are interested in the design and identification of novel antitubercular drugs through drug hybridization and drug repurposing approaches. The projects on tuberculosis are carried out in collaboration with several microbiologist collaborators. In parallel, we are also interested in the development of new drug candidates active against bacterial infections (especially Gram+/- bacteria responsible of lung infections) and new drug-conjugate systems as alternative drug delivery strategies. This project is carried out in close collaboration with Public Health England.

- Biocatalysis and organic synthesis.

Description: As organic chemists we are interested in the development of novel synthetic methodologies for the synthesis of drug-like compounds. In particular, we are developing new and "greener" biocatalytic approaches for the synthesis of aromatic heterocycles and volatile sulphur compounds. We are working on the development of new chemo-enzymatic cascade reactions to produce heterocyclic derivatives using monoamino oxidase biocatalysts (MAO-N) and laccases. In parallel, we are also working on the development of novel approaches for the synthesis of enantiomerically pure volatile sulphur compounds as potential food flavours and aromas, using keto-reductase and nitrilase enzymes.

Supervisor: Dr Maya Thanou

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Research areas/projects of interest:

- Image guided drug delivery using focused ultrasound.

Description: Using liposomes and ultrasound to deliver chemotherapy in brain tumours.

- Novel agents for the sensing and treatment of breast tumours using microwave.

Description: Developing inorganic biomaterials for microwave imaging and electromagnetic radiation enhancement of drug treatment (electroceuticals)

- Novel nanodroplets as phase change contrast agents and drug carrier for combination therapies in sarcoma tumours

Cardiovascular Medicine & Sciences

Supervisor: Professor Albert Ferro

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Research areas/projects of interest:

- Regulation of endothelial cell apoptosis by nitric oxide / beta-catenin signalling: role in atherosclerosis

- Modulation of atherosclerosis by endothelial and monocyte production of the neuroimmune guidance cue netrin-1

Supervisor: Dr Aleksandar Ivetic

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Research areas/projects of interest:

- Leukocyte recruitment and migration during inflammation

- The role of leukocytes in myocardial infarction

- Regulation of endothelial cell permeability by the cytoskeleton

Supervisor: Dr Lingfang Zeng

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Research areas/projects of interest:

- The role of a novel nested intronic gene Laf4ir in cardiac fibrosis and heart failure.

Description: We have found that transverse aortic constriction (TAC)-induced pressure overload induced a translation shift between open reading frame (ORF) 1 and 2 of the Laf4ir gene. Laf4ir-/-

knockout mice showed smaller body weight and enlarged heart. In this project, we intend to investigate the mechanisms involved in the translation shift between ORFs and the potential role of Laf4ir gene in pressure-overload induced cardiac fibrosis and heart failure.

- The role of a novel nested intronic gene Laf4ir in vascular remodelling.

Description: We have found that Laf4ir gene could be activated by vascular injury in the vessel wall resident Sca1+ progenitor cells. High level of LAF4IR proteins were detected in the aorta of ApoE-/-, suggesting Laf4ir may contribute to atherosclerosis development. In a hind limb ischemia model, the blood perfusion of the paw was significantly reduced in Laf4ir+/- as compared to that of wild type mice. There was an extra vein alongside the femoral artery in the same way as found in human subjects.

Supervisor: Dr Qiuping Zhang

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Research areas/projects of interest:

- Investigating the role of nesprin-1 and the LINC complex in cardiac cell function and disease using a nesprin-1 mutant knock-in mouse model

Description: Cardiomyopathies are an important cause of heart failure and sudden cardiac death. Emerging evidence shows that mutations in genes encoding for the proteins of the nuclear envelope (NE) LInker of Nucleoskeleton and Cytoskeleton (LINC) complex, which mechanically couples the nucleus to the cytoskeletal networks, are a major cause of dilated cardiomyopathy (DCM). Our recent data showed mutations in nesprin-1 (one of the components of the LINC complex), which were identified in DCM patients, cause increased NE fragility and compromised LINC complex function as well as defects in myogenesis in vitro. The aim of this project is to study the role of nesprin-1 and the LINC complex in regulating cardiac cell function and disease by using this nesprin-1 knock-in mouse line as a disease model to gain insights into mechanisms, whereby the NE LINC complex disruption caused by mutations in nesprin and other LINC components lead to cardiac muscle cell dysfunction under mechanical stress, with a view to identification of molecular targets for therapeutic development.

Centre for Medical Education

Supervisor: Dr Shuangyu Li

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Research areas/projects of interest:

- Trends in healthcare policy development in China

Description: This PhD project focuses on the healthcare policy level. The candidate will investigate main trends in policy development in China, and deduce the prevailing bureaucratic, scientific and clinical priorities driving policy development in the area. The thesis will use policy analytical approaches drawing on thematic document analysis informed by content analysis and discourse analysis. The thesis will produce knowledge about policy priorities in China, about policy dissemination strategies, and about policy implementation approaches. The project may include a reflexive component with policy makers. The thesis should prepare the student for policy roles at health service, national and international levels.

- Dynamics of China's healthcare system

Description: This PhD project engages the student with investigating the rapidly changing contours and dynamics of China's healthcare system. The candidate will deploy ethnographic methods for mapping service level systems and structures, as well as contemporary changes and instabilities. The investigation will be conducted through interviews and field observations. The thesis will result in a geographic overview of Chinese health service structures and the developmental and investment challenges these structures manifest, and an account of their impact on care processes and outcomes. The thesis may have a reflexive component allowing for feedback of findings to health service and health department personnel.

- Interactional analysis of communication between clinicians and service users in China

Description: This PhD project involves an interactional analysis of communication between clinicians and service users (e.g. patients, caretakers, relatives) in China. The candidate will be trained with interactional analytic methods, including conversation analysis and multimodality, to investigate how clinical agendas are achieved, and policies and guidelines are implemented, through face to face communication. The thesis will provide an understanding of interactional patterns, through which the systems of the chosen clinical event and context are manifested. The results may have significant implications for clinical practice and professional training. The project may include a comparative study of China and the UK.

Immunology & Microbial Sciences

Supervisor: Dr Patricia Barral

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Research areas/projects of interest:

- To understand the molecular mechanisms controlling the function of NKT cells in intestinal inflammation

Description: Previous data from our lab established a critical role for NKT cells in the regulation of intestinal immunity, as these cells recognise and respond to lipids from commensal bacteria (Saez de Guinoa et al EMBO J, 2018; Saez de Guinoa et al, EMBO Rep, 2017). This PhD project seeks to define the mechanisms that control the crosstalk between commensals and immune cells and how those modulate gut health. We aim to understand how NKT cells contribute to the progression of inflammatory bowel disease and how environmental signals control their location, phenotype and function.

- To explore the contribution of NKT cells to the control of tumour development and progression

Description: Our preliminary experiments strongly suggest a protective role for NKT cells in the regulation of tumour progression, although the mechanisms for this immune-mediated protection remain unknown. This project aims to identify the cellular and molecular processes underlying this effect and to translate the relevance of these mechanisms to human patients.

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Research areas/projects of interest:

- Development and function of tumour-associated macrophages and their bearing on immunotherapy.

Supervisor: Dr Toby Lawrence / Dr Pierre Guermonprez

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Research areas/projects of interest:

- Molecular control of non-lymphoid tissue dendritic cell maturation and immune tolerance in homeostasis and during tumourigenesis.

Supervisor: Dr Tassos Grammatikopoulos / Professor Richard Thompson

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Research areas/projects of interest:

- Genetic investigations in neonatal sclerosing cholangitis

Description: Neonatal sclerosing cholangitis (NSC) is a form of severe liver disease, presenting in the newborn period more commonly amongst consanguineous families. NSC is very similar to a more common condition; biliary atresia (BA). Already from 39 NSC and consanguineous BA patients, 26 patients of consanguineous parentage were selected for whole exome sequencing (WES). Initial analysis showed five patients were homozygous and two were compound heterozygous for protein-truncating mutations in DCDC2, encoding doublecortin domain containing 2 (DCDC2), expressed in cholangiocyte cilia. Findings were confirmed on liver immunostaining and electron microscopy. In remaining patients, with no genetic confirmation, available genomic data could be further interrogated and other candidate genes for NSC & BA could be investigated in our liver molecular genetics laboratory.

- The role of DCDC2 in cholangiocyte differentiation and function

Description: We described mutations in DCDC2 encoding doublecortin domain containing 2 protein in children with NSC. This is a microtubule-associated protein located in the axoneme of primary cilia in cholangiocytes. How the loss of ciliary integrity causes neonatal-onset cholangiopathy is unclear. DCDC2 is expressed both in iPS-cholangiocyte-like cells (CLCs). We aim to interrogate specific aspects of these cholangiocytes such as organoid proliferation, resistance to bile toxicity and cell function (e.g. bile acid transport). We will investigate potential differences between cholangiocytes harvested from affected NSC patients and other non-cholangiopathic conditions and delineate the disease mechanisms with potential interaction between DCDC2 and signalling pathways. We will test a multiple hit hypothesis by impaired proliferation and reduced tolerance to bile acid toxicity, combined with a 2nd hit from which the cells cannot recover and attempt cell rescue techniques.

Supervisor: Dr Yun Ma

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Research areas/projects of interest:

- Defining the immunological mechanisms of resistant to immunosuppressive treatment in juvenile autoimmune liver diseases (ALD)

Description: Juvenile AILD includes type-1/type-2 autoimmune hepatitis (AIH-1/AIH-2) and autoimmune sclerosing cholangitis (ASC). AILD is a severe form of chronic liver disease and is associated with immuneregulation impairment. Although immunosuppressive treatment represented by steroids can control the liver disease temporarily, steroids cannot be stopped in 80% patients and cannot prevent relapse. Up to 20% patients are not responding to any types of treatment, including B cell depletion treatment to remove autoantibody producing B cells. The aim of this project is to define the mechanisms of non-response to immunosuppressive and immunoregulatory therapy and then to establish a novel therapy to control autoimmunity.

- Defining the immunological mechanisms leading to the development of de novo autoimmune hepatitis (dn AIH) after liver transplantation

Description: dn AIH is also known as plasma cell hepatitis, which arises after liver transplantation for non-autoimmune liver disease, characterised by enhanced liver enzyme and histologically plasma cell infiltrate and prominent interface activity. Although the majority of dn AIH patients respond to plasma cell hepatitis treatment, it likely recurs and progresses to cirrhosis, 33% of them would require re-transplant or death. There is an urgent need 1) to understand the immunological mechanisms leading to the development of dn AIH after liver transplant; 2) to define whether immunoregulatory therapy after liver transplantation (ThRIL clinical trial, UK) will prevent the occurrence of dn AIH.

- Functional characterization of mucosal associated invariant T (MAIT) cells in human liver transplantation

Description: The majority of donated livers in the UK are from deceased donors after brain death (DBD). MAIT cells are the most abundant innate T cell population in humans and regarded as “new guardians of the liver”. Whether MAIT cells contribute to keeping liver function is unknown. MAIT cells from blood and liver, upon mitogen (P/I) stimulation, significantly upregulate their production of Th1 and Th17 cytokines. We have recently found an association between MAIT cell numbers in liver grafts and the development of acute rejection post transplantation. The aim of this project is to define whether MAIT cell function contribute to graft acceptance or rejection.

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Research areas/projects of interest:

- Immuno-metabolism of monocytes and lymphoid cells

Description: Impairments of innate immunity predispose patients with liver failure to sepsis through monocyte activation and reprogramming. Pivotal metabolites contributing to monocyte function are phosphocholines (PCs). They act as ligands for monocytes and lymphocyte activation and cytokine production. This project will characterise lipid-immune cell interaction in patients with liver failure and sepsis. The student will also characterise the effects of modulating the phospholipid pathways from an immune perspective, in a physiological model where C57BL/6 WT mice will be studied.

Supervisor: Dr Mark McPhail / Dr Tamir Rashid

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Research areas/projects of interest:

- Lipid metabonomics in liver failure

Description: In previous research we applied multi-platform metabolic phenotyping (untargeted 1H NMR spectroscopy and ultra-performance liquid chromatography coupled with mass spectrometry (UPLC-MS)) of plasma in patients with liver failure. This led to a robust predictive model of 90-day survival, based on a panel of discriminatory lipids (mainly phosphocholines (PCs) and lysophosphatidylcholines (LPCs)). That LPC levels are downregulated in the plasma of liver failure patients but the cause or hepatic effects are not known. This project will comprehensively phenotype the hepatocyte metabolome to identify if cell death pathways can be inhibited via metabonomic modulation.

Supervisor: Dr Qihe Xu

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Research areas/projects of interest:

- Integrative Chinese medicine for the prevention and treatment of kidney diseases

Description: Traditional Chinese medicine (TCM) is mainstream in China. At King's, I conducted TCM knowledge-based, omics-guided rediscovery of anti-fibrotic TCM remedies, coordinated the €1.1m EU-China collaboration GP-TCM (2009-2012), led the establishment of the GP-TCM Research Association and founded King's Centre for Integrative Chinese Medicine (CICM) in 2013. My research focuses on TCM-inspired studies of acute kidney injury and chronic kidney disease, anti-fibrotic herbs, as well as pro-fibrotic and nephrotoxic herbs

- Defining renal protecting mechanisms and developing novel renal therapeutics

Description: Tubulointerstitial injury plays an important role in acute kidney injury and chronic kidney disease, but how the renal tubulointerstitium defends against attack is poorly understood. Our research suggests that collecting ducts could be key protective defenders regulated by the vitamin A signalling. In-vitro, in-vivo and clinical studies are ongoing in our lab and we welcome interested students to join us. Together, we can develop new strategies for diagnosis, prevention and treatment of major kidney diseases.

Life Course Sciences

Supervisor: Dr Jordana Bell

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Research areas/projects of interest:

- Epigenomics of complex disease in human cohort based studies

- Genetic and environmental basis of human methylome variation in twins

- The role of the gut microbiome in incident metabolic disease

Supervisor: Dr Gavin Bewick

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Research areas/projects of interest:

- A gut Feeling: Investigating Gut epithelial adaptations to metabolic disease.

Description: Roux-en-Y gastric bypass resolves diabetes, but it is not practical for all obese patients. Remission can also be achieved with non-surgical interventions which exclude nutrients from the duodenum. This highlights the important glucoregulatory role of the small intestine, placing it front and centre in the pathophysiology and treatment of metabolic disease. This project will answer the following key questions: What are the pathological changes in the gut epithelium in response to obesity? Are the changes stem-cell driven and how is gut epithelial cell fate and function altered? How does duodenal exclusion improve gut physiology and glucose homeostasis?

- Manipulating gut endocrine cell fate for the treatment of obesity and diabetes.

Description: Obesity and Diabetes are the fastest growing public health problems, novel treatments are urgently needed. Hormones released from the gastrointestinal tract after a meal regulate appetite, energy expenditure and glucose homeostasis. The gut L-cell is key in this regulation, as it integrates complex nutrient signals and responds by releasing the satiety inducing gut hormones peptide YY, Cholecystokinin (CCK) and the incretin Glucagon-like peptide 1 into the circulation. By understanding how to manipulate gut endocrine cell fate we may be able to Boost gut hormone release by increasing L-cell numbers. This is a novel approach for treating obesity and diabetes.

- Exploring the translational potential of the NPY Y4 receptor for treating Type 1 Diabetes

Description: We recently identified the neuropeptide Y (NPY) receptors as novel targets for promoting human beta-cell survival. The NPY Y4 receptor is the most promising NPY receptor candidate for treating Type 1 diabetes (T1DM). It exhibits a high potency for protecting human beta-cells from damage, has potential to inhibit diabetic hyperglucagonemia and is likely to possess a good side effect profile compared to other NPY receptors. Our objective is to demonstrate the translational potential of targeting the NPY Y4 receptor for treating T1DM.

Supervisor: Dr Karen Edmond [1]/ Dr Peter Dixon

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Research areas/projects of interest:

- Newborn and child health services research including systematic reviews and meta-analyses and clinical trials

- Newborn and child health systems research including systematic reviews and meta-analyses

- Newborn and child neurodevelopmental and nutritional research including systematic reviews and meta-analyses and clinical trials

Supervisor: Dr Mario Falchi

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Research areas/projects of interest:

- Computational biology

Description: This project will work on the TwinsUK cohort, one of the largest and best-characterised prospective cohorts in the world, used to study the genetic aetiology of complex traits and diseases. We have characterised for thousands of these subjects extensive clinical, molecular, and genomics data, including cutting edge multi –omics phenotyping.

[1] Dr Karen Edmond will be joining King's in May 2019 and her King's contact/web information will be updated once available.

- Integrative multi-omics

Description: This project will work on the TwinsUK cohort, one of the largest and best-characterised prospective cohorts in the world, used to study the genetic aetiology of complex traits and diseases. We have characterised for thousands of these subjects extensive clinical, molecular, and genomics data, including cutting edge multi –omics phenotyping.

- Machine learning

Description: This project will work on the TwinsUK cohort, one of the largest and best-characterised prospective cohorts in the world, used to study the genetic aetiology of complex traits and diseases. We have characterised for thousands of these subjects extensive clinical, molecular, and genomics data, including cutting edge multi –omics phenotyping.

Supervisor: Professor Christer Hogstrand

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Research areas/projects of interest:

- The role of the membrane androgen receptor (ZIP9) in pancreatic β-cell maintenance and diabetes

Description: The non-genomic Androgen Receptor (AR) is an androgen-gated plasma membrane Zn2+ channel, named ZIP9 (SLC39A9). In this PhD project, we will investigate the role of ZIP9 in pancreatic β-cell biology and its potential links to diabetes. The student will dissect the signalling pathway associated with androgen-dependent Zn2+ influx and analyse the consequence of its activation on insulin release, cell proliferation and β-cell mass. The student will further examine the influence of endocrine disrupting chemicals in development of diabetes through ZIP9.

Supervisor: Professor Peter Jones

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Research areas/projects of interest:

- Using mesenchymal stromal cells to improve the outcomes of islet transplantation as a therapy for Type 1 diabetes

Description: This project will involve in vitro molecular cell biology and in vivo transplantation work in rodent models of Type 1 diabetes.

- Extracellular matrix and pancreatic beta cell function

Description: This project will study interactions between extracellular matrix and beta cells to assess whether alterations in extracellular matrix are involved in beta cell dysfunction associated with the development of Type 2 diabetes.

- Islet nanocoating for targeted drug delivery in islet transplantation

Description: This project will develop a layer-by-layer deposition method to incorporate bioactive molecules into islet nanocoats to ensure localised drug delivery to the site of islet implantation. This will improve islet survival and function by suppressing inflammatory and immune response in the host niche.

Supervisor: Dr Yemisi Latunde-Dada

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Research areas/projects of interest:

- Phenolic acids in the treatment of iron overload and Type 2 diabetes

Description: Recent evidence indicates a bi-directional relationship between iron and type 2 diabetes (T2D). This is potentiated by oxidative stress and inflammatory cytokines that characterize both iron overload conditions and T2D. Naturally occurring antioxidant plant products are employed in the treatment of T2D and these could have implications for iron metabolism. The study aims to investigate hypoglycaemic and antioxidant effects of phenolic acid. Cells and a mouse model will be employed to investigate the protective functions phenolic acid on the progression of T2D.

Supervisor: Professor Kevin O'Byrne

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Research areas/projects of interest:

- A novel mechanism underlying GnRH pulse generation by KNDy neurones

Description: The gonadotrophin-releasing hormone (GnRH) pulse generator that drives the pulsatile secretion of LH and FSH, is critical for reproduction. The KNDy neurones (co-express: Kisspeptin, Neurokinin B and Dynorphin) of the hypothalamus stimulate GnRH neurones. The KNDy network generates oscillatory patterns of activity and comprise the GnRH pulse generator. Aim: What initiates and maintains the rhythmic activation of the KNDy neural network to drive pulsatile secretion of GnRH?

- Stress and early puberty: is the limbic brain the key?

Description: Puberty is critically dependent upon maturation of the hypothalamo-pituitary-gonadal axis, specifically an increase in hypothalamic GnRH pulse generator frequency, driving gonadotrophic hormone secretion, promoting gonadal steroidogenesis and sexual maturation. However, timing mechanism of puberty and its modulation by stress are unknown. We will test the hypothesis that dynamic developmental changes in kisspeptin and GABA/glutamate activity in the amygdala, a key emotional processing centre, regulate GnRH pulse generator frequency to govern the timing of puberty, and psychological stress delays puberty consequent to an action of urocortin 3 on this novel amygdala neurocircuitry. In-vivo optogenetics, DREADDs and neuropharmacological techniques will be used.

Supervisor: Professor Shanta Persaud

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Research areas/projects of interest:

- Use of the human islet G-protein-coupled receptor expressome to identify new therapies for type 2 diabetes

- Defining novel targets for glycaemic control in diabetes through metabolic tissue cross-talk with islet G-protein-coupled receptors

- Identifying G-protein-coupled receptors that regulate islet development and function: informing strategies for driving stem cell differentiation to beta-cells

Supervisor: Dr Emma Robinson / Professor David Edwards

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Research areas/projects of interest:

- Engineering Big Data solutions to mining Imaging Genetics data through Deep Learning

Description: This project will develop new methods for intelligent feature selection to allow advanced joint modelling of vast imaging and genomics data sets, to determine gene candidates for targeted neuroprotective therapy of vulnerable preterm infants. Imaging genetics is an emerging field that has huge potential to improve understanding of complex neurological conditions, through identifying concrete links between morphological or functional changes in the brain and genetic variants linked to disease. This project will use advanced techniques from sparse predictive modelling and Deep Learning to compress and combine state-of-the-art developmental imaging and

genomics data sets enabling suggestion of sensitive genotype-phenotype candidates as targets for future clinical trials

Supervisor: Dr Kerrin Small

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Research areas/projects of interest:

- Genetic and environmental regulation of gene expression and the development of disease using longitudinal multi-omic datasets to inform precision medicine

Description: This study will examine the interplay of multiple environments and diseases (measured over 25 years) using the largest Twin cohort in the UK.

- Regulation of gene expression in adipose tissue and its role in obesity related diseases and traits

Description: With particular reference to Type 2 Diabetes and cardiovascular disease

- Regulation of gene expression on Chromosome X and its role in healthy ageing and susceptibility to auto-immune diseases

Supervisor: Professor Catherine Williamson

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Research areas/projects of interest:

- Impact of cold exposure in early life on susceptibility to subsequent obesity and diabetes

Description: Intrahepatic cholestasis of pregnancy (ICP) and gestational diabetes mellitus (GDM) are maternal metabolic disorders that occur commonly in the UK and China. It has been shown that the grown up children of pregnancies affected by these disorders have increased rates of obesity and associated cardiometabolic risk factors, including impaired glucose tolerance and dyslipidaemia. Objectives: To perform fetal MRI to establish the impact of maternal metabolic disease on fetal hepatic lipid spectra; To establish whether neonatal cooling can (a) reduce the severity of neonatal liver steatosis quantified using MR spectra (b) induce BAT and cause beiging of WAT (c) improve other features associated with cardiometabolic risk.

Population Health & Environmental Sciences

Supervisor: Professor Frank Kelly

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Research areas/projects of interest:

- Assessing the human health risks of microplastics.

Description: The project will be focused on three novel issues: 1) the extent of microplastic pollution in the atmosphere, including in a size range likely to be inhaled 2) whether tissue uptake of microplastics occurs 3) if microplastics present a hazard to public health.

- Using metabolomics to investigate the metabolic signatures and associated pathways linked to short-term exposure to air pollutants. T

Description: The project aims to examine the intermediate steps that potentially lie on the causal pathway linking exposure to air pollution (particulate matter less than 2.5 microns [PM2.5], nitrogen dioxide [NO2], nitrogen oxides [NOx]) and disease risk using multivariate metabolic phenotyping technologies (metabolomics) that have emerged as a powerful new method to capture biomarker information on a range of toxicological and disease processes.

- Identifying the mechanisms for the effects of air pollution on cardiopulmonary disease in Beijing, China.

Description: The project aims to investigate and understand the pathways and mechanisms from exposure to clinically relevant effects of air pollution in urban and peri-urban residents in Beijing. We will achieve this by using cutting-edge cross-disciplinary concepts and methods, and by leveraging data and knowledge in an existing project, AIRLESS, funded under the 1st round of the Megacities China programme. Our study results will inform interventions and solutions to be considered in a future study.

Supervisor: Dr Vincenzo Abbate

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Research areas/projects of interest:

- Analysis of natural products

- Design of innovative & targeted metal chelators for (nuclear) medicine applications

- New Psychoactive Substances

Supervisor: Dr Salma Ayis / Professor Charles Wolfe

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Research areas/projects of interest:

- Stroke

Description: The natural history of depression, antidepressant use and the risk of recurrence and mortality in stroke patients: Prediction of high risk patients

Supervisor: Dr Salma Ayis / Professor Martin Gulliford

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Research areas/projects of interest:

- The progression of diabetic nephropathy

Description: Investigations include, mortality and long-term care costs.

Supervisor: Dr Salma Ayis / Dr Mariam Molokhia

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Research areas/projects of interest:

- Gynaecology and women health

Description: Improved prediction for a range of poor and unfavourable pregnancy outcomes using advanced statistical methods

Supervisor: Dr Lindsay Bearne

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Research areas/projects of interest:

- Physical activity and exercise in people with inflammatory arthritis: the role of interactive digital health technologies

Description: Inflammatory arthritis (e.g. rheumatoid arthritis) causes disability and reduced quality of life. Physical activity and exercise improves symptoms and function but adherence tends to be poor. There are limited healthcare resources to support long-term activity participation and novel methods, such as interactive digital interventions, may be helpful. This PhD will investigate the role and application of interactive digital interventions to increase physical activity using mixed research methodology.

- Rehabilitation of people with critical limb ischaemia

Description: Critical limb ischaemia, (a constant and intractable pain +/- tissue loss) is a severe form of peripheral arterial disease which requires urgent revascularisation. Working with patients and clinicians, this PhD studentship will aim to develop an evidence-based rehabilitation programme for patient with Critical Limb Ischaemia following revascularization using mixed research methods.

- Investigating the role of habit and duel process theory in exercise adherence in people with chronic musculoskeletal conditions (MSK)

Description: Many people with MSK are prescribed exercise but 50-70 % are non-adherent and so do not get adequate benefit from treatment. Exercise adherence is a crucial area requiring further research and the role of habit is currently under researched. Working with patients and clinicians, this PhD will explore the role of unconscious processes in habit formation and develop an intervention to harness them, in order to enhance adherence to prescribed exercise and maintain it in the longer term.

Supervisor: Dr Abdel Douiri

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Research areas/projects of interest:

- Clinical Prediction, data analytics and computer aids

- Stroke Epidemiology

- Quality improvement in healthcare

Supervisor: Professor Janet Peacock

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Research areas/projects of interest:

- Epidemiology and medical statistics

- Health services research

Supervisor: Dr Peter Schofield / Dr Jayati Das-Munshi

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Research areas/projects of interest:

- Residential instability and psychosis risk – a cross-national study using electronic health records.

Description: This PhD will use Danish population register data and UK linked psychiatric records (SLaM-BRC CRIS and census 2011) to investigate the link between residential instability in childhood and increased risk of later psychotic illness. This would suit a candidate with a strong quantitative background (e.g. statistics / epidemiology) wishing to develop expertise within data science focussing on the social determinants of severe mental illness. The studentship would include analytical methods training and time spent in the two study centres in Denmark and London.

Supervisor: Professor Stephen Sturzenbaum

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Research areas/projects of interest:

- Toxicogenomics

Description: Homeostasis of essential elements and detoxification of non-essential elements are vital drivers of wellbeing, longevity and survival. The identification and characterization of these intricate pathways form the foundations of Toxicogenomics. The outcome will provide novel insights into

pathogenesis, new methods of risk assessment, genetic risk-modifications in preventative medicine and new therapeutic targets for pharmaceutical and biological medicines. By exploiting genomic, proteomic and toxicological tools within model species (the nematode C.elegans) as well as key environment organisms (the earthworm), we aim to expand the horizon of Toxicogenomics.

- Metallobiology

Description: Forward and reverse genetic studies have allowed us to identify key players involved in toxic metal detoxification and essential metal homeostasis. Genes include cadmium-binding metallothioneins (mtl-1, mtl-2) and phytochelatin synthase (pcs-1), copper transporters (cutc-1) and zinc metalloproteinase/ transporters (neprilysins, LZTs). We are also interested in profiling the exposome via molecular genetic, biochemical, biophysical and metabolic approaches to pinpoint differences induced by exposure to heavy metals in wildype and mutant nematodes.

- Neuronal regeneration

Description: To understand neural systems, their development and regeneration, we need a versatile macro-invertebrate model that overcomes the many experimental and ethical hurdles encountered in complex vertebrates. An ideal candidate is the earthworm which is characterized by superior regenerative capacities; for example, it is capable of fully regenerating its brain within few weeks of surgically removal. A recent RNAseq experiment has identified putative molecular genetic drivers, many of which have human homologues. New knowledge gathered can thus be translated into cell culture, vertebrate models and ultimately the clinic.

Supervisor: Dr Nunzianda Frascione

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Research areas/projects of interest:

- Forensic and Analytical Science: Development of biosensors for the detection of evidence at crime scenes

- Forensic Biology – Analysis and characterization of 'Touch DNA' in criminal detection

Institute of Psychiatry, Psychology & Neuroscience

Academic Psychiatry

Supervisor: Dr Michael Craig

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Research areas/projects of interest:

- Born Bad?: Imaging the underlying causes for Criminal Psychopathy

Description: The underlying cause(s) for Criminal Psychopathy is complex but there is compelling evidence that children with severe antisocial behaviour have differences in brain anatomy and function, which increases their risk for Criminal Psychopathy in adulthood. The current project will analyse whether these brain differences are reversible by using cutting-edge brain imaging techniques to study children with severe behavioural problems before and after a well-established effective 'parent-training' intervention

- Birth of the Blues: Imaging techniques to study the foetal and neonatal brain in offspring of depressed mothers

Description: 15% of women suffer from depression during pregnancy. Further studies have found that offspring exposed to prenatal depression are vulnerable to depression across their lifespan. The Developing Human Connectome Project (DHCP) is an ambitious, world famous, multi-centred program that offers a unique opportunity to better understand this relationship by using cutting edge imaging techniques to study the (a) foetal and (b) neonatal brain in offspring of depressed mothers.

- 'Drug-Free' Antidepressants: Comparing 'standard' versus 'modified' rTMS in women with antenatal depression across the UK

Description: Most pregnant women with depression do not want to take medication due to concerns about its safety on foetal development. Repetitive transcranial magnetic stimulation (rTMS) is an effective, drug-free antidepressant treatment. However, 'standard' rTMS protocols involve attending 20-30 daily sessions, lasting 20-30 minutes, which is too long for pregnant women and too expensive for the NHS. Recent studies suggest that 'modified' rTMS using shorter 'theta-burst-stimulation' sessions, twice per day, is just as effective. The current multi-centre study will compare 'standard' versus 'modified' rTMS in women with antenatal depression across the UK.

Supervisor: Professor Paola Dazzan

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Research areas/projects of interest:

- Evaluation of early adversity and its association with persistent activation of the immune response, trajectories of brain development throughout adolescence, and onset to mental health problems

Description: Exposure to early life adversity, such as childhood maltreatment and adverse life events induces a persistent activation of the immune system. This results in raised blood-based pro-inflammatory biomarkers, which reduce neuroplasticity, leading to structural brain alterations such as prefrontal cortical thinning and activation of brain microglia cells, which are particularly evident in individuals who develop mental health problems. This Research Area will focus on the evaluation of early adversity and its association with persistent activation of the immune response and with trajectories of brain

- Evaluation of the relationship between neuroimaging measures of brain structure and peripheral markers of inflammation in patients with first episode psychosis

Description: An activation of the immune system, with an increase in circulating inflammatory markers like cytokines, has been reported in psychosis, and this activation is associated with smaller volumes of structures implicated in the pathophysiology of psychosis, such as the hippocampus. Furthermore, our data have shown that this activation is also associated with a poorer response to antipsychotic drugs. This research area focuses on the evaluation of the relationship between neuroimaging measures of brain structure and peripheral markers of inflammation in patients with first episode psychosis, and examines whether this relationships is differentially altered in patients with a poor treatment response to antipsychotics and with worse long term outcome

- Evaluation of gene expression changes, particularly immune inflammatory profile in patients with psychosis, and on the identification of specific gene expression profiles

Description: Gene expression analysis of peripheral blood microarrays could be a useful tool in detecting markers of presence and progression of a variety of neuropsychiatric diseases including schizophrenia. This Research Area focuses on the evaluation of gene expression changes, particularly immune inflammatory profile in patients with psychosis, and on the identification of specific gene expression profiles that may be different in patients and controls, and that could particularly characterise those patients most at risk of developing a poorer outcome.

Supervisor: Dr Paolo Fusar-Poli

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Research areas/projects of interest:

- Prevention of mental disorders
- Precision medicine
- Evidence synthesis

Supervisor: Dr Sara Hitchman / Professor Ann McNeill

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Research areas/projects of interest:

- Evaluating the policies of the WHO Framework Convention on Tobacco Control (FCTC) at the population level in mainland China

Description: The ITC Project is designed to evaluate the policies of the WHO Framework Convention on Tobacco Control (FCTC) at the population level. The ITC Project is conducting longitudinal cohort surveys in 29 countries and includes over 150 tobacco control collaborators. The ITC China project is a longitudinal face-to-face survey of smokers and non-smokers in China. The student will have the opportunity to complete a PhD with data from the ITC project in an area related to tobacco control that interests them and to work with international collaborators on publications.

Supervisor: Dr Ming Lim / Dr Jonathan O'Muircheartaigh

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Research areas/projects of interest:

- Developing advance imaging and neurophysiology techniques to interrogate disease mechanisms in autoimmune encephalitis

Description: See Proc Natl Acad Sci U S A. 2018 Oct 16;115(42):E9916-E9925; advanced imaging and dynamic causal modelling

Supervisor: Dr Grainne McAlonan

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Research areas/projects of interest:

- Preclinical studies of brain homeostatic mechanisms in autism (ASD).

Description: Our work suggests that the 'responsivity' of neural pathways is altered in ASD. Thus, a drug developed in a neurotypical population will work in the same way in autism. This might be why conventional treatments for mental health conditions may not work so well in ASD. In preclinical studies: We use pharmacological challenges acting on, e.g. GABA, to examine how the brain responds in ASD in vitro systems.

- Clinical studies of brain homeostatic mechanisms in autism (ASD).

Description: Our work suggests that the 'responsivity' of neural pathways is altered in ASD. Thus, a drug developed in a neurotypical population will work in the same way in autism. This might be why conventional treatments for mental health conditions may not work so well in ASD. In clinical studies: We use pharmacological challenges acting on, e.g. GABA, to examine how the brain responds in adults with ASD during functional MRI.

Supervisor: Dr Dafnis Batalle / Professor Grainne McAlonan

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Research areas/projects of interest:

- Mapping of structural and functional brain connectivity to enable the use of computational models of brain connectivity in newborn infants.

Description: State-of-the-art mapping of structural and functional brain connectivity can enable the first use of computational models of brain connectivity in newborn infants. This emerging field uses mathematical models of neuronal activity to couple MRI-derived measures of white-matter structure and correlated functional activity. As neuronal activity is fast and MRI suffers from low temporal resolution, further model refinement is possible through incorporating high temporal resolution electrophysiology (EEG). We expect that this will provide important insights into both the emergence of brain connectivity and the biological alterations which underpin neurodevelopmental impairments resulting from perinatal injury.

- The use of brain network analysis techniques ('connectomics'), machine learning and/or computational models to characterise how neonatal brain structural and functional connectivity is linked to autism spectrum phenotypes later in childhood.

Description: Genetic and environmental risk factors acting from before and shortly after birth are associated with Autism Spectrum Disorders (ASD). However, ASD is highly diverse and not everyone at-risk goes on to develop the condition. Since early interventions work best, understanding underlying mechanisms that lead to ASD and establishing who is most likely to benefit from treatment is currently one of the most important neuroscientific challenges. In this project, the student will use brain network analysis techniques ('connectomics'), machine learning and/or computational models to characterise how neonatal brain structural and functional connectivity is linked to autism spectrum phenotypes later in childhood.

Supervisor: Professor Andrea Mechelli

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Research areas/projects of interest:

- How does the urban environment affect mental health?

Description: This project will use smartphone technologies to monitor how different aspects of the urban environment affect the mental health of city-dwellers in real time. Data from the UK and China will be acquired using the Urban Mind smartphone app, which is available in multiple languages including English, Mandarin and Cantonese. The student will be able to develop and address their own research questions within the broader framework of the Urban Mind project.

Supervisor: Dr Marija-Magdalena Petrinovic / Dr Diana Cash

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Research areas/projects of interest:

- Optogenetic fMRI in a rodent model of Alzheimer's disease

Description: Using our recently established platform that combines optogenetics and fMRI, to precisely dissect neural circuits in healthy and disease-model animals, this project will aim to shed light on the brain-wide consequences of AD pathology, in a novel rat model of AD (Cohen et al., J Neurosci., 2013, 33:6245). In particular, the focus will be on memory and learning pathway and the responses (visualised by fMRI) to optogenetic induction of LTP and LDT in the hippocampal-cortical-amygdala networks

- Mechanisms and biomarkers of autism

Description: Given the worldwide increase in autism, effective interventions are urgently needed. This is however hampered by our poor understanding of causal mechanisms. In our translational research, we combine human and rodent studies to elucidate the neurobiological underpinnings of autism. We use MRI as a translational tool to examine the brain structure, function and biochemistry in patients and then establish whether these findings can be recapitulated in rodents carrying the same mutation. This back-translation into animal models coupled with cutting-edge methods (e.g. CLARITY, optogenetics, electrophysiology) will allow us to identify the cellular and neural circuit basis of brain deficits and generate novel treatment targets.

Supervisor: Dr Marija-Magdalena Petrinovic / Dr Nigel Blackwood

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Research areas/projects of interest:

- Aggression in neurodevelopmental disorders

Description: Aggression is common among individuals with neurodevelopmental disorders (NDDs) such as autism, ADHD, schizophrenia. Aggression has a serious negative impact on both affected individuals and their families-yet we lack effective treatments. Given the worldwide increase in the incidence of NDDs, effective treatments are urgently needed. We combine human and rodent studies to examine neurobiological underpinnings of NDD-associated aggression. We aim to define the brain systems involved in aggression in NDD patients and then establish whether these signatures can be recapitulated in rodents carrying the same mutations. Work on animal models will allow us to identify the cellular basis of aggression and generate novel treatment targets

- Neuroimmune mechanisms of autism-associated aggression

Description: Majority of individuals with autism show aggressive behaviour. Aggression has a serious negative impact on both affected individuals and their families-yet we lack effective treatments. Increasing evidence suggests that neuroimmune interactions are involved in autism-associated aggression. Individuals with aggressive traits display heightened inflammatory cytokine levels and dysregulated immune responses. Immunological dysfunction has also been a recognized feature of autism. Another link between ASD and aggression is serotonin which may serve as a link between the brain and the immune system. We will combine human and rodent studies to examine the causative role of the nervous/immune system interaction in autism-associated aggression

Supervisor: Professor Sukhi Shergill

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Research areas/projects of interest:

- Temporal associations between psychotic symptoms and real-life social interaction

Description: Impairments in social functioning are a core feature of schizophrenia. They are associated with deficits in social cognition and reflected in illness symptoms, in particular paranoid delusions, as well as in diminished brain activation in the social brain network. Successful social interactions require the ability to evaluate others' social signals. Yet, until recently, research did not study the interactive nature of social relationships. We aim to unravel the temporal associations between psychotic symptoms and real-life social interaction and to investigate whether stimulation to social brain areas leads to improved trust and reduced symptoms within social interactions through improved social cognition.

- Optimizing trans-cranial direct current stimulation by combining it with real-time neuroimaging and machine learning: Neuroadaptive Bayesian Optimisation (NBO).

Description: Schizophrenia is associated with deficits in executive function, limiting functional outcome. Non-invasive trans-cranial direct current stimulation (tDCS) is a promising intervention. However, successful clinical translation of tDCS depends on optimal neurostimulation parameters which are unknown and vary across individuals. tDCS is most effective when used with a cognitive task that drives the underlying neural system, facilitating learning; again, the optimal cognitive task is not known. We aim to optimize tDCS by combining it with real-time neuroimaging and machine learning: Neuroadaptive Bayesian Optimisation (NBO). tDCS/NBO will be used to find optimal cognitive task and stimulation parameters for individual patients.

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Research areas/projects of interest:

- The English and Romanian Adoptees study: brain structure and function

Description: In the English and Romanian Adoptees study we are examining the effects of severe adversity on the development of children who spent their early years in the brutally depriving institutions in Romania in the 1980s. They were then adopted by UK families as young children. Now in their late twenties, the deprived individuals have been assessed at ages 6, 11, 15 and 25. Clinical, neuropsychological, brain imaging and genetic data have been collected. Findings from this study have fundamentally transformed our understanding of the effects of early experience on human development and will continue to make a seminal contribution.

- The English and Romanian Adoptees study: the role of genetics

Description: In the English and Romanian Adoptees study we are examining the effects of severe adversity on the development of children who spent their early years in the brutally depriving institutions in Romania in the 1980s. They were then adopted by UK families as young children. Now in their late twenties, the deprived individuals have been assessed at ages 6, 11, 15 and 25. Clinical, neuropsychological, brain imaging and genetic data have been collected. Findings from this study have fundamentally transformed our understanding of the effects of early experience on human development and will continue to make a seminal contribution.

- The English and Romanian Adoptees study: clinical outcomes

Description: In the English and Romanian Adoptees study we are examining the effects of severe adversity on the development of children who spent their early years in the brutally depriving institutions in Romania in the 1980s. They were then adopted by UK families as young children. Now in their late twenties, the deprived individuals have been assessed at ages 6, 11, 15 and 25. Clinical, neuropsychological, brain imaging and genetic data have been collected. Findings from this study have fundamentally transformed our understanding of the effects of early experience on human development and will continue to make a seminal contribution.

Supervisor: Professor Andre Strydom

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Research areas/projects of interest:

- The excited / inhibited brain

Description: There is increasing interest in excitation/ inhibition imbalances (affecting synapses and neurotransmission) in neurodevelopmental disorders such as Autism. This project will use existing EEG data from individuals with Autism (with excess excitation) and Down syndrome (with excess inhibition) to explore existing and novel markers of E/I status, then test the hypothesis that E/I imbalance is driven by different underlying mechanisms in these Neurodevelopmental disorders. The student will attain analysis and programming skills, and could learn to collect and process EEG data from research participants.

- Odd-ball memories

Description: Event-related potentials (ERPs) are used in EEG to relate sensory stimuli to brain responses; one type of ERP experiment uses an auditory paradigm (a person listens to repeated sounds, with an “odd” sound every now and again to break the pattern) as a potential measure of memory. The student will use existing EEG recordings of ERPs in individuals with Down syndrome and relate these to cognitive abilities (including memory). Longitudinal EEG data from DS individuals will then be used to track ageing-related changes as markers of Alzheimer’s disease; student will attain EEG analysis/ programming / research skills.

- Brain fingerprinting

Description: Individuals with Down syndrome have unusual brain features (e.g. brachycephaly) which means that MRI scans are often difficult to interpret while "normal" MRI brain templates are difficult to apply. For this project, the student will use existing MRI data from Down syndrome individuals to explore a morphometric segmentation approach to identify a DS brain "fingerprint" and develop accurate brain and intracranial masks, then use standardised measures to identify early signs of Alzheimer's disease in DS individuals (e.g. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3153069/). The student will attain MRI analysis & data management skills.

Supervisor: Dr Paolo Deluca

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Research areas/projects of interest:

- Implementation of wearable alcohol sensors for improving clinical outcomes.

Description: This study will look at the feasibility of using novel wearable alcohol sensors in clinical and non-clinical populations to monitor and reduce alcohol consumption and alcohol related harms. New wearable devices are coming to market which can be worn on the wrist, are discreet, and provide accurate measurement of blood alcohol concentration. Such methods hold promise to significantly improve users' engagement with a monitoring app and likewise clinicians' ability to accurately assess alcohol consumption, understand the determinants of risky drinking, and trigger real-time interventions.

- Exploring the availability of Novel Psychoactive Substances and other substances over the Internet.

Description: There are numerous online recipes for tampering with medicines, plants, seeds and synthesise at home psychoactive compounds. This study will identify twenty most common recipes and assess them (e.g. for their tampering potential) both via qualitative work with users as well as in lab for purity/impurity using liquid chromatography and tandem mass spectrometry (LC–MS/MS). Other examples of recipes might include extracting mescaline from cacti, DXM dextromethorphan from cough syrup (Robitussin), Opium from Poppy seeds, etc.

Neuroscience

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Research areas/projects of interest:

- Study of the molecular and cellular mechanisms of direct lineage reprogramming of glia into neurons using state-of-the-art single cell transcriptomics

Description: The objective is to delineate the intermediate states through which glial cells must pass while converting into induced neurons following expression of reprogramming factors (e.g. neurogenic transcription factors), and to identify key molecular players that are responsible for reprogramming success or failure.

- Study of the epigenomic basis of glia-to neuron reprogramming using state-of-the art epigenomics

Description: This project aims at uncovering the epigenetic mechanisms that drive chromatin remodelling as well as the remodelling of global nuclear organisation, e.g. of chromosome topology during cell fate conversion. This project also aims at establishing a link between chromatin remodelling and the biomechanical properties of the nucleus as reflected by the dramatic shrinkage in nuclear size during early stages of reprogramming.

- Study of the functional integration of induced neurons derived from reprogrammed glial cells in vivo using rabies virus tracing

Description: This project aims at revealing the input connectome of induced neurons in the cerebral cortex of postnatal mice as well as defining their functional output using optogenetics combined with in vivo calcium imaging. Chronic 2-photon imaging will be used to study long-term survival of induced neurons and its regulation in vivo

Supervisor: Dr Diana Cash

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Research areas/projects of interest:

- Predicting brain age in rodents by deep learning from structural MRI

Description: We will train a 3D Convolutional Neural Network (3D-CNN) to estimate ‘brain age’, based on the longitudinal MRI data from rats that were serially imaged between young adulthood

and old age (3 & 18 months) using methodology similar to Cole et al. (Neuroimage 163:115, 2017). The trained 3D-CNN will then be tested for its ability to estimate brain age in experimental rat models of healthy and unhealthy ageing - e.g. model of 'healthy lifestyle' with dietary restriction and environmental enrichment, or a transgenic model of Alzheimer's disease.

- Biomarkers of brain connectivity from structural and functional networks in a mouse model of frontotemporal dementia (FTD).

Description: A large cohort of FTD model mice and controls (n » 110) will be serially imaged from young to old age using functional (resting state) and structural MRI. These images will be used to train a combination of Convolutional Neural Networks (for structural image classification), Long Short-Term Memory networks and dynamic causal models (for functional network classification) in order to create mechanistic biomarkers based on machine learning, for classifying brains into normal or diseased (i.e. dementia+) and to predict evolution and intervention outcomes.

Supervisor: Dr Alessio Delogu

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Research areas/projects of interest:

- Brain circuitry regulating mood
- Thalamic inhibition in sensory perception
- Regulation of sleep and wake

Supervisor: Professor Diane Hanger

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Research areas/projects of interest:

- Disease-associated changes in tau

Description: Disease-associated changes in tau, a constituent protein of the neurofibrillary tangles that characterise Alzheimer's disease and the tauopathies. We are investigating the effects of phosphorylation of tau on tau function that are implicated in human tauopathies. This work includes identifying the effects of different candidate protein kinases in relation to the development and progression of human neurodegenerative disease. We are also studying the relationship of tau

release from neurons with neurodegenerative disease. See Guo et al., 2017, Pooler et al, 2013 and Hanger et al., 2009.

- Effects on axonal transport of disease-associated proteins and mitochondria in cell and animal models of neurodegenerative disease

Description: Effects on axonal transport of disease-associated proteins and mitochondria in cell and animal models of neurodegenerative disease. Axonal transport is a critically important molecular processes that is dysfunctional in several different neurodegenerative diseases, including Alzheimer's disease. Disrupted axonal transport can lead to the build-up of aggregated proteins that damage neurons. We use live-imaging of cultured neurons to investigate disease-associated alterations in axonal transport. See Bondulich et al., 2016; Rodriguez-Martin et al., 2016; and Rodriguez-Martin et al, 2013.

- Proteostasis and factors affecting protein aggregation in relation to damage to synapses in neurodegenerative disease

Description: We are investigating proteostasis and factors affecting protein aggregation in relation to damage to synapses in neurodegenerative disease. Synaptic dysfunction is one of the best correlates with disease progression in Alzheimer's disease and related disorders. Hence, it is important to understand the molecular mechanisms that when disrupted, lead to the loss of healthy synapses and the demise of neurons in dementia and other neurodegenerative disorders. We are investigating these processes in relevant cell and animal models of disease developed in our lab. See Bondulich et al., 2016 and Pooler et al., 2014.

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Research areas/projects of interest:

- How the CNS translates sensory input into a behavioural output.

Description: My lab is interested in how the CNS translate sensory input into a behavioural output. We use olfaction (sense of smell) to understand the neural computation underlying chemotaxis which is the ability of any organism to use an odour gradient as a guide to find the source of the odour. The olfactory system is highly conserved across species and we use Drosophila to investigate the function of different neural components in the chemotaxis pathway. The advantage of the genetically amenable Drosophila organism is that we have a range of tools that allow us to probe neural connectivity and functionality at a level of detail that is not available in the vertebrate system. We use a combination of gain and loss of neural function and functional imaging to address how different component of the olfactory system modulate downstream neural pathways in the control of chemotaxis. We compliment the in-vivo functional description of neural modulation with optogenetic tools and behaviour to address the functional relevance of our data. Ultimately our goal is to describe the neural pathway that link higher olfactory processing centres to motor circuits in the nerve cord and understand how olfactory information is transformed across the circuit.

- Understanding the neural mechanism underlying outcome specific conditioned inhibiti2. Learning and memory underlies the ability of animals to adapt to novel environmental cues and experiences. Our lab is particularly interested in understanding the neural

Description: Learning and memory underlies the ability of animals to adapt to novel environmental cues and experiences. Our lab is particularly interested in understanding the neural mechanism underlying outcome specific conditioned inhibition. This is a type of choice behaviour where animals learn when a given stimuli is not associated with a reward or punishment and therefore choose not to pursue in innately attractive cue which in effect becomes repulsive. Little is known about the neural circuit that controls this type of behaviour and we are using the Drosophila larvae to gain insight into basic principles of conditioned inhibition. Specifically, we want to understand the neural switch that makes an innately attractive cue repulsive. We have identified the neural components underlying this switch and this project will use a combination of optogenetic tools, functional imaging and behaviour assays to elucidate the neural mechanism underlying the switch.

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Research areas/projects of interest:

- Role of alternative splicing in developing neurons

Description: The nervous system is known to express a large collection of alternatively spliced RNA isoforms, but how this diversity contributes to emergence of individual neuronal identities remains poorly understood. The proposed project will address this important question by focusing on GABAergic interneurons, a heterogeneous group containing >20 distinct categories. We will use a combination of bioinfomatics and experimental approaches including various splicing assays and overexpression and CRISPR-Cas knockouts of critical splicing regulators in vitro and in vivo.

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Research areas/projects of interest:

- Functional contribution of long noncoding RNAs to cell differentiation

Description: Cell differentiation relies on extensive changes in gene expression affecting both protein-coding and noncoding RNAs. We have recently identified a new class of long noncoding RNAs (lncRNAs) enriched in short tandem repeats (STRs), multiple iterations of 2-12 nucleotide-long “words”. We now propose to elucidate the role of STR-lncRNAs in acquisition and maintenance of

cell identity by examining their expression dynamics in progenitor cells undergoing neural differentiation and addressing functional consequences of these changes using appropriate research techniques.

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Research areas/projects of interest:

- Can deep learning algorithms automate the analysis of reach-and-grasp by lab rodents when testing therapies for stroke?

Description: Thousands of research labs worldwide use mice and rats to assess new therapies for CNS injury. However, behavioural assessment of rodents is very time consuming and expensive. The PhD student will use machine learning (DeepLabCut) to automate the kinematic analysis of reach-and-grasp by mice after treatment using a novel therapy for brain injury (stroke) based on movies captured by a new device: https://sotiriskakanos.com/category/mousebot/

- Using deep learning algorithms to analyse recovery of walking by lab rodents when testing therapies for stroke.

Description: Thousands of research labs worldwide use mice and rats to assess new therapies for CNS injury. The "horizontal ladder task" is often used but it takes many hours to analyse accuracy of foot placement from videos played in slow motion. https://www.jove.com/video/1204/the-ladder-rung-walking-task-scoring-system-its-practical. The PhD student will use machine learning (DeepLabCut) to automate the identification of paws and limb joints during walking on the ladder for marker-less kinematic analysis

Supervisor: Dr Rosalyn Moran / Professor Sukhi Shergill

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Research areas/projects of interest:

- A New AI – Brain-Based Artificial Intelligence from Active Inference

Description: Recent advances in artificial intelligence are owed in large part to deep convolution and reinforcement learning – information processing architectures that are found in real nervous systems. A recent theory on brain function, known as Active Inference (the 'new AI'), incorporates probabilistic reasoning and optimization using a top-down hierarchical structure – which may be more readily mapped to human cortical architectures. In this project, we will implement biophysical

architectures inspired by the human brain to perform machine learning tasks and compare to other ML algorithms

- Mechanisms of Aberrant Learning and Inference in Schizophrenia

Description: Altered neurochemical and connectivity profiles are pathological hallmarks of schizophrenia. How these elements contribute to the core symptomatic deficits (classified as 'positive', 'negative' and cognitive) however remains unknown. In this project we will focus on how cognitive disruption is manifest in neural circuits and how computational models of behaviour can be used to deconstruct core 'algorithmic' deficits. The project will include the development of mathematical models of behaviour and the mapping of computational processes to neural processing using fMRI imaging data

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Research areas/projects of interest:

- Non-autonomous control of neural tumour growth

Description: We have developed novel genetic tools in Drosophila for large-scale studies of extrinsic effects on deleterious phenotypes, such as neural tumours. Our tools open up efficient genome-wide screening of a kind not possible before: determining non-autonomous effects of genetic manipulations outside the phenotype domain (eg. tumour) by means of a single cross. We wish to find how we might manipulate glia to make neural tumours bigger or smaller, in order to understand its biology and find potential therapeutic targets.

- Regulation of neural stem cell quiescence by nucleoporins

Description: Stem cells undergo periods pf reversible cell-cycle arrest, termed quiescence. Quiescent neural stem cell (NSC) regulation affects learning, memory, mood, tissue homeostasis and regeneration, yet is poorly understood. We have found that perturbation of nucleocytoplasmic transport components affects NSC quiescence, that levels and stoichiometry of Nucleoporins (nuclear pore constituents) differ between quiescent and active NSCs, and cargo that is differentially partitioned between nucleus and cytoplasm in quiescent versus active NSCs. We aim to enquire whether Nucleoporins present specificity in this cargo regulation.

- Regulation of neural stem cell quiescence by the cytoskeleton.

Description: Fly NSCs change shape dramatically upon entry into quiescence, extending a cellular extension of unknown function. In mice, related shape alterations have been reported but remain controversial as NSCs can also divide whilst harbouring extensions; notwithstanding, induction of quiescence in mouse NSC in vitro increases shape complexity. We aim to discover how quiescence induction leads to NSC shape changes and, reciprocally, how cytoskeletal reconfiguration might itself regulate quiescence/activation?

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Research areas/projects of interest:

- The role of FET family members at the synapse

Description: RNA binding proteins have been linked to several neurodegenerative disorders and amongst these the family of FET proteins (FUS, EWS and TAF15) has been linked to both amyotrophic lateral sclerosis and frontotemporal dementia. We have recently identified the presence of all 3 members of the family at the neuromuscular junction and synapse though their functions are unclear. We are looking to identify the role of these proteins at the synapse to understand how they contribute to disease.

- The neurodevelopmental role of neurodegenerative proteins

Description: Many of the proteins involved in amyotrophic lateral sclerosis and frontotemporal dementia have been shown to have roles in neurodevelopment. However, the effect of mutations in these proteins on the development of the nervous system has not been investigated. We are looking to establish the expression pattern of wildtype and mutant versions of proteins as the nervous system develops to identify key early changes that precede symptom onset.

- Investigating tissue specificity in neurodegeneration

Description: Using slice cultures from mouse models, we are interested in identifying why certain cell types are resistant to cell death compared to others. Slice cultures can be prepared from the cortex, hippocampus, spinal cord and cerebellum of ALS-FUS mice and we are looking at how the cortex and spinal cord differ that makes them more vulnerable to cell death. In particular we are investigating how post-translational modification of FUS and related proteins might alter between the different tissues.

Psychology & Systems Sciences

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Research areas/projects of interest:

- Psychological interventions for people with psychosis

- Cognition and Social Cognition in Psychosis

- Digital interventions for mental health problems using Virtual Reality, mobile devices and wearables devices

Supervisor: Dr Jayati Das-Munshi

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Research areas/projects of interest:

- Physical health in depression: understanding pathways to mortality

Description: People with depression experience an elevated mortality risk. Factors which may underlie this could relate to the patterning of adverse health exposures over the life course and the role of concentrated social disadvantage in accounting for increased/ shared risks. This project will utilise nationally representative UK datasets to better understand aetiological mechanisms relating to the association of depression with mortality and physical health outcomes. This project would suit a student with good Masters-level training in epidemiology, statistics, public health or a related data sciences background.

- Residential instability and psychosis risk- a cross national analysis using electronic health records

Description: There may be strong social risks for the onset of psychosis, particularly those experienced in late adolescence/early adulthood, when the developing brain is more prone to environmental insults. Residential instability in late adolescence may be associated with later psychosis risk. Using large linked datasets from the UK and Denmark, this study will permit an analysis on residential instability and other predictive factors related to moves (e.g. childhood adversity/ familial instability), to assess possible causal pathways for increased psychosis risks. This

project would suit a student with good Masters-level training in epidemiology, statistics, public health or related data science disciplines.

- Neighbourhood/ socioenvironmental predictors for outcomes in psychosis

Description: The course and outcome of severe mental illness may be predicted by the socioenvironmental characteristics of where people reside. It has previously been suggested that recovery in psychosis may be poorer when people reside in areas where they are socially isolated. Through a novel data linkage utilising mental health records and UK census data, this project will seek to determine the association of neighbourhood-level and individual-level factors with severe mental illness outcomes such as recovery, employment, admissions and mortality. This project would suit a student with good Masters-level training in epidemiology, statistics, public health or related data science disciplines.

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Research areas/projects of interest:

- Sedentary behaviour & physical activity in the workplace.

Description: Exploring interventions to support home based workers.

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Research areas/projects of interest:

- Organisational Resilience in healthcare

Supervisor: Dr Rosa Hoekstra

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Research areas/projects of interest:

- Developing autism measures that can be applied in low-income and non-Western settings

Description: Existing measures for autism have all been developed in high-income and primarily Western countries. There is a need for autism measures that can be applied in low-income and non-Western settings (Durkin et al., 2015). Students interested in the validation of Chinese instruments aiding the screening and diagnosis of autism in China are encouraged to apply. Alternatively a cross-cultural study could be conducted, comparing autistic traits in China and the UK. Through both types of project the student will gain a deep understanding of the behavioural and cognitive characteristics of autism and how cultural factors might affect these symptoms (under prime supervision of RAH) and learn and apply a range of state-of-the-art statistical techniques, under main supervision of Dr Ioannis Bakolis.

Supervisor: Professor Jonna Kuntsi

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Research areas/projects of interest:

- Developing remote assessment and monitoring technology for ADHD

Description: Remote technology is changing the way in which many conditions are assessed and managed, with King's investigators leading international developments in relation to disorders such as depression, epilepsy and multiple sclerosis (RADAR-CNS.org; RADAR-Base.org). Benefiting from the RADAR-based platform developed at King's, we propose to develop a remote assessment battery for attention-deficit/hyperactivity disorder (ADHD) that incorporates active (questionnaires, cognitive tasks) and passive (activity) monitoring using mobile and web technologies. After development and piloting, the measures will be used to track developmental changes in symptoms, impairments and health behaviours in adults with ADHD, and to identify predictors and markers of long-term outcomes.

Supervisor: Professor Sabine Landau

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Research areas/projects of interest:

- Causal modelling and evaluation

Description: We are looking for mathematicians, engineers, cardiologists and/or physiologists to join our team, and to build the vision of a personalised in-silico cardiology.

- Generalisability of findings from clinical trials

Description: Generalisability of findings from clinical trials: Clinical trials have been criticised for providing results that are internally valid, that is they are not subject to bias, but are not generalisable to the patient population which clinicians or other medical decision makers are interested in. In other words the findings lack external generalisability. Projects in this area will explore whether trials can be combined with observational data sources, e.g. from the local electronic medical health record system for mental health service users, to provide results that are internally as well as externally valid.

- Individual participant meta-analysis

Description: Individual participant meta-analysis: Individual participant data (IPD) can be pooled across different data sources, e.g. across different trials, to provide the best summary of the existing evidence as well as to address new research questions. One of the major reasons for performing IPD meta-analysis is to investigate whether the effects of treatments or risk factors depend on characteristics of the patients (moderation). The approach can also help to gain further insights into how effects come about (advanced mediation modelling). Projects in this area will further develop IPD meta-analysis approaches and apply them to fill knowledge gaps in mental health.

Supervisor: Dr Grainne McLoughlin

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Research areas/projects of interest:

- Attention in ADHD and ASD

Description: The co-supervisors and I have already published extensively on attentional impairments in attention deficit/hyperactivity disorder (ADHD) and autism spectrum disorders (ASD) and the general population. A particular interest is in theta (7Hz) signals. We have previously shown that the timing of theta signalling is impaired in ADHD. We do not know if that is also the case in ASD and further we do not know whether this impairment extends to adulthood.

- Deep learning of EEG data

Description: In total, we have 3600 EEG datasets. Such a large amount of data would benefit from the neurocomputational expertise available at the Center for Information and Neural Networks (CiNet), Osaka University, Japan. An exciting outcome of such analysis would be whether we could classify ADHD and ASD using EEG data. Ideally, we would use independent component analysis (ICA) to identify EEG signals in the first instance. We have shown that this is a useful approach in our previous work.

- The genetic relationship between emotion and ADHD and ASD and social adjustment in young adulthood

Description: In addition to the large amount of EEG data available on 600 twins, we also have interview and questionnaire data. Many of those with ADHD and ASD may never leave the parental home, they have high university drop-out and may fail to form meaningful relationships outside of their families or hold down a job consistently. Analysis of the genetic aspects of social cognition should provide insights into the impact of such impairments on the outcomes of these disorders

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Research areas/projects of interest:

- Understanding mental and physical health care pathways and clinical outcomes in older adults with multimorbidities

Description: In this studentship the student will explore care pathways through primary and secondary care data linkages and CogStack, a novel data analytics infrastructure applied to electronic health records. In this studentship, the PhD student will have the opportunity to use state-of-the art data analytics applied to electronic records, in order to develop a comprehensive understanding of care pathways and outcomes for frail older patients accessing a liaison service at King's College Foundation Trust (KCH) using a clinical analytics system (Cogstack) with algorithmic semantic processing of unstructured text. The PhD candidate will use CogStack to perform a detailed analysis of patient pathways and outcomes of older patients with multimorbidities. The student will explore the correlation between care pathways and specific outcomes. The range and diversity of disorder of older adults presenting to services may require the student to bundle diagnoses and outcome measurements together into streamlined pathways.

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Research areas/projects of interest:

- Estimating the economic cost of care and clinical outcomes in people with dementia.

Description: In this studentship the PhD student will use Clinical Records Interactive Search (CRIS) to explore care pathways, service use patterns, cost of care and health outcomes for people with dementia. The CRIS database provides an important resource to improve our understanding of the experiences of people with dementia. Until now and without the use of CRIS it has been impossible to fully understand the types of health and mental health problems people with dementia present with, and their health outcome. For people with dementia with multimorbidity, there is a further complication of being under several possible pathways. In the UK context the links between pathway, outcome and costs are not well developed, and these may be the next step of pathway development in dementia care. Another important aspect of CRIS is the link it provides with other anonymised datasets. For example, a link has been established with acute general hospitals and this enables us to look at the impact neurological conditions such as dementia, and treatment may have on physical health. For instance, research suggests that people with dementia are more likely to be hospitalised for falls, urinary tract infections and bacterial pneumonia—that could have been managed with timely outpatient care. The student will be able to explore if this occurs in a much larger linked health database. The PhD student will have the opportunity develop a comprehensive understanding of care pathways and outcomes for people with dementia and explore the correlation between care pathways and specific outcomes using time series analysis and network analysis.

Supervisor: Dr Ted Barker

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Research areas/projects of interest:

- Child development
- Social, behavioural and emotional development
- Developmental psychopathology

Supervisor: Dr June Brown

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Research areas/projects of interest:

- Loneliness and distress among university students

Description: There is considerable concern about rising stress among university students. University counselling services are reporting dramatic increases in demands for their services. Loneliness has been identified to be the strongest predictor of distress in university students and found to be a risk factor for depression. However, there is social stigma about loneliness, making it hard for students to admit to being lonely. Social group memberships may prevent against future depression as well as alleviate depressive symptoms.

Supervisor: Dr Qazi Rahman

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Research areas/projects of interest:

- Psychobiology and biological basis of human sexual orientation

Description: Quantifying genetic, neurodevelopmental, hormonal, neurocognitive, and psychosocial factors in the development of sexual orientation. Methods include twins, cognitive testing, and longitudinal cohort data analysis

- Lesbian, gay, and bisexual (LGB) mental health using quantitative and longitudinal approaches

Description: Twin genetic and other biological approaches in interaction with social factors

Supervisor: Dr Katharine Rimes

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Research areas/projects of interest:

- Psychological processes involved across mental health conditions; in other words, transdiagnostic processes such as self-criticism, self-esteem, perfectionism, shame, self-compassion

- Psychological processes involved in the impact of stigma / discrimination (e.g. about one's sexual orientation, gender, race or ethnicity, appearance, experience of mental or physical illness etc.) on mental or physical health

- Psychological interventions to help people maintain self-confidence and well-being in the context of having one or more characteristic associated with prejudice or discrimination

Supervisor: Professor Gunter Schumann

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Research areas/projects of interest:

- Assessing environmental influences related to urban and rural living, and related economic changes that affect young people's mental health and wellbeing in India, China and Europe

Description: We will develop, validate and translate a paradigmatic and clinically relevant approach to refine classification of psychiatric morbidity within and across diagnoses. Using large-scale data from large scale patients and population-based cohorts, we shall relate clinical symptoms to shared quantifiable neurobehavioural mechanisms, integrating neuroimaging, environmental and multi-modal -omics data, enabling stratification and therapeutic manipulation of core psychopathology. Our approach aims at refining psychiatric classification by characterising neurobehavioural symptom clusters that are caused by shared common neural mechanisms, thus helping to overcome heterogeneity and comorbidity in psychiatric diagnostics

- Refining classification of psychiatric morbidity within and across diagnoses

Description: We work to comprehensively assess environmental influences related to urban and rural living, and related economic changes that affect young people's mental health and wellbeing in India, China and Europe, and investigate their interaction with biological factors. Our research aims to develop precision medicine approaches taking into account culturally and regionally sensitive lifestyle and environmental measures to identify stratification markers and develop targeted interventions that are adapted to local psychosocial, socio-cultural and environmental conditions. To achieve this goal, we will analyse Neuroimaging genetics data and comprehensive environmental characterization, including remote sensing satellite data to capture measures of the physical environment relating to urbanisation

The Dickson Poon School of Law

Supervisor: Professor Robert Blackburn QC

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Research areas/projects of interest:

Comparative constitutions

Supervisor: Professor Ben Bowling

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Research areas/projects of interest:

- Transnational policing

Description: This is my main specific area of interest and the subject of three recent books and numerous articles. This would include legal theory concerning the relationship between different police forces around the world, empirical work on bilateral and multilateral agreements, the work of Interpol and overseas liaison officers.

- Policing and law enforcement

Description: This is a general area of interest and is the subject of a forthcoming monograph (The Politics of the Police 5th edition). I am happy to consider applications in any area of research on the police, policing and law enforcement.

- Technology in policing in crime control

Description: This is a growing area of interest and includes the applications of technology to the police functions of surveillance, investigation, prosecution and punishment. I am particularly interested in the development of such technologies as artificial intelligence in the field of predictive policing, body worn video and facial recognition.

Supervisor: Dr Leslie-Anne Duvic-Paoli

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Research areas/projects of interest:

- International and transnational environmental law

Description: Research areas include: climate law and governance, the law of energy transitions, water-food-energy governance and maritime affairs

- Public international law

Description: Research areas include: international dispute settlement and international organisations

Supervisor: Dr Ozlem Gurses

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Research areas/projects of interest:

- Insurance Law
- Reinsurance Law
- Contract Law

Supervisor: Dr Perry Keller

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Research areas/projects of interest:

- Legal aspects of data privacy, data security and data protection
- Legal issues concerning the regulation of cross border flows of personal data
- Legal aspects of information access rights and public disclosure duties

Supervisor: Dr Alessandro Spano / Professor Andrea Biondi

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Research areas/projects of interest:

- International Trade and Investment.

Description: International trade and investment agreements, competition law, WTO law

- Chinese law

Description: Trade, competition, Intellectual Property Rights protection, company law

- Banking and Financial Law:

Description: Fintech, smart contracts, financial services, banking law

Florence Nightingale Faculty of Nursing, Midwifery & Palliative Care

Adult Nursing

Supervisor: Dr Maria Duaso

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Research areas/projects of interest:

- Developing a digital smoking cessation intervention for Chinese fathers.

Description: China has the largest number of tobacco smokers in the world and the majority of smokers are men (52.9% of adult men smoke, compared to 2.4% of adult women). Life course events such as becoming a father are ideal opportunities to promote smoking cessation and reduce second hand exposure to tobacco smoke of the mother and child. The proposed PhD study will aim to develop and evaluate in a small feasibility trial a digital intervention to help Chinese fathers stop smoking tobacco, following the MRC guidelines for complex interventions.

Supervisor: Professor Angus Forbes

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Website: https://kclpure.kcl.ac.uk/portal/angus.forbes.html

Research areas/projects of interest:

- An exploratory study or a feasibility RCT addressing the pre-pregnancy care of women with Type 2 Diabetes in a Chinese context.

Description: Diabetes pregnancies are associated with adverse maternal and fetal outcomes and women with Type 2 diabetes (T2DM) and are accounting for an increasing proportion of the women entering pregnancy with diabetes. To attenuate these risks guidelines recommend that women have pre-pregnancy care (PPC) which should include: intensifying glucose control; high dose folic acid; stopping teratogenic medications; and assessing pregnancy intentions. Currently, few T2DM pregnancies comply with these guidelines, increasing the risk of adverse pregnancy outcomes and care costs. Hence, effective care models are needed to improve the reproductive support provided to this increasing population. To address this need we will develop a multimodal intervention delivered through primary care. We would like to run a project in China, that considers: • The prevalence of T2DM in the childbearing age population; • The incidence of pregnancy in women with Type 2 diabetes; • The current pre-conception and reproductive health support they receive.

Supervisor: Professor Christine Norton

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Research areas/projects of interest:

- Optimising management of fatigue, pain and urgency in people with Inflammatory Bowel Disease (IBD)

Description: We have a large programme of research in this topic. These symptoms are very common and often unexplained when IBD is in remission. It is envisaged that a PhD student will explore the value of investigations and conservative interventions in improving these symptoms. The PhD will involve quantitative and qualitative methods and health economics and provide an excellent training in multiple research methods.

- Investigating the role of stress at the time of new diagnosis of Inflammatory Bowel Disease (IBD)

Description: A survey will follow people for the first year of IBD, attempting to untangle cause and effect of stress. If we can identify the role of stress and what people feel would be helpful, we shall later be able to design support for people that should help them to live well with the diagnosis, and hopefully help prevent development of major problems such as anxiety and depression.

Supervisor: Dr Wladyslawa Czuber-Dochan / Professor Christine Norton

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Research areas/projects of interest:

- Designing and testing a range of self-care activities, physical and psychological to reduce fatigue for people with chronic health conditions

Description: Fatigue is frequently reported symptom by people affected by chronic conditions, such as cancer, multiple sclerosis (MS), rheumatoid arthritis (RA) or inflammatory bowel disease (IBD). In the literature fatigue description and its experience has been demonstrated to have many similarities with many same or similar factors aggravating fatigue, e.g. stress, anxiety and depression, poor sleep, lack of support. However, there is a limited evidence regarding effective fatigue management methods. There is a need to design and test a range of self-care activities, both physical (e.g. rest, sleep, exercise, balanced diet) and psychological (e.g. stress reduction, positive thinking) to reduce fatigue.

Supervisor: Dr Andreas Xyrichis

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Research areas/projects of interest:

- Improving quality & safety of healthcare in China through team-based practice: an in-depth study of barriers and facilitators.

Description: Team-based healthcare is promoted among Western countries as one of the most promising interventions for improving the quality and safety of healthcare, however little is known about how this applies in the context of China. A study is proposed to identify the social processes and context specific factors that foster or hinder team-based practice in the Chinese healthcare system, with a view to developing evidence-based policy recommendations.

- The effectiveness of behavioural support plans for the reduction of restrictive practices in older persons wards in China: a randomised clinical trial

Description: In the UK, there have been increasing calls for reducing unacceptably high incidences of restrictive practices in healthcare such as use of physical or chemical restraints for patients exhibiting behaviour deemed to be challenging. Recent discussions at King's College London with senior nurses from China show this to be a shared concern, especially in older persons wards, but currently little is done to address this in the Chinese context. Behavioural support plans are gradually being implemented in UK healthcare with suggestive evidence of cost-effectiveness, but translation of these in other countries has not yet been explored. With a backdrop of a rapidly ageing population in China and suggested engrained restrictive attitudes among healthcare professionals, this study will examine the transferability and effectiveness of behavioural support plans for reducing incidences of restrictive practices in older persons wards in China.

- Is a noise-reduction protocol effective in improving inpatient sleep and overall satisfaction with hospital care? A randomised clinical trial.

Description: Patient surveys from the US and the UK over the past decade reveal dissatisfaction with hospital noise to be a persistent and worsening problem. The negative effects of high noise levels on physical and mental health are well documented, but progress in improving the hospital soundscape remains slow. Small studies have shown noise reduction protocols to hold promise at reducing hospital noise but randomised clinical trials to generate strong evidence of effectiveness are lacking. In the context of wider movements in China for improving the quality of hospital care, this study proposes the co-design and examination of the effectiveness of a noise-reduction protocol in inpatients units in China.

Cicely Saunders Institute of Palliative Care, Policy & Rehabilitation

Supervisor: Dr Wei Gao

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Research areas/projects of interest:

- Palliative and end of life care – routine/big data based observational studies and/or comparative effectiveness studies.

- Public health intervention/clinical trials – innovative intervention to improve care for people living with advanced/chronic disease.

- Methodological research focusing on using existing data for medical and health care research.

Supervisor: Professor Richard Harding / Dr Ping Guo

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Research areas/projects of interest:

- Holistic need assessment and outcome measurement in advanced illness

- Care for patients with chronic heart failure or advanced cancer and their families

- Development and evaluation of nursing interventions in advanced diseases

Supervisor: Dr Jonathan Koffman

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Research areas/projects of interest:

- Clinical uncertainty and end of life care

Description: Clinical uncertainty is a particular source of patient distress among those living with a life-limiting disease. It also negatively affects professionals who are poorly equipped to make decisions regarding patient care and lack confidence and competence in essential communication skills. There are a number of promising approaches targeted at recognising and addressing uncertainty but few have been evaluated. Research is needed to: (i) Identify which interventions targeted at clinical uncertainty improve outcomes for patients and families; (ii) Examine how best to integrate a palliative care into care for patients whose situations are clinically uncertain.

Supervisor: Dr Matthew Maddocks

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Research areas/projects of interest:

- Rehabilitation within palliative and end of life care

Description: People are living longer with multi-morbidity, leading to prolonged functional decline and dependency on others towards the end of life. Modern palliative care should embrace rehabilitation to address this growing burden of disability and help people maintain optimal levels of independence and function. Research around rehabilitation approaches for the management of disability towards the end of life is welcomed. This could involve (i) characterising the populations most likely to benefit, and (ii) modelling and testing rehabilitation approaches to preventing or managing disability, using mixed-method approaches and clinical trials. Applicants from professions allied to health (therapists) are particularly encouraged.

Mental Health Nursing

Supervisor: Dr Jennifer Oates / Dr Mary Leamy

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Research areas/projects of interest:

- Health and care staff wellbeing

- Student mental health

- Evaluation of recovery oriented practice in mental health

Supervisor: Dr Vasiliki Tzouvara

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Research areas/projects of interest:

- Dementia research

Description: I am experienced in dementia research particularly in how to improve communication between staff members and people with dementia. I have been involved in developing a dementia communication intervention for improving communication between student nurses and people with dementia in acute settings, and I am currently leading a research project that reviews national and international policies in dementia. I am also interested in psychosocial aspects of dementia and how these can impact on caregivers (both family members and informal carers) and people with dementia. Research in this area is currently lacking, while the numbers of informal carers increases rapidly.

- Loneliness and social isolation

Description: I am very interested in the effects of loneliness and social isolation in people with mental health problems -particularly people experiencing psychosis and depression-, people with dementia, and informal caregivers of people with mental health problems and dementia. My Phd project looked at loneliness and self-stigma among older people with mental health problems.

- Stigma in mental health problems

Description: Mental health problems can be hard for anyone to cope with but it can be made worse by having to deal with stigma and discrimination from others. The common impacts of stigma associated with mental disorders include social exclusion, unsatisfactory housing, and restricted opportunities for employment and education, and poor impair the quality of life. Stigma have been found to negatively impact on one's overall psychological and emotional wellbeing. Considering the increasing numbers of people experiencing mental health problems in the modern society, it is important to understand the effects of stigma and to develop mechanisms and interventions in order to destigmatise mental health problems and the use of mental health services.

Faculty of Natural & Mathematical Sciences

Chemistry

Supervisor: Dr Leigh Aldous

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Research areas/projects of interest:

- Thermoelectrochemistry for the conversion of waste thermal energy into useful electricity

Description: Our interest is related to the conversion of waste heat into useful energy using redox chemistry. This is an entropy-driven process, and as it relies upon chemistry it has no moving mechanical parts. We are tailoring our redox chemistry (electrochemistry), electrolyte and electrodes towards having the highest possible efficiency, while also aiming to be as innocuous as possible, with the end goal of developing wearable devices to exploit waste body heat

- Biomass utilisation

Description: Biomass is basically trees, grass, agricultural waste and a whole range of other things. Like almost everything else, they are made of chemicals. Our research investigates converting these chemicals into useful energy and some of the chemicals required for modern day quality of life. We combine this with the principles of 'green chemistry' or 'sustainable chemistry', looking to recycle as much as possible while making the smallest possible impact outside of our process; our current focus is upon novel, biodegradable cellulose solvents.

- Enzymes and electrodes

Description: Enzymes can have fantastic activity and selectivity. When combined with electrodes, it enables new (electro)analytical, sensing, energy and (electro)synthesis opportunities. We have a range of projects focussing upon the immobilisation of enzymes upon electrode surfaces; detailed analysis was performed using atomic precision instruments such as STM's with our co-supervisor

Supervisor: Dr Sarah Barry

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Research areas/projects of interest:

- Enzymology and Biocatalysis

Description: We have a major interest in the investigation of enzymes from natural product pathways towards the development of novel biocatalysts. We have collaborations with Dr. Maxie Roessler at Queen Mary University and links to Glaxo Smith Kline in this area. A variety of projects

are ongoing including mechanistic enzymology, directed evolution and structural biology of enzymes which I am very happy to discuss in more detail. As structural characterisation of enzymes if of increasing interest to us

- Natural Products as Tools in understanding pathogenicity

Description: We are interested in using natural products as tools to help understand pathogenicity. We would like to use a class of natural products to develop tools to investigate the role of iron uptake in some pathogenic bacteria. This area combines chemical synthesis, biochemistry and microbiology.

- Antimicrobial Resistance:

Description: Projects are ongoing in our group related to the discovery of natural products as antimicrobials as well as the chemoenzymatic synthesis of natural product derivatives to develop novel antimicrobials. These projects involve chemistry and biochemistry.

Supervisor: Dr Andre Cobb

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Research areas/projects of interest:

- Bifunctional rhodamines for the in situ detection of protein orientation:

Description: This project brings together interdepartmental, interdisciplinary and international expertise from synthetic chemistry, cellular biology and structural biology in order to develop new probes that will shed light on how certain proteins work by allowing for the detection of their orientation in situ. The ability to interrogate the mechanics of these systems accurately will shed light on several on-going problems in mechanobiology – e.g. how muscular proteins are regulated and behave during contractions of cardiac/skeletal muscle.

- Amino Acids and d-Foldamers : New helical constructs for catalysis:

Description: Catalysis is a fundamental pursuit of chemistry, especially with respect to minimising both dwindling resources and the impact of chemistry upon the environment. In particular, the development of catalytic methods that do not rely on toxic transition metals to impart their activity has become a priorty within synthetic chemistry. Using methodology pioneered within our research group, this project aims to build environmentally benign, bespoke helical catalysts constructed from conformationally rigid Lego-like subunits and to use this framework to orchestrate reactions in 3D space.

- Synthesis of Pore-Forming Macromolcules

Description: This project seeks to design and synthesize large, stable, pore-forming compounds. Such synthetic channels have the potential to be applied to a variety of areas, including antimicrobials.

Our studies will range from cyclodextrins through to macrocyclic peptides, crown ethers and calixarenes.

Supervisor: Dr Ismael Diez-Perez / Professor Sergi Garcia-Manyes

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Research areas/projects of interest:

- Biomolecular Electronics, Charge diffusion in Biological Molecular Motifs

Description: We cover the most important aspect of biological electron transport using single molecule approaches. In combination with solid-state peptide synthesis and organic synthesis, we design several biomolecular moieties (e.g. helical peptides) and relevant redox active prosthetic groups (e.g metalloporphyrins) to disentangle their role in charge diffusion in Biology. In this research line, we are also investigating the charge transport in essential redox proteins by designing bioengineered single-protein electrical contacts.

- Molecular Spintronics, Electron Spin effects in Biology

Description: we think that the electron spin has a key role in biological electron transport/communication. To this aim, we design and synthesize metal bio-organic compounds to study their role in electron spin selectivity. In particular, we are very interested in the role that chiral structures have in spin polarizing the charge diffusing along a biomolecular structure.

Supervisor: Dr Graeme Hogarth

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Research areas/projects of interest:

- Single-source precursors to metal-sulfide nano-materials for applications in imaging and catalysis

- Functionalised dithiocarbamate ligands for applications in radiopharmaceuticals

- Dithiocarbamates, thiuram disulfides and metal-chalcogenides for applications in metal-based anti-cancer drugs

Supervisor: Dr Rivka Isaacson

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Research areas/projects of interest:

- Exploring structure and interactions of proteins involved in proteostatic quality control mechanisms

Description: In our lab, a student will use a combination of biophysics techniques, including NMR, X-ray crystallography, SAXS, Native MS and EPR, to explore structure and interactions of proteins involved in proteostatic quality control mechanisms are crucial for maintaining the crowded environment of the cell – in mammalian systems, exploring the rescue of stray hydrophobic proteins in the aqueous cytoplasm

- Exploring metabolic shutdown in bacterial spore formation

- Using biophysics techniques to explore mutations that cause craniosynostosis in skull development

Supervisor: Dr Manuel Müller

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Research areas/projects of interest:

- Chemical Biology – Post-translational modifications

Description: We are interested in how proteins orchestrate important cell fate decisions. Post-translational modifications of proteins act as key signals in these processes, but their detailed role is often unclear due to the complexity and redundancy of biological pathways. To address this issue, the Müller lab at the Department of Chemistry, King's College London develops and applies chemical technologies including synthetic proteins, enabling detailed structure function analyses of important cell fate regulators.

Supervisor: Dr Agyris Politis

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Research areas/projects of interest:

- Structural Mass spectrometry.

Description: We use the emerging method of mass spectrometry to study how lipids influence the conformational dynamics of the membrane proteins. Specifically, we target complex membrane transporter-lipid assemblies responsible from the Major Facilitator Transporter (MFS) superfamily,one of the largest families of membrane transport proteins. MFS transporters function by an alternating access mechanism, which couples opening on the one side of the membrane with closing on the opposite side to allow shuttling nutrients and other biomolecules across the membrane. These systems are notoriously difficult to study by conventional structural methods.

- Membrane biology (transporters)

Description: Along with mass spectrometric investigations the project will involve membrane biology and biochemistry. Specifically, the student will learn how to express and purify membrane MFS transporters as well as how to study their stability and folding. We will focus on the human neurotransmitter transporter SERT that transports serotonin in the cell. Moreover, to corroborate the findings from mass spectrometry investigations we will carry out functional analyses by developing assays that specifically measure the activity (transport) of transporters under different conditions (e.g. altering lipid environments).

Supervisor: Dr Ali Salehi-Reyhani

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Research areas/projects of interest:

- Precision healthcare: point of care diagnostics for cancer

Description: Hepatocellular carcinoma is 6th most common cause of cancer but the 2nd biggest cancer-killer. In China, nearly 400k people each year are diagnosed with liver cancer, almost 50% of cases globally. In this highly multidisciplinary project, we are engaged in biomarker discovery and developing next generation devices for the detection of liver cancer at the point-of-care based on our pioneering work in miniaturised HPLC. Working with scientists at Imperial (Prof. Elaine Holmes), clinicians at St. Mary's Hospital London (Prof. Simon Taylor-Robinson) with industrial support from Agilent, global leaders in analytical instrumentation.

- Cancer Diagnostics @ Home

Description: Related to our clinically facing biomarker work above, we are developing novel spectroscopic and machine learning techniques to monitor an individual's health in the home. The long-term vision of this work is for it to be used in national screening programmes or as personal monitoring devices. Working with the EPSRC Centre for Mathematics of Precision Healthcare, Bruker and collaborators at King's (Prof. Mischa Dohler). This work is also being translated to other sectors such as water security, agriculture and the pharmaceutical industry, with major support in these areas from United Utilities and Novartis.

- Cellular Bionics: Therapeutic Anticancer Synthetic Cells

Description: Cellular Bionics is a new discipline that will revolutionise the biochemical engineering by creating a symbiosis between living and non-living systems, coupling the advantages of biological life with those of synthetic systems (quasi-life). We are interested in developing artificial cells as smart chemotherapeutic agents against cancer stem cells, which can actively recognize and react to diseased cells and, with high precision, target them with drugs. Working with Prof. Mark Wallace and Dr. Rama Suntharalingam (King's), Dr. Karen Polizzi and Prof. Oscar Ces (Imperial), aligned with the fabriCELL.org research centre.

Supervisor: Dr Maria Sanz

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Research areas/projects of interest:

- Understanding molecular recognition in odorants.

Description: Our sense of smell is usually referred to as the least known among all our senses. To date, there is no information at the atomic level on the interactions between odorants and olfactory receptors. In this project we will investigate these interactions in a bottom-up manner by partially recreating the ligand binding site and examining complexes of odorants with mimics of amino acid residues. We will use a combination of molecular modelling and a unique broadband rotational spectrometer at King's to obtain new detailed structural data and unravel the intricate interactions involved in olfaction

- Unveiling the first steps of atmospheric aerosol nucleation.

Description: Aerosols play a vital role in cooling the atmosphere and have an important effect on climate. A crucial process in the formation of aerosols is atmospheric particle nucleation, which occurs when stable molecular clusters are formed spontaneously from gas phase molecules. However, nucleation is poorly understood, as there is little information on the structure of the smallest molecular clusters that initiate the process. The aim of this project is to understand the driving force of formation of small clusters that have been proposed to initiate nucleation by means of high resolution rotational spectroscopy and high level theoretical methods.

- Microsolvation of biomolecules.

Description: Biologically relevant molecules present themselves in a variety of conformers, tautomers, and isomers that make their study particularly challenging. We are interested in understanding how certain conformations are selected and how they change responding to the environment. What are the relevant intra- and intermolecular forces determining which conformations are preferred? Do they change upon interaction with water? What are the preferred binding sites for water molecules? We will apply cutting edge spectroscopic methods (broadband rotational spectroscopy) in combination with quantum-mechanical calculations to study complexes of different biomolecules with several water molecules and determine their conformations and relevant interactions.

Supervisor: Dr Kogularamanan Suntharalingam

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Research areas/projects of interest:

- Developing redox-active metal complexes as potential anti-CSC agents.

Description: Cancer stem cells (CSCs) are a distinct population of tumour cells that have the ability to self-renew, differentiate, and form metastatic tumours. CSCs effectively evade conventional therapies. After surviving treatment, CSCs are able to regenerate the original tumour and/or produce invasive cancer cells that can colonise distant organs. Therefore, to provide a durable response and prevent tumour recurrence, chemotherapeutics must have the ability to remove the entire population of cancer cells, including CSCs. Currently there is no clinically approved drug that specifically kills CSCs. Our group aims to harness the diversity and versatility offered by metals to develop inorganic compounds capable of potently and selectively killing CSCs.

- Targeting peptides to deliver theranostic platinum complexes to brain tumours

Description: Brain tumours have poor prognosis and high rates of relapse. One of the main difficulties in diagnosing and treating brain cancers is the presence of the blood brain barrier (BBB). The BBB is a dynamic interface that separates the brain from the circulatory system, and hinders the entry of chemicals into the brain. Recently, targeting peptides have been shown to penetrate the BBB, and enter brain cancer cells through specific receptors. This project, in collaboration with Drs Rita Sousa-Nunes (KCL) and Nicola O'Reilly (Francis Crick Institute), proposes to use targeting peptides to deliver theranostic platinum complexes to brain tumours. This project is envisaged to improve both brain cancer detection and treatment.

- Developing rod-shaped gold nanoparticle capable of killing cancer cells by photothermal therapy

Description: Another aim of the group is to engineer new nano-material systems to deliver therapeutics to their site(s) of action. In collaboration with Dr Graeme Hogarth (KCL) we aim to develop rod-shaped gold nanoparticles (inspired by filoviruses such as Ebola), capable of killing cancer cells by photothermal therapy. We will take advantage of the fact that gold nanostructures can be manipulated to release vibrational energy (heat) upon irradiation with tissue-penetrating near-infrared light. The surface of the gold nanorods will be functionalised with different

permutations and ratios of antibodies specific for receptors on the membrane of cancer cells. This project will enable pattern based recognition of the cancer cell surface, and facilitate personalised photothermal therapy.

Supervisor: Dr Andrew Surman

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Research areas/projects of interest:

- Molecular Imprinting and the Origin of Life.

[Keywords: Synthetic, Supramolecular, Interdisciplinary, Analytical, Automation]

Description: Learning about the mechanisms which could lead to the initially formation of living systems is synthetic chemistry's greatest challenge. Towards the end of his life Prof Paul Lauterbur (Nobel Prize, 2003) published ideas on how Molecular Imprinting might be a vital mechanism in this development, however this has never been investigated experimentally. We would like to test his revolutionary ideas in the lab.

- Analytical approaches to synthetic melanin mimics and other heterogeneous functional materials.

[Keywords: Analytical, Supramolecular, Synthetic, Materials, Interdisciplinary]

Description: Synthetic materials which mimic melanin are of considerable interest in new energy & materials applications. Various approaches exist, but all produce extremely heterogenous systems – in other words, a "horrible" mess, which is nonetheless functional. Our group is interested in applying tools developed to characterise complex biological systems to understand extremely heterogenous synthetic systems, including – but not limited to – IMS-MS, electrophoresis, metabolomics-style LCMS and data processing. We correlate this compositional information with 'functional' measurements from the realms of supramolecular and materials chemistry.

Supervisor: Dr Andrew Surman / Dr Ali Salehi-Reyhani

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Research areas/projects of interest:

- Bio-orthogonal tools for droplet handling, and assembling synthetic tissues.

[Keywords: Synthetic, Supramolecular, Interdisciplinary, Analytical, Automation, Microfluidics]

Description: Droplet-based fluidic devices are the basis for a range of exciting (bio)chemical developments and technologies, as are colloids/liposomes. All have include enclosures (or "bubble") with multiple surfaces. A number of approaches exist to modify such surfaces "bubbles" to control

capture/release, and program hierarchical assembly, but most use biologically-derived macromolecules. We will develop new synthetic systems, able to operate orthogonally to biological control, to provide greater flexibility and robustness to droplet/liposome technologies, and construct synthetic abiotic “tissue".

Supervisor: Dr Martin Ulmschneider

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Research areas/projects of interest:

- Design and characterisation of novel nanotechnology for biomedical applications.

Description: We are interested in developing novel chemistry to efficiently kill cancer cells without harming healthy cells. In addition we are interested in developing technology to deliver these anticancer therapeutics directly to cancer cells.

- Development of novel molecular simulation technology to study drugs, drug delivery, and drug targets

Description: We are working on the development and application of advanced algorithms and methodologies to simulate the delivery of drugs through the vascular system, the transport of drugs across endothelia to reach their target tissues, and the interaction of drugs with their targets.

Supervisor: Dr Gerd Wagner

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Research areas/projects of interest:

- Chemical glycoengineering of therapeutic antibodies

Description: Monoclonal antibodies (mAbs) are amongst the most important and fastest growing classes of modern medicines. Almost all therapeutic mAbs are glycoproteins. Their development and manufacture remains a formidable scientific and practical challenge, due to the structural complexity and heterogeneity of their glycan structures. In this project, we will develop operationally simple and cost effective methods for the controlled generation of defined mAb glycoforms by using chemical inhibitors. These methods will enable the rational optimization of essential properties such as efficacy, antigenicity, solubility, stability and safety. The project will provide training in inhibitor design, synthesis, and in biological and pharmacological assays.

- Chemical tools for antimicrobial research

Description: Antimicrobial resistance (AMR) is one of the most important global healthcare threats of the 21st century. Understanding the conditions under which bacteria become resistant to antibiotics is therefore of great scientific and practical importance. In this project, we will develop novel chemical tools for the proteome-wide profiling of clinical bacterial pathogens, in order to identify the molecular factors that underpin resistance development. This interdisciplinary project will provide training in a broad range of scientific skills, including the design and synthesis of chemical probes, protein mass spectrometry, and microbiology.

- Targeting PSGL-1 – a new approach for the treatment of asthma

Description: PSGL-1 (P-selectin glycoprotein 1) is an important cell adhesion molecule and a drug target in chronic inflammatory conditions of the lung, such as asthma and COPD. In this medicinal chemistry project, we will explore a new strategy for interfering with PSGL-1 activity. Starting from existing hit molecules, we will develop inhibitors that selectively reduce PSGL-1 levels in inflammatory cells and PSGL-1-mediated cell adhesion in models of inflammation. The project will provide training in a broad range of drug discovery skills, including rational inhibitor optimisation, drug target identification, and cell-based assays.

Supervisor: Professor Mark Wallace

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Research areas/projects of interest:

- Synthetic cells and the bottom-up construction of self-replicating artificial organisms.

- The development of new methods for single-molecule imaging of membranes and membrane proteins.

- Single-molecule nanopore sequencing and sensing.

Informatics

Supervisor: Dr Rita Borgo

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Research areas/projects of interest:

- Urban Science, AI/Machine Learning, Visual Analytics

Description: This research proposal will examine the evolution of the ride-hailing (or ride-sharing) phenomena on urban economies. Our interest is in investigating correlations between the growth of ride-hailing services and urban observables e.g., car accidents, traffic congestions, pollution etc. The project will entail the use of large varieties of secondary data sources including pollution indicators, demographic features, socioeconomic factors, etc. Collection, mining and analysis of large heterogenous datasets will be a requirement, therefore use of intelligent analytical methods on the likes of visual analytics coupled with machine learning and AI will represent a crucial component.

- Visual Analytics, AI/Machine Learning, Human-Computer Interaction

Description: Explainable Artificial Intelligence (XAI) is a topic receiving close review and interest across different fields. Lack of ability to present rationale behind decision-making processes inevitably mines trust and introduces uncertainty with respect to accountability of consequences. The proposed research will focus on the creation of a theoretical and applied framework to explore both causality and correlation in decisions made by AI systems. Results will guide the creation of adaptable visualization interfaces: connecting to and integrating with explainable intelligent systems and simultaneously leveraging visual means to help people to interpret the reasoning behind decision-making processes.

Supervisor: Professor Lorenzo Cavallaro

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Research areas/projects of interest:

- Machine learning for security; we conduct research at the intersection of program analysis and machine learning for systems security

Supervisor: Dr Oya Celiktutan / Dr Hongbin Liu

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Research areas/projects of interest:

- Deep Endoscopic Robot Localisation and Mapping

Description: The paradigm of future medical interventions is rapidly moving towards significant reduction in the procedures' invasiveness by using highly flexible endoscopes through natural openings of patients. However, the flexibility of the instrument and the deformability of the natural lumen result in a relative poor understanding of the exact location of the endoscope. This research sets out to use a visual SLAM method for this purpose, and aims at developing spatio-temporal deep learning techniques for detecting visual salient and subtle cues (e.g., the pattern of vessels) on the natural lumens and modelling their dynamics across frames to precisely localise the endoscope.

Supervisor: Dr Oya Celiktutan / Dr Yansha Deng

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Research areas/projects of interest:

- Efficient Event Recognition and Tracking via Aerial Robots

Description: Images captured by aerial robots provide a rich source of information for various applications ranging from surveillance to search and rescue, and understanding human-human and human-vehicle interactions. However, they bring about a long list of challenges from computer vision perspective, including low resolution and camera motion. This research aims to develop effective and computational power efficient deep learning algorithms that run on the aerial robots and, analyse human behaviours from top-view images in real-time.

Supervisor: Dr Oya Celiktutan / Dr Ernest Kamavuako

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Research areas/projects of interest:

- Ego-centric gesture recognition for personalized human-robot collaboration

Description: Human-robot collaboration has been one of the active research areas, motivated by the advances in the fields of robot control and computer vision. In human-robot teams, different users

display different sequences of actions, and have different preferences. Therefore, a robot should act accordingly, and should adapt its manipulation actions to user's needs and profile for enabling harmonious human-robot interaction. This research aims to develop novel deep learning techniques to analyse human gestures and human-object interactions from first person perspective and generate appropriate robotic manipulation actions, with the goal of providing personalised assistance to the user in collaborative tasks.

Supervisor: Professor Zoran Cvetkovic

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Research areas/projects of interest:

- Signal processing and information theory, theory and/or applications to neuroscience.

- Signal processing and machine learning, theory and applications to deep learning for robust speech recognition.

- Immersive sound technologies with applications to Virtual/Augmented Reality, Games and large-scale sound installations.

Supervisor: Dr Yansha Deng

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Research areas/projects of interest:

- Ultra-reliable low-latency communication (URLLC)

Description: One of the major goals of the future 5G systems will be to support ultra-reliable low-latency communication (URLLC), with the requirement of 10ms of control-plane latency, 0.5ms of user-plane latency and reliability of 99.999% for 32 byte long packets with the latency of 1ms separately. The biggest obstacle to URLLC is resource-reservation procedures in the current cellular network systems in uplink transmissions because the reservation phase brings cumbersome stages and heavy signaling

- Low-Complexity Spike-Encoded Signalling and Computation for the Internet of Nano-Things

Description: Spike-encoded signalling is a primary form of molecular communication within the human body, and it underlies the computational efficiency of the brain. In the medical field, understanding the mechanisms enabling spike-encoded communications and processing is a key

research area driven by its application in neurological diseases treatment. In electronic engineering, neuromorphic computing refers to an emerging class of processors that operate by means of spike-encoded signalling with the aim of mimicking the low-power operation of the human brain.

- Machine Learning for Wireless Communication

Description: This project will focus on solving the dynamic optimization problem in 5G networks using machine learning tools. Specifically, the time varying resource allocation and management problem will be studied and treated to optimize the network performance for each time slot. Relying on the supervisor's existing experience on deep reinforcement learning for Narrowband-IoTs, this project will inspire more advanced learning algorithms for intelligent management.

Supervisor: Dr Matthew Howard

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Research areas/projects of interest:

- Developing and evaluating a prototype smart insole

Description: This project involves evaluating and developing a prototype smart insole or sock that is able to measure properties of the foot, such as foot contact locations, pressure points, sheer forces, temperature or moisture. The aim is to develop a system that is useful for use in both testing footwear for individuals (e.g., for selecting footwear that is comfortable for sufferers of specific foot diseases/injuries), and for gaining useful information about the wearer (e.g., estimating posture, to evaluate the ergonomics of work practices). This is a multidisciplinary project requiring electrical and mechanical engineering skills (sensor build), as well as machine learning skills (data processing/robot control).

- Investigating the use of variable impedance actuation and energy harvesting as a means to develop an ultra-energy efficient robot.

Description: This project involves investigating the use of variable impedance actuation and energy harvesting (using the compliant actuator design proposed by our group) as a means to develop an ultra-energy efficient robot. Of particular interest is the relationship between the compliance of different terrains, optimal control/machine learning frameworks and overall energy efficiency. This is a multidisciplinary project requiring electrical and mechanical engineering skills, as well as machine learning skills (data processing/robot control). https://youtu.be/48zcp5c37Vo

Supervisor: Dr Ernest Kamavuako

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Research areas/projects of interest:

- Development of ultrasound guided robotic system for minimally invasive needle insertion.

Description: Epidural anaesthesia is a widely used method for pain relief which is useful in various settings. Despite its popularity, failure of epidural anaesthesia and analgesia is a frequent clinical problem due to various reasons. The aim of this research project is to investigate the use of real-time ultrasonography and develop a robotic system for accurate needle insertion.

- Robust and reliable pattern recognition control system for upper limb myoelectric prostheses

Description: Machine learning (ML), rather than conventional control, has attempted to advance the control possibilities of upper limb myoelectric prostheses, but performance has been limited by unsatisfactory robustness to non-stationarities. The aim of this project is to propose a new generation of myoelectric control systems that are robust and reliable using high-density embroidered sensors.

- Development of an intelligent human-size robot

Description: Our challenge as engineers, now and in the future, is to provide infrastructure to rural and semi-rural communities in the developing world. Also, with increasing urbanization, we face additional challenges in terms of how we can economically provide infrastructure in new urban areas. Demand on services is increasing and thus the use of man-machine can be projected to be needed. The aim of this research is develop a human size robot capable of providing services in busy urban environment.

Supervisor: Dr Hak-Keung Lam

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Research areas/projects of interest:

- Machine Learning and Computational Intelligence

Description: It investigates the stability, performance and robustness, and synthesis of control methodology for nonlinear control systems represented by fuzzy model and fuzzy controller connected in a closed-loop to form a fuzzy-model-based control system. The analysis results will be formulated as a linear-matrix-inequality (LMI) or sum-of-squares (SOS) problem.

- Reinforcement Learning

Description: It researches on data-driven learning-based algorithms to deal with various applications such as recognition and classification problems for bio-signals (ECG signals, EMG signals, Epilepsy signals), gestures, speech, objects, images, etc. It involves the development and improvement of machine learning algorithms and architectures, and computational intelligence techniques.

- Fuzzy-Model-Based Control Systems

Description: It researches on reinforcement learning algorithms and their applications. On the theoretical side, it improves the learning capability of reinforcement learning algorithms; combines the advanced nonlinear control theory with reinforcement learning for control synthesis. The applications involve robotic systems and control systems such as mobile robots, robot arms, balancing robots, autonomous systems and some general nonlinear systems.

Supervisor: Dr Grigorios Loukides

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Research areas/projects of interest:

- Data mining

Description: I am interested in foundations of data mining, including algorithms for mining of data streams, graphs (e.g, social networks) and high-dimensional data (e.g., sequences and trajectories). Examples are works on optimizing the influence received by people on social networks.

- Data privacy

Description: I am interested in data sanitization and data anonymization methods, whose goal is to prevent the leakage of private and sensitive information. Examples include privacy for Internet-of-Things devices.

- Biomedical Informatics

Description: I am interested in electronic health records analysis, including clustering and pattern mining. Examples include clustering-based algorithms for privacy protection of demographics and diagnosis codes.

Supervisor: Dr Daniele Magazzeni

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Research areas/projects of interest:

- Artificial Intelligence and Explainable AI
- AI Planning for Trusted Autonomous Systems
- AI for Autonomous Robot Navigation

Supervisor: Dr Mohammad Reza Nakhai

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Research areas/projects of interest:

- Enabling Artificial Intelligence in Mobile Edge Networking

Description: Multi-access edge computing is a novel paradigm for alleviating the traffic burden on today's congested backbone network by transferring the computing/storage resources from the remote cloud centres to the proximity of user equipment and enabling latency-critical mobile and internet of things applications. This project investigates the design of an intelligent edge networking system based on deep reinforcement learning, federated learning and transfer learning to react cognitively to dynamic mobile environment, adapt with heterogeneous demands of a massive number of users with significantly reduced communication overhead and latency.

- Distributed Online Optimisation in Task-Integrated Communication Networks

Description: The aim is to bring down the cloud computing power as close as possible to the vicinity of the user terminals, so as to enable high-speed real-time applications, such as intelligent transportation, virtual/augmented reality and real-time big-data processing. This is done by enabling distributed computing over the edge nodes, so that their parallelised and coordinated efforts deliver cloud computing power and functionalities at the network edge. The main challenge is the integration of two completely different resources of communication and computing and their joint optimisation and interplay against stochastic and adversarial behaviour of the environment.

Supervisor: Dr Nishanth Sastry

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Research areas/projects of interest:

- Internet of Things and Mobile Edge Computing

Description: Understanding how communications infrastructure at the edge of the network can enhance the performance of the next generation of telecommunication networks.

- Fake news and misinformation

Description: Understanding how to verify news, especially in the context of a) private media like WhatsApp which are easily able to spread false news, causing lynchings and murders as a result; b) Apps such as DeepFake, which create convincing fake videos involving real people.

- Internet and WWW measurements.

Description: I am in general interested in using measurement and big data-based approaches to study the Internet and the WWW ecosystem. For instance, we are currently studying privacy loss and leakage in today's Web ecosystem, as a result of ad networks, third party trackers and cookies.

Supervisor: Professor Osvaldo Simeone

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Research areas/projects of interest:

- Information theory

- Wireless communications

- Machine and statistical learning

Supervisor: Dr Petr Slovak[2] / Dr June Brown

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Research areas/projects of interest:

- Socially Assistive Robots in mental health (prevention interventions and treatment)

Description: The PhD would investigate the development of socially assistive robot (SAR) platform to deliver mental health interventions. Supervisor's pilot work suggest that such SARs systems could enable an entirely new mode of intervention delivery that is fully embedded in users' lives and provides contextualised support and guidance. The student would examine, for example, how SARs can progressively train CBT-based strategies directly with the everyday stressful situations users encounter, personalising its responses to the users current competence; all without the need for extensive in-person training or outside workshops that are necessary for current best practices and strongly constrain the effects and scope of existing intervention programs.

- Intervening agents –delivering behaviour change through conversational agents (e.g., Echo)

Description: Voice assistants are shared, situated, always-on devices; often located in nexus of personal life (kitchen/living room). They are framed as serving the entire house as a unit, providing information and insight. The PhD would investigate questions such as: How can these functionalities be co-opted to facilitate behavioural change interventions, including those in the area of mental health? Specifically, how can algorithms and interaction models be designed to empower and scaffold self-driven interventions, without the need for trained human support? How might the system draw on both user-instigated as well as automatic tracking to intervene at opportune times? What would algorithmic transparency and explanations mean in these contexts?

Supervisor: Dr Kathleen Steinhofel

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Research areas/projects of interest:

- Prediction of adverse drug reactions (liver toxicity) using multi-dimensional data integration and machine learning methods

Description: Drug toxicity prediction is currently largely based on genetic variants and biomarkers using retrospective patient cohorts. Current research in systematically predicting immunologically mediated ADR toxicity is aiming to integrate structural modelling of HLA variants, immunological binding complexes, docking, and structure to create an index on drug toxicity risk. Using real world patient data from liver injury, we are developing new methods, incorporating machine learning (ML)

[2] Dr Petr Slovak formally joins King's in January 2019. His details will be updated on the King's website as soon as it is available.

approaches to examine HLA-drug binding and docking, extending to metabolic and regulation pathways, and molecular structure. The aim is to develop a liver toxicity prediction tool for patients starting new drugs who may be at increased risk of serious ADRs, to allow consideration of lower risk alternative medicines.

- RNA Structure Prediction and Identification of Structural Similarities

Description: RNA has emerged as the prime target for diagnostics, therapeutics and the development of personalized medicine. Recent technological advancements highlighted the prominent role of RNA in biological systems by identifying noncoding RNA -transcripts that have no protein coding capacity- as the largest class of transcripts. Long noncoding RNAs (lncRNAs) that are >200nt in length in particular display remarkable biochemical versatility. They can fold into complex structures and interact with proteins, DNA and other RNAs, modulating the activity, DNA targets or partners of multiprotein complexes. We aim to use algorithmic approaches to structure prediction and for comparing folded structures to enable the search for structural motifs.

- Nature Inspired Optimisation Methods for Big Data

Description: Nature exhibits a number of process that have already been adapted for combinatorial optimisation, examples are Genetic Algorithms, Evolutionary Algorithms, Simulated Annealing, and Swarm Algorithms. We are investigating new computational methods that adapt to nature inspired properties of the input instances to enable methods to cope with either large scale data or large scale search spaces. The utilisation of sampling methods as well as streaming algorithms to find optimal solutions will be investigated.

Supervisor: Dr Guillermo Suarez-Tangil

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Research areas/projects of interest:

- Malware Detection

- Cybercrime and Fraud Detection

- Cybersecurity

Supervisor: Dr Jose Such

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Research areas/projects of interest:

- The Security of AI

Description: AI-powered systems are becoming widespread giving rise to a new generation of smart and intelligent devices. However, the use of AI introduces novel vulnerabilities in systems as they can be manipulated by an adversary. For instance, it is well-known that systems based on machine learning models are susceptible to adversarial attacks, like those recent attacks on the voice recognition capabilities of intelligent personal assistants like Alexa and Siri.

- AI privacy

Description: AI-powered systems are becoming widespread giving rise to a new generation of smart and intelligent devices. However, the use of AI introduces novel privacy challenges that need to be overcome. For instance, machine learning allows to build very detailed profiles of individuals, which could be used to invade user's privacy.

- AI for Security and Privacy

Description: The ever-changing nature of security and privacy threats that users, companies, and governments face require intelligent approaches to detect and address cyber security and privacy issues. AI can provide the "brains" for those systems. In this PhD, you will work on applying AI techniques (such as data-driven ones like Machine Learning and/or knowledge-based ones like argumentation) to cyber security and privacy problems.

Supervisor: Dr Christian Urban

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Research areas/projects of interest:

- Developing derivatives of regular expressions to improve network intrusion prevention

Description: If you want to connect a computer directly to the Internet, it must be immediately hardened against outside attacks. The current technology for this is to use regular expressions in order to automatically scan all incoming network traffic for signs when a computer is under attack and if found, to take appropriate counter-actions. One possible action could be to slow down the traffic from sites where repeated password-guesses originate. Well-known network intrusion prevention systems that use regular expressions for traffic analysis are Snort and Bro. Given the large volume of Internet traffic even the smallest servers can handle nowadays, the regular expressions for traffic analysis have become a real bottleneck. This is not just a nuisance, but actually

a security vulnerability in itself: it can lead to denial-of-service attacks. The proposed project aims to remove this bottleneck by using a little-known technique of building derivatives of regular expressions. These derivatives have not yet been used in the area of network traffic analysis, but have the potential to solve some tenacious problems with existing approaches. The project will require theoretical work, but also a practical implementation (a proof-of-concept at least).

Supervisor: Dr Steffen Zschaler

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Research areas/projects of interest:

- High-Level Modelling Languages for Agent-Based Modelling (ABM) in Sciences and Social Science

Description: ABM involves modelling and simulating the behaviour of individual agents in a bigger context—for example, people in a geography model, staff members in models of emergency departments, or cells and molecules in cell biology. In research, ABM can be a very powerful tool to explain emergent behaviour, yet developing ABMs is difficult and requires substantial software development expertise. Research is needed in developing high-level languages that will reduce the amount of software development expertise and will allow researchers to focus on their research questions when using ABM.

- Search-Based Model Engineering

Description: Optimisation is an increasingly important tool in many different domains, but is challenging to get right requiring a lot of additional expertise. Our research focuses on improving the usability of optimisation techniques in a software engineering context and beyond by applying the power of model-driven engineering and domain-specific language engineering. We are building a tool called MDEOptimiser with the goal of easily supporting different optimisation approaches in a software-engineering context. – depending on the specific research topic there are a number of potential co-supervisors, including from computer science, maths, or geography

- Teaching and Learning of Programming

Description: Programming and computing are important life skills these days. Yet, learning to program is difficult and we still understand very little about how students learn to program. I am a co-founder of the King's Computing Education Research Centre (CERC), a cross-disciplinary centre with members from computer science and education. We undertake research into how students learn as well as into how to support their learning with a variety of tools for coding, automated assessment, etc

Mathematics

Supervisor: Dr Nadav Drukker

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Research areas/projects of interest:

- String theory

Description: This project will be from a theoretical physics perspective

- AdS/CFT correspondence

Description: This project will be from a theoretical physics perspective

- Supersymmetric field theories

Description: This project will be from a theoretical physics perspective

Supervisor: Professor Steven Gilmour

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Research areas/projects of interest:

- Multi-objective optimal design of experiments.

Description: Most optimal design methods assume that an experiment is designed to meet one particular objective. Most experiments are in reality more complicated. Recent research has developed criteria for meeting multiple objectives, especially in the context of factorial designs. This project would aim to extend this work to other design structures, e.g. response surface experiments, experiments with mixtures, experiments for fitting nonlinear models.

- Design of experiments for functional responses.

Description: Traditional design of experiments assumes that a scalar response is observed from each experimental unit. In some experiments the response is a function, e.g. a growth curve, or a spectrum. This project would involve developing methods to optimally design experiments for such response data. The impact of randomisation, and how it affects the appropriate models to be fitted, could also be assessed.

Supervisor: Dr Kalliopi Mylona

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Research areas/projects of interest:

- Optimal Design of Experiments

Description: Haphazard experimentation can be very wasteful of resources. Improvements in the way experiments are designed thus have the potential to generate important increases in knowledge and savings in time and money in many disciplines. For example, better experiments decrease the number of prototypes required in engineering and shorter product and process development times. The methodology we will example, develop in the course of this project will allow the design of cost-efficient experiments that provide a maximum of information.

- Statistical Analysis of Restricted Randomised Experiments

Description: Statistical Analysis of Restricted Randomised Experiments: As designs with restricted randomisation are often much more cost-efficient than completely randomised designs, they are extremely popular in industry. However, there has been little research into how to analyse data for mixed effects supersaturated models. Response surface models often involve a relatively large number of explanatory variables (regressors). Usually, not all the regressors have a significant impact on the responses. One of the challenges for the researcher, is therefore to find a model that will give good predictions of the experimental outcome. We will propose statistical analysis techniques for data from this class of experiments.

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Research areas/projects of interest:

- Levy processes

- Stochastic Analysis

- Stochastic partial differential equations

Physics

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Research areas/projects of interest:

- Non-Hermitian extension of the Standard Model

Description: This project explores the possibility to introduce non-Hermitian extensions of the Standard Model of Particle Physics, while keeping a mathematically consistent description. These extensions are PT-symmetric (Parity/Time-reversal), which is enough for the energies to be real, and the articles already published by the supervisor (arXiv:1501.01232, 1509.01203, 1707.01057, 1805.06380, 1808.00944), involve non-Hermitian mass terms for both scalar and fermionic particles. The research will make use of perturbative and non-perturbative methods in Quantum Field Theory, and will focus on both the mathematical consistency of the models and their phenomenological implications for Higgs and neutrino physics.

Supervisor: Dr Francesca Baletto

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Research areas/projects of interest:

- Machine learning for metallic nanoparticles

Description: Because the lack of periodicity, metallic nanoparticles and nanoalloys can display various isomers each with its own chemophysical properties, allowing and motivating their rational design for target technological applications. Our ability to distinguish those morphologies per nanoparticle's size and chemical ordering is our next challenge. Intelligent artificial methods can be employed for nanoarchitecture classification and predictive modelling of their properties with high accuracy. In any event, the common challenge is to identify the minimally large but comprehensive database. This project starts with the identification of parameters that serve as a metric, their implementation and final use to predict optimal nanoparticles.

- Optical properties of Al and Au-nanoparticles and

Description: Metallic nanoparticles are a new state of matters between atoms and solids, with peculiar properties far from its elemental and bulk counterpart. The relevance of metallic nanoparticles in both optical and biological applications like the enhancement from UV fluorescence, surface enhanced Raman spectroscopy, solar cells, biological and chemical sensing, has been proven. The objective is to simulate how charge carriers are produced during photon absorption, with a

focus on the role played by size, shape and chemical composition in tuning the hot electron/hole generation. The ultimate goal is to see the implications for the photocatalytic water splitting.

- Nanocatalysis

Description: Nanocatalysis is a massive and strategic worldwide industry, e.g. metallic nanoparticles have widespread use in car catalysts and in hydrogen fuel cells, driven by the replacement of precious metals by catalysts tailored at the nanoscale with improved catalytic activity, selectivity, and lifetime and reduced process costs. The objective is to provide the dependence of adsorption maps on nanoparticle size, shape, solvent, and support. This is fundamental as it provides a route for fabrication and commercialization of nanocatalysts based on their geometrical/microscopic characterisation/design. We aim to adapt available electrochemical models and Kinetic Monte Carlo suites to use the so-obtained mapping.

Supervisor: Dr Nicola Bonini

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Research areas/projects of interest:

- First-principles modelling of electrical and thermal transport in materials for nanoelectronics and thermoelectric applications

- First-principles modelling of frequency and temperature dependent dielectric losses in materials for microwave and teraherz applications

- First-principles modelling of two-dimensional materials

Supervisor: Dr Wayne Dickson

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Research areas/projects of interest:

- Ultrasensitive Metamaterials for chemical and biological detection

Description: Metamaterials based on plasmonic constituents can provide strong light matter interaction, enhance local electromagnetic fields and display extraordinary sensitivity to their environment via changes in the local refractive index. To fully take advantage of their ability to detect the local dielectric environment, it is necessary to functionalise or hybridise these materials with sensitising layers to improve specificity. In this project the goal is two-fold: Firstly, self-

assembled plasmonic metamaterials will be hybridised with a functional layer comprised of a molecular imprint polymer for both chemical and biological detection. Secondly, the material will be restructured over large areas (cm^2) to add size selectivity to detect large biological macro-molecules (lentivirus).

- Plasmonic electro-photo-catalysis

Description: The decay of plasmonic excitations by Landau damping can create energetic electron-hole pairs, opening up the possibility to initiate chemical reactions in nanoscale volumes, create novel photo-catalysts, or sub-band photo-detectors. In this project, self-assembled metamaterials will be fabricated and optically characterised for the purposes of CO2 reduction using photo-electro-catalytic techniques. Specifically, this project aims to hybridise well known plasmonic elements with known catalysts to reduce the energy barrier to reactions involving the plasmonically generated carriers.

- Plasmonic metamaterials by Plasma Enhanced Atomic Layer deposition

Description: Atomic layer deposition (ALD) is a unique physical deposition method that allows for uniform, pin-hole free layers to be deposited from a growing library of dielectric, semi-conducting and metallic materials. This project will involve the optimisation and characterisation of metallic layers for plasmonic applications. A significant advantage of ALD is the ability to conformally coat high aspect ratio structures with layers of nanometric thickness. This process will be optimised in order to form high-aspect ratio metamaterials with ultra-thin plasmonic layers, and these structures will be investigated for integration into plasmonic photo-voltaic devices.

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Research areas/projects of interest:

- Mechanobiology across-length scales

Description: The nanomechanical properties of the LINC complex; from the single molecule to the individual cell. Mechanical forces are involved in many physiological processes. While most of the current work in mechanotransduction has been focused on the function of focal adhesion proteins and actin cytoskeleton, the mechanical role intracellular and nuclear proteins remains rather elusive. This project aims at studying the nanomechanical properties of the individual proteins of the LINC complex at the single molecule level and to compare these results with the behaviour in live cells under compressing and stretching forces. These experiments will shed new light onto the mechanisms of force transmission to the cell nucleus on biologically relevant timescales.

- The effects of post-translational modifications on mechanical folding

Description: The nanomechanical effects of oxidative-stress driven post translational modifications in cardiac titin. During every heartbeat, cardiomyocytes are exposed to a cyclic variation of stress and strain. Recent evidence supports the synergistic role of oxidative stress (ROS species) and

inflammation in the progression of heart failure. However, our understanding of the redox-dependent mechanisms that control contraction-relaxation in the intact heart remains poor. The main focus of this PhD project is to get the first molecular insight on how transient chemical reactivity regulates the elasticity of cardiac titin through the combination of nanomechanical techniques across different force- and length-scales

- Protein misfolding at the single molecule level

Description: The molecular mechanisms underpinning the misfolding of cataract-forming human gD-crystallin: a single molecule perspective. The main goal of this proposal is to decipher the molecular mechanisms underpinning the refolding and misfolding dynamics of individual cataract-forming human gD-crystallin proteins. Within a multidisciplinary approach, combining molecular biology engineering techniques with single molecule force spectroscopy using both AFM and Magnetic Tweezers, complemented by biochemistry aggregation assays, mass spectrometry (MS) measurements and molecular dynamics (MD) simulations, our research aims at identifying the distinct molecular conformations that establish the molecular seed for crystallin misfolding and aggregation, eventually linked to cataract formation

Supervisor: Professor Mark Green

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Research areas/projects of interest:

- Nanomaterials

Description: We will focus on luminescent materials, or materials that are multimodal, ie, have a magnetic/MRI active and luminescent functionality, specifically conjugated polymer, rare-earth materials, polyoxometalates, phosphor materials.

- Quantum dot synthesis using chemical routes

Description: We are interested in InP, InN and HgTe based quantum dots using high temperature inorganic

- Biological Imaging using nanomaterials

Description: We work closely with a range of collaborators in various departments in the UK to image a range of disease states, focusing on cancer using a wide range of materials.

Supervisor: Professor Samjid Mannan

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Research areas/projects of interest:

- Electromigration as a tool for nanofabrication.

Description: Electromigration in a solid conductor is defined as the movement of atoms resulting from high electric current density. While normally regarded as a reliability issue for electronic circuitry, the phenomenon can also be used to fabricate nanostructures such as nanowires and nanorods that may be of use in sensing applications. There is scope in the project for probing the fundamental laws that govern electromigration and atomic diffusion on surfaces and at grain boundaries, or to concentrate instead on exploring how to control the atomic movements in order to obtain specific nanostructures.

- Sintering of copper and silver nanoparticles.

Description: Sintering of copper and silver nanoparticles. High temperature electronics requires a robust connection method to join wide bandgap semiconductor devices to circuit boards that can survive hostile environments such as temperatures reaching 300 °C or even higher. Pastes composed of silver or copper nanoparticles are one promising joining method, replacing conventional solders. This project will explore how the properties of such joints can be tailored to specific applications by combining copper and silver nanoparticles with other additives or surface modification techniques.

Supervisor: Dr James Millen

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Research areas/projects of interest:

- Levitated Signal Processing

Description: The vibrations of high-quality mechanical objects act as the beating heart of modern technology, powering clocks, radios, mobile-phones, accelerometers and self-driving cars. In this project we consider a dramatic updating of this key technology: what if the mechanical object is levitating? In this way, it cannot lose energy to the environment, improving its performance and promising operation in the quantum realm. This projects lies within the rapidly growing field of quantum optomechanics.

- Quantum Nano-gyroscope

Description: Spinning objects have a long history in applied sciences, including in image stabilization and navigation. It is possible to control the rotation of levitated nano-scale particles to an incredible 1 part in 1011, promising exquisite force sensing in a compact system with high spatial resolution. In

addition, it is predicted that the rotation can be controlled at the quantum level, and then quantum effects can enhance the sensitivity of a nano-gyroscope by many orders of magnitude over the classical state-of-the-art.

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Research areas/projects of interest:

- Modelling the Mechanisms of Crystal Growth at the Molecular Scale

Description: Atomistic simulations will be used to investigate the mechanism of crystal growth and the key factors which control and inhibit such growth in different environment and conditions. We will focus on ice crystals formed in the clouds, which are important for the environment, to assess how their shape is determined by temperature and affected by pollutants. In addition, or alternatively, we will study calcium oxalate crystals, which form kidney stones and have biomedical implications, to explore how specific additives may inhibit their growth or catalyse their dissolution.

- Elucidating the Activation Mechanisms in Ligand-Gated Ion Channels by Atomistic Simulations

Description: Pentameric ligand-gated ion channels are important neuroreceptors, embedded in the memUnderstanding the effects of pressure-induced deformations and phase transformations on the structural and optoelectronic properties of nanocrystals is important not only from the fundamental point of view, but also for potential applications such as stress sensors and electromechanical nano-devices. We will use and develop a series of computational tools to simulate nanocrystals under pressure under realistic conditions, comparing different materials (e.g. Si, CdSe, ice) and assessing how size, shape and bond character drive transformations toward order or disordered phases.brane of nerve cells, that mediate fast synaptic communication, are involved in many neurological disorders and are targets sites for drugs. However, how they function at the molecular level is still far from being fully understood. We will use innovative simulation methods to investigate the trigger events of receptor activation, which consist in the binding of neurotransmitters and culminate with the opening of the ion channel.

- Towards Realistic Simulations of Nanomaterials under Pressure

Description: Understanding the effects of pressure-induced deformations and phase transformations on the structural and optoelectronic properties of nanocrystals is important not only from the fundamental point of view, but also for potential applications such as stress sensors and electromechanical nano-devices. We will use and develop a series of computational tools to simulate nanocrystals under pressure under realistic conditions, comparing different materials (e.g. Si, CdSe, ice) and assessing how size, shape and bond character drive transformations toward order or disordered phases.

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Research areas/projects of interest:

- Nanophotonics for sensing and therapy applications

Description: Effective detection and treatment of diseases relies on the development of new and enhanced sensing schemes and therapy agents. Nanomaterials are ideal candidates as components in such systems due to their strong interactions electromagnetic radiation. This research area focuses on implementing the principles of nanophotonics into sensing and phototherapy schemes.

- Bioinspired quantum dot assemblies for efficient light harvesting

Description: Biological light harvesting systems have evolved over millions of years. In doing so, they have maximised the collection and transfer of light energy, which is achieved through careful engineering of constituent components. This research area looks to translate the principles found in biomaterials, such as the photosynthetic system, to nanophotonic devices and assemblies. The aim is to improving their efficiency through spatial and energetic engeneering of structures.

- Hybrid nanobiophotonic materials

Description: Biophotonic materials, and especially light-activated membrane proteins, offer many advantages for technological implementation. They are very chemo-, photo- and thermos- stable and have very high cyclicities. Due to their nature, however, they often suffer from narrow bandwidths and low overall conversion efficiencies. This aim of this research area is to develop hybrid nano-/bio photonic materials with improved performances. Such materials can find applications in data storage, desalination of water and various types of optical detection.

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Research areas/projects of interest:

- Spin-orbit interaction of light in nanophotonics

Description: Applications of nanophotonics, the science that studies the behaviour of light in nanostructures, are ubiquitous in diverse areas such as information and communication technologies, healthcare, and sensing. Some challenges exist, such as achieving, at an ultrafast rate, the switching of light into different routes, or the synthesis and analysis of light polarizations. Spin-orbit interactions of light is a newly emerging field that can provide fundamental solutions to these challenges. It exploits the interactions that exist between polarization of light (spin angular

momentum) and wave-vector or propagation direction of light (orbital angular momentum). These spin-orbit interactions can be dramatically enhanced in engineered optical nanostructures.

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Research areas/projects of interest:

- Fabrication of uniform smart capsules for drug delivery via microfluidics

Description: In a relatively simplistic form, a microcapsule is a small sphere with diameters within 1 mm – 1000 mm, with a uniform wall around it. The most important feature of encapsulation is the reduction of evaporation or decrease of active substance release rate from the capsule to the environment. As a result, microcapsules have found increasing applications in pharmaceutical and biomedical industries for drug delivery. Fabrication of microcapsules is usually carried out via conventional emulsification processes, which usually produce drops with a wide size distribution. For many advanced applications in drug delivery, however, capsules with uniform size and shape are required. Microfluidic devices offer an alternate and versatile route to produce uniform emulsions. In contrast to bulk emulsification methods, an emulsion in a microfluidic device is made by precisely fabricating one drop at a time. In this research, preparation of uniform microcapsules will be explored via state-of-art microfluidic method. The main aim is to be able to produce novel microcapsules with desired size and shapes via microfluidics followed by their transformation into microcapsule particles using chemical (polymerization) and/or physicochemical techniques, and finally triggering the release by external sources such as heat, light, or variations in the chemical properties of the capsules' environment.

- Polymer nanocomposite particles

Description: In recent years, there has been increasing interest in the synthesis and application of colloidal organic/inorganic hybrids. The organic-inorganic hybrid materials present the properties of both the inorganic nanoparticles and the polymer by combining thermal, mechanical, optical, and chemical properties of both constituents. Intimate mixing of polymers with inorganic particles can lead to superior properties compared to those of the constituents. Nanocomposite particles can be prepared through hetrophase polymerisation, heterocoagulation, and layer-by-layer self-assembly method. Among these methods, heterophase polymerisation is probably the most frequently used technique. Conventional emulsion, emulsifier-free, miniemulsion, microemulsion, suspension, precipitation, and dispersion polymerisations are the most important types of hetrophase polymerisation. This project targets preparation of structured polymer hybrid nanoparticles using (mini)emulsion polymerisation techniques.

- Fabrication of smart nanoemulsions

Description: Nanoemulsions are an emerging group of dispersed droplets used for pharmaceutical and biomedical aids and vehicles that show great promise for the future of cosmetics, diagnostics, drug therapies and biotechnologies. In order to form drops of submicron size, a large quantity of energy should be provided. This energy is roughly proportional to σDA where σ is the interfacial

tension and DA is the total surface area of drops. The idea behind this project is to produce nanoemulsions by interfacial tension lowering ($\sigma \approx 0$). This may be done, for example, by using a combination of surfactants. The project involves preparation and characterization of nanoemulsions triggered by heat or light. High-energy emulsification such as ultrasonication will also be carried out for the sake of comparison.

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Research areas/projects of interest:

- Fluorescence spectroscopy and microscopy of fluorescent molecular rotors

Description: Fluorescence imaging techniques are powerful tools in the life sciences, because they are non-destructive, minimally invasive and can be applied to living cells and tissues. Fluorescent molecular rotors are dyes whose fluorescence quantum yield (brightness) and fluorescence lifetime depend on the viscosity if their environment, for example the viscosity of the solvent they are dissolved in. The project includes the photophysical characterisation of novel fluorescent molecular rotors, and their application for imaging the viscosity of various cell organelles using Fluorescence Lifetime Imaging (FLIM). This is an interdisciplinary research project at the boundaries of physics, chemistry and biology.

- Development of photon counting imaging with microsecond resolution for oxygen sensing with lightsheet microscopy

Description: The use of a photon counting image intensifier coupled to a camera is an established method to acquire images at a low-light level. The Hubble Space Telescope's faint object camera, for example, was based on this approach. Nowadays, in combination with fast cameras, images can be assembled form individual photons at MHz frame rates. In lightsheet microscopy a thin slice of the sample is illuminated and observed at right angles with a camera - this is ideal for studying cell clusters or tissues. The aim in this project is to build a single-photon sensitive phosphorescence lifetime imaging (PLIM) lightsheet microscope using a special photon counting camera. This unique instrument be extremely useful for studying oxygen in cell clusters and tissues with light, without disturbing them.

- Development of Time-correlated Single Photon-based lightsheet Fluorescence Lifetime Imaging microscopy

Description: In lightsheet microscopy, a thin slice of the sample is illuminated, and the image is observed at right angles with a camera. Fluorescence lifetime imaging (FLIM) can image complex dynamic processes, and to help us to understand life and disease on a molecular scale. FLIM is best done by assembling the image from individual photons - the most accurate and sensitive way of doing this. Conventional cameras can capture images well, but they cannot photon count in the way needed for lightsheet FLIM. The project is to build a single-photon sensitive FLIM lightsheet microscope using a special photon counting camera. This unique instrument will be used to analyse cell signaling events by GTPase enzymes (identified by Förster Resonance energy transfer, FRET) in

live cells and define how these proteins are involved in tumourigenesis. It will also be used to assess the physiological status of neural cells within organoids, by visualising Ca2+ dynamics, e.g. by using cameleon FRET probes.

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Research areas/projects of interest:

- High temperature superconductivity

Description: We guide the design of the next generation of superconductors by using advanced quantum modelling techniques, based on density functional theory. We have on-going collaborations with experimentalists (Beijing Normal University) who do pump-probe measurements on this class of materials, to unveil possibilities for superconductivity out-of-equilbrium.

- Energy materials

Description: We guide the design of eco-friendly materials with applications for energy, such as thermo-electricity (conversion of heat to electricity). We have a direct collaborations with chemists synthesizing new copper based materials that have a high figure of merit (ZT). Here we focus mainly on transport properties and use first principle DFT calculations to model the phonon and electronic excitations.

- Smart materials for Robotics

Description: This effort involves a research involving smart materials with applications for robotics, a collaboration with Dr Hongbin Liu,

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Research areas/projects of interest:

- Ultrafast laser sciences and Attosecond physics

Description: We develop state of art femtosecond ultra-short and intense lasers that are essential for driving strong field- matter interaction with unprecedented conditions. We are focusing our research into the development of high repetition rate Ytterbium CPA femtosecond laser that are now cutting edge technology. The CPA technology was recognised by the Nobel prize in Physics 2018

and is an important topic of advanced light technology. We are investigating innovative schemes to enable the production of few-cycle femtosecond pulses that cover a large range of photon energy from IR to far IR and the synthetisation of new electromagnetic laser fields waveforms

- Production, characterisation and control of attosecond pulses:

Description: We currently produce the most advanced table-top source of XUV and X-ray coherent pulses. These pulses are the shortest ever produced (100 asec; 1 asec= 10-18 sec). Our research is focused on the production, characterisation and control of these attosecond pulses, taking advantage of high harmonic generation high non-linear phenomena. High harmonic generation is a process that enable the up conversion of the CPA femtosecond source to the XUV-X-ray range. In order to achieve the full capability of these sources, we combine our expertise of femtosecond laser technology and strong field physics to provide the optimum attosecond source

- Capturing ultra-fast dynamical process in atoms and molecules using attosecond pump-probe technique:

Description: Electronic and nuclear motions are extremely fast and trigger many photo-induced processes' initial steps from few tens of attosecond to few femtosecond, such as damages in RNA basis, properties in chromophores, ultrafast current in nanoscale samples and dynamics at the quantum level. We have pioneered the "quantum path interferometry" technique that is an insitu pump-probe method enabling capture ultra-fast charge migration with temporal accuracy down to 10 attosecond. Our current research aims to extend this technique to larger molecular systems and to explore condensate phase material, i.e. Periodic crystals, nanofilms and metamaterials

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Research areas/projects of interest:

- Design, nanofabrication and optical studies of nanostructured plasmonic and dielectric metasurfaces and metamaterials

Description: The projects involve design, nanofabrication and optical studies of nanostructured plasmonic and dielectric metasurfaces and metamaterials designing nonlinear optical components and controlling of light with light. Metamaterials and metasurfaces provide unique opportunity to mould a flow of light and design light-matter interactions not possible in conventional materials. Ultrafast optical response of the nanostructures will be studied. The nanostructures will be used for developing novel nanophotonic components for optical information processing and control. One experimental and one modelling projects will be offered.

- Experimental and theoretical studies of complex optical beams for nonlinear optics, sensing and nanoparticles manipulation.

Description: The projects involve experimental and theoretical studies of complex optical beams for nonlinear optics, sensing and nanoparticles manipulation. Complex vector beams carry both spin and

angular optical momentum and open up unprecedented opportunity in light manipulation, sensing, optical communications and optical trapping. Knowledge of and experience in one or several of the following fields will be an advantage: optical vortex beams, lasers, optical metasurfaces, optical forces, polarisation measurements, near-field optics, nanofabrication and numerical modelling.

- Design, fabrication and optical characterisation of advanced plasmonic nanostructures for integrated nanophotonics or sensing applications.

Description: The PhD project involves design, fabrication and optical characterisation of advanced plasmonic nanostructures for integrated nanophotonics or sensing applications. The effects of plasmonic hot-electrons will be studied using ultrafast optical spectroscopy.

Faculty of Social Science & Public Policy

Education, Communication & Society

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Research areas/projects of interest:

- Health communication
- Science communication, Public perceptions, Behaviour/Compliance
- Cognitive Discourse Analysis

Geography

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Research areas/projects of interest:

- The physics of sand transport by turbulent wind

Description: A universal process on beaches and deserts as well as on various extra-terrestrial bodies, notably Mars. Research involves both fieldwork as well as computational modelling.

- Dynamics of dune fields.

Description: Dune field patterns develop out of self-organisation under a variety of boundary conditions and system constraints. Research involves both computer modelling as well as remote sensing techniques

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Research areas/projects of interest:

- Urban analytics using emerging human mobility data

Description: Nowadays, rich behavioural data with location tags from cities and their citizens can be collected automatically. This research topic involves data mining of large spatiotemporal datasets (e.g. smart card data, mobile phone data, social media data) towards alleviating urban issues (e.g. social justice, air pollution, public health and road congestions). There is a wide range of possibilities, and we encourage PhD candidates to develop specific research projects based on their research interests. It is also possible to collaborate with an industrial partner to work on a real-world problem. Students in all background with data mining experiences are welcome to apply. A potential co-supervisor will be from the Department of Informatics.

- Modelling spatial structure and regional dynamics

Description: The general aim of the research is to develop computational methods for a better understanding of the patterns and mechanisms in urban spatial structure and its evolution process. The output of the research can be used for monitoring urban changes and evaluating urban development. The potential case study could be, but not limited to Suzhou province/Shenzhen/Guangzhou in China, London in the UK. Students with an urban

planning/transport geography background, and sound data analysis skills are welcome to apply. A potential co-supervisor would from the Department of informatics.

- Impact assessment of urban development and policy.

Description: An exemplary project could be a comparative study of public policy and transport policy in world cities. In particular, the research is expected to develop quantitative analysis methods to evaluate the social, economic and/or environmental impact of a policy on cities and their citizen's life in various context. Furthermore, a simple simulation tool could be implemented for testing the feasibility of policy or development suggestions and consequently informing decision making. A potential co-supervisor would from the Department of Geography.

Lau China Institute

Supervisor: Dr Charlotte Goodburn

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Research areas/projects of interest:

- Migration and Registration Systems in Asia

Description: Massive internal migration has given rise to urgent debates about citizenship and access to state resources for rural-urban migrants in China, India and elsewhere. Identity registration systems, including China's hukou and India's Aadhaar, have become important mechanisms for granting or withholding resources, and those without registration face challenges in accessing state services in urban areas. Impacts of registration systems, and migrant strategies for negotiating them, are emerging as important research topics. I welcome applications for comparative or single-country studies of migration, citizenship and registration institutions, as well as work which aims to develop a set of conceptual frames for theorising internal movements.

- Chinese investment and manufacturing in India: migration impacts

Description: The setting up of Chinese manufacturing bases and the development of Chinese-style special economic zones across India is leading to new patterns of labour migration. Although in China such manufacturing and labour migration contributed enormously to the Chinese economy and helped to transform rural China's social and economic development, there is little research on whether this strategy will produce similar results in India. I welcome applications for studies of Chinese manufacturing and investment in India, employment practices and labour regimes in Chinese firms operating in India, and new forms of Chinese and Indian labour migration as well as their impacts.

- Chinese rural-urban migration and education

Description: The access to education of migrants remains a contested issue in most Chinese cities. I welcome applications examining any form of education for migrant children, particularly those with innovative or comparative methodologies and a focus beyond tier-1 cities.

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Research areas/projects of interest:

- Authoritarian resilience and party institutions in China

- Chinese youth politics / politics of education

- The Belt and Road Initiative in Europe

Global Health & Social Medicine

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Research areas/projects of interest:

- Health and long-term care policy evaluation using secondary datasets
- Health equity research
- Integrated care model in China